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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

November 15, 2007

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

SUB-COMMITTEE ON ESBWR DESIGN CERTIFICATION

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THURSDAY,

NOVEMBER 15, 2007

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The meeting was convened in Room T-2B3 of Two White Flint North, 11545 Rockville Pike, Rockville, Maryland, at 8:30 a.m., Dr. Michael Corradini, Chairman, presiding.

ACRS MEMBERS PRESENT:

MICHAEL CORRADINI, Chairman

JOHN D. SIEBER

MARIO V. BONACA

GEORGE APOSTOLAKIS

OTTO L. MAYNARD

DENNIS C. BLEY

JOHN W. STETKAR

WILLIAM J. SHACK

SAID ABDEL-KHALIK

SAM J. ARMIJO

<u>NRC STAFF PRESENT:</u>

AMY CUBBAGE
ERIC OESTERLE
R. FOSTER
M. COMAR
JORGE HERNANDEZ
YAMIR DIAZ-CASTILLO
CHANG LI
MUHAMMED SHUABHI
DAVID SHUM
ROBERT RADLINSKI
KIM GRUSS
EDWIN FORREST
AMAR PAL
ERIC OESTERLE
GEORGE GEORGIEV
ROBERT DAVIS
ROCKY FOSTER
RICHARD PELTON
BRUCE MUSICKO
DAN BARSE
AL TARDIFF
MANNY COMAR
CRAIG HARBUCK
MICHAEL MARSHALL

ALSO PRESENT:

JIM KINSEY
MICHAEL ARCARO
JOHN GELS
ARTHUR ALFORD
LARRY TUCKER
HUGH UPTON
GARY MILLER
WAYNE MARTINO
MIKE SILVA
PETER JORDAN
GARY ANTHONY
RUSS KUSIC
ALAN BEARD
DAN WILLIAMSON

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

8:30 a.m.

CHAIRMAN CORRADINI: The meeting will come to order. This is the meeting of the ESBWR Subcommittee. My name is Mike Corradini, Chair of the subcommittee. Other ACRS members in attendance are Said Abdel-Khalik, Sam Armijo, George Apostolakis, Dennis Bley, Mario Bonaca, Otto Maynard, Jack Sieber, and John Stetkar. Graham Wallis and Tom Kress are also attending as consultants for the subcommittee.

Gary Hammer, of the ACRS staff, is the Designated Federal Officer for this meeting.

The purpose of the meeting is to review and discuss the safety evaluation report with open items for several chapters of the ESBWR design certification. We will hear presentations from the NRC's Office of New Reactors and G.E./Hitachi Nuclear Energy Americas, LLC.

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 <u>Federal</u>

Register. Portions of the meeting may be closed for discussion of unclassified safeguards and proprietary information.

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

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

Before we proceed with the meeting, a couple of notes to the subcommittee and consultants. We are going to be having a discussion on four chapters today. We will probably have a subcommittee meeting in January for additional chapters, and consider this with the full committee probably March, full committee meeting. So, in preparation for that, please keep in mind the things that you are most wanting to discuss at full committee and let us know by the end of the day when we get to the end of the discussion, or by your report, consultant reports, so that when we get together and prepare for the full committee, and we'll have a number of chapters, we want to be relatively organized as to what we focus on in the full committee and not go through all of the chapters, because it's just not going to be possible.

MEMBER APOSTOLAKIS: Are we going to write the letter in March?

CHAIRMAN CORRADINI: Yes, we will. We've written the interim letter on the first set of chapters, we will do the same again in March for the next set of chapters.

MEMBER APOSTOLAKIS: The PRA part is separate?

CHAIRMAN CORRADINI: Separate. We are anxiously awaiting for that.

Okay, so let's proceed. I'll call upon Jim Kinsey of G.E./Hitachi Nuclear Energy Americas, LLC, to begin. Jim?

MR. KINSEY: Good morning. My name is Jim Kinsey from G.E./Hitachi. Just a couple of brief opening remarks. We appreciate the subcommittee's attendance this morning and the opportunity to present four more chapters out of our design control document with a portion of a fifth chapter as requested.

I wanted to point out that in some of our previous sessions you have raised some issues and questions that we promised we'd come back around to when we covered the chapters that more directly addressed those issues. Many of those are on the agenda for today, so we expect that we should be able to answer your questions in those areas today.

And also, as Dr. Corradini mentioned, it's, basically, our goal to answer your questions or understand whatever open items you may have at the end of the day today, with our goal being that you'll have no significant issues going forward, but if you do we just want to be sure that we clearly understand those so that we are prepared to address them when we come back around for the full committee.

And, I guess on that note, I'll turn things over to our chapter --

CHAIRMAN CORRADINI: I think there's another comment back here.

MR. KINSEY: Oh, I'm sorry.

MEMBER MAYNARD: Before you start, I hope you got the message I'd sent through the staff. I reviewed Chapter 9, Chapter 9 has a lot of systems in it, and a lot of interaction, and I think we could probably spend a week talking about Chapter 9.

I think that there's four areas that we

need to make sure that we focus on, and then as we have time we can go into lots of others, one of those being the refueling systems, the refueling the pools, the elevation differences, the incline transfer, the fuel pool heatings and coolings, especially without AC. Another was the standby liquid control system, since that's important for shut down there. HVAC, without AC, as to how we handle the smoke and the necessary equipment, instrumentation, control room operators and stuff, and then also fire protection, how do we handle fire protection without AC and without pumps and stuff.

When I started to do this, I did generate a long list of questions. I think we need to make sure we stay focused on those things necessary to make the safety case, and then we can deal with other questions if we have time or submit those to you later.

MR. KINSEY: Appreciate that feedback. I think our presentation will generally touch on those topics and we'll try to focus our attention on those and make sure we answer any questions or clearly describe what's there.

CHAIRMAN CORRADINI: Thank you.

Go ahead.

MR. ALFORD: Good morning. My name is Art Alford of GEH. I am a Regulatory Affairs Chapter Engineer for D.C. Chapter 9. I'd like to introduce both Michael Arcaro and John Gels for the presentation on DCB Chapter 9, Utility Systems, and Section 6.4, Control Room Habitability.

Mike?

MR. ARCARO: Good morning. My name is Mike Arcaro, I'm the Principal Engineer for balance-of-plant auxiliary systems for ESBWR.

What we'd like to do today is provide a broad overview of the auxiliary systems associated with ESBWR, as described in Chapter 9, and we'll also touch on the control room habitability in Section 6.4, which follows along in the Chapter 9, 9.4-1 section for control room ventilation.

As was stated, there's an awful lot of scope in Chapter 9, there's 44 sections in 9, so what we wanted to do is just a broad overview, a big picture look at what the similarities and differences are from previous designs, and some of the design features that are unique for ESBWR.

Chapter 9 provides a description of the auxiliary and support systems required to support the operation of ESBWR under normal, transient, shutdown and emergency conditions. The auxiliary systems include the standard systems, such as service water, cooling water systems, fire protection, heating and ventilation and lighting systems.

ESBWR auxiliary systems do have safety-related systems, safety-related functions being performed, and then RTNSS functions. Examples of safety-related systems are ultimate heat sink. In the ESBWR that's performed by the isolation condenser and passive condenser cooling. Previously plants, ultimate heat sink was safety related as a body of water, lakes, rivers, and we are performing the same function using the passive design with the pools.

Standby liquid control, we'll get into that later, that's a safety-related system for ESBWR. Control Room HVAC is safety related for habitability concerns.

Functions, safety-related functions that are being performed, fuel build in HVAC has safety-related instrumentation and functions for isolation on the high rad signal. Reactor build in HVAC, the same function, isolation on a rad signal, and then the Control Room HVAC system habitability envelope is also safety related.

RTNSS systems, for the first 72 hours we take credit for passive systems, so traditional systems that were safety related in earlier BWR designs are now RTNSS systems, so these systems are not required for the first 72 hours to obtain safe shutdown and perform safety-related functions.

Examples of this are fire protection system, fire protection provides support for cooling, for refilling the fuel and aux pool cooling, post 72 hours. Diesel generators for ESBWR we'll talk about that in a little more detail, is also a RTNSS system post 72 hours, and that's a difference from the standard plan.

Service water, both plant service water and reactor closed fueling water systems, for previous plants were safety related, for ESBWR they are also RTNSS systems.

Typical systems, some systems that are what you are used to in earlier vintages of well and water reactor plants include service air systems and TCCW systems.

MR. WALLIS: Can I ask? Systems like service water are part of the ESBWR design or they are left to some architect-engineer, so they are different for every plant? Are they standard for a given -- are all plants the same?

MR. ARCARO: Well, we'll get -- I have a specific slide for the service water system.

MR. WALLIS: The architect-engineer, whoever it is, has to change the design of those things, so they are different for every plant.

MR. ARCARO: The standard plant has the general service water system. The site-specific part of the service water is the heat removal portion of it.

MR. WALLIS: But, otherwise it's a standard system?

MR. ARCARO: That's correct.

MR. WALLIS: It's part of the design.

MR. ARCARO: That's correct. Service water is -- the system is part of the standard design, and it has site-specific portions of it.

MR. WALLIS: The problem with the present designs in this country, sometimes it's difficult to find out what the design is of something like the service water system.

MR. ARCARO: Right. Yes, the DCD has a standard design, and there's site-specific portions of it that are called out.

MEMBER SIEBER: That means that the piping is part of the standard design?

MR. ARCARO: That's correct.

MEMBER SIEBER: And hangers and supports and all of that.

MR. ARCARO: Right, yes, there is an interface with the site-specific portions, but all the piping into the buildings, the heat exchangers, the design parameters are all standard design.

MEMBER SIEBER: Okay.

MR. ARCARO: Okay, the Section 9.1 of Chapter 9 deals with fuel storage and handling, and John Gels is going to go through and big picture some of the functions, the similarities and differences with that system.

MR. GELS: Thank you, Mike. Thanks, Art.

My name is John Gels. I work in the Mechanical Systems Group for nuclear island systems. I'm going to be discussing Section 9.1 as it relates to fuel storage, fuel handling, and fuel pool cooling.

In many ways, the ESBWR fuel storage handling and cooling systems are very similar to previous designs. There are some significant differences, though, so I'll try to limit my discussion to what's kind of new and unique for ESBWR, and if you have any questions along the way please feel free to ask.

One of the unique differences between ESBWR and ABWR, our previous design, is that whereas in ABWR the spent fuel pool was contained in the reactor building at a higher elevation, it's now in a separate, adjacent building below grade level, in a more secure location.

One of the consequences of this is that, in the previous design when fuel was taken from the reactor it could be transferred directly to the fuel pool in the reactor building. Now it must be transferred from the reactor building to the fuel building at the lower elevation, and so to accomplish this there's also now an incline fuel transfer system included in the design that connects these upper pool volumes with the lower pool volumes in the fuel building.

Both buildings seismic Cat 1 structures, and I guess I'll start with a discussion of the fuel building.

The spent fuel pool itself is deeper than fuel pools in previous designs. That is because cooling, the safety-related cooling for the fuel pool is now passive. In the event the normal fuel pool cooling system is lost, cooling is achieved by passive boiling of the water in the spent fuel pool.

When new fuel is delivered to the fuel building, the --

MR. WALLIS: Passive boiling is a new technical term, is it?

MR. GELS: Well, it's an embellishment on it.

MEMBER MAYNARD: Well, how much water do you start out with above the fuel in the spent fuel pool?

MR. GELS: I believe there's slightly over 14 meters of water in the fuel pool.

MEMBER STETKAR: Is that above the fuel vents or is that total depth?

MR. GELS: That's total depth.

MEMBER SIEBER: Then after you boil for 72 hours how much water above the fuel vent?

MR. GELS: I believe the exact -- I don't know the exact number, but it's --

MEMBER SIEBER: Is it covered?

MR. GELS: -- approximately -- yes, it's covered.

MEMBER SIEBER: Okay.

MR. GELS: It's a meter and a half or so, I think.

MR. TUCKER: This is Larry Tucker.

Since we are talking about levels, how much water above the top of the fuel if the level is at the bottom of the transfer gate slots?

MR. GELS: Are we talking about the spent fuel pool?

MR. TUCKER: Spent fuel pool.

MR. GELS: Okay, well there's a transfer gate between the spent fuel pool and the lower fuel transfer pool. I was going to get into that design.

MR. TUCKER: Oh, okay.

MR. TUCKER: If we continue these questions maybe we should just go to the next slide, as the --

MR. GELS: Yes, we can do that, that might be an easier way. It's just a schematic, but it kind of gives you the general idea.

You can see on the left-hand side of the drawing we have the reactor building, the vessel, the reactor cavity above it.

(Whereupon, off-the-record comments.)

MR. GELS: So, the idea here is, we have the reactor building here on the left side of the drawing, the vessel, the reactor cavity above it. As fuel is taken out of the reactor, like in previous designs, it can be transferred from the reactor cavity to an adjacent pool.

We call the adjacent pool the buffer pool. Here is just, named generically, the auxiliary pools, but since we are getting into this area I'll just give a quick description of the buffer pool.

Whereas previous designs the spent fuel pool is at the upper elevation of the reactor building, we've now transferred it to the fuel building to facilitate refueling. We now have this buffer pool adjacent to the reactor cavity. We can now use this pool to briefly temporarily store spent fuel and store new fuel, for fuel shuffling, because you are going to have the incline fuel transfer system from one of these upper pools connecting it to the lower pools in the fuel building.

So, while we are transferring fuel down, we can still be taking fuel out of the reactor and storing it temporarily in this buffer pool.

CHAIRMAN CORRADINI: Is the -- from your current design, is that, essentially, a couple reloads size?

MR. GELS: The buffer pool I believe is sized to accommodate an entire refueling load of new fuel, and it's designed to contain up to 154 bundles of spent fuel.

CHAIRMAN CORRADINI: Okay, thank you.

MR. GELS: The spent fuel is only allowed to be stored temporarily during an outage, and then it will be cleared before restart.

CHAIRMAN CORRADINI: Thank you.

MR. WALLIS: What is the grade level here, or is this --

MR. GELS: This is swelled up grade level. The spent fuel pool is located at grade level.

MR. WALLIS: What is above them?

MR. GELS: I'm sorry?

MR. WALLIS: Just above the pools somewhere there?

MEMBER MAYNARD: There's quite a bit of elevation.

MR. WALLIS: What's the elevation difference?

MR. TUCKER: This drawing is not to scale.

MEMBER SIEBER: Is the whole fuel pool below grade or just the active part of the fuel pool?

MR. GELS: It's, I believe, entirely below grade.

So, this gives you a general idea, even though it's just a schematic.

So, the incline fuel transfer system is an incline tube that two bundles can be delivered into at a time, and transferred from the upper pools down to the lower pools, and then placed in the spent fuel pool.

There are interlocks that prevent any kind of drain down from the upper pools to the lower pools.

MEMBER MAYNARD: Well, are these manual valves, or is this an automatic system that isolates that?

MR. GELS: The interlocks that prevent drainage would be automatic, couldn't override those.

MEMBER MAYNARD: Okay, but are the valves like motor-operated valves, or are they manual?

MR. GELS: I believe they are motor operated.

MR. ANTHONY: How much experience does GE/Hitachi have with incline fuel transfer systems?

MR. TUCKER: Maybe Hugh could speak to that.

MR. UPTON: This is Hugh Upton with GEH.

GE has a significant amount of experience with incline fuel transfer. The incline fuel transfer system was first introduced in the BWR-6 product line. This tube is exactly identical to the BWR-6 product line.

It's in operation at Grand Gulf. It's in operation at Clinton, and we've had a lot of success with the incline fuel transfer tube.

The difference here between the BWR-6 and the ESBWR incline fuel transfer tube, we do not have to open containment in order to transfer fuel. This tube is outside of containment.

CHAIRMAN CORRADINI: For those that are interested, it's on page 9.1-50 of their DCD.

Go ahead.

MR. GELS: That's just, basically, a view of the fueling operations. By the end of the refueling outage, all spent fuel that's stored in the buffer pool would either have to be transferred to the spent fuel pool or returned to the reactor.

The spent fuel pool is designed to store up to ten years' worth of spent fuel.

MEMBER APOSTOLAKIS: Ten years or 20?

MR. GELS: It's designed to store ten years of spent fuel. The systems are designed to cool 20 years, that's a conservative design.

Normal cooling of the spent fuel is accomplished by the fuel and auxiliary pool cooling system, which is shown in the schematic here, and it's also contained in this Figure 9.1-1 in the DCD. That figure is similar to this one, but it has slightly more detail.

The design of the fuel and auxiliary pool cooling system is the primary purpose of a fuel and auxiliary pool cooling system is to cool fuel in the spent fuel pool. It is a two-train cooling and cleaning system shown down here, it has two pumps, to heat exchangers, two filter demineralizer units. It can accomplish the cooling of the spent fuel pool during normal operation, using either train to accommodate a single failure. So, either train is redundant for cooling during normal operation.

In the event that there's a full core offload to the spent fuel pool, the worst case scenario, heat load, both cooling trains can be used to keep the pool below its design temperatures, and we need not assume a single failure in that event.

In addition to cooling the spent fuel pool, fuel and auxiliary pool's cooling system can achieve several other functions, although it's a non-safety-related system, it can provide several back-up containment cooling functions, including flow paths for suppression pool cooling, drywall spray, cooling of the GDCS pools, and low pressure cooling injection for the reactor vessel. It can also provide alternate shutdown cooling to the reactor water clean-up shutdown cooling system, but none of these functions are credited during a safety analysis.

While one train can be used at all times to cool the spent fuel pool, the other train can be placed in standby mode and will be available to achieve any of those other functions in the containment, be it suppression pool cooling, GDCS pool cooling or cleaning.

Periodically, we would imagine those pools would need cooling or clean up, and during that time it wouldn't be advisable to shut down the fuel pool cooling system.

MR. MILLER: I'm sorry, back to when you were talking about the cooling, and you say that, you know, without active cooling you are, basically, relying on the boil off there, and the core stays covered.

I forget what the requirements are. Is just keeping the core covered, or I thought there used to be like a 23-foot water depth you had to keep above? Maybe I can ask this to the staff.

MR. GELS: I believe during normal operation the system is designed to maintain a safe shielding depth. I think the depth is 3.05 meters or ten feet.

In the event that we are talking about safety-related boiling, the idea is the pool -- the fuel building would be evacuated at the time, personnel wouldn't be allowed in the area, and safe shielding wouldn't be part of the design concern at that point.

MEMBER MAYNARD: Well, I'll ask the staff what the requirements are.

MR. GELS: During a fueling outage, the reactor cavity can be drained to the suppression pool. That's similar to other previous designs. And then, using the fuel in the auxiliary pool cooling system the reactor cavity can be then reflooded, using the flow path that returns water to the containment.

Fuel and auxiliary pool cooling system, while it's a non-safety-related system, it has a number of functions that have been considered RTNSS as back-ups to safety-related functions that are credited in the safety analysis. Although these back-ups to the safety functions are not credited in the safety analysis, they can be credited towards PRA analysis, to address uncertainty in the safety goals. Those functions include suppression pool cooling and low pressure cooling injection to the reactor vessel.

So, while these are still non-safety-related functions, some credit for them is taken in the PRA analysis, and that's a topic of RTNSS, it's a unique design to ESBWR from our previous designs.

MR. BARSE: This might be a question to hold for some time when we are looking at the PRA, but do you know, when the crediting systems that are not safety related what treatment and maintenance requirements apply to that equipment?

MR. GELS: To the equipment --

MR. BARSE: That's not safety related that they are crediting in the PRA.

MR. GELS: That might be better addressed by Gary Miller.

MR. MILLER: Good morning, I'm Gary Miller with GEH, and Principal Engineer for PRA.

Could you repeat that question?

MR. BARSE: Yes, the question is, when you use non-safety-related equipment in the PRA, two questions, what are your assumptions about the maintenance requirements on that equipment, and will there be actual requirements built into tech specs or some other way to ensure that that equipment is maintained as you assume?

MR. MILLER: Okay, for the non-safety equipment that we determine to be falling into the category of RTNSS, that equipment in the PRA we assume, you know, normal -- we don't change the maintenance unavailability assumptions or anything, what we do is, we categorize it as either a high or low regulatory significance.

If it's high regulatory significance, we put it in as a tech spec. If it's low, we have availability controls. That would be part of the discussion in Chapter 19.

MR. BARSE: Okay, can you briefly tell us what availability controls mean, if it's not a tech spec?

MR. MILLER: It's not a tech spec, but if you are familiar with the technical requirements manuals, plants with current standard tech specs, it's a lower level. It recognizes the function, and without putting in limiting conditions for operation or action statements it causes us to track the availability of these functions.

MR. BARSE: Us is GE?

MR. MILLER: Us, I'm sorry, the licensee. I've been with GE for a year and a half, I was one of them.

Yes, it requires the licensee to track the unavailability. And, in addition to that, because these are fairly significant, they would be covered by maintenance rule A4 as well.

MR. KRESS: How do you determine the high or low regulatory interest? Is that an importance factor, or is it an expert panel, or both?

MR. MILLER: Well, for RTNSS it's an importance factor, that's correct.

MR. GELS: I wanted to point out the one thing that's not shown on this schematic is the sub-system for cooling the ICPCC pools. The FAPCS has a completely independent sub-system used for cooling the isolation condenser passive containment cooling pools. It's an entirely non-safety, it consists of one train of heat exchanger and water clean-up unit. It's independent of the other fuel and auxiliary pool cooling system components, because we want to maintain a higher quality of water in these upper pools, as they are credited for boil off during the first 72 hours.

I've kind of run through all of the basic principles behind the fuel pools and FAPCS rather quickly, and I will turn back to Mike.

If you have any questions I'd be happy to answer them.

CHAIRMAN CORRADINI: No, we'll hold them for now. We need to move on.

MR. GELS: Okay.

MR. ARCARO: Section 9.2 of the DCD talks about the water systems. Briefly, going through some of the systems, service water we touched on that, service water for ESBWR is also a RTNSS system, non-safety-required post 72 hours reactor component cooling water system similar to previous designs. For ESBWR, it's also non-safety, it's not required for component cooling water type loads, ECCS type loads, and it's not required for recirc pumps as in previous designs.

Some of the RTNSS requirements for these systems are similar to safety system requirements. We are required to have redundant trains, physical and electrical separation. There is seismic requirements and the requirements for hurricane missiles and flood protection.

Some of the other systems associated with the ESBWR that are on previous cooling water reactors, with some differences. Chill water system, chill water system for previous vintages of plants was safety related for certain applications, such as control room HVAC. For ESBWR, chill water is used for all the ventilation systems, portions of the chill water system are RTNSS that are required to support functions for the nuclear island chill water sub-section.

Condensate storage and transfer, very similar to what we had in the previous vintages of boiling water reactor design. Previous plants used condensate storage and transfer for HPCI and RCCI water sources, when the suppression pool was not available. For ESBWR, we don't have the safety system pumps that previous plants had, so for us condensate storage and transfer is used as an alternate means for reactor vessel fill and functions like that.

The next slide is a simplified slide of the service water system. Again, it's very similar to previous systems. We've got two trains, we've got redundant components, we've got pumps going to flight heat exchangers, both for reactor cooling loads and turbine building loads. The heat sink, which is the part of the design that would be site specific, is a requirement for, you know, heat removal capacity.

On the standard design, we have a cooling tower, as part of the standard design, as a heat sink for service water.

Okay, Section 9.3 is talking about the process auxiliaries, and here is the compressed gas systems, which includes instrument air, service air, containment inerting, high-pressure nitrogen.

Similarities, service air, we talked about that before, service air is doing the same functions that it was doing for previous vintages of boiling water reactors. Instrument air system for previous plants was safety related, had safety functions, for ESBWR the instrument air is non-safety and non-RTNSS. The instrument air fail position of components and the results of the PRA analysis showed that instrument air could be non-safety. The safety functions required for instrument air loads and nitrogen loads are performed by accumulators, with the accumulator and the isolation valve being part of the system that it is serving.

MEMBER STETKAR: Let ask you this quickly, because we don't have much time.

Isolation valves on the isolation condenser, steam supply and condensate containment isolation valves, what direction do they fail, on loss of pneumatic, no nitrogen, no accumulator pressure, do they go closed or do they go open?

MR. GELS: The isolation condenser system isolation valves fail in the current position, they fail as is.

MEMBER STETKAR: So, the containment isolation valves for the isolation condenser, the steam supply and the condensate return, the series valves fail open?

MR. GELS: Well --

MEMBER STETKAR: They fail open, because they are normally open.

MR. GELS: -- yes, they are normally open, and if they would fail they would fail in the open state.

MEMBER ABDEL-KHALIK: Isn't there one valve that's normally closed?

MEMBER STETKAR: No, the containment isolation valves, the series valves on the steam supply, the condensate, return line.

MR. GELS: Correct.

MEMBER STETKAR: They fail as is.

MR. GELS: They fail as is.

All right, the other -- some of the other systems, process sampling, equipment and floor drain, for previous plants these systems were also safety related. For ESBWR, these are non-safety systems.

Standby liquid control, similar system as on previous plants. For ESBWR, some differences. Again, it functions to give you a reverse scram. With ESBWR, you don't have the recirc pumps, so the function is, you know, is required.

Some of the differences, the kind of borate that we are using, the solution that we are using is such that you don't have to worry about it falling out of solution at a low temperature, so the requirements for heat tracing of the piping and the tank aren't there for this design. We still maintain the room temperature above 60 degrees, but the borate solution is such that it's not as susceptible to low temperature.

The design of the system is passive, and that consists of nitrogen accumulators and squib valves, rather than positive displacement pumps like previous systems.

The injection of the borate solution into the vessel is enhanced to provide more mixing and distribution than earlier designs.

MR. WALLIS: How do you do that? Do you have a sparger or something, or what do you do?

CHAIRMAN CORRADINI: You have to go to a mic and identify yourself, please.

MR. MARTINO: Yes, can you repeat the

question?

MR. WALLIS: How do you get this borate solution to mix with it, do you have a sparger or something?

MR. MARTINO: Yes, we do. My name is Wayne Martino at GEH. We have a sparger inside the core bypass region, it injects in the space between the outer-most channels and the core shroud.

We'll go into some more details of that in the ATWS material in Chapter 15.

MR. WALLIS: You do analyze the mixing process?

MR. MARTINO: Yes.

MEMBER MAYNARD: It's my understanding that both the staff at GE are still doing work on the mixing, we get a chance to address that I think in one of the later chapters.

CHAIRMAN CORRADINI: I think Chapter 15 is where we are going to see that, is that correct, Amy?

MS. CUBBAGE: Chapter 15 and 21.

MEMBER MAYNARD: Well, I asked specifically about that, and they said this probably wouldn't be the best place to do that.

CHAIRMAN CORRADINI: Thank you.

MR. ARCARO: All right, hydro-water

chemistry.

MEMBER MAYNARD: Back on the standby electric control system, it's all passive, but valves have to close to keep from injecting nitrogen into the vessel there, I mean, when the level gets so low, so isn't there an active component of shutting that off?

MR. GELS: Yes, but I don't believe that that's considered a safety function of the system. The safety function of the system is to inject the sodium penta borate.

MEMBER MAYNARD: Okay, so if it fails to shut off, and nitrogen gets injected in there, that's not a safety?

MR. GELS: It's very much a concern, but after the reactivity control, providing reactivity control is -- that's the purpose of the valve, it's outside the scope of that valve.

MEMBER MAYNARD: So, the shut off is not safety related then.

MR. GELS: Well, the entire system is considered safety related, but for the purpose of reactivity control that valve function is not safety related for controlling -- for scramming the reactor.

MEMBER MAYNARD: Okay. But, I would think that's an active component, if it has to close.

MR. GELS: Yes, it is.

MEMBER MAYNARD: You are saying for 72 hours, you are really not relying on any active components.

MR. TUCKER: This is Larry Tucker with GEH.

The safety function for the standby liquid control was to bring the reactor sub-critical as a back-up method.

By using the nitrogen accumulator to ensure that we get the sodium penta borate in the right place, we accomplish that safety function.

If the nitrogen does go in to the reactor, it's not a safety concern, but it is an operational trouble that has to be addressed.

MR. WALLIS: And, it can affect the long-term cooling, can't it?

MR. TUCKER: I do not believe so, because of the location of the suctions for the long-term cooling.

CHAIRMAN CORRADINI: Is there someone that wants to make a comment back there?

MR. MARTINO: Yes, this is Wayne Martino. The nitrogen isolation function is redundant, and it's been designed that way to make sure that we terminate the nitrogen injection in a LOCA scenario, where it could put a non-condensable gas in the containment.

So, we've considered that as part of the function of the standby liquid control system.

CHAIRMAN CORRADINI: So, just to clarify, I want to make sure I understand, Otto was trying to get relative to is it an active system, and that's where we started with this?

MEMBER MAYNARD: Yes.

CHAIRMAN CORRADINI: So, are you clear?

MEMBER MAYNARD: Well, I'm clear that it's active, I think it's an active system.

MR. TUCKER: But, it's non-credited, we don't take credit for it.

MEMBER STETKAR: In Chapter 15, in Chapter 15 for long-term cooling post -- post ATWS, long-term cooling, not LOCA, shut the reactor down with standby liquid control, nitrogen keeps going in, you have the isolation condensers now cooling, which require steam and water and not nitrogen, not a LOCA. So, throughout the nitrogen is not an active safety function under those conditions?

MR. TUCKER: That's correct.

CHAIRMAN CORRADINI: So, you can postpone us, but where we are going with this is, if you inject nitrogen unknowingly, how does that affect your isolation condenser performance? So, if you are going to tell us to wait til Chapter 15, we'll wait.

MR. TUCKER: Okay.

CHAIRMAN CORRADINI: But, we'll be there.

MR. TUCKER: That's where the group is going, Chapter 15, and also I believe there are RAIs, you know, in Chapter 21 on this subject, and there's conversations between GEH and the staff on that at this time.

CHAIRMAN CORRADINI: Okay, good.

MR. TUCKER: And, we are well aware of the requirement to make sure that the isolation condensers do not become gas bound with nitrogen.

MR. ARCARO: All right, the other process system in Chapter 9.3 is hydro-water chemistry, and ESBWR provides taps for that system.

MR. ARMIJO: I've got a problem with that. You know, I think the hydrogen water chemistry is important, whether you want to call it important to safety or not that's a debate, but that's a standard way to run a BWR to prevent IASCC in tracking of internals.

I'm just wondering why GEH has chosen not to make that part of the standard certified design, and you might add that same thing for zinc injection, which is proven to control doses effectively.

And, you have made the oxygen injection system standard.

MR. ARCARO: Just those portions that are required outside of hydro-water chemistry.

MR. ARMIJO: Yes, the oxygen, which is just an operational benefit, there's no question about that, but hydrogen is probably much more important in the BWR than the oxygen addition.

And so, my question is, is why is that left as an option when you know that's what you need to keep the BWR materials protected?

MR. ARCARO: Well, you are correct, in ESBWR the hydro-water chemistry is an optional system. Existing plants, lots of existing plants, have either not implemented hydro-water chemistry, or implemented hydro-water chemistry late in life.

ESBWR, the design is such that the gradating factors that reduce the susceptibility to intergranular stress corrosion, there's history with, you know, the previous generation ABWR plants operating for over ten years without hydro-water chemistry, without indications of stress corrosion cracking. So, there's history there. We leave it to the customer to decide, you know, the benefits of hydro-water chemistry versus the dose concerns.

You know, the risk of not implementing hydro-water chemistry at start up is minimal.

MR. ARMIJO: so, GEH's position is hydrogen-water chemistry is not really required for operating the ESBWR. It will be okay --

CHAIRMAN CORRADINI: Somebody over there is going to try to help.

MR. UPTON: This is Hugh Upton with GEH.

GE recommends the application of hydrogen water chemistry in start up. We recommend it. Okay. It's the best way to avoid cracking from occurring.

However, there are also other considerations. We leave it as an option, because of the concern we've seen in the past with additional shielding requirements, because of the additional M16 from hydrogen-water chemistry. Also, it's an additional dose.

The plant itself has been designed from a shielding standpoint to handle the hydrogen-water chemistry, and the additional doses from it with shielding in the main steam tunnel, and also in the turbine building. But, we leave it as an option, because it's an economic consideration.

MR. ARMIJO: I don't take much comfort in that, but it will come up at the combined license, it will be a COL issue, is that the way you --

MR. UPTON: Well, Sam, maybe also, I mean, if you take a look at the -- again, this is Hugh Upton with GEH -- the incubation period on any of the corrosion cracking is a long time. We also are doing, you know, in-service inspections of the welds. If there's any indication at that time, during operation of a plant, that there is IGSCC going on, the utility can opt to back fit hydrogen-water chemistry.

We have allocated the taps, we've allocated the space. It's just a matter of a utility making that decision.

MR. ARMIJO: Yes, but the philosophy is, wait for something to crack and then put in the system that protects you from cracking. It's bazaar. I mean, you have an opportunity here with a brand new plant to start it up with the right water chemistry that mitigates against the nucleation of stress corrosion cracks, and it's hard to understand why GE, GEH I mean, doesn't simply say that's standard for a modern boiling water reactor, and we don't want to go through this series of materials failures that we have in the conventional, in the early BWRs.

So, I'll leave that as that, but it seems to me like that's the modern way to operate a BWR, you provided the shielding. If you hadn't provided the shielding it would really be a mess, but you provided all the shielding, so I just don't understand why that isn't just fundamentally the way the water chemistry for a modern BWR.

CHAIRMAN CORRADINI: Is there a comment?

MR. UPTON: Yes, just one comment.

Sam, also we have done a significant amount of change in material on the ESBWR, that would -- which is designed to mitigate IGSCC.

MR. ARMIJO: Yes, but I think the Japanese experience has proven that the old carbon 316 nuclear grade will crack. Now, they did it without hydrogen, and they ran BWRs without hydrogen, they cracked a lot of components, and with the modern material. So, you can't rely on the material alone, and defense in depth thinking says you want water chemistry to protect you, as well as improved materials and improved fabrication.

So, I think this is an area where I'm certainly uncomfortable.

MEMBER STETKAR: Sir, can you identify yourself? The court reporter needs it.

MR. UPTON: This is Hugh Upton with GEH.

MR. ARCARO: All right, moving on to Section 9.4 of the DCD, this is the heating ventilation and air conditioning systems.

A lot of similarities with the previous plants, control building HVAC, meets the same Reg guides and requirements as previous plants. We'll talk a little bit more about the habitability portion of the system in the 6.4 discussion. But, the enhancements in ESBWR are the control building, the habitability portion, and the electrical DCIS rooms are actually underground and use -- take credit for the passive cooling of the heat removal of the structure itself.

MR. WALLIS: Is there any way to monitor the leakage continuously, because, you know, they get tested, but then things get misplaced and they leak. Do you have any way to monitor the leakage of that?

MR. ARCARO: Well, we do. There is surveillance requirements. Upon start-up, we are going to, you know, there's an ITAAC, we are doing in-leakage. There's outage surveillance requirements for the tracer gas testing and leakage testing, and the DP testing for the control room.

MR. WALLIS: So, this goes on and on, on

some schedule. You don't just test it and leave it.

MR. ARCARO: We do it during the refueling outage, in accordance with the reg guide 197.

MEMBER MAYNARD: You say these are fairly common, yet I think this is the only one that, from a safety-related standpoint we are counting on heating ventilation with no AC power.

MR. ARCARO: That's correct.

MEMBER MAYNARD: Okay, so I think we really need to focus on that, as to with no AC power how are we cooling and how are we making sure that things that need to be maintained within a certain temperature are?

CHAIRMAN CORRADINI: Are you going to cover that now or under 6.4?

MR. ARCARO: I have it in 6.4.

CHAIRMAN CORRADINI: Okay, we can hold that question for a couple of slides.

MEMBER ABDEL-KHALIK: What's the design basis for the reactor building, HVAC?

MR. ARCARO: The design basis is to maintain the temperatures. It has temperature requirements for the safety-related components, and it maintains the requirements for dose and leakage concerns.

MEMBER ABDEL-KHALIK: So, what's the capacity of the reactor building HVAC system?

MR. ARCARO: Mike?

MR. SILVA: Good morning. I'm Mike Silva with the Ops Systems Group, HVAC.

The capacity in terms of air flow?

MEMBER ABDEL-KHALIK: In terms of heat removal capabilities.

MR. SILVA: The heat removal, during normal operation, the heat removal capability, I'm not totally sure, but let's just put it this way, the system is about 50 to 60,000 cfm air flow once through a ventilation system for two of the separate systems, and then there's a third system of clean air, and which maybe sends 30 or 40,000 cfm air flow, with cooling.

MEMBER ABDEL-KHALIK: I guess I've have to translate that somehow, but please continue.

MEMBER MAYNARD: Okay, but again, that would be with fans and stuff, right?

MR. SILVA: Right.

MEMBER MAYNARD: And, my primary interest is in design basis type accidents and stuff, how are we maintaining the temperature.

CHAIRMAN CORRADINI: We are going to need to catch that, but I think we are going to have to move on or we are going to run out of time.

MEMBER MAYNARD: Okay.

MR. ARCARO: All right, control building, we'll touch on that in 6.4.

MR. UPTON: Just one comment before we leave the reactor building HVAC.

The reactor building HVAC, again, this is Hugh Upton with GEH, sorry -- the reactor building HVAC flow rate and capacity has been designed to maintain the heat loads, the temperatures within the reactor building within normal bounds, including all of the heat loads from the equipment that's anticipated in there, in each one of the rooms.

So, even though it's 30 scfm, there is a temperature band to maintain that's part of the system requirements. We can get you that temperature band.

CHAIRMAN CORRADINI: Yes, okay.

MR. ARCARO: Let's see, the fuel building HVAC system, that's a separate building, a separate ventilation system, that's a RTNSS function, and it provides cooling and ventilation for the fuel building.

Radwaste HVAC, similar to previous boiler water designs. It has separate systems for the control room and the general area.

Turbine building ventilation, similar to previous designs, is a once-through system, has different subsystems for different areas.

The reactor building HVAC, touched on that. Again, it's got separate subsystems for the contaminated area refuel pool and the clean area.

Electric building HVAC, this is different from previous designs, in that the electric building HVAC system was safety related on early vintages with BWRs, here it does have RTNSS functions, and it maintains habitability for the tech support center, and maintains the cooling for the diesel and the 1E electric and electronic loads.

Drywell cooling, similar to previous designs. In ESBWR we used chill water for the drywell cooling system rather than the reactor closed cooling water that was used for previous designs.

CHAIRMAN CORRADINI: If you have something you may want to skip, please feel free, because we are going to have to get to control room habitability, and I think people will want to know about fire protection.

MR. ARCARO: Okay, this slide here is just a general schematic on operational for a recirc system. This is the general area for the control building. Outside air comes in through a damper. We have redundancy and back-up components. It's broken into different sections for the air flow, and recircs back on itself.

The other auxiliary systems in Chapter 9, communications, lighting, the diesel generators, and their support systems are part of 9.5, and fire protection.

Fire protection, standard fire protection functions for detection, notification, annunciation, suppression of fires.

Fire protection is also -- has two appendixes in Chapter 9. This is where we do the fire hazard analysis, and the summary of the design requirements.

The design features for Chapter 9, we've talked through most of these, service water, reactor component cooling water, chill water, high pressure nitrogen. We talked about the RTNSS functions for those.

Some of the significant design feature differences, we talked through the diesel auxiliaries not being safety related, being a RTNSS function. One of the recent changes we made is elimination of the hot water system, hot water heating system. Now we are doing that function using electrical heaters rather than the hot water system.

One of the design features of ESBWR is, without AC power during the first 72 hours we take credit for passive heat removal. There's no active heating and air conditioning if you lose power, so the structures and systems are designed such that passive heat removal will maintain the equipment within the EQ envelope, the requirements for the equipment in the different buildings.

That gets us to the Section 6.4 for control room habitability. Section 6.4 provides a description for systems that make up the habitability envelope. They have included the area, habitability area HVAC system, radiation monitoring, lighting and fire protection system.

Some of the design features incorporated in the ESBWR design is, it takes credit for passive heat removal and maintaining the life support functions for the 72 hours without the power.

Control room habitability is required for dose and occupancy requirements for GDC-19. For the first 72 hours, the heat loads are removed passively, so once the non-safety heat loads are gone, which is assumed in the analysis to be within the first two hours, the heat loads that are remaining are removed through passive means to the structure, to the walls, to the ceiling of the building, and that's accomplished by the thermal mass of the structure, the fact that the control room habitability envelope is underground, and we are taking credit for the heat removal to the ground.

Habitability is maintained for the first 72 hours via the emergency filtration unit, and if you go a couple slides down there's a schematic of that. Emergency filtration unit is run off of safety-related batteries. It provides the required flow rate and maintains a positive pressure in the control room for maintaining the life support and habitability for the control room operators.

CHAIRMAN CORRADINI: So, that's one of the loads on the batteries during the 72 hours.

MR. ARCARO: That's correct. The loads assumed are the safety-related loads, lighting, and then the people loads in the space.

MEMBER STETKAR: On the emergency submittal, the normal control room ventilation exhaust is isolated, correct?

MR. ARCARO: That's correct.

MEMBER STETKAR: You say that the control, the EFUs can supply up to 424 cubic feet per minute, which is designed for 21 people, how does the air get out? If I try to pump up a balloon, and it's a solid balloon, I can try to put 424 cubic feet per minute in there, but it's not going in. So, my people who are now breathing the air are not exhausting any air, so how do you ensure that you actually do get 424 cubic feet per minute of new air flow in with the sufficient exhaust going out, for 72 hours, if it's solid, sealed, as it's designed to be?

MR. MARTINO: This is Wayne Martino of GEH.

We are designing the exit for the room, we haven't finalized the mechanism, maybe a relief valve/check valve device to assure that we have a controlled exit flow out of the room to provide the flow that the fan can supply.

CHAIRMAN CORRADINI: So, it's a separate -- just so I understand -- so, it's a separate system to filter it, and another system to, essentially, add --

MEMBER STETKAR: They need exhaust.

CHAIRMAN CORRADINI: -- I understand that, and then a separate system, essentially, to keep fresh air -- the resurgence of the filtered air back in at this rate, and venting exhaust.

MEMBER STETKAR: It will all be part of the same system.

MR. ARCARO: The filter unit provides some pressurization and also the air flow, and then the exhaust mechanism will be a point, a control point, where we exhaust the flow to make sure we maintain circulation and have the air flow required.

MEMBER STETKAR: But, that's not designed yet.

MR. ARCARO: That's correct.

MR. BARSE: Is there an RAI on that issue? I don't remember,.

MR. ARCARO: No.

MEMBER STETKAR: There's an RAI on mixing in the recirc language, which is kind of semi relevant, but not on throughput.

MR. ARCARO: There's several RAIs that talk about stagnation of the gases, or how do you maintain flow.

MEMBER STETKAR: It's partially related.

MR. ARMIJO: What's the peak temperature at the end of that 72 hours? What's the maximum temperature that is allowed?

MR. ARCARO: For the control room habitability area, 93 degrees is the maximum temperature.

CHAIRMAN CORRADINI: Allowed or estimated to occur?

MR. ARMIJO: 93 degrees is too late, I just want to know what the maximum temperature is.

MR. MARTINO: Wayne Martino, 93 degrees is the acceptance criteria, starting from the maximum initial temperature from 78 degrees we get 93 degree heat up. That's every URD requirement that we are implementing, it protects the operator and the equipment in the room.

MEMBER ABDEL-KHALIK: What is the total heat load that you have to remove under these conditions?

MR. ARCARO: During -- for the 72 hours passive cooling, it's around 7,000, 7,000 watts. All you have is, you've got the low power lights, you've got minimal instrumentation. You've got the fractional horsepower fans for the EFU units, and you've got the people heat loads.

You know, it's a small fraction of the loads that are there with the non-safety equipment running.

MEMBER ABDEL-KHALIK: And, you said you relied to some extent on energy storage in the structures, and you also relied on heat transfer to the ground, during that time period?

MR. ARCARO: Correct.

MEMBER ABDEL-KHALIK: Now, what are the conditions of the soil that you assume in this heat transfer process?

MR. MARTINO: Let me clarify, we don't credit heat transfer to the soil, only to the building structure.

MEMBER ABDEL-KHALIK: So, you are only relying on heat storage in the structure, it takes that long?

MR. MARTINO: Yes, this is Wayne Martino.

MEMBER ABDEL-KHALIK: Okay.

MEMBER MAYNARD: On the control room habitability subject, we talked about heat loads, how does it work in the winter time?

MR. ARCARO: Well, we did a run for low temperature, and designed outside ambient temperature as -40 degrees, and I believe the results get it up to 50 some degrees. So, it's still -- you know, it's still chilly.

MEMBER STETKAR: Are the control room

HVAC, the recirc air handling units, are they normally cooled by nuclear island chill water, or are they always cooled by just the control room chill water?

MR. ARCARO: The control room HVAC comes off of the nuclear island chill water loop normally.

MEMBER STETKAR: And then, it switches over to the internal chill water, what I call the internal chilled water.

MR. ARCARO: Well, there is no internal chill water, that's part of the nuclear island loop.

MEMBER STETKAR: Okay, perhaps, I'm being not very specific. There's a tank with two pumps that circulate water through the air handling units under emergency conditions, according to my drawing. That's what I'm calling the internal --

MR. ARCARO: Okay.

MEMBER STETKAR: -- not shown on that.

MR. ARCARO: Right.

MEMBER STETKAR: It's those two little lines going up the side. But, those air handling units are normally cooled by nuclear island chilled water, is that correct?

MR. UPTON: This is Hugh Upton with GEH.

The tank that you are referring to is used to cool the air handling units during an emergency, and it's a gravity-drained tank.

MEMBER STETKAR: I understand that.

MR. UPTON: Okay.

MEMBER STETKAR: What normally cools those air handling units, during normal plant operation?

MR. UPTON: Well, it's part of the chill water system.

MEMBER STETKAR: Nuclear island chilled water?

MR. UPTON: Yes.

MEMBER STETKAR: Thank you.

MEMBER SIEBER: You do have an auxiliary boiler, that is not shown here.

MR. ARCARO: Yes, we do, and it is in Chapter 9.

All right, in summary, Chapter 9 and Section 6.4 provide a description for the auxiliary systems and control room habitability systems, and currently GEH is working with the NRC staff to address the remaining open items.

MR. BARSE: Could I slip one question in on what you talked about a long time ago, on the service air and the instrument air systems, because as I look through your documents I didn't see anything, and I know it's called non-safety related, but you have an interface between nitrogen systems and instrument air. I didn't see anything on the specifications for operation to preclude moisture and contaminants into the -- permeating the service air system, getting into instrument air. I did see you've got a dryer. But, if you have a failure there, does it get bypassed? What happens?

Are there any requirements on that yet, or is that not really in the design?

MR. ARCARO: I believe that in the DCD there is requirements for air quality on the instrument air, the system.

MR. BARSE: I'd like to see those, I didn't find them myself.

MEMBER MAYNARD: I saw that you stated that, you didn't have them for the service air system, didn't state anything about that, and they can't be interconnected in an emergency, as I understand it.

MR. BARSE: It's the same thing now, they changed the design.

MR. ARCARO: I think both in the body of the DCD, and there's a table which has parameters on that, the micron size requirements for instrument air, and the ISI, ISA requirement for cleanliness.

MR. BARSE: Okay, I'll have to look again, or if you could point those out later I'd appreciate it.

MEMBER ABDEL-KHALIK: Have you actually done the thermal response calculation for the control room, 400 cfm, 7 kilowatt of heat load?

MR. ARCARO: Yes.

MEMBER ABDEL-KHALIK: And, you have shown that you get adequate heat transfer through the walls, so that the temperature never goes above 92 degrees or 93 degrees?

MR. ARCARO: Yes, that's correct.

MEMBER STETKAR: Since Said asked, have you done the calculations for the interior temperatures in the cabinets, not just the bulk room temperature, because the cabinets will have power supplies in them, and they, Experience -- Operating Plant shows that the interior temperatures inside the cabinets can be substantially higher than the bulk room temperatures.

MR. ARCARO: And, there is an RAI for that.

MEMBER STETKAR: Okay.

MR. MARTINO: This is Wayne Martino, GEH. That's right, but the equipment has not been procured yet, so we don't have -- that's part of the DAC process for equipment qualification. So, the interior cabinet temperatures have not been calculated or determined yet.

MR. ARMIJO: Okay, so you're limiting temperature would be 93 degrees inside a cabinet?

MEMBER STETKAR: It's typically about 120 degrees inside the cabinet.

MR. ARMIJO: Okay, so you've got some limiting degree room.

MEMBER STETKAR: It depends on the qualification temperature for the --

CHAIRMAN CORRADINI: Just to make sure I understand your answer, so you are saying that you have a design spec that you are looking towards to make sure that the equipment can maintain? I missed that part.

MR. ARCARO: Wayne?

MR. MARTINO: Yes.

MR. UPTON: This is Hugh Upton with GEH.

Yes, part of the design specification for the procurement of our electronics, the DCIS has temperature limits. The environmental qualification we'll have to undergo.

Also, I wanted to add that part of the detail design of both the control room HVAC system and the reactor building HVAC system will be to complete a detailed gothic analysis room by room of the temperature heat up and how the rooms perform under passive cooling.

So, that has not been done yet, but we plan on doing that.

CHAIRMAN CORRADINI: And then, just to clarify Said's question, so in the 7 kilowatt load, with the 400 and something cfm input and exhaust, in the current analysis you did include the losses to the room walls, that was there.

MR. ARCARO: Yes.

CHAIRMAN CORRADINI: Okay.

MR. BARSE: One last follow-up, I did find the tables you talked about on the instrument air. The sketches are real sketches, they aren't real detailed drawings. Will there be bypasses around the dryers and the filters? And, if so, what are the operational requirements?

MR. ARCARO: I guess the instrument air service air in Rev 4 has been revised.

MR. BARSE: I think we have that.

MR. ARCARO: You have Rev 4? Okay, so now we have three service air compressors that are feeding the entire system, and we have dryers that separate the instrument air from the service air, and those dryers maintain the air quality downstream for the instrument air loads.

MR. BARSE: The drawings don't show it, but I was asking, will there be bypass valves around the filters and the dryers? And, if so, will there be operational requirements on how people use them?

MR. ARCARO: To maintain -- I'm not sure what the answer to that is. Later I'll be able to answer that.

CHAIRMAN CORRADINI: Okay, thank you very much. I appreciate it. We are a little bit late.

I'll turn it over to the staff.

Amy, are you leading the charge?

All right, we have our next group.

MS. CUBBAGE: The group is here, and I definitely would like to thank you for your advanced comments, it really helped us frame the presentation. So, we are going to do our best to focus on the areas of interest, we'll touch on some other areas. We have a very large team with us today, hopefully, we can answer any questions you have in the areas of your interest, and any other areas that come up.

So, I'd like to introduce the first set of people here. I don't know if we were able to get everybody at the table. We will swap out when we need to. So, we have Jorge Hernandez from -- Group, and Yamir Diaz-Castillo from our Component Integrity Branch, who specializes in the chemistry area. Ben Parks, and robert Radlinski, our Fire Protection Team Leader, and I'm Amy Cubbage, Lead Project Manager for the ESBWR design certification.

We provided the committee with the safety evaluations for Chapter 9 and 6.4 to support this meeting. We will be coming back in January or later in the year with the rest of Chapter 6 at that time.

Okay, so we are going to brief you on that evaluation, which was based on DCD Revision 3. As you know, we have DCD Revision 4 and the safety evaluations have not addressed that.

MR. WALLIS: Is the second item worthy of a bullet?

MS. CUBBAGE: We always are happy to answer your questions.

So, in addition to the folks sitting here with me, we have a number of reviewers here in the room. I won't run through all the names.

Ed Forrest will be joining us up at the table when the presentation time comes, and I think everybody else is already up here.

Okay, so outline of the presentation, briefly going to show you the applicable regulations, the status of the RAIs for Chapter 9 and 6.4. We'll go through the SCR topics of interest, focusing on the committee's areas of interest. We'll discuss some of the open items that were more significant. There are a number of open items, we aren't going to get into every single one of them here today. We'll touch on some of the action items in the DCD, and again, answer questions.

So, here's the listing of all the regulations, guidance, documents and codes and standards that we looked at for this chapter's review.

We asked a total of 216 RAIs so far in Chapter 9, 150 of those have been resolved. We have 66 open items.

For 6.4, we asked 14 RAIs, and those are all open at this time.

A number of systems included in these chapters, and we'll touch on some of them here today.

I'll turn it over to Jorge for the first slides.

MR. HERNANDEZ: Yes, good morning. My name is Jorge Hernandez from the NRO, from the Balance of Plant Section -- or Branch, I'm sorry.

So, I'm going to briefly discuss the staff evaluation of Section 9.1 in the areas of new and spent fuel storage, the spent fuel cooling systems, and the light and heavy load handling systems.

I'm going to briefly mention significant technical features of the systems, clear and open items, and COL items, if any, in each of the areas.

For the new and spent fuel storage, I want to thank GE for clarifying that the actual capacity of the pool is for ten years. We've been going back and forth in RIAs with them as far as, you know, them clarifying what the capacity of the pool and the system is, I guess. The cooling system itself is able to handle 20 years of fuel in the pool.

MR. WALLIS: How conservative is the packing of the elements then when it has ten years fuel elements in there? How conservative is the spacing? Is it really pushing some limit, or --

MR. HERNANDEZ: That's part of an open item right now, and there's an open item on the thermal hydraulic analysis for the natural convection of the rad, so we have -- I'm not sure if you have already gotten that or not. I guess they were supposed to provide that this week.

MS. CUBBAGE: Right.

MR. HERNANDEZ: And so, we haven't had time to look at it yet.

MEMBER BONACA: So, the capacity is ten years, the capacity of the --

MR. HERNANDEZ: They are clarifying -- staff understood that both the capacity of the cooling system and the pool were for 20 years. I guess the pool itself is going to -- GE is --

MR. TUCKER: This is Larry Tucker with GEH. The utility requirements document for spent fuel capacity is for ten years capacity, with a full core off load. The products would go commercial around 2015, ten years after that, 2025, who knows what the spent fuel world will look like in 2025.

So, what we've done is, we've taken the approach that we are going to provide enough room in the pools, strength in the floor of the pools, and cooling capacity in the pools, for 20 years, and provide ten years of high-density racks, ten years' worth of high-density racks, as an initial offering of the ESBWR, to meet the utility requirement document of EPRI.

MR. BARSE: But the volume.

MR. TUCKER: Yes, sir, and the cooling capacity, and the seismic analysis would support expansion in the future to 20 years capacity, plus a full core off load.

MEMBER BONACA: What was the cycle length that you assumed?

MR. TUCKER: Two years.

MEMBER BONACA: Two years.

MR. HERNANDEZ: Going along, the reactor building, both the pool capacities for 60 percent of the reactor pressure vessel core, the storage racks and the liner amendments are seismically qualified to Seismic Category 1.

The impact to racks from dropped objects is prevented by interlocks and safe mode paths, and those are discussed in Section 9.1-5.

And, the liner is designed to withstand the impact of one fuel assembly.

The staff is currently evaluating -- there's currently a few open items in this section, one, we already mentioned that the applicant has submitted dynamic impact analysis of the fuel racks. To demonstrate the structural integrity during all the expected loads, and load combinations, and those include seismic load, thermal loads, fuel drop at maximum height, and they also need to provide a thermal hydraulic analysis also to demonstrate adequate natural convection on the racks, and also a criticality analysis.

MS. CUBBAGE: On that note, I'll just mention that it's going to come in the form of two topical reports. One was received just a few days ago, and the other we do expect to see, so there's some significant information there that the staff has yet to review and will brief you on when we come with the final SCR.

CHAIRMAN CORRADINI: Good, thank you.

MR. HERNANDEZ: The staff also requested the applicant to provide a drop analysis on the liner, to demonstrate that it would retain, you know, its integrity. We feel that this is an important feature for us to look at, you know, based on the fact that the ESBWR doesn't provide a safety-related make-up and they rely on the water inventory for 72 hours. So that, GE has agreed to let us do an audit on their analysis, and so we are going to be coordinating with their staff.

MR. WALLIS: What is the liner made of?

MR. HERNANDEZ: Sir?

MR. WALLIS: What is the liner made of? What's the material of the liner?

MR. HERNANDEZ: It's stainless steel.

MR. WALLIS: Stainless steel.

MR. KRESS: This drop analysis assumes there's water in there?

MR. HERNANDEZ: Yes. And, we haven't seen the analysis yet, but yes.

MEMBER MAYNARD: And, what is the requirement for cooling, is it just keeping the core -- the fuel covered, or is there a minimum pipe above the fuel?

MR. HERNANDEZ: Usually for active plants, you have a ten-feet, you know, margin, you are supposed to keep at least 10 feet of water, at least that's for chilling purposes.

There's no -- I mean, since we used to boil the water in the pool, and there's not going to be access to the building during an accident, those are the functions that are done for the full 72-hour reactions are done outside of the fuel building. We would have to evaluate that when we see the analysis, and, you know, determine whether, you know, the minimum level of water that they have in their analysis is adequate or not.

MEMBER STETKAR: I'll ask you the question, and maybe we'll get it this time.

There's a statement in the DCD that says, in the spent fuel pool, the bottoms of the pool gates are higher than the minimum water level required to provide adequate shielding and cooling. Do you know, what level is the bottom of those gates above the top of the active fuel? How many feet of water do we have?

MR. HERNANDEZ: I don't have the answer for that right now. If GE wants to address that --

MEMBER STETKAR: In other words, if the water level is there, and we start heating up from there, if we can get there somehow, then what type of margin do we have?

MS. CUBBAGE: I expect that would come in this topical report that we are expecting, and we'll be looking at thoroughly to make sure there's water.

MEMBER STETKAR: I hope you do look at the level that the bottom is.

MEMBER MAYNARD: And then also the ability to make up water after 72 hours, if that room is uninhabitable, you know, how is the make-up water, how is it going to be handled remotely to be able to get the water level back up for shielding and stuff?

MR. HERNANDEZ: We'll relay that.

MR. ARMIJO: You have an open item on the neutron absorbing monitoring program. Those are pretty standard materials they are specifying. What's the concern, is there a new concern, or new phenomenon, you are addressing, or is it a completeness issue?

MR. HERNANDEZ: For that particular item, I want to, you know, address that to Mr. Yamir Diaz-Castillo.

MR. DIAZ-CASTILLO: Yes, it's the completeness issue, and they didn't provide -- program that's needed to verify the material behavior for the panels in the spent fuel pool.

MR. ARMIJO: Okay, but there's no unusual materials or anything like that.

MR. DIAZ-CASTILLO: Well, we weren't clear in the application what kind of material they were going to use, whether it was going to be metamic or borate, so this is now going open issue right now, so we are still waiting for our response from GE.

MR. HERNANDEZ: All right, next slide.

For the fuel auxiliary pool cooling system, the main functions of the FAPCS are to provide safety-related passive cooling the heat-up and boil for 72 hours without make-up. It also provides non-safety-related active cooling to the other pools and the spent fuel pool. There's also some missing functions, the RTNSS functions in there, to provide low pressure cooling injection and spent fuel pool cooling, and there's also some other capabilities of the system to provide ultimate shutdown cooling and drywell spray, but they are not, you know, present in the safety analysis or in the PRA.

MR. WALLIS: Are they required to tell you what -- analyze what happens should the pool drain?

MR. HERNANDEZ: Yes, those are adverse interactions between, you know, the safety systems, and they have siphoning devices from, you know --

MR. WALLIS: Do you worry about catching fire and things like that if the pool drains? Is that part of --

MR. HERNANDEZ: I'm sorry?

MR. WALLIS: You drain the pool, does the fuel catch fire?

MR. HERNANDEZ: Well, yes, there's going to be heat up of the fuel, obviously.

MR. WALLIS: That's part of the safety evaluation, is it, in the event of a fuel pool draining?

MR. HERNANDEZ: Yes, it's part of the evaluation, and like I'm saying -- we'll get to that some day.

CHAIRMAN CORRADINI: And, the accident analysis.

MR. HERNANDEZ: And, the accident analysis, we'll get to that, that's going to be in Chapter -- the accident analysis will be discussed under Chapter 15.

MR. WALLIS: All those interesting --

CHAIRMAN CORRADINI: All those fun things.

MS. CUBBAGE: Chapter 19. We are looking to make sure that there's water in there.

CHAIRMAN CORRADINI: That's my fault.

MR. HERNANDEZ: So, in our evaluation, we requested the applicant to provide some additional information in several areas, in order for us to make, you know, a safety determination, and, you know, the following items, and I'll briefly mention them, have not been addressed.

You know, we want them to provide justification for not providing a safety-related atmospheric clean-up system in their design, and we are still waiting for an answer, a response from GE for that.

The staff also requested the applicant to provide analysis demonstrating, you know, adequate water inventory for both the spent fuel pool and the buffer pools, for 72 hours without make-up.

We also --

CHAIRMAN CORRADINI: Just a quick clarification there. So, the assumption by the staff is, is that there's the potentiality that you'd have spent fuel in the buffer pool existing during some sort of accident? That's what I'm trying to understand, the buffer pool.

MR. HERNANDEZ: Well, yes, that would be a scenario, during refueling we could have a seismic event.

CHAIRMAN CORRADINI: Okay, that's fine.

MR. HERNANDEZ: I mean, and we have in mind that also the spent fuel is going to be in the pool, so it concerns us much less, but, nevertheless, we asked the question.

CHAIRMAN CORRADINI: Right.

MR. HERNANDEZ: And, we also asked the basis for, they credit 200 gpms going as an emergency make-up flow for post-72 hour make-up to the upper pools and the spent fuel pool, so we asked them to provide, you know, an analysis demonstrating, you know, what the initial conditions are, and then what the requirements are.

And, we've asked them also to provide, you know, performance requirements for the cooling systems for the RTNSS functions for low pressure cooling injection and the suppression pool core, and, you know, we are still waiting. I believe the flow rate is 1,500 gpm for the cooling system, where we are asking, you know, how many gpms would you need for the actual functions in PRA.

And then, the last item that I'm going to discuss is level instrumentation elevation relative to the TAF, in other words, some, you know, where are the TAFs located relative to any of the alarms, relative to the TAF and the spent fuel.

With regards to Sections 9.1-4 and 9.1-5 under light and heavy load handling systems, I want to mention that many features for both, you know, the reactor building and the fuel -- cranes is that they have single-failure-proof cranes, also the cranes that are filling machines, and the incline fuel transfer systems are designed to withstand an SSE, and the applicant is committing to NUREGs 0554 and 0612, and all the applicable standards in that area.

We also want to point out that -- and it was mentioned during GE's presentation, that the incline fuel transfer system is not new to the staff, I mean, we've seen it in BWR-6, so we didn't feel that it's really an area that's radical, it's not a first-of-kind design. They do have, you know, like I mentioned, seismic qualifications for those systems that are needed, those components and systems that are needed for retaining the loads, you know, they have interlocks also as well to prevent, you know, opening of the cranes, of the gates, escape valves, or the valves that would allow, you know, a drainage from the upper pool the lower pool.

Also, you know, the transfer of the fuel, I mean, the part on the upper pools and the lower pool, and the spent fuel pool, where the fuels are going to be transferred, are separate from the rest of the pool, so there's not a potential to drain either -- in this case it would be the upper pools that would not be able to drain.

MR. BARSE: Can I ask a question, because I guess I hadn't heard that phrase before, I'll admit my naivete.

What parts of the crane system are involved when you say single-failure-proof cranes?

MR. HERNANDEZ: What parts of the --

MR. BARSE: I mean, they don't have doubled up cables, do they have doubled up foots, is it clutches, is it the electronics, what part of it is single-failure-proof?

MR. HERNANDEZ: Yes, they need to have dual-revving systems.

MR. BARSE: Okay.

MR. HERNANDEZ: Emergency brakes, redundancy in the emergency brakes as well, also -- well, those are the main things.

MR. BARSE: Okay, thanks.

MR. ARMIJO: The incline fuel transfer system is unique, in that its outside containment, compared to the BWR-6.

MR. HERNANDEZ: Yes, GE mentioned that.

MR. ARMIJO: Right. Is there any unusual issues that the staff has looked at, as a result of it being outside containment?

MR. HERNANDEZ: Well, that particular -- there's an open item on -- right now, that we've asked, you know, GE to better explain the details of the system, and that particular, you know, item, you know, being outside the containment, that's not -- the staff was not aware of that up until today, so we would have to look at GE's response on those items, and then we'll --

MEMBER MAYNARD: Wasn't the radiation protection an open item, was it with the incline fuel transfer?

MS. CUBBAGE: Right. Charlie Hinson, our Radiation Protection Engineer is here, and this would be his questions, but I understand them to be the shielding and assuring the access controls in areas when fuel is moving. I don't know if Charlie would like to elaborate.

MEMBER MAYNARD: I think that would be another unique item, not being in containment, radiation protection.

MR. HINSON: Yes, hi, I'm Charlie Hinson. Yes, we had some questions that are outstanding on having the applicant give us the spent fuel dose rates, when a fuel is being transferred in the tube, and the various accessible areas.

There are two areas that are interlocked to access the tube itself, and those are -- they have multiple interlocks and alarms and radiation monitors, but we were also concerned about, are there access paths, and we asked the applicant to provide us the shield wall thicknesses around this fuel transfer tube during transfer of a fuel assembly.

And so, they gave us -- they responded to the RAI and gave us some of the dose rates, which were all very low dose rates, but we had two areas that we still wanted some more information about from the applicant, so we have an outstanding issue on dose rates during fuel transfer operations. That's, essentially, what that was about.

MR. ARMIJO: Is this system capable of transferring stale fuel or damaged fuel from that buffer down through -- has that been -- how is that treated?

MR. HERNANDEZ: I know that they have, I mean, they have two inserts for the system, one is for fuels and the other one is for auxiliary equipment. I'm not sure, and I would like GE to, you know, answer that part. We've not asked the question.

MR. TUCKER: This is Larry Tucker with GEH.

Our operating fleet at BWRs, and also the ESBWRs for failed fuels, there are canisters that you place the bundle in, and top it off to control the concerns that you are asking about. An incline fuel transfer tube can accommodate the canister with a bundle in it.

MR. ARMIJO: Okay.

MEMBER ABDEL-KHALIK: From a structural integrity standpoint, what is this transfer tube supposed to handle, from the maximum loading?

MR. HERNANDEZ: That particular part of the analysis would be done by the structural engineering part, I don't --

MEMBER MAYNARD: About assemblies, or are you talking about weight? There's two assemblies, I thought. I think they said two assemblies.

CHAIRMAN CORRADINI: Is that correct?

MR. TUCKER: That's correct.

MEMBER STETKAR: Does the inclined fuel transfer tube have its own cooling system?

MR. HERNANDEZ: It has a valve for filling, it has a filling valve, to make sure that -- but I'm not sure, I don't think that there's a cooling system for that. There's only two fuel assemblies.

MR. WALLIS: Two at a time, so off loading a core takes a long time?

MR. HERNANDEZ: No, no, no, they have a buffer pool.

CHAIRMAN CORRADINI: The transfer takes a while, the off loading to the buffer pool holds --

MR. WALLIS: About 60 percent of the core.

MEMBER STETKAR: If they have to off load the whole core, they need to use this thing.

MEMBER MAYNARD: Well, talking about the cooling in here, though, has analysis been done, what if the power is lost, AC power is not safety related, so if you lose power what's the cooling capability in this tube with the fuel assembly inside, or two fuel assemblies?

MR. HERNANDEZ: During refueling, so you are talking about a scenario during your fueling operation.

MEMBER MAYNARD: During refueling operation you lose power.

CHAIRMAN CORRADINI: I think he's saying during transfer.

MR. HERNANDEZ: Right, which would be under the fueling scenario, they -- well, I don't -- we have not asked for analysis on that. There is water on the upper pools and on the spent fuel pool to --

MEMBER MAYNARD: But, they are not open.

MR. HERNANDEZ: They are not open.

MR. WALLIS: So, it could get stuck halfway and just keep heating up?

MEMBER SIEBER: Yes.

MS. CUBBAGE: I think --

CHAIRMAN CORRADINI: Can I ask GE to help out and --

MR. HERNANDEZ: We'll take note of that.

MR. TUCKER: This is Larry Tucker with

GEH.

Incline fuel transfer is designed for two bundles at a time, assumed to be irradiated, and to withstand a safe shutdown earthquake with those two bundles inside the transfer tube.

The tube itself, in terms of cooling, is a very large tube, with lots of water, and if the bundles get stuck mid transit, on a rare event that has actually happened at a BWR-6, it shows that there's more than adequate cooling capacity from the volume of water of the tube and the heat radiated through the metal tube to the environment.

MR. ARMIJO: So, you'd count on passive cooling then, is that --

MR. TUCKER: Yes, sir, there's no need for active cooling of that, because as it warms up it radiates heat through the tube.

MR. BARSE: That's based on experience, not analysis, right?

CHAIRMAN CORRADINI: I think that's what he said.

MR. TUCKER: Yes to the first, and confirmed by the second.

MR. BARSE: Thank you.

CHAIRMAN CORRADINI: Let's move on. You

have 25 minutes, so I'm counting on you to --

MR. HERNANDEZ: Briefly, okay, the last open item we have is we asked them to provide the seismic specification of the new fuel -- I mean, they've provide the information for all of the other -- maybe there was some oversight or something, but, you know, we asked them to, just for completeness, to know what the seismic classification is.

CHAIRMAN CORRADINI: Okay, thank you.

MR. HERNANDEZ: And then, there's also COL action items to provide the heavy load listings, the fuel handling procedures, maintenance manuals, safe load paths, QA -- and everything that's, you know, within the scope of NUREG 0612 for the applicant, and with that I'll turn it back.

MS. CUBBAGE: All right, we need to switch out teams here. I forgot to introduce Chang Li earlier, he's our Senior Reviewer in the Balance of Plant, and he's going to talk about the water system.

CHAIRMAN CORRADINI: Okay.

MR. LI: My name is Chang Li with Balance of Plant Branch at NRO.

I review area covers of the water systems. Our review is based on standard review plan section 9.2.1 through 9.2.6, because ESBWR is a passive design, so all the water systems and non-safety-related systems, except the containment isolation, the review is different from active design, which has portions of the water system being safety related.

For the passive design, the standard review criteria that apply only to safety-related portion of the system are not applicable to the ESBWR.

Our initial RAIs, many focus on the level of details, which is like such as drawings, applicable portions of GDC instruments, mitigation for water hammers. And, one area we'll talk in the RAIs we're asking questions about identification of which systems are RTNSS systems, which -- they've responded back, and now they have determined that service water systems, reactor component cooling water systems and portions of chill water systems being the RTNSS systems.

And, when they say RTNSS systems, we are asking they be included in the ITAAC.

The remaining open items, we have questions about the details of drawings, we are working with GE in resolution to this question.

And, the questions about radiation monitoring for the service water systems, we have some response in RAI response, and also we asked questions about the procedures for avoiding water hammers in those RTNSS systems, and we still have --

MR. WALLIS: Do you worry about water hammer in the fire control system?

MR. LI: The water hammer systems that we are asking about are RTNSS systems for performing post-72 hours RTNSS functions.

MR. WALLIS: You are also looking at fire water and possible water hammer in fire water systems?

MS. CUBBAGE: From a fire protection standpoint, or from a RTNSS pool make-up? Which factor? Or, just in general.

MR. WALLIS: When you get to -- probably it's another section, is it?

MR. LI: Yes, yes.

MR. WALLIS: I just want to be sure that you also look at water hammer possibility in the fire protection system.

MR. LI: Yes.

MR. UPTON: This is Hugh Upton with GEH.

Let me address the fire protection system. It's kept solid, except for some of the small spargers, so there isn't -- there's really no potential for water hammer in the fire protection system, by design.

MR. LI: And, we have remaining RAIs not responded about the make-up water systems, whether it's a RTNSS system or not.

MEMBER STETKAR: Let me take -- ask it now, since this is the first place. But, how are you tracking the changes. Because, obviously, a lot of these are auxiliary systems, are evolving quite rapidly.

MS. CUBBAGE: Changes from our safety evaluation?

MEMBER STETKAR: Yes, for example, the turbine component cooling water system, in Rev 3 and Rev 4 of the DCD, is different from the description of that system in the SER.

MS. CUBBAGE: Well, I'll be honest with you, it's a challenge.

MEMBER STETKAR: Instrument air, service air, hot water, have changed completely --

MS. CUBBAGE: Right.

MEMBER STETKAR: -- between Rev 3 and Rev 4, but I understand Rev 3 versus Rev 4, because this SER is based on Rev 3. But, I found some discrepancies between the SER descriptions and even Rev 3 of the DCD, meaning --

MS. CUBBAGE: Right, and we --

MEMBER STETKAR: -- indicating that you hadn't really followed up on that.

MS. CUBBAGE: -- we've identified in a couple of areas, as a matter of fact, when we sent the safety evaluation to GE, they have identified a couple of areas where we did have a little disconnect there. The scenario with the final SER, we are not going to do a wholesale upgrade of our SER to address Rev 4, because we know we are going to get a Rev 5, so it's a little bit of a moving target, and we're doing our best there.

But, on Rev 4, we have an RAI milestone coming up, where we are going to ask GE any questions related to Rev 4, and we are going to go back and verify the DCD, that it matches the SER before we issue a final SER and certify the design.

MEMBER STETKAR: Okay.

MS. CUBBAGE: And, a number of -- and the reason you are seeing these discrepancies I think, in a couple of limited areas, is many of -- we got in a situation where some of the SER inputs were done a long time ago, and then others were taking longer, and so when we tried to sync up with Rev 3 it was a case of trying to make sure everything was upgraded.

MEMBER STETKAR: It's just a little bit

difficult for us, as you can imagine, I know it's really difficult for you, but for us, in terms of we are looking at something that is in turn looking at a moving target --

MS. CUBBAGE: Right, well, we feel that the early interaction is beneficial for you, and for us, and for GE.

MEMBER STETKAR: Oh, yes.

MS. CUBBAGE: So, hopefully, we can -- the inconvenience.

MR. BARSE: Can I follow up with one more on that, because I've been a bit worried about it, too, and I know you said you are going through it page by page, but somehow when that final design comes out, as you go through, it seems to me, and you must have thought about this, you need to go back over the RAIs that have cleared and make sure they are still relevant. Is there a process for that?

MS. CUBBAGE: We are actually facing that as we speak, and, you know, I think the first responsibility is with GEH, because they've responded to an RAI in a manner that now they've changed, and we said it was resolved, it's incumbent upon them to identify to us that they need to update that RAI response, that their response is no longer valid.

And also, to facilitate the staff's review of Rev 4, they did provide us an aid that is a red-line strikeout between Rev 3 and Rev 4.

CHAIRMAN CORRADINI: The changed list that I see.

MS. CUBBAGE: There's a changed list, but in addition there's a courtesy copy they gave us --

CHAIRMAN CORRADINI: Oh, I see.

MS. CUBBAGE: -- a red-line strikeout type.

CHAIRMAN CORRADINI: In the DCD -- I'm sorry, I didn't mean to interrupt you.

MS. CUBBAGE: That's okay.

CHAIRMAN CORRADINI: In the DCD, there are places where if you compare between 3 and 4 there's a change marked.

MS. CUBBAGE: The change bar, but in some cases we found that if they replaced a whole paragraph the change bar and the change list weren't really adequate.

CHAIRMAN CORRADINI: Okay.

MS. CUBBAGE: So, we've asked for Rev 4, and going forward, that we get a little more help on that.

CHAIRMAN CORRADINI: Okay, thanks.

MS. CUBBAGE: With this tool.

MEMBER ABDEL-KHALIK: Does GE have in place a mechanism to track how changes affect earlier responses to earlier RAIs?

MR. KINSEY: Yes, this is Jim Kinsey from GE Hitachi. In addition to the change list tracking system, which addresses changes between revisions for, you know, Revision 3 to 4, for instance in this case, we also have an internal configuration control mechanism that's actually an electronic annotation system. So, we put tags or flags on text within the document, so if, for instance, when we are developing Rev 5 we'll go back and touch a paragraph on a page in the DCD, we can see the annotations and see the history related to previous revisions. So, we can take a look at previous responses and identify if there were any impacts or any issues to identify or address with the NRC.

MEMBER ABDEL-KHALIK: But, the new changes may not have had any relation to prior responses to RAIs. So, tracking in this way may not capture that.

MR. KINSEY: I'm not -- and this is Jim Kinsey again -- I'm not sure if I understand the specific question or concern.

What we are doing is, I guess two things.

We are evaluating changes that we make against the -- I guess I'll call it the history of that portion of the DCD through our annotation process, and then in addition to that, if we find that there was no impact to anything in the past, we also clearly identify the additional change that we are making to NRC, to assess whether they have any new or different questions or concerns going forward.

So, we try to look both directions, or identify it in two different ways.

MS. CUBBAGE: I mean, I can give you a real-life example. They started off this design with a bottled air system, the EBAS, for controlling the habitability. We had a number of RAIs in that area, and so between the staff and GE we had to assess whether those RAIs were completely irrelevant with the new system, or partially relevant, we've had to do that.

MR. TUCKER: This is Larry Tucker with GEH.

Following up on Amy's example, the ESBWR design, we've implemented configuration control of that. For the EBAS change out we determined that as a design change for the ESBWR, and we filled out an engineering change authorization form, which describes the change, it has a checklist of, it inquires about the affected analysis, drawings, commitments to the NRC, positions on reg guides, or any other kinds of correspondence, including RAIs, as you go through that change.

That change is brought forward to our senior management, and either approved or rejected at that time. So, we share with Amy and you the challenge of making sure that we keep all our analysis and design in lock step with what was presented in the DCD, and that's why even at this early stage we are putting in appropriate engineering configuration management controls to the design.

MS. CUBBAGE: And then just one more point on that, and then we'll move on, is that where DCD is applied we do not expect the type of changes we've seen in previous DCD regs, and they are all related to resolution of open items, and working with the staff going forward on that.

MR. SHUABHI: Let me just add, this is Muhammed Shuabhi with the staff. It's also, when we get revisions to the DCD, we do go through the revisions of the DCD, the new revisions, and make sure that we still agree that the DCD is accurate, or we ask new questions in RAIs and things.

So, while initially the responsibility is with GE, and they've got the primary responsibility to identify to us those changes, we also go through the DCD to make sure that our concerns are still addressed, and that the newest DCD rev and the final DCD rev are consistent with what we are reviewing.

MR. LI: Okay, I have the last item. COL action items, I have two bullets. The first one, COL applicant would develop provisions to preclude long-term corrosions and a fire in the service water systems, procedures for avoiding water hammer in CWS, RCCWS corrosions.

The second bullet, COL applicant will provide the design of station water system, that's, actually, I was going to address testing change in Revision 4, and, actually, there are other five COL interface items that are identified in my SER, which was in Revision 3 in Tier 1, but now it's mostly -- and we are reviewing it, we may have new RAIs associated with those changes.

MS. CUBBAGE: Okay, I think I need to bring up another reviewer I forgot to introduce.

This is David Shum.

CHAIRMAN CORRADINI: We'll do a time check.

MS. CUBBAGE: Yes.

CHAIRMAN CORRADINI: So, what do you think? Are we close to being -- should we --

MS. CUBBAGE: Do you want to take a quick break?

CHAIRMAN CORRADINI: No, I'd rather not. What I'd like to do is see if we can get through this, can we get through this by quarter of, do you think?

MR. SHUM: Me?

MS. CUBBAGE: No, everybody. We can recognize going in with this agenda that 9 might go over, and we could make up time on other chapters, but we'll move as quickly as we can.

Go ahead, David.

MR. SHUM: Good morning, my name is David Shum. I'm from the Balance of Plant System Branch, and I'm the Reviewer for this sections, compressed air, which contains instrumentation air, service air and high-pressure nitrogen supply system. I also reviewed the auxiliary boiler system, and floor drain systems.

All these systems are non-safety systems, and have no safety functions, other than the penetration and isolation function for this high-pressure nitrogen supply system and floor drain system.

Since this is non-safety and non-maintenance systems, so there's no open issues, except -- except one for -- one open issue for the auxiliary boiler systems, which GE had not addressed the fail of the systems would affect any other safety systems.

Any question on these systems?

MR. BARSE: Yes, the same one I raised with GE. Historically, even though this is -- historically, contaminants in instrument air systems have led to all sorts of funny operability things, opening or closing when they are not expected, things not relieving when they are supposed to, there is an interface from the service air system over to where the nitrogen system comes in on the fuel valves we did hear about.

Have you looked at the possibility of dryers and filters being bypassed and getting contamination into the system, and have you worried about that at all?

MR. SHUM: First of all, the instrumentation air to get the supply, to get air from the service air systems, service air systems itself has three compressors, a little vent for the filters, dryers, and then supplies the air to the instrumentation air system.

And, the instrumentation air itself has filters. I mean, each train has its own filters, and dryers, before it supplies air to --

MR. BARSE: I guess I didn't say it just right.

In older systems, those same kind of designs have had bypasses.

MR. SHUM: I heard that.

MR. BARSE: Okay. That's what I'm worried about.

MR. SHUM: By looking at that diagram, I didn't see there's any bypass at all.

MR. BARSE: Did you ask about it?

MR. SHUM: No, because it's not --

MR. BARSE: Well, we'll ask.

MR. SHUM: -- because it is not safety systems, and also, also, my main focus was on whether it failed, the system on any safety -- any other safety system or not, which I didn't see there was any problem at all.

MR. BARSE: Thank you.

MR. RADLINSKI: Can I respond to that, too?

Bob Radlinski, I'm in the Fire Protection

Branch, and other systems as well.

Generally, a bypass is only used in an emergency or a back-up situation, where filters need to be placed.

MR. BARSE: There's a whole history that shows that generally isn't all the time.

MR. RADLINSKI: Okay. That's the design intent.

MR. BARSE: Yes.

MR. RADLINSKI: Obviously, long-term effects of moisture are detrimental, but if you were to operate in a bypass situation, and you expected to get moisture in the system, you would go around and blow down the system and remove the moisture.

MR. BARSE: It's a hard job.

MR. RADLINSKI: Right.

MEMBER STETKAR: Let me ask a related question, and I don't know if we have the right people here.

Containment isolation valves, pneumatically operated containment isolation valves on the ESBWR, are they normally energized solenoids, or are they normally de-energized? Does anyone -- it might be different -- okay, if you don't have it, that's fine.

CHAIRMAN CORRADINI: Let's go on. John will write that one down.

MEMBER STETKAR: Write it down.

CHAIRMAN CORRADINI: He has a big list.

MR. SHUM: So, next slide is -- I'm also the reviewer for the system for the diesel generator systems. The systems, the diesel generator itself is not our branch, we only review the diesel generator supporting systems.

And, since this diesel generators are not safety systems, so the only things we are focusing on whether it fail, this system will affect any other safety system or not. And, we found that in the very beginning we find that, we find out that they need to use their system as, you know, to supply power to the monitors systems and also some of the cooling systems, problems.

MS. CUBBAGE: Post-72 hours.

MR. SHUM: Post-72 hours. So, because of that capacity to make this a RTNSS system, so they did.

However, they have not put this into the -- they have not had ITAACs for all of the systems, so this is an open issue.

MS. CUBBAGE: That was an open issue in

Rev 3, I believe that's been addressed in DCD Rev 4.

MR. SHUM: Right. I looked --

CHAIRMAN CORRADINI: Yet to be looked at.

MS. CUBBAGE: Yet to be looked at.

MR. SHUM: I glanced it, I found out they only list about two of them.

MS. CUBBAGE: Okay, still open.

MR. SHUM: Still open, every one, every single one.

CHAIRMAN CORRADINI: Okay. Questions?

MEMBER STETKAR: So, on control power, DC control power for starting the diesels, closing the diesel output breaker, controlling the load sequencing, if there is load sequencing, or a automatic or manual, doesn't make any difference, is that supplied from the non-safety batteries?

MS. CUBBAGE: Yes, that's beyond your area, right?

MR. SHUM: Right, that's electrical.

MEMBER STETKAR: Okay. The only concern here is, let me bring it out on the table, non-safety batteries are rated for two hours. After two hours in a station blackout you don't have those batteries. It's difficult to start and load a diesel at 72 hours, if you can't start it and you can't load it.

Keep that in mind.

MEMBER MAYNARD: I agree with that, but there's no reason they would be waiting 72 hours to start that.

MEMBER STETKAR: That's okey, the design says they shall be available -- what, they should be available at 72 hours, to provide back-up.

We should go on.

MR. UPTON: Dr. Stetkar, we are checking on that right now, but I believe that there are a separate set of batteries within the diesel generators themselves.

MEMBER STETKAR: Not just the diesel generator, it's this closing the output breaker, closing the breakers on the PIP buses, controlling the diesel -- the diesel may start, it's getting the diesel loaded onto the bus and operating stably, and closing loads onto the bus.

MR. UPTON: I'll have to take that as an open item and get back to you.

MEMBER SIEBER: Part of the answer to that is just because it's non-safety doesn't mean it won't last more than two hours. You can buy a battery that will do anything.

MEMBER STETKAR: Except under a station

blackout, they are not guaranteed. They are designed to hold load for two hours, and that's it.

MR. SHUM: So, there still are some open issues. One is they don't have ITAAC for each of the supporting systems, and also there's a COL applicant to ensure the safety and reliability of these systems.

MS. CUBBAGE: Next.

MR. SHUM: Any questions?

CHAIRMAN CORRADINI: No, I think we can move on. Thank you.

MS. CUBBAGE: Thank you.

CHAIRMAN CORRADINI: Thank you very much.

MR. DIAZ-CASTILLO: My name is Yamir Diaz-Castillo, I'm with the -- Branch with NRO. I'm the Technical Reviewer for Sections 9.3.9, which is the hydrogen water chemistry system, 9.3.10, which is the oxygen injection system, and 9.3.11, which is the steam injection system.

Let me start by saying that none of these systems are safety related, and they have no safety functions.

I'll start with the hydrogen water chemistry system, which this is just hydrogen through the -- water system -- all the combination of -- This system is not part of the ESBWR design, however, the

ESBWR design includes the capability to connect this system.

The decision to implement the system relies on the COL applicant. If the system is implemented, it would follow the EPRI and BWR water hydrogen chemistry guidelines and also the guidelines for permanent diesel or hydrogen water installations.

MR. ARMIJO: For the record, I'd just like you to -- the wording on what the purpose of this system is, you have it to mitigate corrosion and recombination of dissolved oxidants. The real purpose of that system is to mitigate irradiation assisted stress corrosion cracking of core internals, many of those core internals, while not necessarily safety related, like shrouds, top guides, possibly even the steam dryers and the chimneys, all of these things, welded stainless steel components, are protected by virtue of hydrogen water chemistry, also by virtue of improved materials.

Improved materials by themselves will not prevent cracking, so hydrogen water chemistry is a proven effective way to prevent that cracking of components that somehow NRC gets involved with when things fail.

So, still I think again, I made the point before to GEH, that these kinds of systems should be standard to the boiling water reactor, and they do affect components that gets the NRC torqued up every time they fail.

So, something is -- either I'm missing something, or the staff is missing something, on not making these kinds of systems a requirement, as it certainly is important as an oxygen injection system, which is kind of -- which is not optional, it's built into the design, and this thing isn't.

So, I'll leave it at that for the staff to consider.

MS. GRUSS: This is Kim Gruss.

Yes, I think we understand the concern, and we'll take it back with us.

MEMBER SIEBER: You actually have to have a regulation that would require that. However, I'm not aware of any.

MR. ARMIJO: You don't for oxygen, you just put it in.

MS. CUBBAGE: They put it in.

MEMBER SIEBER: Well, maybe I'm just in a jaw bone, or I'm promoting regulation, I hate to have this become a safety-related system, in order to get it used. I mean, I feel like we are in Alice in

Wonderland, not implementing things that we know work to protect materials that we know are susceptible to cracking. I just don't understand --

MR. BARSE: Then they become safety concerns.

MR. ARMIJO: Yes, and then they become safety concerns. So, is the strategy to wait for something to crack and then put in these systems that we know worked before?

MS. CUBBAGE: We certainly understand your concern and your issue. We are going to move on.

MR. ARMIJO: Okay.

MR. WALLIS: Well, what we'd like to do is make it your concern as well, not just you understand that.

MS. GRUSS: I think, you know, IASCC is a concern to us, and from a materials integrity and performance perspective we look at those materials, and the environment in which they are in.

This is not a regulatory requirement, and one thing that we would have to do to make such is go through a rulemaking to change it. So, we are counting on not only GE selecting IASCC resistant materials, we are also counting on their welding controls to minimize incidents of crack initiators.

We are also relying on the quality of those materials and trained weld operators.

And so, the combination of those things alone provides us with the assurance that it will be minimized.

I agree with you that hydrogen water chemistry can significantly minimize the incidence of IASCC.

MR. ARMIJO: I think it's the most powerful tool to prevent IASCC, more powerful than the materials, more powerful than the welding, and it's strange to see that it's being treated as an option.

MEMBER SIEBER: Well, it's investment protection.

MR. ARMIJO: If it were just investment protection, when something cracks the NRC shouldn't be involved.

But never mind, I'll drop it at that.

CHAIRMAN CORRADINI: I think we need to move on, but I think you'll keep on hearing this, so we will just address it.

MR. WALLIS: Just one thing, the ISI program is what satisfies the safety requirement that you go out and find it. What you do about it, or how you caused it is a different question.

And, the same situation exists for PWRs too, you know, there's no regulation on water chemistry for them, and in PWRs, the older ones, went through lessons with generators over there.

MS. CUBBAGE: Okay, did you have any points on the last two, oxygen and zinc?

MR. DIAZ-CASTILLO: Well, the oxygen, you know, system, just oxygen to the condensate water system also to help with suppression of corrosion and corrosion product relief, and the COL applicant will provide a description of the oxygen for stability.

Next, we have the zinc injection system, which is also an optional system. It would inject into the condensate water system to help with the reduction of corrosion films and radiation fields.

This decision to implement these systems also relies on the COL applicant.

And, last but not least, currently there are no open items for any of these systems.

MR. PARKS: My name is Benjamin Parks. I'm with the Office of Nuclear Reactor Regulation, Reactor Systems Branch, and I'm assisting NRO with the review of the standby liquid control system.

The staff reviewed it using guidance in SRP Section 9.3-5, and we reviewed it against the requirements of 10 CFR 5062, which is the requirements for reduction of risk from anticipated transients without scram.

I guess most notably about the ESBWR standby liquid control system design is that it is an accumulator-driven, largely passive system, and it does have direct injection to the core bypass.

Particular to the standby liquid control system review, and that is not -- it's performance during an ATWS scenario, the open items include system performance related ITAAC. We observed in DCD Revision 3, not Revision 4, this review is based on Revision 3, that we had open items and we are interacting with GEH on what ITAAC would establish that the boron was being injected into the vessel acceptably.

And, the other open item we have was for leak detection and monitoring.

Now, by way update in Revision 4, I'm aware of significant improvements to the ITAAC and a lot of performance-related ITAAC have been added, that I have not yet had a chance to review. And, GE has also responded to our RAI on the detection and monitoring. They responded, I believe, on November 9th, and we are still responding and providing feedback to that RAI response.

MR. WALLIS: Are you concerned about injection of nitrogen into the system?

MR. PARKS: I am going to work from my memory, because this issue was raised about a year ago on the staff side. We were concerned about it.

I believe that in terms of the system's performance it would be more appropriate to discuss it during Chapter 15.

MR. WALLIS: All right.

MR. PARKS: I'm noting your concern, I will go back and look at our internal deliberations over it, and be able to provide you more at that time.

MR. WALLIS: Thank you.

MR. PARKS: I'm the ATWS reviewer, by the way, so it will be me.

MR. WALLIS: Okay.

CHAIRMAN CORRADINI: But, we are going to see you again.

MR. PARKS: If I can schedule a vacation.

MEMBER MAYNARD: I just saw one parameter on here that kind of got my attention. It's on the injection rate, and for the standby liquid control system. It says that the approximate average velocity for the first, basically, 20 feet of the injection is 100 feet per second.

MR. PARKS: That's out of Table 9.3-5.

MEMBER MAYNARD: And, it just seemed pretty high to me.

MR. PARKS: That's from the DCD or the staff's SE.

MEMBER MAYNARD: No, that's on the DCD, this is.

MR. PARKS: We are reviewing performance parameters, that is not the injection velocity we assumed in our analyses. I think it was 100 feet per second is correct, 30 meters per second. The injection nozzle is clean, and we are talking about a pretty significant pressure difference.

So, we believe that that, I guess, is a realistic injection rate. These are really tiny nozzles.

MEMBER MAYNARD: Yes, but that's a long distance, 4 meters. I'm sorry, cubic meters.

MR. PARKS: That's also, it assumes initial -- when it comes to the system performance, I don't think that our own analyses assume that flow rate for the entire transient. I think that when we do steady state calculations, we assume significantly less than that.

MR. KRESS: How big is the injection line itself, from the accumulator to the --

MR. PARKS: From the accumulator to the nozzle, I don't -- I believe that's the injection rate into the vessel, into the bypass.

MR. KRESS: Yes, well, how big is that line?

MR. PARKS: Off the top of my head, I can't remember.

Wayne?

MR. MARTINO: Wayne Martino.

I'm not exactly sure, but I think it's something like 30 meters, 100 feet distance.

MR. KRESS: And, I am still wanting the diameter.

MR. MARTINO: Oh, the diameter of the line?

MR. KRESS: Yes.

MR. KINSEY: Excuse me, this is Jim Kinsey from GE Hitachi. I pulled up the DCD and it's reflected as a 3-inch line, 80 millimeters.

MR. KRESS: Two-inch line?

MR. KINSEY: Three.

MR. KRESS: Three inch.

MEMBER MAYNARD: Also note in Rev 4, I think it's to biometric flow as opposed to --

MR. PARKS: Right, and I believe the performance requirements give a five-minute volume injection, and so we'll be reviewing that, which won't be that approximate average initial injection philosophy. It's really hard to assess.

MEMBER MAYNARD: I really don't think it needs anymore discussion.

MS. CUBBAGE: All right, we are going to swap out for Ed Forrest to come.

CHAIRMAN CORRADINI: So, excuse me, can we take a five-minute break?

Let's take five minutes.

(Whereupon, at 10:45 a.m., a recess until 10:54 p.m.)

CHAIRMAN CORRADINI: Okay. We're back in the saddle. Okay. Sir?

MR. FORREST: I assume I can be heard okay?

CHAIRMAN CORRADINI: You're doing great.

MR. FORREST: My name is Ed Forrest. I'm a technical reviewer in the HVAC systems. I brought up to the table with me Syed Haider. He's relatively new to the agency, but he's made some significant contributions. And I thought I might need a bodyguard.

In any case, I'm glad to see I'm not the oldest guy in the room.

CHAIRMAN CORRADINI: Not a chance. We don't go to that point.

MR. FORREST: Yes. There are really just four basic issues I want to talk about two today. Two of them effect the control room and control room habitability. One of them is your favorite topic on the reactor building. And then it's all the other systems in general information.

I think John's question was great: How does the air get out? We've been wondering. And its effects.

What we look at was the adequacy of the emergency filter unit system itself. And it turns out that they changed from an air bottle system between Rev. 2 of the DCD to the emergency filter unit system in Rev. 3. And they used to size the air flow they used ASHRI 62 standard in 1980, 9 addition. I think they've even gone up to the 2000 or so edition in the Rev. 4.

And the staff looked at this standard and we pretty much concurred that the level of air flow was supported by the standard. But then when we got to looking at the standard, we realized that the standard was designed on a well ventilated system in which the outside air entered the recirculation, the section of the recirculation air handler and was distributed throughout the volume. And that there was an exit point or an outside air out take from the standard.

So we begin to wonder what the impact of not having the recirculation portion of the system available, the recirculation AHU. And in fact and under emergency conditions, the recirculation AHU is shut down.

So we thought we started looking at it, and we realized that the 424 cfm that's coming from the outside is unconditioned air, could be 117 degrees,could be 40 degree minus, negative, coming into the control room. And that this air comes into the recirculation plenum, the suction plenum for the recirculation fan. And there's no recirculation fan going. So this plenum, in effect, becomes the distribution plenum for the EFU flow throughout the control room.

The plenum was sized for 11,000 cfm recirculation. We're putting in 424 cfm. Maybe only the first few registers see the flow, other effects can take place. A high temperature input may stratify up in the recirculation plenum. May not get distributed very well. Cold temperatures might really come through a lot faster. There's effect we don't know.

The concern we have is does the fresh air get to the operator's face. Does the carbon dioxide that the operator and the bio-effluents to the operator is breathing out get cleared out, go out the room. And we've asked GE to address this. And we're hoping and anticipating that they'll also tell us how the air gets out. Because there's no defined flow path through the control room at this time. The basic perception was they counting on seals in the doors as a leak-through type thing. We think that if those seals are leaking at 424 cfm then we have another problem that would have to be pursued. I don't think they'll the tracer gas.

But in any case, we are interested in John's question, you know, how does the air get out and how pressure is controlled in that room also. Because we don't want to get a situation where the fan backs up because pressure is building up in the room. And then we don't get the air supply that we need. We don't want to get a situation where the pressure builds up in a room and we can't open the door. So we'd like to have more information on that.

Carbon dioxide levels, there is a point

somewhere where if carbon dioxide levels reach that point, and it's not just carbon dioxide, it's bio-effluents, operator performance can be degraded, can cause confusion, can cause other issues.

We want GE to address the carbon dioxide buildup issue and give us the benefit of their thoughts on this. We think if there's no distribution in mixing within the control room, the levels could be much higher and maybe approach some level where it was uncomfortable or counter-productive for the operators.

DR. WALLIS: At 424 cubic feet per minute this is still a problem?

MR. FORREST: It's 434 cubic feet per minute of air coming through the EFU unit. Is that your question?

DR. WALLIS: I just can't imagine that carbon dioxide buildup would be a problem.

MEMBER STETKAR: No. That's what the design to supply.

MR. FORREST: I think the question is where does the problem occur. The chances of it exceeding something like an OSHA limit, which might be up at 5,000 parts per million, that might be small. It's the chances of it exceeding what ASHRI 62 calls a comfort limit, which is down around 1,000 ppm per minute. That could be much higher. It's a question of it needs to be looked at and addressed by GE.

DR. WALLIS: Okay.

MR. FORREST: The second issue is the favorite control room habitability issue, the passive heat sink. We have a number of concerns about the use of the passive heat sink. Although the control room is below grade, there are passageways all around the walls of the control room of the control room habitability area. So there's conditioned space, and I think there's also conditioned space below the control room habitability area. And that sets the outside temperature of the concrete walls of the heat sink.

The inside walls are taken to be at 78 degree, the maximum design temperature of the control room.

There's a question about area of heat transfer. If you have a false ceiling plenum above, this becomes a barrier to heat transfer and prevents or retards heat flowing through the ceiling.

If you have a supply plenum on the floor, which is the current design, then that too is also a barrier to heat transfer leaving thing.

If an operator hangs a poster on the wall, a set of drawings or maps, these become barriers.

So there's a question of what really constitutes the massive concrete and what its temperatures are on both sides that would be used for the removal of heat in a heat sink.

There's also a question of heat loads. The 7300 watts that was mentioned earlier is taken to be the electrical equipment and lighting type loads. It does not consider the loads coming in through HVAC system, 424 cfm at 117 degrees, 80 percent relative humidity -- not relative humidity. Eighty percent wet bulb coincident, it's about 20 percent relative humidity is the design number which was currently, I believe, in DCD 4. That has a substantial heat content.

But if you also look at their 88 degree wet bulb temperature, which they look at, which could be 100 relative humidity, the heat content is much higher.

If it comes in at 88 degrees, it's going to start condensing on the concrete walls. It's going to effect the heat transfer.

So we're concerned about getting a clear analysis of how the heat content of the air coming into the room is being accounted for n the heat removal.

We also have the concern about cold temperature. Because if you've got minus 40 degree air coming in to that control room at 424 cfm, the parkas will be broken out very early and people will be in gloves. And there is no real source of heat, and particularly if you're counting on 7300 watts.

So GE has stated to us at least in a phone call that they are going to re-evaluate both ends of the thing in terms of temperature.

You have personnel heat loads.

We believe that a comprehensive heat transfer analyses must be performed, and probably should be summarized within the DCD in a tabular type form maybe of what the assumptions were and what the conclusions reached by the analyses is. And the analyses should certainly be made available to us.

So we're concerned about the temperature versus time in terms of the heat up of the room. The heat of the room off of equipment and off of the HVAC might be much faster than the concrete can absorb the heat. Even though the concrete may have the capacity, it's just the rate of heat transfer is much slower in the concrete than it would be from convective into air.

So we're interested in GE giving us a kind of a perception of temperature versus time for the first 72 hours.

MEMBER ABDEL-KHALIK: Now we were told that a detailed analyses has already been done. So that analyses was not made available to you to review?

CHAIRMAN CORRADINI: I want to turn to GE about that. I thought you said you committed to a GOTHIC analysis. But is one already done?

MR. UPTON: There was at GE.

MR. MARTINO: There is a detailed analysis of the control room habitability area heat up that has been completed. And when we get questions from the staff we respond based on that analysis.

CHAIRMAN CORRADINI: It's part of the EQ-- okay. I'm sorry.

MR. MARTINO: We plan to do a more detailed analysis as part of the EQ post-certification work.

MR. UPTON: One more comment. The initial analysis that we did on control room heat up, it was using a staff approved code. I think it's called the Habitability -- CONTAIN. The CONTAIN code. So it was based on those results that the DCD was written. And we have committed to do detailed analysis in the future as we get our heat loads.

MR. FORREST: One of the other considerations is margins and any heat transfer assessment of this nature. There's enough uncertainty that's substantial margins should be in place to cover these uncertainties, particularly since in the real life if it happened, you just can't throw up doors. There's not much you can do. So we believe that margins should be identified.

GE has said they're using a 15 percent margin on heat loads. We believe that's the 7300 watt number plus maybe the personnel heat loads. But it's not really taking on what might be the major heat load, the HVAC system input into the room.

Surveillance requirements. If you're really concerned about the control room concrete structures being available to absorb heat, you've to assure that it falls within the temperature ranges that you used within your analysis. And this would require surveillances on both surfaces of the heat transfer, and not at 2:00 a.m. in the morning when it's nice and cool, but at reasonable representative times so that you know that you're maintaining your conditions.

MEMBER ABDEL-KHALIK: The entire control

room is below grade, is that correct?

MR. FORREST: The entire control is below grade. I think the ceiling of the control room is just about grade level.

MEMBER ABDEL-KHALIK: Now the outer surface of the walls of the control room is that in direct contact with the outside world?

MR. FORREST: No, no. The outer surfaces of the control room habitability area are located within the control building structure. And there's passage ways and equipment rooms, I believe, below. And these are conditioned areas of the control building which lose their conditioning upon a design bases accidents. So as these rooms heat up, you could get a situation where the temperature on the outside wall of the concrete was higher than the inside wall of the concrete. And it would be a heat source instead of a heat sink.

MEMBER ABDEL-KHALIK: Right.

MR. FORREST: And that is a concern that the staff has. And that is why surveillance needs to--

MEMBER ARMIJO: But were these kinds of issues addressed in your CONTAIN analyses, you know, adjacent rooms and equipment and heating up? Was it that level of detail?

MR. UPTON: It was the configuration of the control building that we currently have, yes.

This is Hugh Upton, by the way, with GEH.

I want to make one correction here. It is true that the control room envelop has corridors so it is not in direct contact with exterior building walls. However, there is one wall that is in direct contact with that within the control room habitability envelop. But the configuration that we currently have in the GAs is the one that was analyzed by the CONTAIN code.

CHAIRMAN CORRADINI: Let's move on.

MR. FORREST: Okay. I want to move on to the next one. I know we're all interested in the reactor building and the reactor building HVAC system.

The reactor building HVAC system isolates upon the initiation of an accident, LOCA with a loop shutdown. There is no HVAC system going at this particular down.

The reason they do that is stated in their DCD is they want to control the release of radioactivity to the environment. But quite frankly, there's no controls on the release of radioactivity in the environment. Unlike conventional plants, the ESBWR does not treat its reactor building as a containment. There's no standby gas treatment system safety related that draws it down. There's no filtering of the air that would be released by a standby gas treatment system. There is no monitoring of any of the releases leaving the reactor building.

Now they do have a contaminated air ventilation system which does have filters, which could operate at around 10,000 cfm, which is a fairly substantial rate. But this system is shutdown upon accident and not credited for accident mitigation whatsoever.

So with air in the reactor building containing possibly some degree of primary containment leakage to L_A, this is free to leak out of the rector building through any crack, crevice. There is no real driving force for it other than meteorological conditions on the outside which can create some differential pressures. But still, there is nothing to contain it.

In order to meet the requirements of a design bases analysis, some reduction in the potential source would have to be made. And GE has assumed that there would be a 40 percent mixing of the primary containment leakage L_A with the reactor building air prior to its exit from the building. The basis for this mixing is not clear. We've asked some questions to get a better handle on it.

Typical staff perception is to credit for mixing is not granted unless there's a mechanical or physical means that promotes it or some clear analytical basis for doing it. Forty percent mixing is a fairly high degree of mixing.

As far as releases, the design bases release for this building is 50 percent of the air by mass per day. Around 733 cfm is my calculation. An awful lot will not leak at that rate. But with a high design bases leakage like that, it doesn't require much maintenance on seals or maintaining tightness of the building. And this is one area that we've asked them --

DR. WALLIS: This is a release at what wind velocity outside?

CHAIRMAN CORRADINI: This is not containment now. This is the building outside of containment.

DR. WALLIS: I know that. I heard that. But I mean if it's a leaky building and there's a wind blowing, then the end blows through the building.

MR. FORREST: That's correct. And

whatever is drawn out, comes in from some other side. So there's air exchange. We don't have a number for leakage under the worst wind condition of any particular area or any assumptions from GE as to what that wind condition would be.

What we have is a design bases saying it will be no greater than 50 percent of the air per day on a mass basis.

So we've asked how they intend to demonstrate it. And they have through an RAI how they intend to test it. In a conventional system we would draw it down and hold it at a negative pressure for a period of time and show that the pressure can be maintained at some desired flow rate.

Here it appears they're looking at some type of pressure test from the outside. And using the parameters on the fan curve, certified fan curve to assess the pressure in the building. And we have some concerns and we will be addressing these with GE in further communications.

But those are the three major things. Oh, one other thing is because they do not consider the reactor building and containment, they have made the statement in the DCD that GDC-16 does not apply. GDC-16 is what gives you control over releases to the environment.

We think that GE needs to provide more information on how they intend to control releases to the environment. How they intend to monitor them, you know. And we would direct them to maybe consider such things as GDC-60 or GDC-64. Sixty has something about controlling the effuents to the environment, 64 is a monitoring type thing.

CHAIRMAN CORRADINI: This is just a clarification to make sure I understand. But there's nothing that requires them to have the containment building be a barrier.

MR. FORREST: Sure.

CHAIRMAN CORRADINI: Why would GD -- I've got all the numbers mixed up in my head. The first GDC you mentioned, it wouldn't apply, would it, since it's not the containment boundary?

MR. FORREST: It's an SRP guidance to use GDC-16. If GE chooses to go against an SRP guidance, they have to provide a means that is acceptable to the staff that provides an equivalent level of assurance that they're not creating a more difficult safety issue. And we're looking at that equivalent level of assurance. And we could certainly consider the GDCs as part of that.

CHAIRMAN CORRADINI: Okay. Thank you.

I just wanted to make sure that they're not being held to a different standard relevant to current operation BWRs for a containment building. That's all I guess I'm trying to ascertain.

MR. FORREST: No. I don't think they're being held to a different standard. I think they have to do the same thing a current vintage plant would do, is if they do not accept GDC in some fashion, they have to explain why, what they propose is adequate.

CHAIRMAN CORRADINI: Okay.

MR. FORREST: The last thing is just all the other system together, lumped together. And I believe it's Chapter 19 these are listed as RTNSS systems.

And we have concern about the equipment that are in these buildings that may have temperature problems with the -- during a post-accident type thing, may require cooling for both 72 hours and for post-72 hours. And we're looking for information from GE that will say here's the systems that have to work in order to maintain specific components. And that we then in turn will be in a position to review the temperature rise and adequacy of the HVAC within those systems. Right now we lack information.

Thank you very much.

CHAIRMAN CORRADINI: Thank you very much.

MS. CUBBAGE: This is the last topic, fire protection.

CHAIRMAN CORRADINI: Good.

MR. FORREST: I'm going to take my bodyguard with me.

MR. RADLINSKI: Good morning. My name is Bob Radlinski. I'm the fire protection team leader. And I was also the technical reviewer for the ESBWR DCD.

I've got five slides. The first three are just going to give a high level, a very high level summary of the ESBWR fire protection program, open items and COL action items. The last two slides are going to address Mr. Maynard's concerns that were forwarded to us.

Generally speaking the ESBWR design includes a deterministic fire protection program which meets the intent of the so called enhanced fire protection criteria that were put forth in several SECYs.

For those of you who are not familiar with the enhanced fire protection, one key feature of that is that in the analyses for post-fire safe shutdown you assume that everything in a particular fire area or any fire area is destroyed by the fire and also that there's no access into that fire area to take any mitigating actions.

The system also provides a backup function which is seismic category 1, but not safety related, to provide a source of makeup water following a design bases accident. And those aspects of the system are treated under the RTNSS program.

Like all new reactors and particularly the ESBWR there are a number of plant features that reduce --

MEMBER BLEY: I'm sorry. Can I ask a question.

MR. RADLINSKI: Sure.

MEMBER BLEY: When you assume that everything fails in that room do you assume it all fails at the same time or do you assume fails in the worst possible sequence, or something else? Or do you think about that?

MR. RADLINSKI: It would be the worst possible sequence.

MEMBER BLEY: Would it really?

MR. RADLINSKI: But -- well, there's still an open item with regards to spurious actuations

MEMBER BLEY: Okay.

MR. RADLINSKI: So that would probably fall out of that discussion.

MEMBER BLEY: Okay. Thanks.

MR. RADLINSKI: As I was saying, the new reactors those of you who have been in fire protection for existing reactors, you really have to change your way of thinking because it's a whole new ballgame for new reactors. The systems are designed from the ground up by committing to this enhanced fire protection criteria, for the part redundant divisions are being separated by three hour physical barriers. Not 20 feet of separation, but that's physical barriers wherever that's feasible. It's not feasible in containment. It's not feasible in the control room. But everywhere else in the plant in general we have three hour barrier protection between redundant divisions. For the ESBWR in particular you have an inerted containment during operation, which would not support a fire. You no longer reactor cooling pump. lube oil systems which were a significant hazard. You have minimal equipment for the passive system. Liberal use of fiberoptic cabling as opposed to copper conductors. And also digital control system.

All those together significantly reduce

the risk associated with fire in the new reactor plants.

A couple of exceptions that the ESBWR has taken, and this is in regards to the guidance that is provided in one Reg. Guide 1.189 have to do with the main control room complex, and also safety related computer rules where they've reduced the level of fire protection recommended in that guidance. And that's primarily based on, again, the reduced the fire hazard, reduced fire load, combustible loading in those areas.

And the second exception is that the diesel generators, which in this case are nonsafety related, are not designed to continue operating in the event of a suppression discharge over the diesels.

I'd also like to point out, too, that both the AP1000 DCD and the ABWR DCD took exactly the same exceptions to the guidance for the main control room. And they were accepted for both of those plants. So we will be accepting those for the ESBWR as well.

Any comments about performance based fire protection.

MEMBER SIEBER: A question about diesels. If the diesel is non-safety related the fire protection requirements should not be as severe as, for example, a diesel in a current plant. Is that correct?

MR. RADLINSKI: Correct. That's why we're accepting it. We have no problem accepting it.

MEMBER SIEBER: Okay. Thanks.

MR. RADLINSKI: Okay. Next slide. Just roughly going over the significant open items, significant is kind of a relative term. We don't consider them to be deal breakers. We have some differences with GEH that we're still negotiating with them with regards to certain specific COL action items that we feel should be identified.

With regard to the post-fire safe shutdown circuit analysis, which they have not done yet and they mentioned in the DCD that they are not able to do that analyses until they've completed the design of the DCD system.

And also we're not quite in agreement with what constitutes a final fire hazard analysis for the plant.

We've also asked for their approach for identifying and evaluating multiple spurious actuations. They've not identified any specific areas where there's a potential for that. But as many of you know who have been involved in existing plants, multiple spurious actuations during a fire situation isn't an open issue, ongoing issue. It's not been resolved yet for existing reactors. And we intend to follow whatever resolution they have for existing rectors for new reactors.

Yes.

MEMBER STETKAR: Did I hear you say they had not identified any locations where multiple spurious actuations are possible? Because it would seem like DCIS cabinet rooms are locations where they could be possible.

MR. RADLINSKI: The only mention of multiple spurious is that they said they took them into consideration in the analyses of the control room fire. Okay?

MEMBER STETKAR: Control room fire?

MR. RADLINSKI: Right. But there's no specific identification for this system in this fire area you could have these spurious actuations.

MEMBER STETKAR: Right.

MR. RADLINSKI: And this is how we address those. This is how we mitigate them. There's none of that.

MEMBER STETKAR: But in the RAIs did they come back and say there were no locations where multiple spurious actuations were possible?

MR. RADLINSKI: We're still waiting. We're waiting for a response.

MEMBER STETKAR: Okay. I guess I misinterpreted what you said.

MR. RADLINSKI: Okay. And kind of going along with that with the multiple spurious because typically if you have a multiple spurious, you have operator manual actions that you would use to mitigate that. We're looking to coming to some sort of agreement on how they identify operator manual actions and how they deal with the. And again, they haven't identified any in particular, although there is one that's sort of questionable.

CHAIRMAN CORRADINI: If that's the one for the 100 degree cool down, it's probably a separate topic. Is that the one you mentioned?

MR. RADLINSKI: I believe it is, yes. If they have to go to the remote shutdown panel, they say they may have to take operator manual action. I assume it's at the panel.

CHAIRMAN CORRADINI: This is probably a more generic issue and you're going to probably tell me it's in Chapter 15.

MEMBER STETKAR: It is. Go ahead.

CHAIRMAN CORRADINI: With that I'll be quiet. Go ahead, John.

MEMBER STETKAR: The question I had is that if operator mitigation is required or there's credit taken for it to control the cool down rate, and I don't care whether it's in the remote shutdown area or the main control room after a fire, then it would seem that actuation of the isolation condensers could give you a faster than 100 degree cool down rate under any kind of transient condition.

MS. CUBBAGE: Right. My understanding on that is that they have the capability and would like to do that, but we would not be required to do that for safety. But we are trying to get that clarified with GE.

MEMBER STETKAR: Well, the question is can the isolation condensers if all four of them are --

MS. CUBBAGE: Yes.

MEMBER STETKAR: -- actuated, give you faster -- hands off, give you faster than 100 degree per hour cool down rate?

MS. CUBBAGE: Yes. The answer to that is yes.

MEMBER STETKAR: They can?

MS. CUBBAGE: But I believe it would not

be an immediate safety issue. I believe the plant is designed to accommodate, I don't know how many times they can accommodate it. But GE could respond to that.

MEMBER STETKAR: Right.

MS. CUBBAGE: I think they're nodding yes.

MR. UPTON: This is Hugh Upton with GEH.

Yes, the RPV is designed for a certain number of thermal cycles in which we cool down with the ICs operating at their max capacity without operator intervention.

MEMBER STETKAR: But do you know what the cool down rate is for that?

MR. UPTON: I do not know what that is off the top of my head.

MEMBER STETKAR: Okay.

MR. RADLINSKI: And if the operator manual action is at the remote shutdown panel, then it is perfectly acceptable from a fire protection criteria standpoint. What we're concerned about is they have to go somewhere else in the plant to perform some other operation, than we want to know what the criteria will be for that.

The third slide, it's a list of the COL action items. I don't know if one of you --

MR. UPTON: Excuse me. Let me make one more comment.

This is Hugh Upton with GEH.

Your concern about the ICs, it's also bounded by the depressurization from the DPVs at ATWS, the ADS system, rather. That would bound the decrease in the RPV. Yes.

MS. CUBBAGE: Right. An inadvertent isolation condenser action, which is a Chapter 15 event.

MEMBER STETKAR: It's a single one. WE've had this discussion before. But it's a single one. This is all four.

MS. CUBBAGE: I think we do all four as an infrequent event rather than a -- the COL items, I think.

MR. RADLINSKI: I would like to mention one. For the most part, the COL action items are site specific fire protection issues.

If you go down to the fifth bullet, proposed license condition. Again, those of you who are familiar with existing plants, there's a standard fire protection license condition that talks about you can make changes to your plant, you can self approve as long as there is no adverse effect on safe shutdown.

We want to go back. We want to get rid of that. We want to go back to 5059 approach to make it consistent with the rest of the plant. And that guidance was in Revision 1 of Reg. Guide 1.189. So I just wanted to bring that to the attention of GE that that's what we're looking for; we're looking for 5059-like approach.

MEMBER SIEBER: Now you said the analysis met the fire protection, are deterministic and not NFPA-805?

MR. RADLINSKI: That's correct. 805 right now, I mean it's by letter. This certainly only applies to existing plants. They could not apply it.

MEMBER SIEBER: Right.

MR. RADLINSKI: Yes. And, again, you were not here, but right now there is no guidance for a performance-based fire protection program for a new reactor. Okay. There's an inter PA standard 806 in preparation, but that's a long way off.

DR. WALLIS: It's a bit strange. It's been put in for existing plants because it's a good thing, presumably. And it's not going to be put in future plants? It seems a bit odd, somehow.

MR. RADLINSKI: Well, one of the problems is the enhanced fire protection criteria from these SECYs is a deterministic approach. It says you will separate all your redundant trains. And that's, you know, what percent; it's 80/90 percent of your fire protection right there. If you've got that passive protection --

DR. WALLIS: So you don't need the other?

MR. RADLINSKI: So you don't need the performance-based approach. In fact, none of the licensees, and I've questioned this with NEI and some of the licensees, they're not interested in having it at least for the original design. Okay.

If they were going to express an interest, it would be later on once the plant is designed or at least under construction. And it would be a mechanism for making self-approving changes. Okay. But the original change, there's really -- there hasn't been any interest that we're aware of.

Okay. The next two slides are going to attempt to address Mr. Maynard's questions, concerns.

Post-fire safe shutdown of the ESBWR does not require AC power. They've done analyses that says if you lose off-site power, we can still shut the plant down.

Shutdown is primarily achieved with the

isolation condenser system, which again, does not require AC power.

And their post-fire safe shutdown analyses assumes one train fails due to the fire. They demonstrate the system can still perform its function if one train failed in that one fire area that's completely burned up. Okay.

You asked questions about firefighting. Again, safe shutdown post-fire does not rely on firefighting. Okay. If for some reason the fire brigade can't respond, doesn't respond, they can't get in there and put the fire out, the analyses demonstrates that you can still safely shut the plant down without that one level of defense-in-depth. Okay. But it's not required necessarily.

MEMBER SIEBER: Same as for existing plants, right?

MR. RADLINSKI: Yes. Absolutely.

MEMBER SIEBER: There's no change.

MR. RADLINSKI: All your fire protection detection systems, suppression systems are all based on DC power, they all have battery. So they don't rely on AC.

Lightening, there are battery powered fixed lights for access/egress routes. They're portable battery powered lights for the fire brigade to use during fire fighting.

And finally, the fire hazard analyses evaluates access for manual firefighting for each fire area. And I was hoping that GE was going to say something about the security aspects of it. But presumably that would be a consideration in the fire hazard analysis when you look at access in responding to a fire whether or not you have to go find a key or something or a card key or whatever to get through the door.

So ideally the worst case fire is a control room fire. And in that situation you would have to go to remove shutdown panel, and there probably aren't any doors, security doors that you have to go through to get from the control to the remote shutdown panel.

MEMBER STETKAR: Let me just interject something from having done a lot of this space fire analyses.

Probably the worst fire location is the DCIS rooms in the rector building. Just -- I'll just throw that out.

MR. RADLINSKI: Okay.

DR. WALLIS: Is there going to be a

discussion at some point about external fires of --

MR. RADLINSKI: Transportation --

CHAIRMAN CORRADINI: You're talking external from outside the plant, aren't you?

DR. WALLIS: A large fire induced by some cause outside the --

MR. RADLINSKI: Like a transformer fire or--

MEMBER SIEBER: No, bigger than that.

MR. RADLINSKI: External event.

MS. CUBBAGE: As far as the PRA, they look at external events. We may be getting into some of that with Chapter 13 discussion.

DR. WALLIS: What happens to the control room when there's a big external fire?

MS. CUBBAGE: Okay. We'll talk about that this afternoon.

CHAIRMAN CORRADINI: That's been brought up by Dana under Chapter 2 about control room habitability from outside events interjecting their influence on --

MEMBER ARMIJO: Okay. So we've already got that.

CHAIRMAN CORRADINI: We've already labeled it as something to worry about.

MEMBER ARMIJO: Okay.

MR. RADLINSKI: That's it.

MS. CUBBAGE: And that basically concludes our presentation.

CHAIRMAN CORRADINI: Done? You get the last question.

MEMBER STETKAR: One last one. This isn't even a question. Well, it is kind of.

In section 9.5.33 emergency lighting, something that nobody looks at, you had an RAI 9.5-60 that asked for justification for the emergency lighting supplies in the remote shutdown areas. And apparently in the SER it's on -- if you're looking in the SER, Amy, it's--

MS. CUBBAGE: No. It at 9.5-61, is that where you're talking.

MEMBER STETKAR: Yes. It's RAI 9.5-60. Six-zero.

MS. CUBBAGE: Sixty.

MEMBER STETKAR: In the SER it says the applicant -- let me see if I can summarize this.

MS. CUBBAGE: I can read it here.

MEMBER STETKAR: The applicant basically said that in the remote shutdown area there's an eight hour battery powered emergency lighting and you basically accepted that. Why shouldn't we supply 72 hour emergency lighting in the remote shutdown area where the operators may need to spend 72 hours?

MS. CUBBAGE: We're going to ask Amar Pal to come up.

MEMBER MAYNARD: Why would they need to spend 72 hours in remote shutdown?

MR. PAL: This is Amar Pal, NOR

I reviewed just that issue. And they said they are going to have eight hour battery pack. So if the battery pack all the time for eight hours. IF the fire doesn't occurring, whenever the fire occurs then you're going to AC power. So you going to lose all the normal lighting. So that way I think if they are okay, probably loss of off-site power or loss of AC power, then the battery pack comes in to the picture and you'll have enough lights for entire eight hour duration.

CHAIRMAN CORRADINI: But I think his question is why is it --

MEMBER STETKAR: Why is not 72 hours? They supply 72 hour emergency lighting for several DCIS cabinet areas, which aren't normally habited by human beings who have to see things. But they don't supply 72 hours for places that could be occupied by human beings who have to see things.

MR. PAL: The 72 hour lighting is provided for in the control room.

MEMBER STETKAR: That's right.

MR. PAL: That's all. And nowhere else.

MEMBER STETKAR: And in some apparently some remote DCIS cabinet rooms, but not -- I'm just hung up on this because the only two places that people live in this plant are the main control room or the remote shutdown areas.

MR. UPTON: Let me try and address that. This is Hugh Upton with GEH.

The remote shutdown panel, again, is there for emergency shutdown of the plant. We're not going to be in the remote shutdown panel for 72 hours.

In other words, it's not going to take 72 hours to place the plant in a stable condition from the remote shutdown panel.

MEMBER STETKAR: If the main control room is not habitable, if the main control room burns up,it's a charred mass --

MR. UPTON: Right. Then you go to the remote shutdown panel and you begin an orderly shutdown of the plant.

MEMBER STETKAR: And monitor from where?

Monitor plant conditions from where? Remote shutdown panels?

Where do the operators go if they must -- take an extreme case where the main control room is a charred mess and the operators must now -- now the automatic shutdown system should work, the operators now relocate to the remote shutdown areas and must monitor plant status.

MR. TUCKER: This is Larry Tucker of GEH.

We need to understand a little bit better where you're coming from.

When there is an event and you need to shut the plant down, the plant shuts down very quickly.

MEMBER STETKAR: I understand.

MR. TUCKER: And it goes to a stable condition.

MEMBER STETKAR: Understand.

MR. TUCKER: And in general there is no credited operator actions for the next 72 hours from the onset of the event. So the operator --

CHAIRMAN CORRADINI: But John's question is simply the operators will probably want to understand plants, what's going on --

MEMBER STETKAR: What status?

CHAIRMAN CORRADINI: Where do they go to do that if the control room is unavailable.

DR. WALLIS: Can they see what's there?

CHAIRMAN CORRADINI: Why don't --

MR. TUCKER: I believe we're beyond the design requirements here.

MEMBER STETKAR: The main control room is a charred mass. And the plant shuts down automatically and the operators relocate to the remote shutdown areas.

MR. TUCKER: So we're assuming that there's a loss of off-site power and a fire in the control room and --

MEMBER STETKAR: No, no, no. I said the main control room is a charred mess. I didn't assume anything else.

MR. TUCKER: Then --

MR. UPTON: But the only time that you would require emergency lighting for eight hours is if you lost AC power.

MEMBER STETKAR: Yes.

MR. UPTON: So we're beyond --

MR. TUCKER: So we're well beyond what's required.

MR. UPTON: -- our design basis.

MEMBER STETKAR: Because all of the off-site power controls are in the main control room. You can loss it from a fire in the main control room?

MR. TUCKER: Yes. So that was why I was asking what was our entry condition into your question?

MEMBER STETKAR: Loss of all AC power, main control room unhabitable; period.

MR. TUCKER: But you --

MEMBER STETKAR: My only concern is why does it not --

MR. TUCKER: -- the safety function is to shut -- safely shut the plant down and the plant is safely shut down and it's maintained.

MEMBER STETKAR: Why do you supply 72 hours of emergency lighting for DCIS cabinet rooms which are not inhabited by people, but you do not supply 72 hours lighting for areas that may or will be inhabited by people? That's the basic. I don't understand the discrepancy of why we need 72 hours of lighting for a cabinet room so the cabinet can see itself and not for a control room where people should be able to monitor the status of the plant.

PARTICIPANT: -- of the staff.

Let us take us take this back as an item to look into. I'm not -- I'm not sure that --

MEMBER STETKAR: Okay. Ask the staff to look into that.

PARTICIPANT: Yes. I don't think that the requirement is that you assume a fire in the control room and a loss of off-site power. But let us go back and at least get back to you with an answer. You know, get back to you with an answer on that question. We understand the concern.

MEMBER STETKAR: Right.

CHAIRMAN CORRADINI: I think they're clear.

Anything else, Amy?

MS. CUBBAGE: No. I think we're ready to go to Chapter 10.

CHAIRMAN CORRADINI: Yes, I would appreciate it if we can go to Chapter 10. And I think General Electric -- GEH will begin. And we'll probably hope to finish that before lunch.

MEMBER SIEBER: That's a big hope.

CHAIRMAN CORRADINI: Oh no, it's in the plan.

MR. JORDAN: We accept the challenge.

Good morning, Mr. Chairman, members of the Committee.

My name is Peter Jordan. I am the Regulatory Affairs engineer assigned to Chapter 10 by GEH. And this morning this discussion about Chapter 10 will be presented by Gary Anthony, who is the lead chapter engineer. And, hopefully picking up on your comment because this is a chapter not nearly as involved as many others in the DCD, that Mr. Anthony might be able to pick up a few seconds or minutes or whatever on the presentation.

Anyway, go ahead, Gary.

MR. ANTHONY: Good morning, ladies and gentlemen. My name is Gary Anthony. I'm the principle engineer presenting my favorite ESBWR Chapter 10, Steam and Power Conversion Systems.

I have with me today Mr. Rusk Kusic, Senior Engineer, and also the author of Chapter 10 if you have some particular questions.

I have my Lead Engineer, Mr. Hugh Upton also.

And I'll try to spend this up so we can get to lunch.

I'd like to do a quick Chapter 10 overview today. I'll be discussing the design parameters, do an equipment review, review the turbine and generator, look at the main steam system, discuss feedwater and mitigation of flow accelerated corrosion, what we call FAC, then do a review of the principal design features, look at the power cycle schematic, which is DCD Figure 10.1-1 and I'll try to do that fairly quickly. And discuss the scope of enhanced design features we have in the ESBWR system. And I'll finish with a summary.

The content and level of detail that's used in DCD Chapter 10 considers the guidance in NUREG-0800, the NRC standard review plan, sections 10.2 through 10.4.7.

Turbine, generator and power cycle systems do not perform or support any nuclear safety-related functions.

The standard ESBWR parameters are summarized in:

DCD section 10.1 which describes the principle design features and lists the corresponding design parameter in Table 10.1-1.

Also in DCD section 10.4 it describes the circulating water cooling requirements, which we call the circ water system.

For an equipment overview, the ESBWR balance plant or BOP is based upon a conventional BWR power cycle system. It's 20 percent larger than the

BWR-6s

Chapter 10 presents the equipment required to basically condense unused steam into condensate and convert that water into high quality feedwater in a purification subsystem. We use filters and demineralizers for extremely pure water in the parts per billion to parts per trillion range that we can now monitor.

We're using Reg. Guide 156 as our standard. And we're also taking a look at the EPRI Water Guidelines in 2004 as requested by the NRC.

Water is then heated with standard extraction steam through low pressure and high pressure feed water heats and is then fed to the reactor in a normal system for a BWR.

Steam is generated then transported to the turbine via the main steam piping and converted to electrical energy from thermal energy. Any wet or excess steam is exhausted back to the condenser in a normal BWR system.

To take a quick look at the turbine and generator for a few minutes. We use one double flow high pressure turbine, three double flow low pressure turbines, what we call a 6F52 or six flow 52 inch blade machine.

Turbine rotors utilize an integral forging. We call them monoblocks. They're running about 500,000 pounds or 250 tons, and they're single forgings. This is to minimize the probability of missile generation. And they pretested to 120 percent of rated speed. That's a ten percent extra margin.

GE has a long history with this design replacing the shrunk on wheel type that the NRC and the utilities had problems with before. We've used them since about 1992, and we've got well over 4 million operational hours on these monoblock forgings. We've had no problems with them at all.

MEMBER SIEBER: These are GE machines?

MR. ANTHONY: These are GE machines, yes.

MEMBER SIEBER: All right.

MR. ANTHONY: Turned last stage blades, as I said earlier, are 52 inches long and have been fully shop tested. There are a few in service at 50 Hertz and we have a few at coal stations at this time.

We use a standard design synchronous generator with a water cooled stator windings, a hydrogen cooled rotor. This unit is rated at a monstrous 1933 MVA. It's about 1600 megawatts electric gross depending on vacuum conditions.

MEMBER APOSTOLAKIS: Do these last stage

blades erode with droplet impingement?

MR. ANTHONY: Anything will erode when you have droplets in there. We have an advanced system for extracting the moisture. We have a hydrophobic steel which allows the moisture to go down the extraction steam line. And we keep them down to an absolute minimum.

There's very high quality materials placed on these blades to keep down to a minimum.

DR. WALLIS: So they have a long life? How long was their life?

MR. ANTHONY: At the present time we have 10 to 12 year inspections required on all major pieces of equipment. And at that point in time we will give a long term life on the equipment. We're expecting 30 years.

MEMBER SIEBER: How much cobalt is used in valves and turbine blades and so forth?

MR. ANTHONY: Basically from industry experience, cobalt is still the best seat material for lightening surfaces.

MEMBER SIEBER: That's why I asked the question.

MR. ANTHONY: But in the rest of our specifications we go out with the absolute minimum allowed in spurious materials that are coming into the forgings themselves. So we limit it in the base materials and we only use the cobalt where it's necessary.

MEMBER SIEBER: You use it on the leading edge of your longer low pressure --

MR. ANTHONY: No, sir. We use flame-hardening. High quality material and flame hardening. We don't use cobalt overlay strips.

MEMBER SIEBER: Okay.

MEMBER ABDEL-KHALIK: What is the maximum moisture content in the low pressure stages of the turbine?

MR. ANTHONY: We don't design that particular part as GEH. Those are all proprietary designs for GE Steam Turbine. And if you'd like, we could have a GE Steam Turbine representative discuss the --

MEMBER ABDEL-KHALIK: Oh, that's a different part of the company, so you're not allowed to know that either?

CHAIRMAN CORRADINI: I don't think he's allowed to share it.

MEMBER ABDEL-KHALIK: The way you said it, I thought I'd try.

MR. TUCKER: This is Larry Tucker with GEH.

There are other turbine vendors in the audience today.

CHAIRMAN CORRADINI: That's perfectly understood.

MR. TUCKER: And we're more than willing to get the right person to share with the ACRS in appropriate forum.

MEMBER SIEBER: Well, it doesn't have a safety basis anyway.

MEMBER ABDEL-KHALIK: I was just following up on the question, the earlier question regarding erosion.

MR. ANTHONY: Something you'd like me to answer?

MEMBER ABDEL-KHALIK: No, not at this time since you don't have the information.

MR. ANTHONY: Let's take a quick look at the turbine main steam systems. Basically it transports steam from the nuclear boiler to the turbine inlet. The system is nonsafety related, but it's built as a quality group B system. It's designed, procured, installed, tested, inspected and "N" stamped ASME Section III, Class 2 requirements.

It is also designed to seismic category II requirements.

The old BWR MSIV leakage control system has been replaced with what we call the NRC approved isolated condenser system method, which has been retrofitted into some of the operating BWR plants.

DR. WALLIS: Presumably MSVs are safety related?

MEMBER APOSTOLAKIS: Yes.

MR. ANTHONY: Yes. MSIVs are safety related.

MEMBER APOSTOLAKIS: So they're part of a different discussion?

MR. ANTHONY: Yes, those are the B-21 system. We start at the seismic isolation going into the turbine building.

MEMBER SIEBER: Do you have any ATWS mitigation that relies on reactor trip at turbine trip?

MR. ANTHONY: The turbine building is basically set aside from that. ATWS is contained in the reactor building. The only thing the MSIV isolation system, if you get an MSIV isolation, the fail-safe system for the bypass valves and drain lines work as if it were happening as a LOCA. And it's fully automated.

For extraction steam and feedwater, basically the standard plant design incorporates seven feedwater heaters, 4 moisture separator reheaters and multiple extraction points.

We use three low pressure heaters and they're located in the condenser necks.

The system contains an open feedwater heater tank. We call that number 4. That provides the reserve inventory for mitigating abnormal events, which is about three minutes at full power on a loss of all condensate pumps.

The MSRs have a standard high efficiency chevron-type moisture separators. They're used to improve steam quality and increase the thermal efficiency of our unit.

We use reliable steam seal designs that are instituted to contain the radioactive gases and steam.

And materials are selected for a 60 year life.

Let's talk a bit about the feedwater some more and the mitigation of flow accelerated corrosion, FAC.

We use the applicable operating

experiences and recommendations provided in the NRC General Letter 89-09 and NUREG-1344. These are applied to the system and operation.

Now potentially affected by FAC are analyzed from actual plant design data. We have three models. To determine where the increased wall thickness or FAC resistant resistent materials must be used to meet the 60 year design life.

MEMBER APOSTOLAKIS: Do you have automatic release from the seals on the turbine or this is some system of flow that prevents that?

MEMBER SIEBER: There is a seal.

MR. ANTHONY: It provides steam to seal the turbine and we have vacuum, light duty vacuum system that keeps steam or any radioactive --

MEMBER APOSTOLAKIS: In in-flow instead of an out-flow?

MR. ANTHONY: Yes. Negative vacuum around the edges.

MEMBER SIEBER: The back into seal to leak in rather than leak out.

MR. ANTHONY: We also take a look at using the EPRI CHECKWORKS or an equal design system program.

MEMBER APOSTOLAKIS: Doesn't that take a long time to calibrate? Doesn't that take a long time to calibrate to your system, that CHECKWORKS?

MR. ANTHONY: CHECKWORKS? Yes, it does. It take a lot of input.

MEMBER APOSTOLAKIS: It took years?

MR. ANTHONY: And the utility can use that as the long term program. We have several that we're using up front with our designer, AE designer to take a look at potential elbows and locations that might be tight.

MEMBER ARMIJO: Now you use a lot of chrome molly steel in these systems.

MR. ANTHONY: Yes, I'll be getting to that in just a second.

MEMBER ARMIJO: Okay.

MR. ANTHONY: Basically we start with good engineering; piping design principles to ensure flow velocities are limited. And we try to have no two phased flows, which basically is what eats up a lot of the pipes.

We've done an internal study that was completed on the Class I piping in the reactor building, main steam lines on feedwater and the main steam lines with regular carbon steel were much, much greater than 60 years. We do have to do some CFD analysis on some of that piping for spots that we potentially could need to do some redesign on just because of impact flow.

And feedwater came out to be greater than 60 years when using P22 pipe and 02 control. And as you said earlier, the P22 pipe is what we're using the two and a quarter chrome one percent molly to make sure we have a good hemotype layer. And it's also where you guys have discussed earlier today 02 control. We're requiring 50 to 100 ppb of 02 control to keep an excellent corrosion layer on the piping. That limits the loss of material and gives us our 60 year life design.

MEMBER SIEBER: Main steam system Schedule A?

MR. ANTHONY: It's custom built pipe at this size. We designed it as a wall thickness.

MEMBER SIEBER: You say it will have a schedule?

MR. ANTHONY: Yes. It's really big pipe.

Some of the principle design features.

The standard main condenser is a water-cooled surface steam type made with corrosion-resistant materials and very robust spargers.

We'll be doing a CFD analyses on this also.

MEMBER ARMIJO: Are there options on the condenser materials?

MR. ANTHONY: Yes, we have two materials. We have both a stainless steel and a titanium listed in the DCD. Typically the titanium would be for a salt water service, but could be opted for fresh water service as needed.

MEMBER ARMIJO: But there's no copper containing materials in the options?

MR. ANTHONY: No.

MEMBER ARMIJO: Good.

MR. ANTHONY: No, sir.

The normal BWR has a 33 percent bypass valve plant, you're probably fairly familiar with those, 25 to 40 percent, around 33. This turbine bypass system is designed with a full bypass capability --

MEMBER ABDEL-KHALIK: Now you've had experience with plants that have full bypass capability?

MR. ANTHONY: Yes, we do have some experience with them. Even some of the 1972 plants were built with it, even though they weren't designed well enough to use it. But there are plants that do have the capability.

MEMBER ABDEL-KHALIK: Have those systems been actually actuated?

MR. ANTHONY: Yes. And we have tests from a plant that we're using for the basis of the design for our island mode system, which I'll talk about in just a minute.

MEMBER SIEBER: Some of them have been inadvertently actuated.

MEMBER MAYNARD: Do you accomplish the increase by larger valves or more valves?

MR. ANTHONY: More valves. We use a dozen valves. We also have a much larger condenser than normal.

MEMBER SIEBER: I presume there's a lot of baffles in the condenser to keep from --

MR. ANTHONY: We'll have baffles and specifically designed spargers. And we'll do a full CFD analysis on each section of the condenser because we are loading it with 19 million pounds mass an hour of steam.

MEMBER SIEBER: That is a lot.

MEMBER STETKAR: I had a question once you go onto design features. On the main feedwater system there's a low load low flow control valve.

MR. ANTHONY: Correct. We have a startup

valve and a low flow.

MEMBER STETKAR: Yes, up to about 20 percent power. There's only one of those? There's no parallel -- there's a single --

MR. ANTHONY: At the present time if you look at the drawing we only have one on feed pump. We call it a startup system.

MEMBER STETKAR: Right.

MR. ANTHONY: We're also taking a look at having -- since we're not looking at having any single capability of failures, we're going to have that probably on two feed pumps. Such that either one of those could be a startup system.

MEMBER STETKAR: Okay. That's being looked at.

MR. ANTHONY: We have an HFE requirement on all of our systems to look at single failure proof, and that's one of the items that we may need to spend a little more money on.

MEMBER SIEBER: But that's not a safety issue? It's a reliability issue?

MR. ANTHONY: That's correct. It's an availability/reliability issue.

More principle features we have is loss of grid, what we call the island mode. We have a #4 feedwater heater sizing. It's like a big accumulator in the middle of our balance of plant system. It's got 680 cubic meters of water in it. That's about 100,000 gallons of spare water in the middle of our system.

We keep spare feedwater and condensate pumps as backups for increased reliability. And all of this really --

MEMBER ABDEL-KHALIK: I'm sorry. Can you explain that third bullet? I guess I didn't appreciate its usefulness. Could you just take one more minute, please?

MR. ANTHONY: Certainly.

What I've done is I've listed some of the things that operators of plants have always wanted or European plants have requested in the design of the system.

Loss of grid. What happens to the plant on a loss of grid? Basically we have this plant design such if you lose the outside grid and the reactor and turbine is still in good shape, it will power the house load. We call that island load. Everything runs down to about 4 percent steam, the generator puts out enough power back through its own transformers to supply a basic house power.

Everything that's needed on the island nuclear and nonsafety. Circ water pumps, service water pumps, everything.

MEMBER STETKAR: Do you have any operating experience on the turbine generator control system?

MR. ANTHONY: We have operating experience from a plant that has this system built into it. And from their lessons learned, we found that we needed a high flow system for standard operation and a very tight logic system for low control system.

MEMBER STETKAR: The logic system was what I was asking about.

MR. ANTHONY: Yes. And we have that built in the General Electric Turbine Control system to control in island mode.

MEMBER STETKAR: But you don't have any actual operating experience on that particular --

MR. ANTHONY: We have Leibstadt plant that does, yes.

MEMBER STETKAR: Okay.

MR. ANTHONY: We're using all of their data. They've graciously given the data --

MEMBER STETKAR: That's okay.

MR. ANTHONY: We know the logic system that's needed.

MEMBER STETKAR: Okay. But you don't have one on a GE design logic system yet?

MR. ANTHONY: Not that I know of at this time.

MEMBER STETKAR: Okay. Thank you.

MEMBER SIEBER: This have electric heat pumps or steam driven steam pumps?

MR. ANTHONY: Well, actually I'll get to that in another slide. But they're electric.

MEMBER SIEBER: Okay. And when you get back to 4 percent, that means you're dropping a lot of pressure across the feed rate valve?

MR. ANTHONY: Well, we use --

MEMBER SIEBER: How do you control that?

MR. ANTHONY: We use a variable speed ASD drive feed pumps.

MEMBER SIEBER: Oh, okay.

MR. ANTHONY: And that cuts down on a lot of the valve damage.

MEMBER SIEBER: Right. I don't think you can control it with just valves?

MR. ANTHONY: No. No. We have variable speed pumps like the turbines used to be, but we don't use the steam for those reasons.

MEMBER SIEBER: Right. Okay.

MR. ANTHONY: The second item in that third bullet which we were talking about was the #4 open feedwater heating sizing. A lot of plants use this as a giant accumulator in the middle of the system such that if you get plant transients in the condensate system, it has -- this create a huge capacitor for the plant, a giant accumulator. And you get, you know, three or four minutes on the total loss of condensate. That's an infinity of time for an operator, you know, to have to get one more condensate pump going.

CHAIRMAN CORRADINI: Thank you. That helps.

MR. ANTHONY: Okay. Would you like me to continue on that bullet or --

CHAIRMAN CORRADINI: No.

MR. ANTHONY: Okay. We also have a flexible circulating water system. That's the heat sink. That's site specific outside of the buildings itself. It's very flexible. This includes a series or parallel flow condenser options, depending on where you site this plant.

Let's take a quick look at the power cycle.

As we said earlier, we got 19.3 million

pounds mass an hour; that's the results of 4,500 megawatts approximately of output on an ESBWR.

The first thing that comes off is the bypass valves. So if you have isolation of anything on the turbine side, you still have bypass valves that are directly controlled to the condenser.

Our seals are taken off right after that so we always have steam for the seals that come off main steam.

We have a conventional stop valve and control valves, four of each, completely independent of each other.

We come to a standard high pressure turbine. It'll get a little bigger, but it's a standard one.

This exhausts to the MSRs. We have four MSRs because they're so large instead of the two.

We go two choices of CIVs, either the integral or double CIVs at this point.

We have three low pressure turbines. This is what gets you the six flow design; two flows, two flows and two flows that's six.

And the 52 inch blades would be the last ones on there.

Three heaters in the necks of each one of the condenser shelves. This is depicting a series circ water flow, so these are three different vacuums that runs 671,000 gallons per minute of circ water through here to cool the system.

Condensate is taken from here into four condensate pumps. Only three are required to run with a 100 percent backup in one pump.

We use the lowest temp condensate water coming from the hot wells to purify. And that makes the resins work the best, unlike some of the older plants that had them in a slightly warmer place.

We go through filters down to one micron if it were -- or a 10th of a micron if we're using hallow fibers, full condensate heat beds. This bypass valve is closed at all times unless we have an upset in the system. So we have 100 percent condensate cleanup system on here.

We go through some auxiliary cooler loads, steam jet air ejector, off-gas in the seals.

This runs over to our number four tank. As I said 100,000 gallons, giant accumulator. It's basically just a tank capacitor or giant flywheel for the system.

PWRs have it, a lot of European plants have it. We have this in coal stations.

This runs for four independent ASD drive booster pumps which feed feed pumps. And it's shown here we just discussed a little while, this looks like a startup control valve in case you don't have to run large flows through these feedwater pumps.

It comes back into the number 5, 6 and 7 high pressure feedwater heaters and then up to the reactor.

MEMBER ABDEL-KHALIK: So what happens if you lose condenser vacuum on one of the LP turbines?

MR. ANTHONY: You would typically close off the combined interset valve to stop steam, do a power reduction and be able to control the plant just by spinning that on the best vacuum you can. It will basically force your plant down over a short period of time.

MEMBER ABDEL-KHALIK: And how long does that take before -- I mean, do the other turbines speed up?

MEMBER SIEBER: No.

MR. ANTHONY: No. A very dedicated control system on this side. We have a speed side control system with double backup systems on it. And when you have any type of transient on the system itself that would lose horsepower for one reason or another, either a generator or load reduction or a loss of steam to any system, we have a standard power control system that will basically shut the control valves down to make the turbine safe at 1800 rpms.

MEMBER ABDEL-KHALIK: And the time constant for that process is how long?

MR. ANTHONY: I don't remember. It's 4 milliseconds or eight milliseconds.

MEMBER ABDEL-KHALIK: Oh, I see.

MR. ANTHONY: We're extremely fast.

MEMBER ABDEL-KHALIK: Thanks.

MEMBER BLEY: Did you say that you can continue operating that way or it will eventually drive you down to the --

MR. ANTHONY: It will eventually drive us down.

MEMBER BLEY: What takes you down?

MR. ANTHONY: Well, because the three condensers are connected with a single pipe over to the --

MEMBER BLEY: Thank you very much.

MEMBER STETKAR: Gary, on the feedwater tank, do you need a positive steam over pressure in the feedwater tank --

MR. ANTHONY: Yes, you do.

MEMBER STETKAR: -- or positive suction? You do?

MR. ANTHONY: Yes.

MEMBER STETKAR: For the feedwater pumps.

MR. ANTHONY: Well, at the present time it's fed through this -- you see this extraction steam load?

MEMBER STETKAR: Yes. Yes. But that's required for net positive suction head for the --

MR. ANTHONY: Under full power, yes.

MEMBER SIEBER: Well, it'll keep oxygen out, too.

MR. ANTHONY: Yes. It's a deairator in the top. The water sprayed in the top is a deairator and the bottom of the tank is basically a holding tank. We have 59 pounds it runs on normally.

MEMBER SIEBER: A quick question on circulating water. Do you do chemical treatment? And if so, do you use chlorine? And if so, it is gas or otherwise?

MR. ANTHONY: Yes, chemical treatment. No, that is not a GEH responsibility. That is a site design responsibility. Each architectural engineer depending on the water supplied selects the best chemical treatment system.

MEMBER SIEBER: I bring it up because if you use gas, you use chlorine and it's close to the control room ventilation intake --

MR. ANTHONY: That would be done under a hazardous gas --

MEMBER SIEBER: Sooner or later you're going to have a problem.

MR. ANTHONY: Yes.

MEMBER SIEBER: Yes. A line break or something or you're changing tanks and this goes right into the control room.

MR. ANTHONY: Yes, I'm used to that. I came from the Brunswick station. We used gas and chlorine.

MEMBER SIEBER: Right.

MR. ANTHONY: It requires a lot of sensors.

MEMBER SIEBER: It's a real adventure.

MR. ANTHONY: But that's up to the architectural engineer that the utility works for to design that --

MEMBER SIEBER: And you give them advice, right?

MR. ANTHONY: We do have a lot of lessons learned and recommendations we can give them.

MEMBER SIEBER: Okay.

MR. ANTHONY: Okay. Let's go over some of the enhanced design features. As we talked about earlier, we have integral forging, the big monoblocks. This is to reduce missile probabilities. And the turbine is also favorably oriented to the reactor building and control building, i.e., the shaft is perpendicular to the reactor control building unlike some of the older plants. It's basically a safer design basis.

We have adjustable speed, motor-driven feedwater pumps using variable frequency drives. This reduces dose by elimination of the steam going to the old drives and improves maintainability because we can go into the rooms anytime we need to monitor them or repair them.

Gland seal steam system evaporator has been eliminated. The turbine seals are back onto normal main steam, like the old BWR-4s that worked quite well. This improves reliability and reduces maintenance does through simplification of systems on the plant.

The turbine utilizes a fully electronic, redundant, fail safe and testable overspeed protection system. And this is for improved reliability. This has been modified on many machines.

MEMBER STETKAR: And you do not have a mechanical overspeed trip?

MR. ANTHONY: That is correct. We do not use a mechanical overspeed trip. We found them very unreliable.

MEMBER STETKAR: Right.

MR. ANTHONY: And hard to maintain.

MEMBER SIEBER: Well, they trip you at different speeds.

MR. ANTHONY: Yes.

MEMBER SIEBER: Do you have redundancy in your trip, overspeed trip?

MR. ANTHONY: Yes, we do. We've had several discussions with the NRC and we've provided them with documents and schematics showing what it looks like. We use six probes and two sets of three, only two out of the three probes ever have to work on a set.

MEMBER SIEBER: Do you count teeth on a gear or something?

MR. ANTHONY: We count teeth. We have a large toothed wheel. We can take any probe out of service to test it on line. We have three systems to do that. We have normal speed and overspeed and an emergency overspeed systems that all independent.

MEMBER SIEBER: Okay. Thanks.

MEMBER STETKAR: Gary, do all the turbine trip signals go through, I think you call it an emergency trip device, set of solenoids that drain the hydraulics?

MR. ANTHONY: Yes, we do. All two of them, and they come from either end. So either the primary system can trip the solenoid or from the opposite side coil we can cut the wires on the emergency system and take it out.

MEMBER STETKAR: There are emergency trip -- I'll call it block because it's --

MR. ANTHONY: Yes. Two blocks, three coils each.

MEMBER STETKAR: Okay.

MR. ANTHONY: Each one of them can be tripped by the system.

MEMBER STETKAR: Thanks.

MR. ANTHONY: And it's all single failure proof design.

In summary, the DCD Chapter 10 provides a description of the standard plant design features.

The ESBWR balance of plant is designed with flexibility and can be sited anywhere design parameters are met for the cooling water systems. We have one basic set of numbers that have to be met.

This is a standard heat cycle for electric power conversion, stop valves, control valves, intercept valves, nonreturn valves; all the same. Extraction steam, HP/LP, monoblock turbines, and the standard tube condenser.

The design incorporates the best practices, incorporates many industry lessons learned. We have spare pumps, which is very important, large #4 feedwater tank, 100 percent bypass valve and as a spare on there, we don't even need -- you know, we only need 11 out of 12. We have the island mode system, the early review of materials to keep FAC down to an absolute minimum, and MSR designs for the utility to have maintainability on it.

All of this is to increase reliability, less balance of plant initiating transients, longer plant system life, good cycle efficiency and equipment availability through online testing and maintenance.

That's the end of my presentation.

CHAIRMAN CORRADINI: Any questions by the Committee.

MEMBER BLEY: Yes. Just one quick one. Until you've gained more experience with that low power control system on the island mode operation, if you should lose the turbine what's the sequence of events that occurs?

MR. ANTHONY: If it's a turbine trip, it would be like a standard plant.

MEMBER BLEY: Okay.

MR. ANTHONY: The stop valves would close, bypass valves would open and the SRI or select rod insertion in the scurry system would bring the reactor down to about 60 percent power where operations would make a choice on whether we were going to go back up in power if the turbine could get back on line, or continue on down to a safe shutdown situation.

Basically we're doing --

MEMBER BLEY: There's actually a time for that, to make that decision?

MR. ANTHONY: Yes.

MEMBER SIEBER: Yes. Well, you end up on bypass.

MR. ANTHONY: You end up on bypass.

MEMBER BLEY: That's right.

MR. ANTHONY: And automatically the power goes down and the reactor down to 60 percent power, which is the standard for the condenser.

MEMBER BLEY: How long can they stand on

that 60 percent bypass.

MR. ANTHONY: Indefinitely.

MEMBER BLEY: Really?

MR. ANTHONY: That's the design for the standard --

MEMBER BLEY: Okay.

MR. ANTHONY: -- you know off steam --

MEMBER BLEY: Everything inside will let it run --

MR. ANTHONY: It's all automatic. The operators can take their time, review the plant, take a look at the alarms and annunciators and make a choice on whether they're going down the rest of the way or continue back up.

MEMBER STETKAR: Where does steam for the feedwater tank come, since you were talking about it? Where does steam for the feedwater tank come post turbine trip? I'm assuming it normally comes from extraction of steam.

MR. ANTHONY: Yes. It normally comes from extraction steam. The tank is overpressured and we have automated valves and vent system on it such that it slowly vents off to the condenser. It's in a controlled fashion.

MEMBER STETKAR: Yes, but to keep a main

feed water pump running for 60 percent reactor power, you've got to have a main feed water pumps running?

MR. ANTHONY: Yes, you will have -- water pumps which are a lot less needed, they will drive back and the MPSH required for those pumps is much less because we have a power booster pump feeding them.

MEMBER MAYNARD: The old pressure was only required for 100?

MR. ANTHONY: A 100 percent power, that's correct. At 60 percent power we're basically at zero pounds on that.

MEMBER SIEBER: Or you have condensate pumps that are usually deep draft pumps and --

MR. ANTHONY: Yes.

Anything else, gentlemen?

CHAIRMAN CORRADINI: Committee members? No.

Thank you very much.

MR. ANTHONY: Thank you.

CHAIRMAN CORRADINI: So I've already talked to the staff and they are ready to start after lunch. So why don't we take a break.

So can I ask for 45 minutes? Is that like incredibly mean or can we do that. We'll be back here at 1:00.

(Whereupon, at 12:14 p.m. the hearing was adjourned, to reconvene this same day at 1:00 p.m.)

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

1:01 p.m.

CHAIRMAN CORRADINI: Okay. Let's get started on our afternoon.

You going to start us off?

MR. OESTERLE: Yes, I will.

Thank you all for coming back from lunch.

My name is Eric Oesterle, I'm the Senior Project Manager in the Office of New Reactors. And I would be managing the review for Chapter 10 "Steam and Power Conversion System."

The purpose of the presentation this afternoon is to brief the Subcommittee on the staff's of Revision 3 of the ESBWR design certification application, that's Chapter "Steam and Power Conversion System."

We're also here to answer any questions as this Subcommittee may choose to ask them.

I want to mention, as I have in previous presentations, that the staff's review was performed to Revision 3 of the ESBWR DCD. And we do have Revision 4 of the ESBWR in house and it is currently in review. So some of the open items that you may be discussing in this presentation are from the SER with open items that we issued to you back in September.

Some of those open items, may in fact, be resolved based upon our review of Revision 4.

I also wanted to indicate that some of the challenges that Amy mentioned this morning with the SER with open items maintaining consistency with the DCD revisions, so those challenges we also faced on Chapter 10. And so we have worked out some of those challenges with GE. They have responded to us and identified some areas where there are inconsistencies. And we are continuing to work with GE to resolve those as we develop our final safety analysis report.

With me today at the lead Chapter 10 reviewers, Jorge Hernandez, George Georgiev, Robert Davis and Yamir Dias-Castillo.

Let me go heads up on the slides here.

What we'll go through in the presentation is:

A review of the applicable regulations;

A status summary of the RAIs;

Some selected SER technical topics;

Open items;

COL action items; and

Discussion of Committee questions.

On this slide we're presenting a summary of the regulations and other review guidance that the staff used in performing the review of Chapter 10. I won't go into detail into each and every one of these, but you can see what they are.

In terms of the summary of the RAIs, we originally started out with 50 RAIs on Chapter 10. Forty-six of those were resolved on the date that we submitted the SER with open items to the Subcommittee back in September. And that left us with four open items. Those open items will be discussed later in the presentation and some of those may be resolved yet by the Revision 4 to the ESBWR DCD.

At this point I'd like to turn it over to Jorge Hernandez for discussion on Section 10.2.2 on the turbine generator design.

MR. HERNANDEZ: Good afternoon, again. My name is Jorge Hernandez from the Advanced Plant Branch, NRO.

I'm going to be discussing the staff evaluation for sections 10.2 and 10.3 and 10.4. I'm going to start off with the turbine generator design.

I'm not going to touch a lot into design of this system. You know, GE's already addressed the description of the system. So I'm just going to touch on the topics that the staff evaluated. Mostly I'm going to mention some of the key features from the turbine generator or the electronic overspeed protection system, which is fully electronic and does not incorporate a mechanical trip system. And then it also provides digital instrument and controls.

For this particular sections we don't have any COL items. We had one open item which at this point has already been resolved. It's still open in the SER, as Eric mentioned. And it has to do with the electronic overspeed system.

We requested the applicant to demonstrate, you know, how the design provided diverse protection means without the mechanical trip. And as I mentioned before, the proposed system provides a primary trip with three redundant channels and two out of three or GE has already described that part.

And it also has an emergency trip which has the same arrangement and it's powered from different sources.

The applicant considers that the emergency trip system provides diverse protection means because it employs redundant channels which are powered from diverse sources and not controlled from different software codes. Each channel of the emergency trip is powered from a separate UPS. And the controls use different softwares. So they address both redundancy and diversity. The staff found that the system provides diverse protection means.

We also wanted to know that in addition to the reliability of the protection system that the impact to the nuclear safety is really minimal given the design provides favorable orientation and also it reduces the risk incidents because it includes a rotor, is monoblock design.

MEMBER APOSTOLAKIS: What does that mean? What is a monoblock design?

MR. HERNANDEZ: Well, it's a rotor, it's forged -- it's a one piece.

MEMBER APOSTOLAKIS: Oh, that's what it is. They called it something else.

MR. HERNANDEZ: Okay.

MEMBER MAYNARD: Quick question. The manual trip function feature from the control room, does it go through one of these systems or does it have it's own?

MR. HERNANDEZ: Well, there's a manual trip on the machine itself, on the turbine --

MEMBER MAYNARD: I understand that. But from the control room can't they push a button to trip it?

MR. HERNANDEZ: Right.

MEMBER MAYNARD: Does that go through basically the turbine digital control system or is it--

MR. HERNANDEZ: Yes.

MEMBER MAYNARD: -- go straight to --

MR. HERNANDEZ: It goes to -- well, I guess we can have GE address that.

MR. KUSIC: Russ Kusic with GEH.

The manual push button, it's an electronic trip. It feeds through the trip manifold assemblies, the same trip manifold assemblies that trip the turbine on normal overspeed or any other trip. But it does not go through the controls. It's a separate set of relays that interrupts the power to the trip manifold assembly solenoids.

MEMBER MAYNARD: Okay.

MR. HERNANDEZ: And with that, I'll let George discuss section 10.2.3, which is the turbine --

MEMBER APOSTOLAKIS: I thought the missiles were the blades and not the shaft.

MEMBER SIEBER: They are.

MEMBER APOSTOLAKIS: And what does the monoblock design do anything about missiles?

MEMBER SHACK: It's anything that leaves the --

MR. GEORGIEVE: I have it. I'll be talking about this.

MEMBER APOSTOLAKIS: You'll be talking about this?

MR. GEORGIEVE: So maybe it will be more proper for me to answer it.

Thank you.

My name is George Georgieve. I am Senior Materials Engineer with Component Integrity Branch. And I was assigned here for section 10.2.3.

And as you can see from the first slide that being the material fellow, you know I will be talking more about material properties. And we can attach on what you ask how the new improved monoblock or rotor does to reduce stresses in susceptible locations. Basically, the way it's done you have a solid forging, then it -- and you rove in the seats for the blades. And the blades are set on top of this. So in this way you reduce the stresses at the bottom of the shaft.

And the former shaft is shrunk. It was a straight shaft with a key and shank. And that was the historic soft spot.

And in modern turbine design in our industry, at least, they all went either with the monoblock or the welded type of design which the Europeans started, basically, the forging is welded together.

But starting with the materials, to begin with the materials property factor very prominently in the calculation of probability of missile generation, the P1 type of probability. And you start with a very high quality steel forging to begin with. It's done with the NiCrMoV, a lower alloy forging which if it's built here to American spec will be SA 470 04 471. And they got a chemistry requirements and other mechanical properties.

But in our standard review of section with place fracture toughness requirement which all been about the specs. But basically by the time you meet it you end up with a very tough material which is resistent to fracture at high speeds.

In addition, to that, that's a starting point. Then after you wrap machine you preservice examine using ultrasonic examine of the shaft to ascertain that there is no sound fabrication or residual flaws that you have to repair or take into to whenever you do the analysis.

And those two things taken together will ensure that you start with a good shaft you put in service.

Next slide, please.

And that lists to the area of review. And the reason we review this is not only safety aspect, is the turbine missile generation which falls back in GDC 4. And in order for us to take or for the applicant to state that they meet the GDC, they have to have this type of low probability of missile generation. In our guidance we have broken it down from favorably --

MEMBER APOSTOLAKIS: The GDC is it safe enough?

MR. GEORGIEVE: General design criteria 4, it a general criteria which specify you that you design item against missiles. And turbine missile is one of these because of high speed --

MEMBER APOSTOLAKIS: But the GDC itself does not have --

MR. GEORGIEVE: No, no. The GDC doesn't. That's embedded in our guidance. Actually it's a two standard review plan.

MEMBER APOSTOLAKIS: So the staff has interpreted it that if you meet this, you'll met the GDC?

MR. GEORGIEVE: That's right. And that is a --

MEMBER APOSTOLAKIS: No, that's fine. That's fine.

MR. GEORGIEVE: It's a historic. We don't do any different for operating plants replacing their turbine --

MEMBER APOSTOLAKIS: -- ten to the minus 5 is produced?

MR. GEORGIEVE: Yes. That is if you -- turbine, you're supposed to meet that. The higher. It is a -- this design, the ESBWR it is purported to be. Of course if some COL decide to go with unfavorable, they certainly can do so but they have to meet these guidelines.

CHAIRMAN CORRADINI: Just so I'm clear. Favorable is like that, unfavorable is like that, right?

MR. GEORGIEVE: Well, as the applicant states they do have a -- it's --

CHAIRMAN CORRADINI: It's perpendicular versus parallel to the --

MR. GEORGIEVE: Right. Yes. It's a perpendicular to the reactor --

MEMBER APOSTOLAKIS: Perpendicular is what? Favorable?

CHAIRMAN CORRADINI: Unfavorable.

DR. WALLIS: Why do you only talk about rotors? I thought that the blades the subject -- they come off some time.

MR. GEORGIEVE: But they do. They do. Yes, they do. But if we make sure we start with a good design, good material the likelihood to come off is less.

DR. WALLIS: It doesn't mention blades at all. You just talk about rotors.

MR. GEORGIEVE: The rotor's heavy. Yes. The blades are attached to the -- and basically you have the shaft --

DR. WALLIS: Well, a 40 foot long blade is a pretty good missile, isn't it?

MR. GEORGIEVE: It is.

MEMBER APOSTOLAKIS: But can you tell us plain English how one goes about to calculate the probability -- to evaluate the probability like this? What does it involve?

MR. GEORGIEVE: What is involved is type of material properties. You have a certain fracture toughness numbers there that you could use in the design when you analyze the shaft. And then you have partialized tangential and other stresses that you have to take in your design.

And then when you get the materials properties and the size of that oscillating -- you can calculate in terms of time, then you end up with a number. Then you do have another conforming, which is the turbine valve testing that you factor in.

So all these enclosed in the turbine maintenance problem, all these three elements. And actually what we do historically we have required from applicants to within three years of putting the service we give as these turbine -- which is based on three elements -- the overspeed protection and the turbine valve testing and the material properties which include fracture toughness calculation, the flaws.

And we do have --

CHAIRMAN CORRADINI: I think there's a comment over here to assist.

MR. GEORGIEVE: In the Reg. Guide 1.15 that--

MR. TUCKER: This is Larry Tucker with GEH.

Part of what we do in doing this is assessment is exactly right. That you consider the materials, you consider the design. But I think there was a slide earlier that is the most telling evidence that we meet that requirement. If you refer back that this design has over 4 million hours with zero failures. Zero rotor cracks and zero thrown blades, so you can calculate the probability from those numbers.

MR. GEORGIEVE: They have even Monte Carlo kind of a analysis in this. We usually discover by using the last review it --

MEMBER APOSTOLAKIS: Performing the probability for what?

MR. GEORGIEVE: Probability of missile generation. A missile detaching from the rotor and piercing through the casing.

MEMBER APOSTOLAKIS: Yes, but it is a condition of probabilities for something given something.

MR. GEORGIEVE: Per year, yes.

MEMBER APOSTOLAKIS: Per year.

MR. GEORGIEVE: Per year, yes.

DR. WALLIS: Well, it was claimed behind me that you could calculate this from the fact that you had 4 million hours of experience. That's only a thousand years and you're talking about 100,000 years here. I'm not quite sure how you extrapolate from

1,000 years experience to 100,000 years.

MEMBER APOSTOLAKIS: Oh, hours.

DR. WALLIS: It's per hour

MEMBER APOSTOLAKIS: No, no, per year.

DR. WALLIS: I thought it was per year. So you're talking about 100,000 years.

MEMBER APOSTOLAKIS: So it's the combination; statistics plus the analysis?

DR. WALLIS: Yes. The analysis is much more important.

CHAIRMAN CORRADINI: Are you saying that for George's sake?

MEMBER APOSTOLAKIS: This is a performance-based agency.

MR. GEORGIEVE: And I thought -- on the way with three slides. Okay.

Well, and as you can see, I'll sum it up, what we ended up was we have the -- we close all the 16 because we -- provided information. But ended with ITAAC which specify, which is a P1 level of commitment, that wherever the COL holder, whoever get the license will be obligated to submit us this report to substantiate that they have this probability. P1 is like ten to the minus five.

And this provide the basis to conclude

that the turbine meets our general design criteria.

MR. OESTERLE: No open items in the COL items?

MR. GEORGIEVE: That's correct. Yes.

MR. HERNANDEZ: All right. So for the turbine main steam system, I'm just going to mention a few key features for the system.

First of all, there's no safety related components of the system. The system starts downstream of the seismic interface and up to the turbine stop valves and the turbine bypass valves.

So the main steam isolation valve is covered in Chapter 3 and then the main steam isolation system is covered in Chapter 5. And those are going to be discussed in a separate meeting.

MEMBER STETKAR: One question. Where are the main feedwater isolation discussed?

MR. HERNANDEZ: Main feedwater is ten percent. The main steam isolation valve --

MEMBER STETKAR: Nothing is discussed in either section 5 or section 10. So where are the main feedwater isolation discussed? Ten refers me to 5, 5 refers me to 10 at the moment.

MS. GRUSS: This is Kim Gruss.

I think that MSIVs are discussed in 3.9.6, are they not?

MEMBER STETKAR: We haven't seen 3 yet. They may be, but we haven't seen 3 yet. I'm asking about main feedwater isolation since this says main steam isolation is in 3. Section 10 of the SER says that main feedwater and main steam isolation is reviewed in section 5. And, in fact, it says

MS. GRUSS: In 10.5?

MEMBER STETKAR: It says section 5.4 of this report discussed in detail the portions of the main steam and feedwater piping located upstream including main steam isolation. Section 10 says these systems are evaluated by the staff is Chapter 10.

So they refer me correctly to each other, but neither one of them says anything about feedwater or steam isolation.

This slide says the MSIVs are in Chapter 3. So I'll accept the fact that they may be there when we see it. Where is main feedwater isolation reviewed?

MS. CUBBAGE: The containment isolation in general is 6.2.

MEMBER STETKAR: 6.2? So the main steam isolation is in 6.2 or Chapter 3?

MS. CUBBAGE: I'm just saying containment isolation is Chapter 6. I think the valves themselves from a component perspective would be in Chapter 3, the MSIVs.

MEMBER STETKAR: MFIV? This says MSIVs. I'm asking about feedwater.

MS. CUBBAGE: Right.

MEMBER STETKAR: They also have check valves and isolation valves --

MS. GRUSS: Yes. Those should also be addressed in Chapter 3 as well.

MEMBER STETKAR: All right.

MS. GRUSS: All valves, all components.

MEMBER STETKAR: I hope so.

MS. GRUSS: MOVs.

MS. CUBBAGE: And I don't think you're going to see an enormous amount of detail. I don't think these are unique components for ESBWR.

CHAIRMAN CORRADINI: I thought we did 3.

MEMBER STETKAR: No, we haven't done 3.

MS. CUBBAGE: No, we haven't done 3 yet.

MEMBER STETKAR: The DCD covers them in Chapter 5. GEH is okay because they're all discussed in Chapter 5.

CHAIRMAN CORRADINI: So is there a particular question you have --

MS. CUBBAGE: Yes. I mean if our SER --

MEMBER STETKAR: I want to know how they work and I want -- and if the staff looked at them.

CHAIRMAN CORRADINI: I don't think you have the benefit of the last meeting where John was asking where it was, and so we were waiting for it here.

MS. CUBBAGE: Well, we certainly appreciate that if the SE is confusing is pointing and back and forth, we need to fix that. That's a given. So, thank you.

MR. OESTERLE: We'll take an action to look that up and get back to you.

MS. CUBBAGE: Well, we'll need to fix the SE to reference the right places.

MEMBER STETKAR: Section 10.3.2, third paragraph. But you need section 5.4 also that refers to section 10.

MEMBER APOSTOLAKIS: So when has this been reviewed, Chapter 3 you say we have not reviewed it.

CHAIRMAN CORRADINI: We'll get to it. Let's move on here. I will have an answer for you by the end of the day.

MR. HERNANDEZ: Well, again, on the turbine main steam system the staff focused on the review on the ability of the system to provide path for efficient products coming from MSIV leakage to the condenser. So we verified that the system is seismically analyzed and able to provide that in fact that path to the condenser, it's classified as seismic category 2. And it has a fail safe arrangement which in loss of power the valves are required to establish a path will open.

We have no open items and no COL on this section. And we found it acceptable.

For section 10.36 I'll leave Mr. Robert Davis to discuss that.

MR. DAVIS: My name is Bob Davis. I'm with the Component Integrity Branch. And I review the class -- well, it would be class 2 and 3. In this case there's only class 2 because there are no class 3 feedwater and main steam.

And the feedwater valves that somebody was just asking about, there is an RAI question that's open. I know on the material side they did not include the materials specs for the check valves and the feedwater isolation and we're still waiting to resolve that RAI.

The class 2 steam and feedwater systems piping is the same as it is for class 1. It's carbon steel for the steam and 2 1/4 chrome for the feedwater.

The fracture toughness requirements of the ESBWR meet requirements of section 3 class 2 components.

Only carbon steel and low alloy steel ferritic steel are used in class 2 systems. There's no stainless steel.

The DCD does not specify the use of class 3 components.

The fabrication and welding of steam and feedwater systems meet the requirements of ASME Code Section III and they conform with the guidance of RG 1.50 for preheating and post weld heat for alloy steels and RG 1.71, which pertains to qualifications of welding in restricted environments.

The cleaning and cleanliness controls conform with the guidance of RG 1.37, which is quality assurance requirements for cleaning of fluid systems and associated components in nuclear power plants.

For the ESBWR, as I'm sure everyone noticed earlier, GEH has talked about FAC. They have completed their assessment for FAC for class 1. They have not completed it for class 2. And in particular, noncode class piping which, as we all know, is usually is what is the most problematic. But they did provide a description of -- they did indicate that they will perform their assessment in the same manner as they did for class 1. The materials are the same as they were for the class 1 systems as it is for class 2. And they will follow the guidance and recommendations of the generic letters and NUREGs that the NRC has published. In addition, they'll use CHECKWORKS and other codes to verify that their system design, that their corrosion rate is what they think it will be, that it will meet their 60 year life.

Along with mitigation for FAC, that's only part is to mitigate for FAC. And then of course the follow up on that is to have a FAC program to monitor FAC, to make sure their design was right and to follow that through throughout the life of the plant. And they have committed in the ESBWR design any applicant that comes in will have to have an FAC program.

The only open items that we had, and this is they failed to list the material specifications and grades earlier for the steam and feedwater materials. That has been corrected in Revision 4, so that will no longer be an open item.

We also had issues with their discussion on the RG for preheat/post weld heat treated low alloy steels. That information has been included in Revision 4 of the ESBWR DCD and therefore is resolved.

They did provide a description of the steps that they would take in their design to mitigate FAC for class 2 piping. They've included that in Revision 4. But we still want them to change the DCD and provide a description for what they're doing in noncode class piping to ensure that because, as we all know, that's the piping that hurts people is the non-ASME class 1, 2 and 3 piping is what typically fails. So that will remain an open item until they provide a description.

And there was an issue, they were not going to code stamp or have ANI review for the class 2 portion of turbine main steam system, but they have since agreed to review the DCD.

CHAIRMAN CORRADINI: This report information, I read that and I didn't appreciate. So that was a voluntary action. It's not required for class 2 piping?

MR. DAVIS: Well, they just updated a reg. guide. And I think it's RG 1.26. And it basically indicates how you classify systems 1, 2 and 3. And evidently the old reg. guide would allow them to make that portion of the system to class 2 but not to code stamp them. And that's not part of -- I didn't review how they classified things or how they don't classify them. But when the new reg. guide came out I guess that is more called a loophole. But that provision that allowed them to do that was removed, basically. And therefore we asked them, it's either class 2 or it isn't. If it's not code stamped, then that brings into question what ISI has actually done. So they've agreed that it will be coded and will be N-stamped, it will be ANI reviewed. That means it'll get all the section 11 ISI requirements.

CHAIRMAN CORRADINI: Okay. Thank you.

MR. DAVIS: And I'm finished.

MR. HERNANDEZ: Going to the main condenser, the review of the main condenser was mostly focused on the ability of the condenser to provide a hold-up volume for the MSIV fission product leakage from the MSIVs.

There's one -- the anchorage and the supports for the main condenser are seismic qualified and, you know, the staff found that it's unacceptable. There's one COL item for this section, which is the applicant choose to address DCD section 10.4.6 and it's related to providing threshold limits and procedures to address chemistry excursions on the condenser. And there's no open items on this section.

For the condenser air removal system, key features of the system. There's two mechanical vacuum pumps which are used for start up operations, two jet air ejectors which are usually during operation.

DR. WALLIS: No more radioactive release from the jet air ejectors?

MR. HERNANDEZ: Those are monitored in the--

DR. WALLIS: What is the normal release from them?

MR. HERNANDEZ: That would be covered in a different section. That would be in Chapter 12. I don't know the answer to that.

DR. WALLIS: I was trying to understand. What's the normal release and what's the allowable release on that system?

MS. CUBBAGE: Dr. Wallis, I don't think we have the people here to answer that.

DR. WALLIS: You don't know that. There must be some specs on that.

MS. CUBBAGE: So that, we could take it back.

DR. WALLIS: A different section.

MS. CUBBAGE: But I think it's a section

that's already been covered. So if we need to, we can take that back.

DR. WALLIS: Oh, it's already been covered?

MS. CUBBAGE: Yes. Chapters 11 and 12 where we look at our effluents.

MR. HERNANDEZ: And the exhaust of compartment systems are to the off gas system and to the turbine building component exhaust during start up.

There's no COL items for this section and no open items either.

DR. WALLIS: Well, why are you concerned about it at all?

MR. HERNANDEZ: For this? Well, that there is monitoring systems on the exhaust. And that they have two pumps which are capable of maintaining a vacuum under --

DR. WALLIS: I would think you would be concerned about the way in which they monitor the radioactive release, that's sort of the safety aspect or health aspect.

MR. HERNANDEZ: Right.

DR. WALLIS: But you don't say anything about that.

MR. HERNANDEZ: Right, but --

DR. WALLIS: So otherwise why bother to mention it?

MR. HERNANDEZ: There's no safety impact-- there's no safety design for this system.

MS. CUBBAGE: Radiation monitoring in effluent doses, those are covered. I should say normal operating doses were covered in Chapter 11.

MEMBER SIEBER: Yes, but that's on the stack. Not individual components. If you have activity in the stack, it has to come from the reactor.

MEMBER BLEY: It's a tech spec on it, and we'll get to that later today I think. Yes, it's right here.

MEMBER ARMIJO: It' a big number.

MEMBER BLEY: Yes. It's 2,000 --

MR. HERNANDEZ: We can make a note of that particular portion and request information from -- here.

So moving along for the turbine gland seal system. The sealing system, steam is not only provided by the main steam or extraction steams, but there is also the related to the auxiliary boiler steam at all loads if it's needed.

There's two 100 percent capacity exhaust blowers which maintain vacuum in the gland steam condenser and then they direct the noncondensable gases to the turbine building compartment exhaust.

And then there's monitoring for releases through the radiation monitoring system, the ERMS. And those are, again, discussed in Chapter 5, I think.

There's also a high radiation and flow alarms provided in the control room for this system.

And we don't have any open items and there's COL items.

The turbine bypass systems provide full load rejection or turbine trip capability without using SRV and without having a reactor trip, because that was already discussed GEH presentation. And the applicant claims that there's no single failure that can disable more than 50 percent of the installed bypass capacity.

And also, you know, a failure of the TBS lines does not impact essential systems.

We found the design acceptable and do not have any --

DR. WALLIS: When you have full load rejection, can the condenser handle that?

MR. HERNANDEZ: Yes.

DR. WALLIS: The condenser for the--

MR. HERNANDEZ: Right. And also there's enough flow rate from the circ water in order to handle the heat load.

On the circ water system, there is no safety design basis again for this system. It provides, like I mentioned, enough cooling water to commodate a full load coming from the turbine bypass system and also to remove heat during normal operations.

It isolates on a turbine building condenser area high water level signal.

The staff find the design acceptable and there's no COL items in this area. But there are portions outside of the scope of DCD in which the COL applicant needs to address. Those are the intake structure and the power heat sink and the intake pumps.

nd there's no open items in this section.

Going to the condensate purification system, that is going to be addressed by Yamir Dias-Castillo.

MR. DIAZ-CASTILLO: Hi. My name is Yamir Dias-Castillo with the Component Integrity Branch. I will review section 10.4.6 which is the condensate purification system.

This is not safety related and it was performing the safety function.

The system purifies and treats condensate load to maintain reactor feedwater purity and it does this by passing condensate loads through a series of-- demineralizers to remove those product impurities and suspended solids. This conforms with the guidance of GT 1.56.

There are no open items and no COL action items. However, the staff is currently in discussions with GEH regarding use of EPRI BWR water chemistry guidance, which I think they mentioned that in their presentation.

MR. HERNANDEZ: On the condensate and feedwater system there's four feedwater pumps and four condensate pumps, three of them are usually in service and one of them is in standby.

There is coincident logic and redundant controllers and input signals to reduce spurious trips.

And during normal operation flow control is provided by the adjustable speed controls and reactor feedwater pumps. And during low power operations there's a low flow control valve which is used for low power operation flow control.

MEMBER STETKAR: All right. How many feedwater pumps did you say there were?

MR. HERNANDEZ: Four. On DCD there's four in total.

MEMBER SIEBER: Three of them are main feedwater pumps and one is a startup pump, though, right?

MR. HERNANDEZ: No, no, no. They' all full--

MEMBER SIEBER: They're full capacity? Thanks. Sorry.

MR. HERNANDEZ: They have one standby.

MEMBER SIEBER: Thank you.

MR. HERNANDEZ: There's no open items on this section and no COL items.

MR. OESTERLE: And that concludes our presentation of Chapter 10.

I'd like to turn it over to the Subcommittee for additional questions or discussion.

CHAIRMAN CORRADINI: Additional questions? Nothing?

MS. CUBBAGE: I'd just like to follow up on the turbine gland seal question. I did look in DCD chapters 11 and 12. In 12 there are specs for the amount of release and in 11 there's a subsystem for radiation monitoring. And it provides the detectors and the ranges.

MR. OESTERLE: We look forward to coming back to address the closure of open items on the this Chapter will the full Committee when we have our final safety evaluation prepared.

CHAIRMAN CORRADINI: Thank you, Eric. Thank you very much.

So we should move on to Chapter 13.

MR. BEARD: Well, good afternoon. Alan Beard with GE Hitachi. Jim Kinsey as well.

This should be fairly brief and to the point, but review of Chapter 13 which is Conduct of Operation.

Most of this Chapter is from the point of view of the responsibility of the COL applicant, but there are some elements to DCD -- part of the design certification.

Go to the next slide, please.

So we will provide a quick overview of Chapter 13 and the items that relate to the organization structure and how they will be operated-- putting together the plans and the training programs that are necessary to ensure that the plant is operated in a safe manner.

And then the final item there physical security, we'll touch on that briefly in open session. And then depending on what the Committee's interests are on those items, it may be possible that we need to go into a close session to discuss some of those items.

Next slide, please.

In Chapter 13, like I said, primarily the responsibility of the COL applicant on the COL items listed here. The open items that you worry about when the staff goes up are primarily in the area of 13.6, which is security and we'll explain why there's so many open items in that particular area when we get to that point.

So we'll continue on to section 13.1. 13.1 talks about the organizational structure. The main point that we want to come across here is GE has spent a lot of time and effort among the staff in identifying a very methodical method for coming up with a human factors engineering program that will support safe operation. A lot of that is in the digital performed instrument system, but there are a lot of the elements in this programs that are going to lead to provide input into our training programs and into the procedure that the -- the core measure developing procedures and capture that through --

MEMBER BLEY: I'd like to ask you a question now. I don't know the most appropriate place, but this is a good intro for it.

You're doing a new design. We've got the operating procedures since TMI essentially done by owners groups and you guys were certainly a part of that.

I don't quite understand. Maybe you could explain the philosophy to me of why when we're building trying to integrate the I&C into the design and human into the design, why you're not doing the emergency procedures at this stage instead of them having them added on at the end by the applicant?

MR. BEARD: Okay. We're allow Wayne Martino to address that question.

MR. MARTINO: The emergency procedures will be part of the integrated plant, the reference plant.

Wayne Martino, GEH.

They are not part of the DCD certification. There's an ITAAC item that covers the procedure development.

This is appropriate because the detailed design of the plant is not at the point that we can develop the emergency procedures at this time.

MEMBER APOSTOLAKIS: But that doesn't answer the question.

MEMBER BLEY: You're designing the whole island and that's where most of these are aimed at.

MR. MARTINO: And we are ramping up in this effort. And we're leveraging the work that's already been done by owners' group. We've had drafts prepared of emergency procedure guidelines.

What part of your question did I not answer, please?

MEMBER BLEY: It seems a real opportunity to me to match up the developing I&C with the developing design with the operations as you put it all together. And I know there's no regulatory requirement to do this, but I just wonder why -- and maybe you are. Maybe that's kind of what you just said. That you're actually writing them as you go because you're not submitting because it's not required at this point in time.

MR. MARTINO: That's right.

MEMBER BLEY: Is that what you're saying?

MR. TUCKER: This is Larry Tucker with GEH.

We are as aware of this opportunity as you are. However, up until now it's not been appropriate because the design has not been advanced far enough to avail ourselves of that. However, in 2008 that changes. And as such, we've brought on board several SROs in our human factors organization, previous SROs. And we've also just had an individual start who was the emergency prepared procedure writer at an operating plant, BWR, and he has joined our staff in the last month. So it's --

MEMBER BLEY: So this will kind of move ahead with the finalization of the I&C?

MR. TUCKER: All this together and 2008 and 2008 is the appropriate time to do that as more of the detailed design is established, then we want to bring these procedures along with it.

MEMBER BLEY: We're glad to hear that. Thank you.

MR. BEARD: Any other question on 13.1. Moving to 13.2.

13.2 describes the necessary training programs that need to be developed. The great detail of those is actually captured in Chapter 18. 13.2 just kind of commits the COL applicant submitting the necessary descriptions the time line and the types of procedures that will be developed. A lot of the types of procedures are found in the implementing details in Chapter 18 there.

We do factor in a lot of the operating experience, as we are constantly reviewing the OER reports out of EPRI as well as the foreign vendors that we have information available from. But, again, the bottom line is the COL applicant is responsible for the majority of this.

There will be a design centered working group approach, a focused approached that would go into push very hard to standardize this across the entire operating fleet of the ESBWRs.

Next slide. 13.3 emergency planning. And no surprise here. This is primarily responsibility of the combined operating license applicant. To the point that we can do things within the design of the plant, we're certainly incorporating those right now. An example of that is our technical support center. We have TSC that meets the requirements of NUREG 0696 that's located on the ground floor of our electrical building. It has the dedicated spaces for the necessary functions that need to be carried out should you need to activate the TSC.

We don't have a safety parameters display system in the legal sense, but it is a function that is capable from our DCIS and all the parameters from that you would get on an SPDS are available to the staff.

MEMBER SIEBER: Why did you put an SPDS in there?

MR. BEARD: Well, SPDS was a response to a TMI item where --

MEMBER SIEBER: And I understand that.

MR. BEARD: Because we believe that that information is readily extractable from the information we're processing --

MEMBER SIEBER: But it extracted somebody has to go take all this data and put it together as opposed to looking at a icon display and saying here's one of the --

MR. BEARD: In this case it's a -- well, it's a program element that will bring up an SPDS type of a display, but it's not a dedicated system is the point I was trying to make. We're taking the information from our existing DCIS and then putting it on screens that provide an SPDS type of capability.

MEMBER SIEBER: The question is is your tech support center picking it up?

MR. BEARD: Well --

MEMBER SIEBER: Twenty-seven people?

MR. BEARD: Yes. We meet the requirements within 0696 and I don't know the exact number, but it was in the 20s.

MEMBER SIEBER: Twenty-seven.

MR. BEARD: Twenty-seven.

MEMBER SIEBER: And if you end up manning that around the clock, do you have any provisions or place for people to sleep and eat without going outside the radiologically protected area?

MR. BEARD: There are comfort facilities, but there no bunk rooms or anything like that.

MEMBER SIEBER: Yes. The comfort facilities are things you sit on? That'll last you about 12 hours.

MR. BEARD: Okay. It is provided with environmental control for our HEPA type of filtration units provide radiological protection for the staff who are manning that.

We do not have a safety related power supply to power that equipment. That is consistent with the staff interpretation that that's not necessary. It is provided electrical power from the on-site diesels but recognizing those on-site diesels are not safety related.

MEMBER SIEBER: So if they fail, you don't have a TSC?

MR. BEARD: Correct. We go to the emergency or the EOF to carry out that function.

MEMBER SIEBER: Does it have safety related diesels?

MR. BEARD: The EOF?

MEMBER SIEBER: Yes.

MR. BEARD: No.

MEMBER SIEBER: That's even close to the plant, right?

MR. BEARD: Well, it depends on the ability.

MEMBER MAYNARD: Well, the current TSCs don't have to have a safety related power supply. They have a back up diesel, typically, but that's not a safety related --

MR. BEARD: And that's consistent with our design.

MEMBER MAYNARD: Yes.

MR. BEARD: And then the EOF and the operational center, you know those to be site specific, utility specific elements. The COL addresses part of our application.

Next slide, please.

13.4 operational program implementation. I'm getting to sound like a broken record, but primarily the responsibility of the COL applicant. We have developed a list of the various elements of that, but it will be the responsibility of the COL to provide a schedule and a list of the procedures that will be developed as part of that -- satisfying that particular element.

MEMBER APOSTOLAKIS: If most of this is the responsibility of the COL applicant, why is it in the SRP at this stage?

MS. CUBBAGE: Well, we have one SRP. We don't have one for design certs and for COL.

MEMBER APOSTOLAKIS: That's everything. I see.

MS. CUBBAGE: Right. So we have very, as you've seen in the SER, very short writeups in these areas to confirm that the appropriate COL action items are in there for those areas.

MR. BEARD: Okay. 13.5, please.

MEMBER STETKAR: Well, let me ask another question. Today's plants you have four distinct emergency facilities. You have the control room.

MR. BEARD: Yes.

MEMBER STETKAR: You have the on-site

support center which you don't discuss, as far as I can see. You have the technical support center and the EOF. Where is the on-site support center?

MR. BEARD: The OSC, the operational support center is something that the COL will address, however there is space provided within our service building to support that function.

MEMBER STETKAR: Is it shielded and atmospheric controlled and all that?

MR. BEARD: No. That's only required for the technical support center not for the operational support center.

MEMBER STETKAR: Oh. That's where you put your operators and maintenance people to send out to do the in plant work?

MR. BEARD: Right. That's where you stage the people necessary to recover from the event.

MEMBER STETKAR: And there's no shielding or atmosphere controlled or anything?

MR. BEARD: No. There are no specific requirements imposed.

MEMBER ARMIJO: Should there be if you want to protect them.

MEMBER SIEBER: No.

MEMBER MAYNARD: Is there extra room in

the TSC? Because some people have moved part of that into the --

MR. BEARD: Well the sizing of the TSC is for the necessary number of people. Whether you would argue that that's sufficient room for them to be in there, I'm not going to get into that argument.

MEMBER MAYNARD: Yes. I think part of the COL's the appropriate place to handle this. Because the licensee is going to have some of their own idea on it. But typically, I think, you find that you need more room than what you've built into these things, especially the TSC.

MEMBER SIEBER: Yes. And these are not simple structures. You know, an operation support center has to be in the plant area because that's where you're dispatching people from. So it's got to be a shielded building with a good ventilation system. And once the plant is built it's difficult to find a place to build another shielded building. You know, plus unless you think of it before you actually start shoveling dirt to build the plant.

MR. TUCKER: This is Larry Tucker GEH.

The operational support center and how the requirements of that are addressed are very site specific and it is the responsibility of the COL applicant.

The actual implementation, the current practice for the majority of plant is that they have an operational support center prime designated for that and it doesn't have special shielding, but it is inside the owner protected area.

There is also identified an alternate location for the operational support center. So what happens is if doses come up, it come in the plume, and then people migrate to the other facility. That's the current practice across the industry. And, again, this is the responsibility --it's a site specific requirement of the --

MEMBER SIEBER: That may be the current practice of some utilities, but that's not the current practice of all licensees.

MR. TUCKER: You are current. However, that is the general way it's approached and that complies with the requirements.

MR. BEARD: Okay. Section 13.5 plant procedures. Again, primarily the COL responsibility and the types of procedures that are required to be developed here, it's just an example. So the operating maintenance procedures, those would be used by the health physics group that they use for monitoring as well as things like handing of heavy loads or new fueling types of procedures.

Finally, 13.6 physical security. I need to point out that 13.6 itself is classified -- it's withheld from public disclosure under the provisions of 10 CFR 2.390. But there is some description in there that are non-safeguards descriptions. Some of the key elements of the physical security for the power plants, things like lighting, communications, some of the physical barriers we credit in our response to security events.

As I indicate in that next bullet, much of the information here is safeguards information. The industry, and I'm sure you would hear this from the staff, based on Commission expectations that we be more proactive in designing physical security into these plants up front, there have been several task forces that have convened. We have done significant effort to try and look at these plants from a materials point of view and to identify potential design enhancements that we make early on to further increase our capability to resist those types of attacks. I think that's been a very worthwhile effort. I've been pat of those groups, and I have to tell it, it's been an eye-opening experience. You know, we get some of these special operations types of guys working on these things. And they start throwing on scenarios. And my comment many times is I'm glad you're on our side.

But the bottom line, I think the most positive comment I get out of some of these reviews are, you know, these guys are used to really challenging the safety design. And, you know, finding problems. And some of the guys have commented at the end of this, they go, "This is no fun. This plant is too safe from a security perspective."

So anyway, you will hear later, but we have three separate safeguard submittals that are going into the NRC. Two of those just were finished yesterday or last night. Actually, this morning. I'm sorry. And we'll be submitting to the NRC tomorrow when Jim gets back to the office and can put together the transmittal letter.

And then we have a third report, a safeguards assessment report that will be going into the staff the early part of next week. And, again, it does a very methodical look at various attach scenarios identifying target sets and looking at how this plant responds to those types of events.

Let's go to the next slide, please.

The actual implementation of the physical security plant is going to be the responsibility of the COL.

Contained in 13.6 there is description of ten, eleven, twelve elements of the physical security plan. That was necessary. The level of detail we provide in there provides the supporting information. We do have an ITAC on physical security. That was an element that has been required. And so the industry worked to come up with what we hope was a generic ITAC that should be acceptable. And we have the information 13.6 to support that.

It shouldn't come to a surprise to anybody in this group that the passive plants really when you start looking at the physical security offer some very unique capabilities and it really -- it's been an eye-opener to the security people because some of the things that they've done to cause core damage on the existing plants are just not mechanisms that work on a passive plant.

I think Al Tardiff when he gets up here will indicate that we've done that.

DR. WALLIS: So this is the responsibility of the COL, but you can do a lot presumably with the robustness of the plant?

MR. BEARD: And we are doing a lot within the walls of the building we are doing a lot of things to make it very difficult to get to areas that we considered to be vulnerable.

Final slide, just a summary.

As I've said, you know, the vast majority of this, and as Amy indicated, is the responsibility of the operator, the license holder. They only have one SRP so the FSAR will be, when the COLs submit that will have a lot more of this information.

There are a number of open items in the area, primarily with security, and we are working with the staff to resolve those. Most of those items will be resolved through the topical reports that were submitted.

So with that, I have completed my remarks. I'm up for any generic questions.

MEMBER MAYNARD: I would just to pile on a little bit with Dennis. And I know you're not required to have your emergency operating procedures in some of the things at this stage. The sooner you start that the better, though. Because it's kind of like doing the PRA in parallel with the design. Some of these other things may identify early enough to where a simple change in the design or something may solve a lot of problems that otherwise you don't find until the tail end and then it becomes a lot more difficult.

MR. BEARD: I think one point that we may not have made is there are existing BWR emergency procedure guidelines which form the basis for the detailed emergency operating procedures. And we have undertaken an effort to take those existing EPGs, update them to reflect the design of the ESBWR, incorporate the element and in doing that identify are there instruments that we might want to make available or things like that, or provide additional means for introducing or problem with the containment, or whatever.

And so although we haven't done the detailed procedures and documented all that, you know in updating that EPG we certainly have done a lot of that type of stuff.

MEMBER SIEBER: The process, actually, goes like the past is that the vendor provides emergency guidelines and the applicant COL writes -- actually writes procedures. Because you have a writers' guides with style and all that so that all procedures as consistent.

MR. BEARD: Well, again --

MEMBER SIEBER: And then your vendors provides EPGs, or SAMGs, excuse me. So there has to be involvement by both the vendor and the licensee.

MR. BEARD: And while I can't say here with 100 percent certainty because it's subject to contract provisions we'll have with our utilities, it is our expectation that this will be a fleet model type of deployment and that those procedures will be developed generically. And whether that's GEH or another contractor doing that, but it'll be the same procedures at North Anna 3 or Grand Gulf 3 or Riverbend.

MEMBER STETKAR: Are you going to build a simulator that's GE controlled or the license going to do that? Because that's the perfect place to try out the emergency procedures, see how they work, see what the human factors are.

MR. BEARD: Larry Tucker.

MR. TUCKER: This is Larry Tucker with GEH.

The multi-benefits of a simulator is obvious to us as well. There are discussions -- and it's also to our potential customers, our future customers.

We're in negotiations and discussions now with the various utilities on moving forward with simulators. Besides the emergency procedures, it also the simulator provides a key benefit in training the operators. And if you want to have certified operators by the time that the first plant goes in and you start backing up all the requirements, 2008/2009 is about as late as you can start a simulator and still meet those requirements. So that's why those negotiations and discusses are ongoing right now.

MEMBER STETKAR: Well, I'm sure this isn't part of a design control document, but I do think it's a good idea.

MS. CUBBAGE: It's more than a good idea, it's a requirement.

MEMBER STETKAR: Pardon?

MS. CUBBAGE: It's a regulation.

MEMBER SIEBER: Oh, all right.

CHAIRMAN CORRADINI: Other comments about Chapter 13 for GEH?

So just to remind the Subcommittee if we have questions that require us to go into closed session, we'll do that after the open part of this with the staff. Okay? So if you have something, hold it and we can go into a closed session.

Go ahead. I'm sorry, Excuse me.

Thank you very much.

MR. FOSTER: Good afternoon. My name is Rocky Foster. I'm the Project Manager for the ESBWR Design Certification Review for Chapter 13 for "Conduct of Operations."

But I'd like to first remind everybody that this presentations is on a non-safeguards level because we do have a time period slotted for after this presentation if the Committee would like to discuss safeguards level material.

As I stated, the purpose is to brief the Subcommittee on the staff's review of Chapter 13 of the application. And to answer any questions that the Committee might have.

Our reviewers for the Chapter 13 is Richard Pelton and Bruce is sitting in for Dan Barse on this and Al Tardiff.

MS. CUBBAGE: Who is here as well.

MR. FOSTER: Who is here just in case.

And as far as what we will cover --

PARTICIPANTS: It has to do with the name tags.

MR. FOSTER: We've got our presentation on the applicable regulations that were used to review the application, on the status of the RAIs. And then for each of the ares of reviews for the technical topics. Any open items we might have the COL information items.

And you can tell we have a long list of regulations and other view guidance that we use for our review.

And from the RAI status, we had an original number of 43 RAIs for this area. We've been able to resolve six of them so far. And we've got 39 open items. The lion's share is in physical security, okay. But we do have a few in emergency preparedness. And that within physical security we have broken down by detection aids, unattended openings and special security areas/vital components.

We've grouped ours a little bit different than how GE grouped theirs. We'll basically talk about the easier ones first that we have and then get into the more difficult areas of the application.

For 13.1, and as GE previously stated, is the organizational structure. And as the staff reviewed it we found that it was consistent with human system interface.

This again, 13.1 organization structure will be addressed by the COL applicant.

MEMBER APOSTOLAKIS: Human system

interface, though, that's a NUREG 0700 or something?

MR. PELTON: 0711,

MEMBER APOSTOLAKIS: Huh?

MR. PELTON: 0711.

MEMBER APOSTOLAKIS: Okay.

MR. FOSTER: And operational programs 13.4 is consistent with SECY-05-0197. Again, operational programs will be addressed by the COL applicant.

The trainings programs and the operational procedure programs was the area that we'll talk about.

In the training program development plans and the operational procedure development plans they all incorporate the appropriate human factor element and are consistent with the SRPs.

The DCD itself, actually referred us to Chapter 18. Where we went to Chapter 18 to get the information. And our tech staff reviewed those areas using the criteria in Chapter 13.

Again, we interfaced with Chapter 18 for the human factors engineering. And for 13.2 that actually interfaces with NEDO-33275, the --

MEMBER APOSTOLAKIS: Has human factor engineering benefitted from human reliability models or are they completely different fields? Does anybody know?

MS. CUBBAGE: I didn't hear the question, actually.

MEMBER APOSTOLAKIS: The human factors guidance, has that benefitted from the work that the agency has done and the industry on human reliability or are they just --

MS. CUBBAGE: I was going to say, I hate to push it off, but Chapter 18 and 19 might be a better place to discuss this. Because this area is really focused on training and procures. The human factors program we're going to have a long presentation on that at a future date?

MEMBER APOSTOLAKIS: January?

MS. CUBBAGE: It'll probably be February.

MR. TUCKER: Just an aside --

MS. CUBBAGE: But if GE would like to add anything at this point.

MR. TUCKER: This is Larry Tucker of GEH.

The short answer to your question is yes.

MEMBER APOSTOLAKIS: It can't be shorter than that.

CHAIRMAN CORRADINI: Only if you write it down.

MEMBER ABDEL-KHALIK: Only from a regulator.

MEMBER BLEY: There is a subsection in Chapter 18 on HRA which tries to explain.

MS. CUBBAGE: Yes, and topical reports that were submitted.

MEMBER BLEY: But I don't think we have those yet.

MR. FOSTER: Section 13.5 interfaces with NEDO-33274 and NEDO-33276.

The licensed and non-license staff training programs, again, will be addressed by the COL applicant. And the operating procedures program will be addressed by the COL applicant.

And it will turn it over for an emergency preparedness.

MR. MUSICKO: Thank you. I'm Bruce Musicko, I'm a Senior Emergency Preparedness Specialist with ENSER.

With respect to certified designs, standard design certifications, the emergency planning or preparedness is a very minor subset of the DCD design control document in that the extent to which an applicant wishes to address emergency planning is optional, except for essentially identifying the location of the technical support, the TSC. There are additional things that they can do, but they're not required to do them.

As you see in the slide, the first bullet, emergency planning is mostly programmatic in nature, including facilities, equipment, personnel and training. But with respect to a certified design, various aspects of the facilities or even equipment could be included in the certified design if the applicant chose to address them. But they don't have to.

In this case the applicant did provide some information pertaining to the technical support center specifically dealing with size, location, data displays, power. And these are some of the general requirements that are required or actually provided for in the applicable guidance document, which is NUREG 0696, which is available on our public website, which gives a lot of the details associated with what our review would entail looking at the specifics for these facilities.

For example, the operational support center that you brought up, there's no habitability requirement for operational support center. It's primarily a staging area in order to support emergency operations. And so there's some flexibility with respect to where that will be located.

DR. WALLIS: I would think some of emergency preparedness would be in the design. If you have a really serious event, knowing what's going is very important.

MR. MUSICKO: That's true.

DR. WALLIS: And having the right kind of indications there, which are robust, is part of the design. And that's emergency preparedness.

MR. MUSICKO: Yes. Yes, you're exactly right.

DR. WALLIS: Do they do that, a good job of that?

MR. MUSICKO: Well, we'd have to look at--

DR. WALLIS: That sort of be on design basis, and so they don't do it?

MR. MUSICKO: We have to look at the specifics which hasn't been provided yet. The COL applicant would likely provide that.

But you're absolutely correct that various data displays must be available in these emergency operation facilities. And they are called out in our review as required.

DR. WALLIS: Okay.

MR. MUSICKO: And so we would review it at a later stage. However, the extent to which a standard design certification applicant would choose to address that in a certified design where it would be identical for all plants wherever they locate the reactor, they may not want to tie themselves down.

In general for a certified design what we've seen in the past and here is that there's just a limited amount of information that's provided. But basically emergency planning or preparedness is identified as a COL action item or COL information item where the programmatic aspects which would include the actual physical facilities would be addressed by the COL applicant.

So as far as a standard design certification review is concerned for EP, emergency planning, it's basically what they care to include in the certified design we would look at. And, again, the first bullet, if it's -- the second bullet. It would be limited to non-site-specific features that are technically relevant to the design useable for multiple sites, multiple units at multiple sites.

And we've specifically written this criteria into the standard review plan, SRP Section 13.3 as the scope of review that would be applicable to a standard design certification. We would not review programmatic aspects, because those are not related to a standard design. And those would vary from COL applicant to COL applicant.

With respect to the OSC again, if it would be advisable, I would assume, that a COL applicant would choose to have some sort of habitability protection to the staging teams that go there, I mean like a roof in case it rains, things like that. But as far as radiological habitability is concerned there is no requirement, nor is there guidance that says you must have it.

MEMBER SIEBER: Part 20 give you requirements.

MR. MUSICKO: Part 20 deals with radiation exposure, which would be for emergency responders, not necessarily those in the OSC. OSC would be part of the emergency response teams and they would be subject to those limits, yes.

Now, in comparison to that we have the technical support center, the TSC. There is some guidance that pertains to habitability, specifically the habitability, radiological habitability. Specifically with respect to the TSC is that it must be comparable to the control room.

So we might see a common ventilation system. We might see something separate. But they're both required to meet general design criteria GDC 19 with respect to doses, which includes getting into the Part 20.

Now, as far as the TSC is concerned, if the doses were to be exceeded or the habitability could not be maintained, whether it's radiological habitability or it's just the ventilation system went down and it got hot, they are allowed in NUREG 0696 to evacuate the technical support center where the management contingent in the TSC would relocate to the control room. That's the only group of people that would go there, not the entire TSC group.

So there is some habitability requirements pertaining to the TSC, in essence comparable with the control room.

I'm looking at the fourth bullet now. The DCD satisfied the TSC size/location/display/power. We had a number of RAIs that were responded to. We currently have two open items.

MR. FOSTER: Do you want to go on to the next slide for the RAIs?

MR. MUSICKO: Sure.

MR. FOSTER: Okay.

MR. MUSICKO: One specifically, and we're still reviewing the response, deals with -- this may get into the number of people with the TSC. NUREG 0696 addresses the number of people in the TSC, specifically the TSC working space shall be sized for a minimum of 25 persons including 20 persons dedicated by the licensee and five NRC personnel. This minimum size shall be increased if the maximum staffing level specified by the licensee's emergency plan exceeds 20 persons.

And they have a criteria up above. This is section 2.4 dealing with the technical support center of NUREG 0696 that says that the working space without crowding for the personnel assigned to the TSC as a maximum level of occupancy, minimum size of working space provided shall be approximately 75 square feet per person.

I've had a chance to look at some TSCs over the years. And the amount of space that they afford for the five NRC personnel could be questionable with respect to 75 square feet. However, it's pretty easy to check it and, in fact, it's usually captured as an ITAC -- would be captured as an ITAC in a COL application safety evaluation report. And you can physically go out there with a tape measure if you want to, or just look at diagrams to verify. There's enough working space.

The intent is that the working space is adequate to accommodate the tasks that are performed within the technical support center.

Moving right along. I think I've covered most of that.

In essence, there's usually a COL information action or COL action item that would identify the COL applicant as being responsible for providing the emergency plan.

Now there was a little bit of discussion earlier about the emergency procedures. You need to distinguish between emergency operations procedures and emergency implementing procedures, emergency plan implement procedures, which are in essence the procedures the emergency response personnel would use to carry out the responsibilities to initiate certain actions, notify state agencies in that site. In contrast, the emergency operation procedures, those are procedures that pertain to the operation of the plant itself. That does not fall within the scope of our section, emergency planning or emergency preparedness except to the extent that items such as the emergency action levels, EALs, which would be part of their emergency plan implementing procedures would initiate an action in an emergency operation procedure.

So there's basically two sets of procedures.

In addition to the possible on-site facilities that may be addressed in a certified design, again you have the operational support center, OSC, technical support center, TSC. The EOF, emergency operation facilities would not be addressed because that's an off-site facility and would be applicant specific, licensee specific. And could be located near a site, it could be located farther away. It could be a common EOF associated with one licensee or one utility that has a number of plants. There's a tendency now to combine that effort into one EOF and vary the location from the plants. So we would not expect the EOF to be part of the design certification.

And in some cases you might for a certified design identify a specific location for decontamination facility, maybe an HP area, health physics area.

So there's some flexibility with respect to the extent to which an applicant for a certified design may address certain EP related facilities or equipment. But in general we tend to see just the TSC location and size. There may be a little additional information such as capabilities to receive certain information associated with the plant.

MEMBER STETKAR: Bruce?bm

Yes.

MEMBER STETKAR: You may have gone through this, but I'm not as familiar with the regulations and requirements as most people are.

Is there a requirement to maintain the information displays and habitability of the TSC for longer than 2 hours in station blackout?

MR. MUSICKO: Yes. Yes. It's for the duration of the accident.

MEMBER STETKAR: Will the GEH design satisfy those?

MR. MUSICKO: Well, what I can say, I'm not sure of the exact details and feel free to jump in if you can add to it, what we're seeing is that there is a 72 hour power capability which they get off batteries that support the habitability of the TSC assuming you can have -- or you have backup power. I think there's backup power for GE, but you can address that if you'd like.

MEMBER STETKAR: Yes.

MR. BEARD: Okay. Alan Beard, GEH.

I need to take exception to what Bruce

said. We're not providing a 72 hour safety related capability of electrical power to the TSC. It's not required.

We do have the capability from either one of our on-site nonsafety diesels to power the necessary loads within the technical support center. Either one of those diesels operating gives us the necessary power. We've got enough fuel oil on site to run those diesels for at least 72 hours.

MEMBER STETKAR: I asked about a station blackout, though?

MR. BEARD: Well the technical -- we haven't gone into the definition of station blackout because station blackout assumes you have safety related diesels.

MEMBER STETKAR: Let me succinct then. In the event that there is no AC power available on site from any supply whatsoever is there a requirement that the technical support center, a requirement that the technical support center be operable for longer than two hours?

MR. BARSE: This is Dan Barse, Team Leader for Emergency Preparedness.

I believe the answer to that is no. And that they would evacuate the TSC and go to the control room, this is what would happen.

MEMBER STETKAR: I was asking about the requirement. I knew I'd get you to say something.

MR. MUSICKO: Well, there is some flexibility with respect to the TSC. After the Three Mile Island accident the TSC concept was brought up in regard to how close it was to the control room. Because the TSC basically relieved the control room of certain communication responsibilities so the operators could concentrate on fixing the plant, operating the plant not having to notify off-site agencies. And we came up with a guidance with respect to the TSC's location where it would be approximately two minutes walking distance from the control room so you could have runners basically -- or walkers in case going back and forth.

Now if you remember those times, and I do, at those times the technology wasn't quite that advanced. And one of the most sophisticated pieces of equipment that I recall was a fax machine that had just come into being. But none of the engineers, including myself, knew how to operate a fax machine. And so we had to get a specialist or a secretary to come in and tell us how the paper went in and how to operate it.

We're seeing a change in that recently in regard to the advanced communication capabilities that now exist. So there is some flexibility within the place of the location of the TSC.

If you look at section 13.3 of the standard review plan you'll see that we've addressed that that there is some flexibility if they can make the case that there is advanced communication capabilities that would provide for the intended purpose of having a quick back-and-forth discussion between the control room, the TSC, if their communications broke down.

So it was a backup to the control room where if your communications went down, you could run to the control run and get information.

So the location is fluid right now.

Now in addition to that we're seeing a future trend coming in that where you have an existing plant which may have a two unit plant which may have one TSC, if they're going to add two additional units where the certified design may certify a specific location for a TSC, if you were to add two additional reactors to an existing site, then would you have three TSCs? And then you get into trouble or a concern with respect to okay if you're going to activate a TSC, which one do you activate? If you have an accident effecting more than one unit, are you can activate two TSCs?

So we're seeing a trend coming where there may be a common TSC for the entire site, which makes it a lot simpler.

Also a TSC that may be located outside of the annex building or near the reactor building from a security standpoint in case there was a threat, a security threat, would it could not be possibly taken out at the same time the control. Maybe have a back facility located separately. Maybe a plane hitting the site, for example. So there's a benefit to that.

MR. FOSTER: Thank you, Bruce.

Any more questions on emergency preparedness.

MEMBER SIEBER: Yes. Just so everybody understands, as you move from unusual event to where the site area to general, the emergency 4 classification, the organization changes. And the person who is charge of the emergency changes as you step up through those things. And that is, besides the fact that everybody would rush to the control room when something bad is going on in the plant, that's one of the reasons why locations and facilities were chosen the way they were.

MR. MUSICKO: That's the specific reason why the TSC was required about Three Mile Island. Because the control room --

MEMBER SIEBER: Because of the control room.

MR. MUSICKO: Right, wasn't big enough.

MEMBER SIEBER: Even Carter was there.

MR. FOSTER: All right. Next section is 13.6 physical security.

MR. TARDIFF: Hi. My name is Al Tardiff. I work in the Reactor Security Branch in the Office of Nuclear Security and Incident Response. I'm going to present the physical security review on the ESBWR today.

Topics of interest include many security features are being identified through voluntary security assessments. The applicants on a voluntary basis are applying design basis threat scenarios and identify features associated with detection, delay and response to bolster the physical security posture of the facility.

Many of the issues still remaining within the review are focused towards taking credit for design features. Actually designing design features that they want to take for. Examples are delay features of door systems for adequate delay, cabinets that house the critical components, power supplies for communication systems and exclusion detection system and maintenance of those features identified.

Some of the issues to be resolved also include correction of previously made assumptions within the ESBWR analyses.

There are other open items, but they generally can be binned within a few categories.

The first bullet, accommodation of detection aids in the design. This looks at primarily with the vital area entrances.

Identification and design of unattended openings. Unattended openings are those unattended passages or openings through which -- at security barriers, such as culverts or HVAC ductwork.

Identification of special security areas and location and the design of unique physical protection measures for vital components. And that has to do -- that gets into the safeguards information or official use only information that has to do with unique features identified during security assessments.

All the outstanding issues are planned to be resolved through submission of technical reports.

COL information items. The COL information items include final design considerations for access controls, power supplies, unattended openings and the alarms for the unique features identified during the security assessments.

Also the administrative controls for unique features identified during the security assessments.

Capturing the COL information items and specifically attached to the unique features identified ensure a smooth transition of these unique features from the design into the COL.

MR. FOSTER: That is it.

MEMBER MAYNARD: I don't want to get into any of the details, I just want to -- on the security. Has a review encompassed taking a look at security versus what impact that may have on operations and responding to an emergency? You know, some of the things may be great for security but it may inhibit the operator from doing what's needed. I was just curious if that's part of the review in what you're looking at?

MR. TARDIFF: As part of the voluntary review we asked them to look at those types of effects. It is not a requirement today.

The proposed 7358 does have a safety security interface requirement. So we are asking the question while they're not required to put in provisions for that at this time.

CHAIRMAN CORRADINI: Any other questions from the Committee?

MEMBER BLEY: Just to follow up what Otta said. When the staff looks, you raise those questions yourselves and is that a source of generating RAIs back to these folks?

MR. TARDIFF: Yes.

MR. BARSE: This is Dan Barse.

And I would in the emergency preparedness area also we look at that or we have that consciously in mind when we do review as to what impact, you know, would a security barrier or a security event have on responders either getting to the site or being in a safe place during the event if it's a terrorist-type attack. Those are the considerations that we look at. And we would be asking in the RAI. So we didn't seek discussions of that.

MEMBER BLEY: Thank you.

CHAIRMAN CORRADINI: Other questions.

So I guess this is a point that if we have questions that need to go into closed session, I wanted to see if the Committee members have anything.

Jack? Graham?

MEMBER ARMIJO: No. I just didn't understand the agenda. I thought there was something that was -- we can go into it fine.

CHAIRMAN CORRADINI: There was no plan. We can go into it if we need to, but only if we need to.

MEMBER MAYNARD: Will we have an opportunity at some point to review security in more depth for this design?

DR. WALLIS: I think there's a better time and place, isn't there?

MEMBER SIEBER: It depends on how old you are.

MS. CUBBAGE: If you're talking about the integration of security into the standard design, I mean this is the time to ask those type of questions. You were provided, I believe, through Gary the safeguards reports and these additional topical reports that GE referred to haven't even been submitted yet. We'll be expecting those any day. We can get those to you as well.

This is the time if you want to --

MEMBER MAYNARD: I think the majority of

mine would probably come more at the COL stage than looking at the --

MS. CUBBAGE: Right. At the COL stage. Yes, that would be the more programmatic aspects of physical security. And anything that's outside of the nuclear island.

DR. WALLIS: Well, there are some things, though, which can be done at the design stage which could make a significant difference. And we have actually emphasized that in our letter. And hope at sometimes, and probably not here, we want a chance to look at those.

MEMBER BONOCA: But this is tied to the conduct of operation, this portions, I would suspect.

DR. WALLIS: Right.

MEMBER BONOCA: It's more like force-on-force and issues that --

MS. CUBBAGE: The force-on-force aspects are the COL stage. Integrating security into the design is at this stage. At this point a lot of that is voluntary, as Al as alluded to in his presentation. If you want to get into that in more detail, this is the venue.

CHAIRMAN CORRADINI: I don't sense a great urgency by the group to jump into closed session and talk about it at this point. So I think we'll pass at this point.

MS. CUBBAGE: Right. And then there is a rule out for public comment right now on aircraft assessment. That is something that we have not gotten into detail yet on this review. But should that rule become effective, then we need to address that as a requirement in this design.

MEMBER BONOCA: We will be reviewing that rule, and we will comment on that probably in the March time frame. But I would expect that that has nothing to do with what you would presenting today here.

CHAIRMAN CORRADINI: No.

MS. CUBBAGE: No.

MEMBER STETKAR:

MEMBER STETKAR: Does the fire hazards analysis evaluate impacts on the portion of the security systems that are included in the design. I'm thinking about power supplies, signals, things like that.

MS. CUBBAGE: Al, I don't if you have anything to add on that? I know fire protection --

MEMBER STETKAR: I am looking at a yes or no.

MR. UPTON: This is Huge Upton with GEH.

The actual fire hazard analysis just takes a look at the combustible loads in each one of the rooms and then determines what fire protection mechanisms are necessary to fight those fires, sprinklers and that sort of thing. So it doesn't-- the question is I don't think it addresses what you're after.

DR. WALLIS: Go back to something we had earlier about the control room. In the control room they've apparently gone away from bottled air to external air. Now if there's an all encompassing fire, it doesn't do much good to bring in external air. But that there are some considerations here which could be important at this stage, not at some later stage. But I'm not sure we want to go into that today.

CHAIRMAN CORRADINI: Well I think if we do, we'll have to do it in a different venue.

DR. WALLIS: Yes.

MS. CUBBAGE: I mean we're prepared to go into the closed session if you want to do that. And it may be short, but --

DR. WALLIS: No. I think there's another place and another time, isn't there, for this sort of thing?

MS. CUBBAGE: No. Not really.

MEMBER SIEBER: Well, apparently not.

MS. CUBBAGE: That's what I'm trying to tell you. We want to hear --

CHAIRMAN CORRADINI: It could be in the COL stage for a specific application. But at the DCD stage, this is it.

MEMBER STETKAR: I think if it has anything to do with physical location of the security center or its environmental controls or power supplies, this is the time.

MS. CUBBAGE: Or any voluntary actions.

DR. WALLIS: But the concern I would have would be with actual features of the design itself, which design to resist certain events. Is that something--

MS. CUBBAGE: There's here.

CHAIRMAN CORRADINI: That's here and now. Granted, at --

DR. WALLIS: But that could go on for a long time. Do you have a big presentation or something?

MS. CUBBAGE: We don't have a presentation, but we --

DR. WALLIS: Well in that case, if you're not prepared, I'm not sure I want to ask any questions.

MEMBER APOSTOLAKIS: Right.

MR. TARDIFF: We could probably answer the questions that you ask, though.

MS. CUBBAGE: Right. We didn't bring paper that would have to be protected and taken back.

DR. WALLIS: Well, personally I think that this is an important enough subject that it may be -- should be subject that you actually have a closed section devoted to it. Not something you just slip in like this when someone wants to do it. But you actually prepare something.

CHAIRMAN CORRADINI: Why don't I take that back and talk with Amy about it. Because I don't think they're prepared for it now and I don't think that we're generate questions --

MS. CUBBAGE: Well, I think Al would be happy to answer. I mean, it's not that he's not prepared. We just don't have handouts.

MR. FOSTER: Yes, we take you -- the slides that we have the physical security to elaborate in these areas.

MEMBER ARMIJO: So you're prepared to

describe it?

MR. FOSTER: Yes.

MEMBER ABDEL-KHALIK: Without us having to ask a question and extract something?

MEMBER SIEBER: It's important when you think about standardizing all of this stuff in the area of security I think that it lessens security to have everything standardized so that no matter what plant you go to, you know what door to go in.

MS. CUBBAGE: The other thing I'll offer is -- go ahead. The other thing I'll offer is that the closed session was intended for an opportunity for GE if they chose to, they could describe some of the features that they have voluntarily incorporated into the design.

MR. TARDIFF: Are the unique features that I keep alluding to.

MEMBER ARMIJO: Right. And I'm just getting very curious and we're not going to talk about it.

CHAIRMAN CORRADINI: Did you have something you wanted to add?

MR. KINSEY: This is Jim Kinsey from GE.

I guess we're in the same situation as the NRC staff. We're prepared to answer questions and discuss the features that we've built into the plant if you're interested in talking through that today. This is probably the --

MEMBER MAYNARD: I would recommend we go ahead and go into close session for maybe 15 minutes and at least identify whether we need another session or answered their questions or whatever.

MEMBER SIEBER: Maybe we have to ask the Designated Federal Official if this room is good enough.

MR. HAMMER: If it's on the agenda, we can do it.

MEMBER MAYNARD: Well, is it just close session because it's safeguards?

MS. CUBBAGE: Not safeguards.

MR. TARDIFF: It's not safeguards.

MS. CUBBAGE: Not safeguards. Right, All. You would be able to keep it at a nonsafeguards but security related level?

MR. TARDIFF: No.

MS. CUBBAGE: You have to go safeguards?

MR. TARDIFF: Yes.

MS. CUBBAGE: Okay. And is this room appropriate if you shut the door?

MEMBER SIEBER: Well, you said it's

safeguards?

MS. CUBBAGE: And we just have to shut that door.

CHAIRMAN CORRADINI: Two of our members will have to --

MEMBER APOSTOLAKIS: When we go to the room upstairs, they can't come here --

(All talk at once).

CHAIRMAN CORRADINI: So I don't think with a red badge they're allowed to stay and discuss it based on what I understand.

MEMBER BLEY: We couldn't get the documents.

CHAIRMAN CORRADINI: So I don't think if they can't get the documents, they can't have the discussion.

MR. TARDIFF: You could have a red badge and still be safeguards cleared in matters if you are red badged and are safeguards cleared.

CHAIRMAN CORRADINI: I'm not going to take the chance.

MEMBER STETKAR: Well, we haven't been informed that we've been cleared.

MEMBER BLEY: And we asked to get the documents and they said we have to wait until the process goes further.

CHAIRMAN CORRADINI: So should we go into a short closed sessions on it.

MEMBER APOSTOLAKIS: Let's do that.

CHAIRMAN CORRADINI: Okay.

(Whereupon, off the record at 2:45 p.m. until 3:20 p.m.)

CHAIRMAN CORRADINI: Jim, do you want to lead us off here?

MR. KINSEY: This Jim Kinsey GE Hitachi of. We're going to present an overview of the Chapter 16 if the draft control document Technical Specifications.

And I'd like to ask Dan Williamson who give an overview of the tech specs.

MR. WILLIAMSON: Good afternoon.

Going to cover today, as the agenda shows, with some help here, really briefly cover the philosophy we used and the methods we used to develop the ESBWR generic tech specs that are in Chapter 16 and 16B of the DCD, 16B being the bases.

We'll also discuss some differences that exist in the specs, differences from existing fleet tech specs, which you're familiar with. And then we'll discuss some of the COL applicant items that are there, like the applications we'll deal with when they may come in.

And I understand, I've been told that I don't have to encourage you to ask questions. Please feel free at any point in time.

In the development of the ESBWR tech specs we started with the latest BWR standard tech specs in the existing fleet, the BWR-6 NUREG 1434. And we also utilized the latest generic changes to those specs and have been keeping up with generic changes even over the last couple of years.

MEMBER ARMIJO: I got to ask.

MR. WILLIAMSON: Yes, sir.

MEMBER ARMIJO: Why did you start with the BWR-6 tech specs as opposed to the ABWR tech specs? I mean ESBWR is pretty different from all the others.

MR. WILLIAMSON: Good question. Good question.

MEMBER ARMIJO: But why not the ABWR?

MR. WILLIAMSON: Good question. The ABWR tech specs when they were developed, they were developed at a time when the BWR standard, the BWR-4 and 6 standards were being finalized. So the ABWR tech specs actually started with a pre-REV 0 look at NUREG 1433, in that case. So in fact the more later and greater tech specs are reflected in the BWR-6 standard.

MEMBER ARMIJO: Okay.

MR. WILLIAMSON: And the ABWR specs were basically frozen at that time and haven't kept up with the generic change process and all. But certainly they were a desk reference as were the SBWR tech specs. So we weren't exclusive to the BWR-6 standard, but that did form the basis. It gave us our standard content, numbering, form and format for consistency in the presentation, which facilitates the NRC review in reviewing the prior reviews they had done on passive plant certification. They tended to follow a comparison to the existing standard.

MEMBER ARMIJO: Okay.

MR. WILLIAMSON: This also provides SRO familiarity. When we go into training SROs that are coming from the existing fleet, they're going to have tech specs that they're used to seeing, they're very comfortable with.

MEMBER APOSTOLAKIS: I have a question. You know that it's a lot of work to risk-inform these tech specs. Do you remember this end stop business has been approved? But my question is does all these work of the lats few years on risk-informing this kind of stuff, does it play any role in here, or is going again the future licensees would have to request to go to a risk-informed regime?

MR. WILLIAMSON: The standard tech specs, the NUREG 1434 there are efforts underway and have been for a few years to do risk-informed generic changes. There's a separate little subcommittee that has many tasks that look at risk-informed improvements. Those improvements that have been approved and adopted, staff has written SERs on. To the extent they're applicable to the ESBWR design, they show up as part of the ESBWR tech specs.

It is not a complete risk-informed rewrite of the tech specs. I know there are future plans for some of that.

So there are pieces that have these risk-informed improvements on a case-by-case basis. And, again, our focus point was to provide -- to start with something that was easy for the -- something that was firm and known. Not to create something brand new for the staff to review and approve. So we started with the standard as it exists today, the applications, the risk-informed pieces that are approved today. And that positions the ESBWR also to continue to follow the rest of the fleet as they move forward with additional improvements and additional changes.

MEMBER SIEBER: If the opportunity arises during your presentation, would you point out an example of a risk-informed tech spec?

MR. WILLIAMSON: Sure. I will do that. Remind me because it isn't something I would have gotten into. But there probably will be a more appropriate time to do that.

MEMBER SIEBER: Just a simple one.

MR. WILLIAMSON: Okay. Well, we're talking about it now, might as well. Some of what's called the motherhood, the 3.0s, the how you use tech specs.

MEMBER SIEBER: 3.0.4?

MR. WILLIAMSON: 3.0.3, 3.0.4. In fact there was missed surveillance, SR 3.0.4 --

MEMBER SIEBER: Right.

MR. WILLIAMSON: -- that had some risk-informed looks. And what was done, essentially the risk-informed pieces show up in the bases. That if you miss a surveillance, you're allowed a time to--

MEMBER SIEBER: Point five percent?

MR. WILLIAMSON: Well, in fact the risk-informed pieces said you essentially have another frequency interval to go complete that surveillance provided you look at your maintenance rule. You put this issue into your maintenance rule evaluation. And so there's some references in the bases that essentially commit you to a maintenance rule look for that particular writing. And so the ESBWR bases have that same commitment to do that kind of maintenance rule activity on a missed surveillance.

MEMBER SIEBER: Yes. But the LCOs remains the way it was?

MR. WILLIAMSON: Right. The LCOs and the surveillance actions --

MEMBER SIEBER: Remains the way it was?

MR. WILLIAMSON: Exactly.

MEMBER SIEBER: And so when you got to the bases, you're actually outside of what the DCD would have as an approved occupant, right?

MR. WILLIAMSON: Well, the bases are part of what the staff required in approving this change for the fleet. And this is a fleet change that all the PWRs and BWRs have today.

MR. KINSEY: And the bases with that discussion are a part of the DCD, or a part of the document that's certified by the staff.

MEMBER SIEBER: Yes, but the staff doesn't approve it, do you or do you?

MS. CUBBAGE: We do. It doesn't have the same degree of finality as the rest of the certification. And when we issue a combined license, they will have tech specs that are based on the standard and become part of that license.

MEMBER SIEBER: Okay.

MEMBER APOSTOLAKIS: Now let me understand this in simple terms. Are we certifying designs and eventually the COLs, approve the COL and we are perpetuating the dual system that we have for existing LWRs?

MR. WILLIAMSON: Yes.

MEMBER APOSTOLAKIS: That's what we're doing at a higher level? We take deterministic stuff and improvise and still later wants to be published in form, they have to come here and use the appropriate-- but they are not using risk-informed measures--

MEMBER SIEBER: One change at a time.

MEMBER APOSTOLAKIS: One change at a time.

MEMBER SIEBER: One change at a time. Yes. Or you can group them together. But it's not going to be a new standard tech spec document, as far as I can see.

MS. CUBBAGE: I don't think anything would have precluded GE from proposing a risk-informed tech spec approach. It would have been a much more complex review, and this is what they opted to do was to base it on the standard.

MR. WILLIAMSON: It facilitated the schedule that was laid out for both us and the staff to reach certification, but not try to introduce something that was nonstandard.

MEMBER APOSTOLAKIS: Well, maybe it's fundamentally that we have really risk-informed the GPCs or rules. We have issued regulatory guides but basically the fundamental regulations would not be risk-informed.

MS. CUBBAGE: That's right.

MEMBER APOSTOLAKIS: And the ECCS rule that is in the works would be the first major, if it ever passes.

MS. CUBBAGE: Right. And then --

MEMBER APOSTOLAKIS: Right? The same with the licensees or the vendors the same way. We have to go back to the books.

MS. CUBBAGE: Right. The technology-neutral licensing framework, that's down the road that if whenever --

MEMBER APOSTOLAKIS: Or for next month --

MS. CUBBAGE: Yes. Yes. That's what I'm

saying. I mean, there's been potential for some radical licensing approaches, but not in the time frame that they're looking for a certification.

MEMBER APOSTOLAKIS: Yes, and I think that's a problem. Not problem. I mean this is the root cause is that the regulations themselves have not been risk-informed.

MEMBER SIEBER: Right.

MEMBER APOSTOLAKIS: And everything else is on the side.

MR. WILLIAMSON: Yes. Speaking of regulations --

MEMBER APOSTOLAKIS: It's about time we speak about regulations.

MR. WILLIAMSON: Starting with the standard BWR-6 standard is really just a starting point. That just kind of gives us a basket to work in and creates the standard look and feel. And it gives us a good scope of are we including enough of the right stuff. But the reality is 10 CFR 5036 will dictate the actual content of tech specs.

Having gone through back in the day when Grand Gulf was licensed when the first BWR-6 came along and used the BWR-5 standards, there are lessons learned in making this kind of transitions. And we're not ignorant of those lessons that were learned. It is a key and it is a route of 5036 that you may take your design specific safety analysis and the design specific systems that you have and evaluate them against the criterion in 5036, four criterion.

And so that's where the real rubber begins to meet the road. And in ESBWR we did do that, provided a detailed -- in one of our RAI responses in fact we documented a very detailed look at the safety analysis and the specific systems that ESBWR had against the criterion of 5036.

So it's very much a key that the design drives what the tech specs are. They're simply a reflection, operating reflection of what the design is.

We also took advantage of the fact that we have perspective clients. We have real SROs that have been involved in the review of the development of the tech specs. And we've factored in their comments, both in a useability review and in making sure tests can be performed and the light.

I also wrote myself a note. There was a question earlier about we'll defer that to Chapter 16. I believe it was a question about off-gas or --

MEMBER ARMIJO: Yes. Steam jet air

ejector.

MS. CUBBAGE: For the gland seal.

MR. WILLIAMSON: Yes. We did have a tech spec 373 if you have your specs memorized on off-gas system. Yes, it might have been renumbered at one time. Yes, there is a tech specs on off-gas activity.

And I wasn't sure exactly what the question was. 10 CFR 5036(a) also mandates tech specs on effluent controls. A lot of the admin control section of tech specs is what meets that regulation and provides for procedures and controls on effluent releases and reporting and the things that come under 5036. But in addition to that, there is the one spec on the steam jet air ejector off-gas activity.

MR. KINSEY: So does that answer the question from earlier, or series of questions? You think so?

MR. WILLIAMSON: Differences; that's how we're the same as the current fleet. Now some of the differences, obviously the ESBWR is a passive design. And as you've been hearing, the passive design results in a reduction in number of systems. Certainly results in a number of active systems. Diesel generators are not credited in the event so we don't have tech specs on diesel generators.

There's no safety pumps or MOVs. So these are some differences, obvious differences that you're going to run into.

The ECCS system is different for the ESBWR relying on passive gravity drain systems, squib valves. So we have developed ECCS inoperability actions and we're still working on those. Those are things that are still part of the open items that we're working with the NRC on. But the new ECCS design will dictate new ECCS actions.

In general, I think it was a bullet on a previous slide. We tried to maintain -- when the systems were the same, we tried to maintain the same actions and surveillances that the existing fleet has. But, obviously, ECCS would be a case outside of that box.

MEMBER APOSTOLAKIS: So, I need to be educated here. I understand how in an active system situation you have months tests of pumps and so on. How do you test the passive system?

MR. WILLIAMSON: The tests in large part-- well, the squib valves are -- you got mini checks on the squib valves.

MEMBER SIEBER: To test the active part.

MR. WILLIAMSON: Yes.

CHAIRMAN CORRADINI: You also change or do so some sort -- I think it was some sort of random checking of the charge, right?

MR. WILLIAMSON: Exactly. The squib valves set of things that are done. And then the other side of the system is the pool. And so there are surveillances on pool level temperature. So a lot less surveillance is on a passive system then you would find on a HPCI/RCCI

MEMBER APOSTOLAKIS: That's it. You make sure you have enough water.

MR. WILLIAMSON: Make sure you have enough--

MEMBER APOSTOLAKIS: And at the right temperature?

MR. WILLIAMSON: Enough water at the right temperature. And you got a squib valve that's going to fire. And there's the instrumentation side of the world which is the specs are divided in instrumentation and systems and so --

MEMBER ABDEL-KHALIK: How do you do periodic checks to make sure that there is no trap noncondensible gas?

MR. WILLIAMSON: A design question like that I would normally defer to design engineering.

The system is open at the pool end, so I'm not sure gases would be trapped --

MR. UPTON: This is Hugh Upton with GEH. I'll take that question. But you have ask specifically what are you talking about. If you're talking about the ICs, the ICs have a noncondensible vent to the suppression pool.

MEMBER ABDEL-KHALIK: No. There are some parts in the piping where you have a check valve and then you have one of those squib valves. So it is possible for a noncondensible gas to be trapped between those two valves, unless you have some startup procedure that prevents that from happening.

MEMBER APOSTOLAKIS: Is not water there for a long time, for years, does it ever circulate at all?

CHAIRMAN CORRADINI: May I ask a question just to interject just to help the question with George?

So maybe I'm missing something. So with the isolation condenser you could, if you so chose as you're coming down for maintenance or refueling, to essentially exercise the isolation condenser, open the valves and essentially reject heat that way just to verify operation, close up and let it refill, right?

Nothing stops you from doing that?

MEMBER APOSTOLAKIS: That is --

CHAIRMAN CORRADINI: Well, that was my next question. First, am I right that you can do that because it nitrogen operated with an accumulator backup? So do you? Is it part of the ongoing at a refueling or ever so many times to actually say, okay, let's just put it on the isolation condenser make sure everything is hunky dory and then come back off, or is that not part of the plan is the question?

MR. UPTON: This is Hugh Upton with GEH.

Typically what's done is during construction there is going to be pre-opt testing and startup testing on the ICs. That's when the capacity will be demonstrated.

I don't believe that there's periodic surveillance to demonstrate the heat transfer characteristics of the IC or --

MR. WILLIAMSON: Or any sort of degradation because of --

MR. UPTON: But again, let me say that the design assumes a very conservative fouling factor on both the ICs and the PCCS.

CHAIRMAN CORRADINI: But let me just finish on this one and then I'll turn it back to

George. But just to use any analogy, what is the current regulation for containment leak rate testing and wouldn't it be logical that a containment, which is the best example in a current plant of that passive system, that has to be at some periodic thing go through a containment leak rate test. You would do some sort on a passive basis a test such as an insolation condenser? It seems that's the logical analogy for a current operating plant.

MR. UPTON: For the PCCS is part of the containment. So the containment leak rate test will demonstrate leak type integrity for the PCCS.

MS. CUBBAGE: There's a surveillance requirement in the tech specs to verify each ICs train is capable of removing the required heat load every 24 months. I don't know how that's done, but it's in there.

MEMBER ARMIJO: It is a requirement. They have to figure out.

MEMBER APOSTOLAKIS: Say it again, what?

CHAIRMAN CORRADINI: No. She's repeating what is a requirement for maintenance.

MS. CUBBAGE: Surveillance requirement for isolation condenser is every 24 months verify each IC train is capable of removing the required heat load.

MEMBER APOSTOLAKIS: Right. So the question was how do you do that?

MS. CUBBAGE: I have no idea. That would be a question for GE.

MR. UPTON: I'm being advised that we can do that in-service testing an IC at a time.

MEMBER APOSTOLAKIS: So it's part of in-service testing.

MR. UPTON: That's what I understand. That's correct.

MEMBER APOSTOLAKIS: Okay. And so this would be every 24 months?

MS. CUBBAGE: On a staggered basis. Do one.

MEMBER APOSTOLAKIS: Yes, do one and then you do the other. Okay. And that's covered by tech specs?

MS. CUBBAGE: That is a tech specs surveillance requirement.

MEMBER APOSTOLAKIS: Yes.

CHAIRMAN CORRADINI: Thank you.

Does that help you with your class of questions?

MEMBER APOSTOLAKIS: Yes. Yes, absolutely. I thought that we were standing there.

MS. CUBBAGE: Well, that's the isolation condenser. I think --

MEMBER APOSTOLAKIS: I suspect that you would not be allowed --

MR. WILLIAMSON: And to tell you, ICS is one ECCS system, GDCS is another. There is a surveillance in GDCS to verify --

MEMBER APOSTOLAKIS: So all of these systems are subject to what Amy just read.

MR. WILLIAMSON: Well, GDCS will not inject. We won't do an injection test with GDCS. But we have a surveillance that was added in Rev. 4. It's not part of the Rev. 3 review. But in Rev. 4 we did add a surveillance based on an RAI that requires for GDCS to verify the flow path of each GDCS injection branch line and equalizing line is not obstructed. This would be kind of visual, likely borescope, kind of check on the GDCS line.

CHAIRMAN CORRADINI: And to remind me of the functioning of the system, would the GDCS that's a -- I'm going to get this wrong so I'll just say, is that some sort of squib valve, is that not correct.

MR. WILLIAMSON: True.

CHAIRMAN CORRADINI: Okay. So that's the way you do it by an unimpeded path from the once and only once opening valve up through the line? Similarly, I would assume through your other pathways up to your squib valves. And then for the PCCS, how is that done? Because I have to go get a drawing to remind myself. I'm sorry.

MS. CUBBAGE: It's not filled with water.

CHAIRMAN CORRADINI: That's totally an open an line, is that not correct?

MR. WILLIAMSON: Yes, that's correct.

CHAIRMAN CORRADINI: Okay.

MR. UPTON: Now this is Huge Upton with GEH.

The PCCS is a totally passive, there are no valves in the system to operate.

CHAIRMAN CORRADINI: Okay.

MS. CUBBAGE: And it's not water filled.

MR. UPTON: And it's not water filled, exactly. It's open to the containment.

MEMBER ABDEL-KHALIK: How would you see in that last part, the part between the squib valve and the check valve?

MR. WILLIAMSON: Well, I don't have the procedures drafted, but in our discussions when we adopted this -- in the response to the RAI the discussion was it could be done with borescope. There are test connections that are available that one could do a visual look into the piping.

So we verified that the surveillance was doable before we added to the tech specs.

MEMBER ABDEL-KHALIK: I think we sometime we ought to look at that. Because it just seems like there is a possibility that you can have one big glob of gas between these two valves, you open the squib valve and nothing happens.

MR. WILLIAMSON: Well, Hugh or Larry, I would defer to design engineering to answer this. But essentially if I've got a gravity fed -- I'm not sure that air would bind me if I'm gravity feeding the vessel.

MR. UPTON: Yes. Let me try and address the question.

This is Hugh Upton with GEH.

There's a couple of things that we need to know about the design of the GDCS system. First of all, the piping is going to be slopped back to the GDCS pool.

Secondly, the check valve itself is normally in the open position. It is not closed. So you're not going to be able to build up gas between the squib valve and the check valve. It will be drained back to the pool, which will then end up back in the containment if it's noncondensible.

MEMBER ABDEL-KHALIK: I guess this is going to be a detailed piping design problem. And perhaps, you know, you can design the pipe to eliminate the possibility altogether.

MS. CUBBAGE: I mean, do we need to take that one back or is GE taking that one back, or can they speak to would not the gravity head of water overcome this small amount of air in the line.

MR. TUCKER: This is Larry Tucker with GEH.

The check valve is to prevent flow coming from the reactor back to the pool. So in normal operation the pool is a higher level and the plant is slopped from the pool down towards the reactor with the check valve open. Okay. So there's no --

MS. CUBBAGE: And water against the squib.

MR. TUCKER: And water against up against the squib.

MR. UPTON: And water against the squib. That's correct.

MS. CUBBAGE: And then reactor water against the other side of the squib.

MR. TUCKER: Right.

MR. UPTON: That's correct. That's correct.

MR. TUCKER: So there's no way that gas could build up in that line because it would bubble back up to the pool.

MR. UPTON: Right.

MS. CUBBAGE: Does that resolve the question?

MR. TUCKER: And then if the squib opens, if the reactor is at a higher pressure, the check valve goes closed to prevent backflow to the pool.

CHAIRMAN CORRADINI: Do you have more question, Said?

MEMBER ABDEL-KHALIK: No, I don't.

CHAIRMAN CORRADINI: Well, thank you.

MR. WILLIAMSON: Role of RTNSS, regulatory treatment of nonsafety systems. The subject came up earlier. It does show up in a few cases in the draft Chapter 16 SER. RTNSS is not really a tech spec issue or Chapter 16 issue, but I'm going to discuss it briefly simply because there is a little bit of overlap and it's probably useful to at least understand that overlap.

And the detail, the RTNSS evaluation and the RTNSS detail comes at Chapter 19, which will be a later meeting, so I'm not going to spend a lot of time on it, nor did we bring anybody to really discuss in detail the RTNSS evaluation itself.

But in general, the RTNSS requirements look for an appropriate level regulatory oversight for these nonsafety systems that would be credited 0.72 hours. And it looks to impose for certain systems that meet threshold, an appropriate availability control mechanism. And these are words are phrases from SECY-94-084, the Commission's policy on establishing this framework.

When this evaluation is done if there's an identification of a need for high regulatory oversight, that equates to us as meeting a risk criteria, one of the 5036 criterion for tech specs. And in the RTNSS evaluation that was done there has been one system identified that met that criterion, that would be the diverse protection system, the instrumentation associated with the diverse protection system.

Do that is a tech spec that is not yet drafted, but it's committed to be drafted as a result of the RTNSS evaluation.

There is another tier of items that can be identified from the RTNSS evaluation that would require a lesser level of regulatory oversight. And these are the things that show up in the availability control manual. I believe Gary Miller mentioned about this availability control manual.

So many of the RAIs from the staff dealt with why isn't this system in tech spec or, you know, where is it. And so many of the responses and back and forth, and some of that's reflected in the SER, deal with this topic of the availability control manual. That no, it didn't meet tech spec threshold, but yes it is covered in the availability control manual.

So I did want to point that out it is a unique to passive plants issue, this RTNSS process. And that it does have potential impact specs, and in our case it did create one tech spec.

Another difference, assuming there are no questions, is that in the ESBWR design was actually implemented design change such that three of the four electrical divisions that are designed are all that's needed to satisfy safety. And two divisions actually that are needed, and it's all that's needed to satisfy all safety functions, and then the third division affords the single failure protection.

So the tech specs following the design and the safety analysis as they're dictated to do, have spec-ed three divisions that are required to be operable in the applicable nodes.

The tech specs also ensure by the construction, we made sure that they assure that all the circuits and logic and sensors and the power supplies are all on the same three divisions. There's no case that anybody can get confused and have three of these divisions of this kind of thing and three different divisions of power or whatever. So the specs are very detailed in prescribing that those three divisions are all the same three divisions.

And, again, focusing on the fact that any two divisions will accurate all safety systems is another unique design feature. That we don't really have a single division that actuates a single division of GECS, for instance.

So question?

MEMBER STETKAR: Yes. How do you account for the fact that, the way you presented it it sounds like all four divisions are equal and any three of the four are okay. In fact, any two of the four. That seems, from what I understand, to be mostly correctly but in some cases not correct. Because in a few cases there are a particular two divisions that provide safety functions, like divisions 1 and division 2 only. Not divisions 1, 2, 3 or 4. So how to ensure, for example one of my favorite things, a remote shutdown facility panels that I was talking about earlier, one is supplied from division 1, one is supplied from division 2 period? So either that or the DCD is wrong.

CHAIRMAN CORRADINI: Can you repeat that so I understand it?

MEMBER STETKAR: According to the DCD the instrumentation systems in section 7 -- I've read ahead a little bit. The remote shutdown panels are powered from-- are division 1 and division 2. They're not four-fold-redundant. So that means that somehow division 1 and division 2 are somewhat different than division 3 and division 4 in my treatment. I would think that they should be different in my treatment of the tech specs. How do you account for that, or am I misinterpreting something on the DCD?

MR. UPTON: You may be misinterpreting.

This is Hugh Upton with GEH.

That was not our intent. The intent was that, for instance, one shutdown panel could be powered from divisions 1 and 3, while the other one would be powered from 2 and 4. Okay. So we have to take back under consideration.

CHAIRMAN CORRADINI: He specifically says

1 and 2.

MR. UPTON: We have to take that back. Well have to look into it. I'm not sure. We don't have the right people here to answer that question.

MS. CUBBAGE: It speaks to division 1 and 2 safety related parameters being displayed.

MEMBER STETKAR: Right.

MS. CUBBAGE: So if you lose division 1 and 2, I'm not sure what you're displaying the way it's written here.

MEMBER STETKAR: I am aiming at --

MS. CUBBAGE: I was looking at 7.1.3.2.3.2.

MEMBER STETKAR: Right. Yes. I mean that's the first place I came across.

CHAIRMAN CORRADINI: I think you've piqued their interest and they're going to come and answer you.

MEMBER STETKAR: Yes.

MR. BEARD: Alan Beard with GEH.

Division 1 and 2, the existence of the remote shutdown panels are there to address the evaluation of the main control, either due to fire or toxic gas. That is their only regulatory basis.

They interface with division 1 or division

2. They are basically a computer node on the network that allows a person or an operator at that station to work with that division's worth of equipment. It was never intended that we would have N+2 type of capability for the remote shutdown station.

MEMBER STETKAR: I guess I was confused. Because they are in the DCD, they are summarized under things that are called safe shutdown systems which include things like standby liquid control and safety related information, post-accident monitoring.

MR. BEARD: But the purpose of remote shutdown stations is to allow the operator to interface with the equipment. The automatic capability is not to grade it by what happens with the remote shutdown station. So the automated capability that we talk about, the safest shutdown capability, is carried out automatically by the safety system watcher control.

MEMBER STETKAR: But it is true if I have divisions 1 and 2 down, the remote shutdown capability is disabled, is that correct?

MR. BEARD: The operator would not have the ability to interface with those divisions. That's correct.

MEMBER MAYNARD: But if you have both

those down, you're going to be down?

MEMBER STETKAR: No. no. No, you can have two down for eight hours or something.

MS. CUBBAGE: Well, one -- you can one out of service and then the second one is the signal failure, right?

MEMBER STETKAR: Right.

MR. TUCKER: This is Larry Tucker with GEH.

The design is somewhat similar, very similar to some of the European designs. And most of the plants, the electrical system is designed to be single failure proof, but maintenance is in fact a single failure if you take a train down from maintenance.

The most closely that I would describe it is single failure with maintenance, and that's why you have the four trains. And that's more like the European design of some of the later plants. Leibstadt--

MEMBER STETKAR: Yes, but the Leibstadt has two separate, completely separate --

MR. TUCKER: That's why I said it's somewhat similar.

MEMBER STETKAR: Their remote shutdown is completely different from what we're talking about here, though.

MR. TUCKER: Well, I'm focusing on the safety functions of safe shutdown of the reactor.

MEMBER STETKAR: Yes.

MR. TUCKER: The remote shutdown panel is more for operator interface monitoring. But the safe shutdown functions happen whether the operator can see anything at the remote shutdown panel or not. There's no operator action credited at the remote shutdown panel to assure safe shutdown, is I guess one wy to say it.

MR. WILLIAMSON: Actually, Larry was segueing into about the only other thing I was going to mention is that it is there, it does facilitate maintenance, online maintenance of a division. It is, again, one of those things the utilities were interested, particularly interested in their capability of doing.

I also wanted to highlight the fact that each division has two sets of batteries, two batteries. And the testing that will be done every 24 months these batteries must undergo a service discharge test and be restored back to service. But while that's being done, the Division still remains in service. From a tech spec perspective, from a fully operable perspective we won't consider it operable. It will be one of those divisions that's not required. But in fact it will remain in service and it will remain capable of doing what it needs to do. The duration, the 72 hour durations won't be there because you only have one of the two batteries, but functionally when the maintenance is being done the plant's not going to see this division as an out-of-service division. So I wanted to highlight that point.

And, these divisions will be tested. There's periodic testing that must be done. And they're going to run these divisions throughout the course of the cycle so that they're not impacting outage critical path with these tests. So there actually will be a rotation of times when different divisions would be in test or not in test.

And this being a safety related division, all four divisions are a part of the design, they're all safety related, they all fall under Appendix B and they all fall under the maintenance rule. Any degradation in any of the systems would be covered by the Appendix B corrective action process. And any planned maintenance would be governed by maintenance rule evaluations.

Going on to the next slide, the last item we wanted to talk about was the fact that there are COL applicant items in Chapter 16 and 16B. And these are very similar to standard tech specs. Optional features or provisions, site specific details. You can see example list on the slide. Obviously, the site description needs to be unique to each site so there are some bracketed material that the COL applicant will have to fill in.

Effluent reporting, where you're multiple site, single site there's some different provisions allowing you to make one report instead of multiple. So there were different wording options that are provided in the tech specs.

And if you happen to have a unique site-specific chemical hazard, there are different actions that might apply in the control room ventilation, in particular if that's applicable to your suite.

So these items will be completed with the COL applications. And they're indicated in the DCD with the brackets. And these brackets have reviewer's notes to facilitate both the staff review and the licensee when they go to fill in the brackets to clue them in about any unique features that must be included when they fill in those brackets.

So in summary we have prepared the ESBWR tech specs to be standardized and to be focused on the ESBWR design. And they're geared to support the COL applications need for completeness and technical sufficiency. And we continue to work with the NRC to close out open items.

MEMBER APOSTOLAKIS: Coming back to your have your discussion, there's something I don't understand. It was said that each train or each train of the isolation condenser would be tested once every two years. It will be truly tested in the sense that it will remove heat. Where does that heat come from?

MS. WASTLER: The timing of --reactor steam.

MEMBER APOSTOLAKIS: Oh, from the reactor.

MR. WILLIAMSON: An in-service test. The in-service wasn't mit to be --

MEMBER APOSTOLAKIS: The reactor itself?

MEMBER ABDEL-KHALIK: So you would do the test while the reactor is actually operational?

MR. WILLIAMSON: While shutdown.

MEMBER SHACK: While shutdown.

MR. WILLIAMSON: Yes. It would not be a test you would do while critical without a special test provision.

MEMBER ABDEL-KHALIK: But what is the capacity of the signal --

MEMBER APOSTOLAKIS: So that's why am I asking, the cycle is two years, right? So one will be tested in the middle of the cycle?

MR. WILLIAMSON: No. Every two year cycle one of the four will be tested. Over the course of eight years it will be tested.

MEMBER APOSTOLAKIS: Oh. So the interim is four years?

MR. WILLIAMSON: Is eight.

MEMBER APOSTOLAKIS: Eight.

MR. WILLIAMSON: A particular one gets tested every eight years.

MEMBER APOSTOLAKIS: I see. Okay. Okay. Okay.

MEMBER ABDEL-KHALIK: But what's the capacity of a single ICS?

MR. WILLIAMSON: I defer to my design brethren.

MR. TUCKER: It's about 35 megawatts.

MEMBER ABDEL-KHALIK: Thirty-five megawatts. So that corresponds to?

MR. TUCKER: About two-thirds of a percent of thermal power.

MR. MARTINO: This is Wayne Martino of GE. We consider that we can test the ICs during operation.

MEMBER APOSTOLAKIS: Really?

MR. MARTINO: Yes.

MEMBER BLEY: I asked that at the last one, they said no big deal.

MEMBER APOSTOLAKIS: What's not big deal--

MEMBER BLEY: It's not a big power load if you were to open it during operation.

MEMBER ABDEL-KHALIK: It is 35 megawatts--

MR. TUCKER: This is Larry Tucker of GEH.

The isolation condensers are open to the reactor in terms of the steam being able to go to the isolation condensers while we're in power operations. There is condensation that fills the return line, and there is a value that keeps the flow from happening. It would be perfectly possible to open that valve and start the cooling of the isolation condenser and demonstrate that you can transfer heat to the pool--

CHAIRMAN CORRADINI: Just warn the people near the exit of the steam.

MEMBER APOSTOLAKIS: Whether this will be done will be determined by the utility?

MR. TUCKER: Yes. Whether they choose to

do that on line or they choose they do it just after we shutdown while there is still decay heat available, that's really up to the COL applicant in how they approach their operating strategy.

MEMBER ABDEL-KHALIK: But if you open that valve, that's normally closed?

MR. TUCKER: Right.

MEMBER ABDEL-KHALIK: How would you actually verify that you were moving 35 megawatts?

MR. TUCKER: You measure the heat of both -- then you would start seeing a steam flow through the isolation condenser, which there would be --

MEMBER ABDEL-KHALIK: Are there flow indications on those -- not that I remember.

MR. TUCKER: I think you would observe it by temperature.

MEMBER MAYNARD: Well, I think we need to be careful, though, we don't create a bigger problem by testing --

MR. TUCKER: Larry Tucker with GEH.

MEMBER APOSTOLAKIS: Well, Otta, are you saying that this -- you ought to do during power pressure?

MEMBER MAYNARD: Well, I think you need to have a lot more thought put into it than us sitting here -- I think the main thing is that there is test interval. I think the staff and the applicant need to decide what constitutes an appropriate test.

MEMBER APOSTOLAKIS: So every --

MEMBER MAYNARD: Well, the frequency could be determined by a number of different things. First of all, you can test certain components. You may want to cycle the valve a lot more often than once every eight years. As far as demonstrating the performance of the IC, I don't know. That may be appropriate, may not.

MR. UPTON: We test a lot of circuit quite frequently.

MEMBER MAYNARD: Yes. The parts of it you that you can test frequently. To do the full integrated test on it, I'm not sure that it's needed to be done that often.

Also, the frequency can be set after a while based on operating experience and what other issues may or may not come up. I mean, if you test these things frequently for five or ten years and you never run into a problem, then you may very well want to extend the frequency. If you want to run into problem, you may want to shorten the frequency.

MR. TUCKER: This is Larry Tucker with

GEH.

Our system engineer has informed us that there are flow indication indicators on the return line from the IC condenser to the reactor. It's just a design detail below the summary level sketch of the DCD.

MR. WILLIAMSON: And I didn't get into it, but there are tech spec surveillances that do require this. In an overlapping fashion you could confirm each cycle for each four trains that the systems is capable of automatic actuation, which typically involves that these valves would be cycled and ASME would require them to be cycled also, strobe tested. So there are requirements for each train to go through the testing, at least a series of overlapping tests, that shows that it would function and actuate. The actual confirmation of heat removal is the one piece that would be on a different frequency.

MEMBER STETKAR: Let me make sure I understand. I think I do. The kind of stepping way back from this thing, the big picture philosophy of the four divisions.

As I understand it, the tech specs allow one of those divisions, a division, pick a division to be inoperable indefinitely?

MR. WILLIAMSON: Yes.

MEMBER STETKAR: And then if the second division becomes inoperable, you start a time clock.

MR. WILLIAMSON: Twenty-four hours.

MEMBER STETKAR: Twenty-four hours? Okay. Okay. I just want to make sure that I --

MR. KINSEY: Because at that point you're not singly using all your tolerance --

MEMBER STETKAR: That's right. Because then you're down to two.

Thanks.

CHAIRMAN CORRADINI: Other questions? Okay. Thank you very much.

MR. WILLIAMSON: We yield our extra time to --

MR. COMAR: Good afternoon. I'm Manny Comer, Project Manager Chapter 16 Technical Specifications for the ESBWR.

To my right is Craig, he is the Chief Reviewer for the Technical Specification Branch. We went through and coordinated the review.

We have provided a copy of SER to you with the open items. And with that, I'm going to start the briefing.

And the purpose is to brief the

Subcommittee on the Chapter 16 of the ESBWR application is based on Rev. 3 and the RAI responses that we have received so far. And then answer if the Committee has any other questions on it.

You already talked about the Project Manager for Chapter 16, and there are other reviewers who will present here if there are some detailed questions that the Committee might have. And they'll be happy to answer those.

The outline of this presentation is we're talk about the applicable regulations that we've used, the RAI status summary and then Craig will get into the review criteria and the open issues and the COL action items.

These are some of the overarching regulations that we used for the review of Chapter 16 tech specs.

We originally requested 162 RAIs, of them 112 have been resolved as of DCD Rev. 3. And six more resolved as a consequence of the review of DCD Rev.4 It means that review is still ongoing and we're not complete with it. And that is what alludes to. So the balance left is 44 of the open items that the staff is discussing with NRC.

I am going to hand over to Craig to talk about the criteria and the other details.

MR. HARBUCK: Okay. My name is Craig Harbuck. And I'm Senior Reactor Engineer in the Technical Specifications Branch, NRO.

Typically when we look at tech specs for design cert there's three big things we keep in mind while we're looking to make sure, and these are listed on this slide. It's what I call review criteria.

First off, 5036 outlines what has to be in the tech specs, safety limits, setpoints, SEOs, SRs, design features and administrative controls. And so we make sure that we're meeting those requirements.

It's not a requirement, but we also are interested in seeing that the proposed specifications match the format and content and usage rules of the tech specs, which by doing so solve a lot of problems that were resolved by going through the improve standard tech specs.

And then lastly we need to make sure that the tech specs are consistent with the design as approved. And also the accident analyses. Especially the accident analyses because 5036 and its four criteria, a big emphasis there is on preserving the validity of the accident analyses.

As Manny mentioned, we have over 162 or

around 162 questions. And we reduced that number down, but I'm going to mention the main categories. Some of these items in this list cover multiple issues, but this is the main points I'd like to present in the open issues.

But I also before you start, and I'll just mention our very first question was one asking GE to do a little more -- provide a little more detail on they derived the DLCOs by comparing to all their systems in the design against the accident analyses and 5036 criteria. And part of that we consider still be open in the sense that there's changes to the design since that was responded to. And so once we're far enough along, that will probably need to be updated, or perhaps need to be updated. We'll be checking up on that.

On bracketed information, we were presented with two kinds of information in the initial version of the tech specs. And it was unclear what the brackets meant. So initially that question was related to that. And Revision 3 the brackets took on two distinct meanings and we're wanting to -- and a set of those would be resolved in time for the design certification. So we're going to want to make sure that all those are resolved.

And then as Dan mentioned earlier, the brackets that would be with the COL action item of bracket information, in tech specs the goal is to have all those associated with reviewer's notes so that it would be clear what the applicant, the COL applicant would need to do in order to resolve or close or get rid of those brackets.

Another big issue in instrumentation setpoint methodology. The ESBWR uses the digital instrumentation interface for processing the signals from the sensors. And this presents a bit of a challenge on how you write tech specs. It was -- and the staff has had a lot of detailed questions about that and we're -- so a good fraction of our open issues are specific requests for additional information now termed open items, and the SER with open items are pending our review.

Also related to instrumentation is the questions dealt with surveillance requirements. And there's six main kinds of surveillance requirements. The channel check, channel functional test, logic system functional test, response times test, the staggered -- the response time testing; those things all need to be understood in how they're going to be done in the context of additional instrumentation and control.

And you have a question?

MEMBER STETKAR: Yes. I noticed that most -- I'll say most because I don't remember all, is a big word. Most of the logic channel functional tests are 24 months on a staggered test basis. And since I'm not familiar with NUREGs and what's gone on in the past, is that consistent with -- what's the basis for that testing interval? Because that means each channel is functionally tested once every eight years?

MR. HARBUCK: The staggered testing, and I might ask GE to also respond to this if they can. But the idea is that you don't want to test something and you make an error because you tested the next one and --

MEMBER STETKAR: I understand the concept of staggered testing.

MR. HARBUCK: All right.

MEMBER STETKAR: I'm asking about what's the basis for once every eight years testing each channel every two years.

MR. HARBUCK: Well, in the standard test specs, typically such tests are done on a refueling cycle interval.

MEMBER STETKAR: Right.

MR. HARBUCK: And so that would be 18 months or 24 months, and that's where that comes from.

The staggered testing, I believe, I'd have to check, but I believe is in the standards.

MEMBER STETKAR: Okay.

MR. HARBUCK: So it probably comes out of maintaining consistency with the standard tech techs.

DR. WALLIS: Is there any technical basis? I mean shouldn't it be related to the expectation for the time by which it will be nonfunctional or something? I mean, it's got to be related to something meaningful?

MR. HARBUCK: When you look at the basis--

MEMBER APOSTOLAKIS: This is the existing tech specs for safety systems, is that monthly tests or out of the blue?

DR. WALLIS: You just guess something.

MEMBER APOSTOLAKIS: That's what the risk-informed initiatives are trying to do.

DR. WALLIS: Was it related to the outages or something?

MEMBER APOSTOLAKIS: Isn't every month is reasonable --

DR. WALLIS: The outages, is that where you start? Is it convenience you're doing it?

MR. HARBUCK: It's basically taking, I think, a conclusion from past precedents and applying it to these specs.

DR. WALLIS: There's no rationale?

MR. HARBUCK: No, that's not entirely true. When you look at the basis for the instrumentation and the references that are listed in support of what the frequency of a surveillance is, there's a reference to -- I believe it's a PRA analyses.

MEMBER APOSTOLAKIS: Ah. It was a prudent, conservative thing to do.

MEMBER STETKAR: Every two hears?

MEMBER APOSTOLAKIS: No, not this.

MEMBER STETKAR: What he's saying is that the evidence -- has the same base.

MEMBER APOSTOLAKIS: There is no base --

MR. WILLIAMSON: Dan Williamson GE Hitachi.

MEMBER STETKAR: Here we go.

MR. WILLIAMSON: Craig is right, there is a bracket. It's one of these things that's bracketed because it's not yet resolved. There is a reference to the PRA topical. But it's one of those things that as we resolve it, it's probably not the right answer.

And to answer the question, let me back up a little bit and step into what I think were several of the questions I heard.

The logic system functional test that would be done each outage is essentially taking one division, putting a division A trip into it. Now the logic is any two to trip. And so the test would be now I run it through on B trip and see if I get an output trip. Throwing a C trip, see if I get an output trip. Throwing a D trip, see if I get an output trip.

So I'm testing this one entire division of does it see all the other divisions' communication paths appropriately.

Now, what's the right frequency? Yes, it should be based on a lot of stuff. And we talked to the digital I&C folks and the vendors that are supplying this stuff, they're saying it's software, it doesn't change. You know, it works or it doesn't work. And the software is self-tested. And if anything happens to it, you know it. You probably could justify pick a very long time.

MEMBER BLEY: This test is only on the software portion of the --

MR. WILLIAMSON: The logic system functional test is specifically looking at the combination of divisions.

MEMBER BLEY: Which is all done in software?

MR. WILLIAMSON: There are output load drivers also.

MEMBER APOSTOLAKIS: Or a loop provided?

MR. WILLIAMSON: Right. The focus of that test is mainly software.

MR. TUCKER: This is Larry Tucker with GEH.

One of the things about going to the digital control information system is that if there is indeed a problem itself revealing at the time it occurs, so while we do these surveillance tests many of the problems that people postulate would be self-revealed in the course of the digital system doing its own diagnostics periodically.

MEMBER BLEY: And have you reached the point where you folks are confident that that is really happening with the things you might be concerned it? Or you're still examining it I think is what I heard..

MR. WILLIAMSON: No. We're examining the words to put in the bases for why we picked 24 months.

MEMBER BLEY: Okay.

MR. WILLIAMSON: And the reality is that we review the design and the prior 24 months was somewhat picked out of the air but its been proven over time to be a very good time as finding the failures that need to be found in appropriate interval.

We look at those old relay designs and the types of failures mechanisms that might occur that needed to be found and we look at the software and we say, yes, we are very comfortable that 24 months is much better, at least as good as what was being done in the past for the reasons it was done.

We left it at 24 months to facilitate the review. Essentially for someone to be able to say, you know, yes the design is so much better. This 24 month frequency remains okay.

Now what might be a better, the right frequency down the road.

MEMBER BLEY: Let me put it another way. I'm assuming there will be a document at sometime that lays out the complete rationale on this sort of thing. Is that true or is that a pipe dream of mine?

MS. CUBBAGE: Craig, this is an open right now?

MR. HARBUCK: Yes.

MS. CUBBAGE: So it's an open item, so you'll get an opportunity to hear the resolution of this open item when we come with the final SE.

MEMBER BLEY: Let me just throw something in. I've been hearing over my shoulders, watchdog circuits and the like, and watchdog circuits test certain things but they don't test everything.

MS. CUBBAGE: Well, I mean if you want to get into the details of the digital I&C and how it does self-diagnostics and all that stuff, that's Chapter 7.

MEMBER BLEY: Okay.

MS. CUBBAGE: And we've got a lot of work to do yet on Chapter 7.

MEMBER BLEY: Chapter 7.

Well, I guess what I'm trying to ask is given whatever's in Chapter 7 once you're finished with that, it seems to me it would be important to have a rationale that links to what you eventually understand in Chapter 7 that explains where these intervals come from?

MS. CUBBAGE: Right. Our Chapter 7 and 16 team are joined at the hip in this area as far as looking at what are appropriate tech specs for a digital system and surveillance frequencies, et cetera.

MEMBER APOSTOLAKIS: You've me a little bit confused here. Forgive me. I thought I heard earlier that pieces of the system, like the squid valves, would be tested more frequently than we already use, is that correct?

MR. UPTON: Twenty percent of the squid valve -- this is Hugh Upton, GEH.

Twenty percent of the squid valve charges are removed and actually exploded or initiated and replaced every shutdown, every outage. Every refueling outage. Every refueling outage.

MEMBER APOSTOLAKIS: The software is tested--

MEMBER MAYNARD: Ten years.

MEMBER APOSTOLAKIS: -- more frequently than every two years? No? Everything is tested every two years for each loop?

MR. UPTON: What we're looking at is the chemical composition of the squib charges to confirm that they're still good. That's what's tested every refueling outage, 20 percent.

MEMBER MAYNARD: Well, I think it could be very difficult to go through surveillance frequency in this type of meeting. The surveillance frequencies are very complex. Some of the things that we're talking about are more of the full channel checks, the integrated test type things; those are usually the longer term. Each one of those components will typically have a different surveillance frequency associated with a part of that channel or certain components. And the surveillance sections of the tech specs are really quite involved as far as frequency on individual components versus bigger parts of it, verses the entire channel.

MEMBER APOSTOLAKIS: So individual components will be tested more frequently in general?

MEMBER MAYNARD: Typically.

MEMBER APOSTOLAKIS: Yes, that's what I understood. So it's more of an integral test every two years?

MEMBER MAYNARD: Well--

MEMBER APOSTOLAKIS: No, that's what they said earlier. That they will remove 35 megawatt or 45 megawatt, do you confirm that? That's the biannual test?

MR. UPTON: Yes, that's correct.

MR. WILLIAMSON: Make sure one valve opens.

MEMBER APOSTOLAKIS: Confirm the right --

and the right heat removal. I mean, come on --

MEMBER MAYNARD: But it would be good to discuss the basic when we get a chance. But I think that current set of tech specs, most of those frequencies and stuff were not really established with a basis. It was engineering judgment I think on the part of the regulator and the applicant.

MEMBER STETKAR: Let me read something here, because I'm reading from the SER. This is channel calibration surveillance frequency, but it's a channel calibration.

Twenty-four month channel calibration surveillance frequency has been shown to be acceptable by NEDO-33-201 ESBWR design certification probabilistic risk assessment.

So theoretically the 24 month surveillance interval, at least for some instrumentation channel calibration is tied to the PRA according to this

MR. WILLIAMSON: Dan Williamson, GEH.

Let me clarify, and I believe even in the SER that the reference that you read to the topical is in brackets.

MEMBER STETKAR: It's in brackets.

MR. WILLIAMSON: That in particular for the channel calibration also gives me the opportunity to point out that the setpoint methodology was recently submitted by GEH and is under -- the open item is it's under staff review. But the calibration and the calibration frequency is linked to the setpoint methodology and it's not linked to PRA.

So in the case of the channel calibration, that is one of the references, one of the bracketed items that will change to reference the appropriate document, not the PRA.

MEMBER APOSTOLAKIS: Typically if you try to tie frequency of a test to come probabilistic inactive systems, you usually assume some distribution of failure. So you're saying might do it X months or hours then I can do the calculations and find some unavailability. For a passive system, I don't know that you can do that. Or the software. Software. I mean what -- if you start giving me failure rates, that will be on opposite sides. I don't think you can do that.

Another way of looking at it is these we have very high confidence that these systems will function and this two year thing is an excellent defense-in-depth measure.

MS. CUBBAGE: All right.

MR. TUCKER: To see if there's any --

MEMBER APOSTOLAKIS: Huh? To see if there's anything that I have not thought of in advance--

MR. TUCKER: To answer the software is not degrading, is it something else.

MEMBER APOSTOLAKIS: Yes. So as a matter of defense-in-depth I want to look at every two years.

MR. TUCKER: Correct.

MEMBER APOSTOLAKIS: And that takes care of it because the defense-in-depth really is one of those great principles that does not need justification.

MEMBER BLEY: Can I ask something? This is kind of -- almost --

MEMBER APOSTOLAKIS: Yes, thank you very much.

MEMBER BLEY: -- but George's comment got me interested. There will be over time, no doubt, software upgrades to all the instrumentation. And don't recall seeing anything. Is there anything in the tech specs that deals with somehow confirmatory testing after every software upgrade?

MS. CUBBAGE: I think you're getting into Chapter 7.

MEMBER BLEY: In Chapter 7?

MS. CUBBAGE: Yes.

MEMBER BLEY: It's not a tech spec matter?

MR. HARBUCK: Yes. In terms of tech specs, I think that general principles that post modification or post maintenance testing is not something that we kept in the tech specs as an explicit requirement. It's sort of understood as, you know, you do what's necessary to make that equipment operable whatever you've done it so you meet the LOC. The details of that are not retained in the spec.

DR. WALLIS: And let me suggest that there's a human aspect to this, too. That the management likes to have some assurance every so often that things are working.

MEMBER APOSTOLAKIS: Well, that's defense-in-depth is.

MS. CUBBAGE: Right. And I think GE alluded to the online monitoring capabilities and self-diagnostics that we're still looking at in the Chapter 7 arena that I think are providing some constant assurance that the digital system is performing as expected.

MEMBER ABDEL-KHALIK: Are there surveillance tests for these digital instrumentation and control any different than the startup testing that we have to do for them?

MR. WILLIAMSON: Dan Williamson, GEH.

We have a hand full of RAIs that GEH has not responded to yet that are the topic of what we've been talking about and your specific questions.

These surveillances that are listed on Craig's sheet and how they interface with digital and it'll actually wrap up the question on will something document how all this stuff comes together? And it'll be the responses to these handful of RAIs.

MS. CUBBAGE: Right. GE's RAI responses, DCD revs as necessary and the staff's final safety evaluation. So we're certainly not looking for the Committee to give us any finality on this, but we'd be interested in hearing any of your concerns to make sure that we do address them when we resolve this issue.

MEMBER MAYNARD: Some of the surveillance tests will be very similar to the startup tests. Some won't be.

MEMBER ABDEL-KHALIK: Well, but the issue of frequency, at least you have a starting point for all four of them that are pretty much the same and then you can just go from there.

MS. CUBBAGE: And there may be the

capability during pre-op tests to do some more extensive testing than you would do with fuel in the reactor and water in the systems. You might be able to do some more thorough pre-op testing than you would be able to do later.

MR. HARBUCK: Okay. Just to continue.

This last note, staggered test basis. I'll briefly explain, for those who may not be familiar, prior to improve standard tech specs staggered test basis was defined as an interval and you took the number of components and divided by that number into the interval to determine how often you did the test.

For some reason the standard tech specs they figured it was easier to multiple than divide, so they specified the interval for each component and then you multiplied times the number of the components to get the actual interval for each separate division or channel.

And up until now we usually if you had X components of the design, that's how many the LCO required. Well, now we've got a more robust design the desire from electrical down to instrument is to require three of four channels that are in the design. And so there's some question about how we determine what the overall interval for each division is.

Do we determine it using the number that's in the design or the number that's the LCO requires it to be operated? And we haven't resolved that one yet. That's what that's there for.

Continuing on to the reactor coolant system

MEMBER APOSTOLAKIS: I hope we're going to have another result. Because I'm really perplexed by all this.

We are assuming that we know what the testing frequency does to the reliability of the thing. And I'm not convinced we know. I don't even know that we can calculate it.

CHAIRMAN CORRADINI: In some sense you don't know.

MEMBER APOSTOLAKIS: So it's all a matter of --

CHAIRMAN CORRADINI: In some sense they're using past experience as their starting point.

MEMBER APOSTOLAKIS: Past experience with what? The passive systems.

CHAIRMAN CORRADINI: Well, the passive systems instruments --I guess.

MEMBER APOSTOLAKIS: I don't know. I

mean, I'd like to see that. I'd like to see that past experience.

MS. CUBBAGE: Right. I mean I think we tailored a short presentation because we weren't sure if the Committee would be interested in tech specs in general. So if we need to come back, we can come back or we can cover it at the final SER.

MEMBER APOSTOLAKIS: Well, I'd like to see more.

MS. CUBBAGE: Or maybe as part of the PRA discussions we could tie in some of this. But I don't think we were prepared --

MEMBER APOSTOLAKIS: PRA usually starts with what you plan to do and evaluates the probabilities and so on. And then you got another part of that says I will use PRA arguments to determine the frequency, which we don't do typically in the view of the PRA.

MEMBER MAYNARD: I think it depends on what the review of the design certification really mean.

When we come to the COL stage we're going to be reviewing tech specs. To me it depends on are we locked in to whatever comes up here? I mean, is this going to be the final set of tech specs with a few specific numbers put in by the licensee?

MS. CUBBAGE: Yes, in essence yes.

MEMBER MAYNARD: Okay. So this--

MS. CUBBAGE: I mean from a regulatory perspective there is a little less finality on tech specs than there are on the rest of the certification. But all intents and purposes, this is the time --

MEMBER MAYNARD: So this would be the time?

MS. CUBBAGE: But if something was left in brackets, as you said, there would be an opportunity later.

MEMBER APOSTOLAKIS: This is not the last time we are addressing this issue.

MS. CUBBAGE: No. We'll come back.

MEMBER APOSTOLAKIS: That was good.

CHAIRMAN CORRADINI: They surrender, George.

CHAIRMAN CORRADINI: I have three parts to the answer. One is this is the first time we have to look at it. There are a number of brackets to be filled in. And we're going to have to look at all of it totality in some sense at the end. If we as a Subcommittee or the Committee as a whole wants to look at these tech specs as a whole as we come to the end, we're going to look at it.

MEMBER APOSTOLAKIS: Well, this specific thing that was just mentioned about which way to go and all that, I would be very curious to look at them.

MS. CUBBAGE: And to the extent that some of these are open items already, we're already thinking about these and would be coming back at the final SER.

MEMBER APOSTOLAKIS: You would probably be coming back.

MS. CUBBAGE: But we are interested to hear. It's good to know that you're interested so that we can prepare for it.

MEMBER MAYNARD: I think we do need another discussion.

MS. CUBBAGE: Yes.

MEMBER MAYNARD: You know, in my opinion Chapter 15 and 16 really establishes safety limits for the plant. I mean is 16 is where you really draw the line and the license of this is exactly your limits of how you operate. And you get that out of Chapter 15. And so I think this is a real key area for us.

CHAIRMAN CORRADINI: So we will come back.

MEMBER APOSTOLAKIS: The Chairman knows it.

CHAIRMAN CORRADINI: Well, I had a sense that you didn't want to --

MS. CUBBAGE: And it may be that we don't want to wait until the final.

CHAIRMAN CORRADINI: If we have more information, though, relative to this I think we can bring it up earlier. We don't have to wait until the very final instant.

MEMBER APOSTOLAKIS: No.

MEMBER BONOCA: That makes sense, let's move on. Let's move on.

CHAIRMAN CORRADINI: But I do think, though, that more will come out. We will have much more information as the months progress and we can bring it up.

MS. CUBBAGE: Absolutely.

MEMBER BLEY: Mr. Chairman, it seems to me it would make sense. As we go through the rest of the Chapters whenever we do a new chapter, we might want to come back and look at the relevant tech specs on that chapter as we go. Because looking at them all at once --

MS. CUBBAGE: And actually what we could do is that after we go through all the chapters cycle back for one sessions on tech specs since you will have had the benefit of all the others.

CHAIRMAN CORRADINI: Your thought, though just to make sure I understand, is as we go through the chapters looking at those particular tech specs. I think the only problem with that is we've gone through a number of them and they're still incomplete. So --

MEMBER BLEY: And that will keep happening and they get more complete.

CHAIRMAN CORRADINI: Yes.

MEMBER BLEY: Or completely changed.

CHAIRMAN CORRADINI: So let me figure out how to do that next, But I think we're still in an incomplete stage on it.

MS. CUBBAGE: I think so. Because when we come back in two months with ECCS, we're not likely going to be any further along on this. So it really wouldn't be worth cycling back that soon.

CHAIRMAN CORRADINI: At least allayed your current concerns.

MEMBER APOSTOLAKIS: I never had any doubt.

MR. HARBUCK: And moving on to reactor --

MEMBER APOSTOLAKIS: You seemed to be surprised that I have no doubts.

CHAIRMAN CORRADINI: Let's go on.

MR. HARBUCK: The design has 18 safety relief valves, but except for I think ATWS mitigation, we're told that only one valve is needed for the postulated events-- for over pressure reactor for the reactor ventilation system. And so the associated tech spec requires two SRVs to be operable. We've asked for analyses that explicitly accounts for only one valve. Right now they have an analyses, as I understand it, that recognizes all the valves are there and they all open a little bit, but we wanted to have it so it's explicitly there's one value. That came from the tech staff. So we're looking for that to backup that LCO one.

We also recognize that if you have a loss of shutdown cooling or a leak in modes in 5 and 6 under certain conditions that the GDCSs is consistent that we're relying on -- safety related system we're relying to respond to that. And so we want to make sure that to the vent path there's requirement tech specs that the vent path for the RCS is available so that GDCS can perform that function. Exactly how we do that, that's what we're discussing.

And as Dan mentioned earlier, they're working on the action requirements for the ECCS systems, the automatic depressurization system and the GDCS and the ICS. And so all the action requirements in the tech specs now are indicated as tented or bracketed. And there's analysis that they're working that we'll review when we receive it, and make our judgment about the perceived reactions.

Okay. Moving on to containment --

CHAIRMAN CORRADINI: Can I ask a timing question about that --

MR. HARBUCK: Yes.

CHAIRMAN CORRADINI: -- since you've been around timing. When do we expect to see that so just from the standpoint of for us to review it and know where to expect it. Are we talking abouts?

MR. HARBUCK: I'm not sure. I could probably figure it out.

MS. CUBBAGE: What are we looking for?

MR. HARBUCK: We just want to know when we expect response on that particular question.

MS. CUBBAGE: Oh. I think we'd have to ask GEH for that.

MR. HARBUCK: That's what I suggested.

MS. CUBBAGE: I don't think you're going to find it in your book.

MR. HARBUCK: I was looking for somebody

to jump up and volunteer that.

MR. WILLIAMSON: Yes. Without making a regulatory commitment, we would anticipate --

CHAIRMAN CORRADINI: This is only a --

MR. HARBUCK: Count your fingers.

MR. WILLIAMSON: It would be in Rev. 5 and if it's prepared before then, we will likely try to make it available to the staff because we know the timeliness of their review shouldn't wait on Rev. 5.

MS. CUBBAGE: For the Committee benefits,, that's March 2008. And if it is available, GEH will submit it.

MEMBER APOSTOLAKIS: What is the best estimate of now may revisions there are going to be? You mentioned Rev. 5.

CHAIRMAN CORRADINI: She said that would be the target is March -- spring of '08.

MEMBER MAYNARD: The next one? He's wanting to know how many revs after that.

CHAIRMAN CORRADINI: And your question is what?

MEMBER APOSTOLAKIS: How many revisions.

MEMBER MAYNARD: Well, we're on four now.

MEMBER APOSTOLAKIS: Even among friends, right.

MS. CUBBAGE: Our current schedule is based on DCD Rev. 5 being the rev that is certified. It's possible there could be additional revs required for some cleanup or to address any outstanding issues. But our current schedule is based on Rev. 5. And as you know, the AP1000 was up to 15/16. But they rev'ed more frequently. They rev'ed much more frequently and they didn't do a complete rev. There were only certain pages that rev'ed. So you recall at Rev. 16 maybe 20 pages got rev'ed. It's a different --

MEMBER APOSTOLAKIS: So you can revise even after you have certified --

MS. CUBBAGE: No. Well, only if you go through the amendment process allowed by the new Part 52 Rule, which is what AP1000 is proposing.

MEMBER APOSTOLAKIS: Okay.

CHAIRMAN CORRADINI: Is rev like iteration, it shows the -- Okay. Go ahead. I'm sorry.

MEMBER ABDEL-KHALIK: Well, we won't have this before we review Chapter 15?

CHAIRMAN CORRADINI: No, we will not. That's part of what I was getting to when Danny was asking about can we look at them in coincidence with them.

Okay. I'm sorry.

MR. HARBUCK: Okay. As proposed in Revision 3, we're going to the GDCS pool temperature by making the assumption of equilibrium with the average blowout temperature of the air in the drywall. And we had a number of questions about that.

The reactor water cleanup shutdown cooling system is a high pressure system but it's not safety related and it has isolation valves in case there is a leak of some sort. And we were wanting to know how they planned to test those valves explicitly. I think there's some experimentation that's involved with the actuation of those isolations, but the valves themselves didn't seem to be covered.

We recognize that monitoring oxygen concentration in a small containment, relatively small drywell is important so we asked that there be an LCO limited added for that.

There's a surveillance requirement that requires determining the leakage capacity, the drywell, the wetwell vacuum breaker lines. And we would like to expand that. And I understand that's an issue in another section. That there's more to it than just that simple statement. But we have an issue on that.

DR. WALLIS: Do they test the vacuum breakers themselves?

MR. HARBUCK: Yes.

DR. WALLIS: They are an important part of the function. And vacuum breakers historically have not worked very well.

MR. HARBUCK: There is a surveillance requirement on it, a specific spec in 3.6, I believe.

MR. UPTON: If I might, this is Huge Upton with GEH.

The vacuum breaker for the ESBWR is a completely redesigned unique feature, okay? And it's been tested and demonstrated to be quite leak tight. So it does not -- your database on vacuum breakers needs to be adjusted, I guess on the SBWR test program.

CHAIRMAN CORRADINI: So I probably already have supposed to have read that. So where the vacuum breakers?

MR. UPTON: The vacuum breakers are discussed in Chapter 5.

CHAIRMAN CORRADINI: Okay. Thank you.

DR. WALLIS: I thought you meant where are they physically in the plant.

CHAIRMAN CORRADINI: I was trying to

remember what chapter they were in that I should have caught.

MS. CUBBAGE: And did you find the surveillance? I found it here. There's surveillance requirements for leakage to the verify they are closed, that they can open.

MR. HARBUCK: And it's more than one place.

MS. CUBBAGE: 3.6.1.6. Anyway.

MR. HARBUCK: Okay. Moving on, control room habitability area temperature post accident. The current plan is for those 72 hours the temperature rise in the control room is going to be limited by two things. They are coming through the filter ventilation system from the outside and losses to ambient -- walls, the concrete.

And so there's a limit on tech spec of controlling the temperature and then there's an assumed temperature rise, and that peak temperature is deemed to be acceptable. And we'd like to see analysis on that to support that. So we're waiting for that.

DR. WALLIS: Is there a limit on the temperature of the walls? Is it supposed to control--

MR. HARBUCK: The trips are here for the control room habitability area. I think it's like 78 degree or something.

DR. WALLIS: Yes, but the outside temperature of the walls. I mean the walls are part of the analysis, aren't they, and if they get too hot or too cold from the outside, that would change their behavior.

MR. HARBUCK: Well, presumably the air conditioning functions will establish what the initial temperature is. When the temperature if it gets too high -- or this is part of the issue, I guess --

DR. WALLIS: They assume the walls are in equilibrium with everything else?

MR. HARBUCK: There is an assumption there. And that's part of the resolution figuring out the details of that.

All right. We've mentioned the availability controls. And after 72 hours for the safety related systems to continue to cool the containment and the vessel and reactor, you need to put more water into the pool because the inventory is almost used up since they're evaporating away. So we want to have availability of controls to provide that level of assurance that those pools could be replenished at that point in the event that, say, AC power didn't get restored.

There's also a concern that since it's a passive plant, 72 hours there's no active system soon to be available to, say, replenish the spent fuel pool if it was at the appropriate time, do you have analyses that shows that the amount of water or inventory you have is sufficient to mitigate or take care of that heat. And so and then that would then determine what level do we require in the availability controls for, like, spent fuel pool.

And getting on to electrical, you may have heard that there's plans to utilize the value regulated lead acid batteries and since these are different from the usual vended lead acid batteries that are normally in existing plants, we have some questions about temperature control and measurement and how we determine the stated charge of the battery.

These things are sealed so, you know, measuring specific gravity is not necessary the best way to -- I mean you can't do that. So flow current is the option. And we need to verify just how reliable that is and determine if the sizing of the battery needs to be adjusted to take any uncertainty into account.

CHAIRMAN CORRADINI: Not that I don't believe you, so I tried to find vacuum breakers in 5.

MR. UPTON: I was mistaken. They're actually in 6.

CHAIRMAN CORRADINI: I'll look again.

MR. UPTON: That was my error.

CHAIRMAN CORRADINI: It's not that I don't trust you, but I need verification and validation.

MR. HARBUCK: Because COL action items are typically proposed by the applicant and then reiterate then if we accept them in the SE. And so what I've got here on the slide it's our understanding of what we think it means. And that would be replace the brackets with plant specific information. And that information should be good enough to operate maybe not the most -- it may be too conservative, but we think it should be able to operate once the COL license is issued. So that would be our understanding of that action.

I'm not sure that is 100 percent consistent with what is being proposed.

And part of this, I've termed it adoption of topical reports. Typically there's conditions and things that you have to meet. Often times, and I think in this case in most cases this is reflected as reviewers' notes in the tech specs. So it's just simply saying, you know, make sure you comply with what the reviewer note says. And it may be redundant.

I'm not sure if this second one is explicitly called out, say, Revision 4 of the DCD, but that thought is there and it's understood.

MEMBER MAYNARD: I need to make sure I understand what you're saying on this first bullet. Are you saying that they need to provide plant specific, the information in the DCD?

MR. HARBUCK: No, no. I'm saying that the DCD needs to highlight or indicate information that needs to be provided by a COL applicant.

MEMBER MAYNARD: Okay. All right.

MS. CUBBAGE: And there is a COL applicant item in DCD Rev. 4 saying that the COLs would fill in the bracketed information.

MEMBER MAYNARD: That's right.

MR. HARBUCK: And the idea is just how complete should that be.

MEMBER MAYNARD: Okay.

MEMBER SIEBER: But there's other items in there that the vendors should know now there is a responsibility, but they aren't in the tech specs.

MS. CUBBAGE: That's right. And the curly brackets are the things that we anticipated that GE would fill in as part of the certification.

MEMBER SIEBER: That's the other set?

MS. CUBBAGE: And so we're waiting for those to be filled in and we're not sure if all of them ultimately will get filled in, as I understand at the moment. But trying to minimize what's left.

MEMBER SIEBER: For failure they will.

MS. CUBBAGE: Well, we're trying to minimize what's left in brackets for the COL. And some of those may not be filled in by the COL applicant. It may be something that's closer to startup. I'm not sure if any of them will fall in that category. But there would be a licensed condition such that they would be filled in before startup.

MR. HARBUCK: To conclude, because of the issues and analyses that remain to be settled, we can't conclude yet that we meet the applicable regulations, but we're making progress. And I'd like to just emphasize that the review of tech specs is a bit unique among all the chapters because we rely so much on the technical validation from other branches and other groups. And sometimes the line is fuzzy between tech specs and the technical stuff. And you have to have the technical stuff there, but the purpose of our review is not so much to make those judgments ourselves, but to make someone who has got the authority and qualification to do so has made those judgment.

Now, any additionals.

CHAIRMAN CORRADINI: Does the Committee have any other questions?

MR. HARBUCK: Okay. Well, thank you.

CHAIRMAN CORRADINI: Well, thank you so much. We really appreciate it.

So let me end off today by going around to all the members and trying to get any last point that I can capture. And also advice relative to what issues, whether we take this up at a full Committee and we're going to write another interim letter. What issues do you think are key that the staff is going to need to present there? Because we're going to probably have a half dozen at least chapters that we're going to have to go through or more.

MS. CUBBAGE: Eight.

CHAIRMAN CORRADINI: Six plus two, eight chapters that we're going to go through. And it won't be possible to go through all of them in total. It's we're going to have to pick the key things we want to have them discuss, and then also to get GEH's folks over here so they have the proper technical backup in case we have questions in depth.

MS. CUBBAGE: Right. Because if we need to be prepared on every topic, we'd have to bring a 100 reviewers in here.

CHAIRMAN CORRADINI: So can I start with Jack and just kind of go around. And I'll try to take notes as to things. If you have written comments, you can send them to Gary and to I.

Jack, I'm sorry.

MEMBER STETKAR: Okay. We had four chapters to go through, auxiliary systems. And I basically have no comments on auxiliary systems.

Steam and power conversation system, you know that one is a little bit more complex, it's mostly not safety related. Or almost, I guess, all of it's not related except just for a few minor items. And I had no comments on that.

Conduct of operations. There were only a few staff comments and this pretty much reads the way they've read for the last 20 years, And so there's no earth shaking change there.

On the technical specifications, this is very complex because starting with the BWR-6 tech specs the differences between BWR-6 and the ESBWR are pretty significant, mostly resulting in dropping out of various parts of the tech spec. So you have a couple of questions there.

Of those that you don't drop out because of the system, do they actually physically match the plant system; that's the first question. And until we go through all the plant systems, I don't think we can answer that. And that's why I sort of like the idea that someone mentioned during this discussion that when you go through plant systems, you bring in the tech specs right at that time so that we have the design in front of us, including the intent of the design and the tech specs that are related to it.

The other thing that I need to do more thoroughly is -- and I don't think that looking at the BWR-6 when I'm looking at the ESBWR tech specs is going to do it. But to look at the plant with a fresh eye to decide is anything being missed that didn't show up in the BWR-6 because it wasn't there, but it's important with respect to the ESBWR. I've done that as my homework assignment for coming here. And I didn't find any. I think I have to continue to --

MS. CUBBAGE: I think what might be helpful for you is to see GE's response to RAI 16.0-1.

And I can take an action to get that to you through Gary. It's a very comprehensive evaluation. It was the first RAI we asked for that very same reason; we wanted to make sure nothing had been missed.

MEMBER STETKAR: Okay. And I guess I have a comment about surveillance frequencies.

I had the pleasure of working at the first commercial station and our first refueling took us a year because we recalibrated and tested every instrument and every logic circuit in the plant. And I had the opportunity to watch over 45 years how the surveillance requirements became less and less stringent as we gained more knowledge on how much specific instruments drift over time, what are their failure modes and so forth.

Now we have a sort of a new horse coming along which is digital instrumentation with digital logic. I don't have any reason to believe that this is going to be less foolproof than the wired logic that we had four years go. And on the other hand, I think that this was an area that we need to pay attention to.

I'm satisfied with this surveillance frequencies and the outage times because I've watched these things through the years, and they're strictly engineering judgment. There is no risk calculation or anything like that. And it's based on failure rates; instruments where you saw, you know, significant number of failures had an increased frequency of surveillance. Or perhaps in detectors you might have to change the error band, the sensitivity it and adjust setpoints down.

So I'm not particularly worried about that. But you want to establish for the first customer or so a few extra things that allow us to become a little more familiar over the first cycle or two with the logic, the operation of logic systems, the operation of detectors to the extent that there's new detectors that haven't been used in nuclear power before.

On the other hand, I would think that the surveillance requirements and full instrumentation would be simpler in a passive plant. You just don't have that much equipment and the tech specs are obviously shorter because there's whole sections of them missing for equipment that doesn't exist in this plant that did exist in previous plants.

Overall, I think the tech specs chapter was difficult to review because it had a lot of little pieces, a lot of detail in it. And it was sort of harder for me to keep track without running several lists of things. And also because we didn't have full information on the plant design by virtue of the other chapters.

So I would say that that's, in my judgment, certainly an interim judgment and we can't make a final decision until we are pretty close to a final document.

MS. CUBBAGE: Thank you.

MEMBER ABDEL-KHALIK: I agree with what Jack said. I still think that would be a good idea to provide some logic for the surveillance frequency.

I was pleased to hear that there's going to be a surveillance for the gravity for the cooling system, even if is just checking whether or not its obstructed. I'd like that surveillance to be confirmed that the system is actually full of water, even though.

MEMBER APOSTOLAKIS: Surveillance the same as -- we using the terms interchangeable?

MEMBER ABDEL-KHALIK: No. In this case the system is not operable. You just put a borescope and make sure it's not obstructed; that's the surveillance. But if you're going to do that you might as well confirm that it is full of water. That would be my only comment on that case. Even though the system is designed with inclination --

MS. CUBBAGE: Could I just ask for clarification on both of those?

MEMBER ABDEL-KHALIK: Yes.

MS. CUBBAGE: Would the concerns with surveillance frequency is the focus on the I&C or is it in general surveillance frequencies?

CHAIRMAN CORRADINI: I guess I heard from Said one, and from others, that it's somewhat digital I&C.

MEMBER ABDEL-KHALIK: Right.

CHAIRMAN CORRADINI: In some sense is for one characterization. And then your concern, or your thing is passive systems?

MEMBER ABDEL-KHALIK: Right. Right.

MS. CUBBAGE: Okay. Because I think what I had proposed on the -- when we come back for Chapter 7, I think we need to integrate some tech spec discussion. Because it seems like the most challenging part of the tech spec review is really to the I&C.

MEMBER ABDEL-KHALIK: That's all.

MEMBER SIEBER: I presume you used the term surveillance, that has a specific meaning in tech spec space? And I presume that when you use that term, it's a little broader.

CHAIRMAN CORRADINI: Did you have anything on the other chapters?

MEMBER ABDEL-KHALIK: No.

CHAIRMAN CORRADINI: Okay. Graham?

DR. WALLIS: Well, I think we had sort of easy chapters today, apart perhaps from the tech specs. But I'm not an expert on tech specs. I view the discussion today with a kind of sense of wonder than feeling like a contributor.

MEMBER APOSTOLAKIS: That'll be the last one.

DR. WALLIS: I'm looking forward to Chapter 15.

CHAIRMAN CORRADINI: Okay.

MS. CUBBAGE: And Craig just reminded me that the terms surveillance requirement is actually defined in the regulations.

MEMBER SIEBER: Yes, it is.

MEMBER BLEY: I had a few things, Mike.

The rehashing a little bit what we talked about. We had a discussion early on today about the idea that some nonsafety equipment -- well, that the nonsafety equipment is being categorized as high or low regulatory interest with the high interest ones ending up with tech specs and the low interest ones ending with some kind of availability requirements, no LCO --

MS. CUBBAGE: Yes.

MEMBER BLEY: -- but tracking availability. And I think --

CHAIRMAN CORRADINI: Are these the RTNSS?

MS. CUBBAGE: Yes. Yes, and the ones that end up with the tech specs is because they meet the criteria 5036.

MEMBER BLEY: I think I need to understand that better.

MS. CUBBAGE: We'll be coming back and discussing the whole RTNSS program, what was scoped in, why, what the treatment is.

MEMBER BLEY: Oh, good. Good.

MS. CUBBAGE: And why. And that's a little ways off yet That's going to come with 19 --

MR. MARSHALL: This is Michael Marshall, Tech Spec Branch Chief.

And there's a whole separate chapter of RTNSS. RTNSS we characterize it as we have lower priority or lower regulatory priority, is just an ultimate treatment from a regulatory point of view for a systems past 72 hours in the passive plants.

MS. CUBBAGE: Right. And if you're interested in looking, for those who don't know what availability control is because it's very unique to the passive plants, Appendix 19(a) in the DCD Rev. 4 you can see them. And they look like tech specs. You just won't find an action statement that says shut the plant down. You're going to have action statements that say, all right, notify the plant manager. They have to take corrective actions.

MEMBER BLEY: That's Appendix 19(a)?

MS. CUBBAGE: Yes

MEMBER BLEY: Which I've got.

MS. CUBBAGE: Yes.

MEMBER BLEY: Okay. The only other thing I want to bring then is aux systems was that discussion we had about instrument error and the interface with nitrogen systems. Folks from GEH gave me a little more information at one of the breaks following up what I was asking about. And no surprise, there are bypasses, of course, on the filters and on the dryers. But there's a whole system of operational tracking that's associated with it that, I don't know, at least the presentation we had on it staff said they assumed there were no bypasses because there weren't any on the little cartoons. But there are.

MS. CUBBAGE: Well, I think --

MEMBER BLEY: And you folks might want to look at that and see that you're comfortable with it.

MS. CUBBAGE: Right. I mean I think what the review was saying that he looked to make sure that failure of instrument error would not be a safety significant issue.

MEMBER BLEY: I'm sorry. I also heard him say that that there were no bypasses?

MS. CUBBAGE: I think he did. He did. But he also said that he didn't ask and he didn't delve into it because he wasn't concerned about the consequence.

MEMBER BLEY: I would suggest, and I haven't looked further, that if you can get contamination or moisture that somehow ends up going through those little lines, you know, there might be a safety issue associated with it. IF you think that's a possibility. And I think that's a possibility.

On the chapter -- on the conduct of ops, I was real happy with what I heard toward the end of that. It's encouraging.

I guess on the tech specs it's really there's a lot more to look at, so I won't say anything specifically on that subject..

CHAIRMAN CORRADINI: Okay.

MEMBER ABDEL-KHALIK: Mike one issue I forgot to bring up is the thermoresponse of the control room.

CHAIRMAN CORRADINI: And just to remind, so yours is a modeling of the --

MEMBER ABDEL-KHALIK: The control room response to ensure habitability, what is the peak temperature going to be, were the boundary conditions used in the calculations are, et cetera, to ensure what the temperature history will be.

MS. CUBBAGE: I think I'd like to defer that one to GEH if they're going to be able to handle that at the full Committee. The staff would be planning to present at the final SER stage the resolution of that issue. But unless we receive additional information from GEH, we wouldn't be in a position of providing you any more at time. So I don't know if they heard what you were saying, okay?

CHAIRMAN CORRADINI: If I could just split it. There were two issues. One was with operator habitability, It was to the temperatures, whether it be the cold or the hot swing and how they can inhabit. But the second was, if I understood it, was also components and cabinets. And there was a second different analyses that eventually was to be performed, if I remember correctly.

MEMBER BLEY: And there was a third one. I believe it was air mixing and delivery to the --

CHAIRMAN CORRADINI: Right.

MEMBER MAYNARD: Well, I was going to bring this up when you got to me, too. I think there's so many open items on the HVAC that we need to at some point bring that back. I'm not that the full Committee, I'm not sure are quite ready for the full Committee. But if it is, I think it might still come out as an open item because there were a --

MEMBER BLEY: True.

MEMBER MAYNARD: -- lot of still open issues for that.

MEMBER STETKAR: I'd expand that, Mike, also. I held back this morning just because of time. I did -- believe me.

We talked a lot about the control room, which obviously is important. But the same types of HVAC room heat up equipment survivability issues apply for the general areas of the control building that do include safety related DCIS cabinets. They apply for the nonradiological areas of the reactor building that include the safety related batteries, the safety related uninterruptible power supplies and other safety related DCIS. And maybe, and I'm not sure, parts of the electrical and control building that include nonsafety, I think, DCIS but potentially important. That's kind of it.

MS. CUBBAGE: I think that's an EQ issue. Yes.

MEMBER STETKAR: And it's not just general area. The main concern is demonstrating that the temperatures inside the cabinets will remain lower than the qualification temperatures for all the digital equipment.

CHAIRMAN CORRADINI: Let me turn for a moment, because personally I guess I would favor Otto's approach, which is I don't think we can bring it up to the full Committee when we don't have the full picture yet.

MEMBER STETKAR: Right. Right.

CHAIRMAN CORRADINI: So maybe the question is when will we get a picture that we want to revisit?

MS. CUBBAGE: Well, I think what I'd like to emphasize is that I'm hearing a lot of concerns that echo what the staff has been asking. And I don't think I heard -- perhaps this last item --

CHAIRMAN CORRADINI: I haven't heard anything else --

MS. CUBBAGE: -- but if I haven't heard anything -- well, except for this last issue here, I think all the other concerns are captured by the staff's open items. So what we're looking for the Committee is to agree that our open items are sufficient. And if you have additional open items, then we need to tack those on. But as far as coming back at the full Committee if GE wants to come in and try to address some of your issues, that -- you know, they can try to do that. But at this point I don't think the staff will be able to provide more than what you've already heard.

CHAIRMAN CORRADINI: So what you're really saying is that if from just a timing standpoint, GEH is still in the middle of doing what they need to do to address your requests for information.

MS. CUBBAGE: Right.

CHAIRMAN CORRADINI: The most that probably could be done at the full Committee is to acknowledge what the open items are, add what additional concerns we might have it and leave it until you can address it.

MS. CUBBAGE: Now I say that, but the full Committee is a ways off.

CHAIRMAN CORRADINI: Right.

MS. CUBBAGE: If GE were to respond to all these RAIs near term and we said they're all good, you know, we may be able to tell you some more. But I don't think we're going to have time to get into the resolution of all these open items at a short full Committee setting.

MR. KINSEY: And this Jim Kinsey from GEH.

I guess along the lines of Amy's discussion, it would be helpful to us, though, to understand whether the Subcommittee has any significant or additional concerns beyond those already described as open items. It would be --

MS. CUBBAGE: Right. That's a very important emphasis of this meeting.

MR. KINSEY: Even if they aren't documented as such, yes. That would help to move toward resolution.

CHAIRMAN CORRADINI: We will take that as our action item to get through Gary and Amy, you have something to make sure we're clear as to what we're looking for.

Dennis?

MEMBER BLEY: Yes. One last thing. Reading the RAIs I wasn't clear how far you were going on, say, this habitability issue in the control room hearing Mr. Forrest's presentation goes a lot further. I guess I'm just sitting here thinking if he's going to review this stuff, I have no doubt he's going to get at all these issues. Is that documented somewhere?

MS. CUBBAGE: It will be in the final -- well, first of all, you're going to have GE's going to have to respond to the RAIs. So that will be in writing on the docket. And if you're interested we can get you those responses when they come in. And then as necessary, they'll have to update the DCD if there was an impact. And then our final SER will explain why these issues have been resolved.

CHAIRMAN CORRADINI: Good.

Sam, I'm sorry. I jumped a bit. Go ahead.

MEMBER ARMIJO: Are you finished?

I only had comments on parts of Chapter 10 and Chapter 9.

First of all, Chapter 10 I'd like to compliment GEH on the excellent treatment of the materials issues of the turbine and the condensers. I mean, they picked from -- taking lessons learned from prior operation on choice of titanium and stainless steel for the condenser.

They used words they're picking materials for greater than 60 years life. That's nice to see because I think that should be the philosophy for the entire NSSS system.

They use a 2 1/2 one chrome molly in their feedwater lines, although they probably could have gotten away with lesser chrome content, they choose to go to something they know would work.

And they've protected these materials and the system with a feedwater oxygen control to make sure everything works as they want it to work. And that's not an optional system.

And where my problems are, and I'll repeat it and try to be brief.

In Chapter 9 hydrogen water chemistry, really the most powerful proven tool available to prevent irradiation assisted stress corrosion cracking of internals and also prevent cracking of any noninternals like welded stainless steels, that's an optional system. So there's a lack of consistency in the DCD that I see that I think should be corrected, certainly with respect to hydrogen water chemistry system not being optional. And zinc possibly, but I don't know about that. But also is a very effective way of reducing dose.

And it just seems strange to me that those things are left for later.

CHAIRMAN CORRADINI: Okay. That's it.

MEMBER ARMIJO: That's it.

CHAIRMAN CORRADINI: Mario?

MEMBER BONOCA: Yes, specifically regarding new issues, if any, I don't think I have any issues that the staff has not identified as an open item or an RAI. I think that there's more a place to have additional information areas of particular interest are HVAC systems. There's a lot of information there we will get, the control room particularly.

You know, all the issues raised regarding temperatures. I mean, those are clearly areas where we need to have information.

I am not uncomfortable that GE doesn't have the proper design. It's simply we don't have information about it to give us confidence. And probably in some cases they'd like to do some analysis.

The other area is technical specifications. It seems much more complicated than I expected when I came, more open still to some definitions and I said we need to understand the basis for those various frequencies. After all the debate we had, I did not come with a clear idea of how they're going to address them. But I understand that those are open items and the fact that -- staff and we will get information for that.

One area that may of interest to the rest of the Committee is the closed session on the safeguards issue. I mean there was some information there which I thought was validated about what GE has done. And I think what they have done is quite significant. And, you know, I don't know how to monitor that into a full Committee meeting.

MS. CUBBAGE: Well, maybe in light of the fact that we're about to receive some additional deliverables from GE in this are, that maybe at a future date we could schedule another closed session and then, you know, maybe not in the full Committee forum, but any member who wanted to come could --

MEMBER BONOCA: Yes. Well, I think that it would be an area of interest to them. So whatever it is, if the information is available --

CHAIRMAN CORRADINI: Okay. Thank you.

MEMBER MAYNARD: Covered most of the things on the HVAC system. I felt very comfortable after hearing the staff reviewer talk about -- and in fact, if anything, I got the impression we may have to ask are you going too far. That's good it's going to that depth there. So I think that will address most of those issues.

Standby liquid control system, ejection of nitrogen. I think we said we were going to look at that in Chapter 15 as to why that's not a problem or whatever. So I think we want to make sure we don't lose track of that in case the nitrogen does get injected after the boron gets injected.

I didn't have any comments on 10 or 13, Chapter 16. I think we need to keep in mind that testing is very good and it's useful. Too much testing can be a bad thing, though. I think we need to make sure we don't overboard in some of these areas.

I think use of the BWR-6 tech specs I think is a good start. And I agree with Jack, you know there's a lot of things really not applicable here. But I think it's important to keep the same language and to keep the same philosophy and the formatting so that it's an easy transition for the operator, especially going into a new design. As much familiar as possible with the existing tech specs and stuff I think will be beneficial.

I think it would be worthwhile to have some more discussion on some of the allowed outage times and the surveillance frequency. I don't think we have to go through everyone of them. I think it would be nice to understand some of the basis. But also I don't want to go overboard on this. I don't believe there has to be an analyses and a basis for every frequency. I have no problem with engineering judgment. I think it's important to understand when you're using engineering judgment to set that basis versus when you really have another basis behind. So I think some discussion on that in the future.

MEMBER BONOCA: And I agree with you, Otto. In most case, I mean whatever wasn't the basis to the PRA, typically they are conservative estimates and I think we over test. So that's true.

But I was left at the end of it with a sense that there is some piecemeal approach, there was information from PRAs is being used for some surveillances and other areas and -- so I understand where it comes from. And there is an approach to it.

MEMBER MAYNARD: Yes. That's why I think

it would be good to understand.

MEMBER BONOCA: And the other thing is, you know, at some point I would like to have an answer to is why not PRA basis. I mean clearly the PRA provides the most significant information insofar as past history and reflected in so much information.

MEMBER APOSTOLAKIS: I think it's going to effect -- would be defense-in-depth. But it would be nice to have a discussion of it.

MEMBER BONOCA: Yes, I mean that's the point, you know, why not the best information you do have, which is the story that better to use as a basis for determining frequency or components in the PRAs.

MEMBER MAYNARD: That's all I've got.

MEMBER STETKAR: I don't have anything.

CHAIRMAN CORRADINI: I have them all? All right.

MEMBER STETKAR: Yes.

CHAIRMAN CORRADINI: I'll get them. Thank you.

Tom?

MR. KRESS: And I'm going to make it unanimous on the question of the control room ventilation. I think especially Said's problem with the temperature. I think that needs a final looking at.

In general, I would like to congratulate both the staff and GE on a very compete job from what I've seen. Very complete.

When it comes to the high importance or low importance to determine RTNSS, this may not be appropriate at this time, but I have a problem with using importance measures the way we do to determine that. I'll tell you why.

If I have something like ESBWR which has a very low CDF, it's going to put importance -- it's going to use importance measures that will put things in RTNSS that probably shouldn't be there. I would defer to George on this, but I would have had an importance measure that doesn't use the absolute CDF value, but uses some CDF acceptance value. You think about it.

And anyway, you've got the rules in there and the regulations you have to follow. So, you know, it's a comment that we might want to think about in the future.

I wasn't quite convinced yet on the analysis of the case of the isolated inclined transfer tube. I'd like to see that analyses to be sure.

And I'd also like to second the question that sooner or later we need to look at the nitrogen getting injected in the RCS and the potential effects on long term cooling.

With respect to surveillance frequencies, I agree with George. It's almost going to have to be a defense-in-depth thing. And we need to know what the basis is for those. And if it's just engineering judgment, let's say so. But I think -- I don't see that you can risk-inform that. You can risk-inform allowed outage times very nicely. But surveillance frequencies, I don't think so. So I would second George's comment. I think it's defense-in-depth.

And finally, like Mario, I was much impressed with attention to the security issues. I thought there was an extremely nice job, and was glad to see that.

CHAIRMAN CORRADINI: You have the last word, Dr. Apostolakis.

MEMBER APOSTOLAKIS: Yes. My issues have been mentioned already. I'd really like to hear people's views about frequency of testing.

The only thing I want to say is that I second Tom's commentary. I really believe both sides are doing a professional job, a very good job. This was a good meeting. And the issues, wherever there were questions, were difficult or there is not information at this point. But I'm very pleased with the way this going.

And that's it, Mr. Chairman.

CHAIRMAN CORRADINI: Okay. So first let me thank GEH and the staff. I think both have done, again, for our third meeting a really excellent job of summarizing and presenting what has been done.

The plan, let me go with the plan first. The plan is to in the third week in January to have a two day Subcommittee meeting where Chapter 15 --

MEMBER APOSTOLAKIS: Oh, you have the dates then.

CHAIRMAN CORRADINI: We just have a week. We've already agreed to at the last full Committee.

MEMBER APOSTOLAKIS: You have a week?

CHAIRMAN CORRADINI: We have in that week a couple of days for us relative to primarily Chapter 15 and associated chapters, which I'm guessing may be Chapter 6 reengineering safety features.

MS. CUBBAGE: Right. It could be as many as four chapters. It would be four, six, fifteen and twenty-one. And I see -- look at his eyes light up.

MEMBER APOSTOLAKIS: Third week meaning--

MS. CUBBAGE: The week of the 14th of

January.

CHAIRMAN CORRADINI: Week of the 14th.

MS. CUBBAGE: So it's possible that one of those may drop off, but --

CHAIRMAN CORRADINI: WE had agreed. I'm just reminding you.

MEMBER APOSTOLAKIS: No. I wasn't there, was I?

CHAIRMAN CORRADINI: I think we did that in your absence. You were incapacitated.

MEMBER APOSTOLAKIS: So which days do you have in mind?

CHAIRMAN CORRADINI: That's yet to be determined because Dr. Banerjee has other Thermal-Hydraulic Subcommittee he wants to install there, since we're all going to be here.

MEMBER BLEY: I had 15 to 18.

CHAIRMAN CORRADINI: Two days within those four.

MS. CUBBAGE: Right. And if we did all four of those --

MEMBER APOSTOLAKIS: I can be here on the 18th only.

CHAIRMAN CORRADINI: So before we diverge on that, so I'm just alerting the Committee to that because we'll probably learn more relative to the schedulers since we're not trying to schedule on which of the days we fit in relative to that.

But if I could just remind everybody, if you have written comments relative to the four chapters, please feel free to send to me. What we're going to do is send it to myself and to Gary. Gary will pass them on to Amy and Jim and GEH so they get a feeling for the broader set of comments kind of behind the scenes that don't rise up.

Secondly, if you have other things that you want to be emphasized at the March meeting where we take up another interim letter, let me know now because we'll add to that list from the January meeting.

MS. CUBBAGE: Yes.

CHAIRMAN CORRADINI: And other than that, I can't think of anything else, other than to thank again the folks from GE. Thank you very much for your time. And the staff.

MS. CUBBAGE: Thank you. Yes. I'd definitely like to thank the Committee for a very productive day.

MEMBER APOSTOLAKIS: Gary, when is the PRA issue coming up again? I mean, eleven, too, has not been reviewed by us, right?

MR. HARBUCK: The ESBWR PRA?

CHAIRMAN CORRADINI: Correct.

MR. HARBUCK: I am not sure.

MS. CUBBAGE: We need to come back at least twice.

MEMBER APOSTOLAKIS: Are we done with level one then? No?

MS. CUBBAGE: You haven't seen the SER. We don't have an SER to send you yet. Because we just--

MEMBER APOSTOLAKIS: GE has actually made presentation from level one.

MS. CUBBAGE: They have. And we've received Rev. 2 of the PRA just this fall in its entirely. We're still reviewing it. We need to write an SE.

MEMBER APOSTOLAKIS: So the two new members will have a chance to go over it?

MS. CUBBAGE: Yes. Yes.

CHAIRMAN CORRADINI: Yes. Because things have been postponed. This actually, today was supposed to have been the level two PRA day originally.

MEMBER APOSTOLAKIS: Level two?

MS. CUBBAGE: Those were advance informational sessions. We always intended that we needed to come with an SER.

MEMBER APOSTOLAKIS: Do you have any idea when this may happen?

MS. CUBBAGE: Spring. I mean, for with an SER.

CHAIRMAN CORRADINI: Birds come and the flowers bloom. How about that?

MS. CUBBAGE: We just recently received Rev. 2 of the PRA, so --

MEMBER BLEY: Is that the same as Chapter 18 or is that --

MS. CUBBAGE: No. Eighteen is much closer. We're hoping for a February Subcommittee meeting.

MEMBER BLEY: Okay.

MS. CUBBAGE: We have the SE input. WE're well along. Human factors, yes.

CHAIRMAN CORRADINI: So will all of us be here for SOARCA tomorrow? If so, I'll work with Gary. You will not? But we'll get to you. I'll work with Gary to find out what the current plan is in that week which Subcommittee is which day.

MEMBER APOSTOLAKIS: For January?

CHAIRMAN CORRADINI: For January. Okay. Meeting is over. Meeting is adjourned.

(Whereupon, at 5:28 p.m. the meeting was adjourned.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on Reactor Safeguards

Docket Number: n/a

Location: Rockville, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Charles Morrison
Official Reporter
Neal R. Gross & Co., Inc.

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Presentation to the ACRS Subcommittee

ESBWR Design Certification Review
Chapter 16
"Technical Specifications"

November 15, 2007

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 16

Purpose

- Brief the Subcommittee on the staff's review of Chapter 16 of the ESBWR DCD application
- Review based on applicant DCD Rev. 3 and RAI responses received from applicant
- Answer the Committee's questions

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 16

Project and Technical Review Team

- Lead PM
  - Manny Comar, Project Manager
- Lead Tech. Reviewers
  - Craig Harbuck, Sr. Reactor Engineer
  - Andrez Drozed, Sr. Reactor Engineer
  - Jorge Hernandez, Reactor System Engineer
  - Hulbert Li, Sr. Electronics Engineer
  - Sang Rhow, Electronics Engineer
  - George Thomas, Sr. Reactor Systems Engineer
  - Hanry Wagage, Sr. Reactor Engineer

ACRS Subcommittee Presentation ESBWR Design Certification Review Chapter 16

Outline of Presentation

- Applicable Regulations and Review Guidance
- RAI Status Summary
- TS Review Criteria
- Open Issues
- COL Action Items
- Conclusion
- Discussion / Committee questions

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 16

Applicable Regulations and Review Guidance

- 10 CFR 50.34, 50.36 and 50.36a
- 10 CFR 52.47(a) and 52.79(a), 52.103
- 10 CFR Part 50, Appendix A
- Primary SRP Section: 16.0

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 16

RAI Status Summary

• Original number of RAIs	162
• Number of RAIs resolved	112 (118)*
• Number of Open Items	50 (44)*

*Based on rev 4

ACRS Subcommittee Presentation ESBWR Design Certification Review Chapter 16

TS Review Criteria

- Meet requirements of 10 CFR 50.36 regarding SLs, LSSS, LCOs, SRs, Design Features, and Administrative Controls
- Conform to STS conventions regarding format and usage rules
- Consistent with Plant design and accident analyses

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 16

Open Issues

- Resolution of Bracketed information
- Instrumentation Setpoint Methodology
- Surveillance Requirements for Digital Instrumentation and Control
  - Using Self Test Report for Channel Check and Channel Functional Test
  - Logic System Functional Test
  - Response Time Test
  - Staggered Test Basis

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 16

Open Issues (continued)

- Analysis to demonstrate one Safety Relief Valve is adequate for RPV overpressure protection
- RCS vent path to ensure GDCS operability in Modes 5 and 6
- Analyses to support ECCS TS Action requirements

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 16

Open Issues (continued)

- Determination of drywell air temperature and GDCS pool temperature
- SR for RWCU/SDC system isolation valves
- Containment oxygen concentration TS limit
- SR to measure drywell-wetwell bypass leakage
- Control Room Habitability Area temperature post DBA

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 16

Open Issues (continued)

- Availability Controls for makeup water to IC/PCC pools and spent fuel pool
- Analyses to demonstrate water inventory above RPV during refueling and in spent fuel pool sufficient to mitigate loss of cooling for 72 hours
- VRLA battery issues
  - Temperature control and measurement
  - Using float current to indicate state of charge

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 16

Chapter 16 COL Action Items

- Replace information in curly and square brackets with valid plant specific information suitable for plant operation

- Confirm conditions related to adoption of topical reports are met

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 16

Conclusion

- Pending resolution of Open Items, cannot conclude the ESBWR generic TS comply with 10 CFR 50.34, 50.36 and 50.36a

- Completion of generic TS review contingent upon resolution of design and analysis issues outside of DCD Chapter 16

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 16

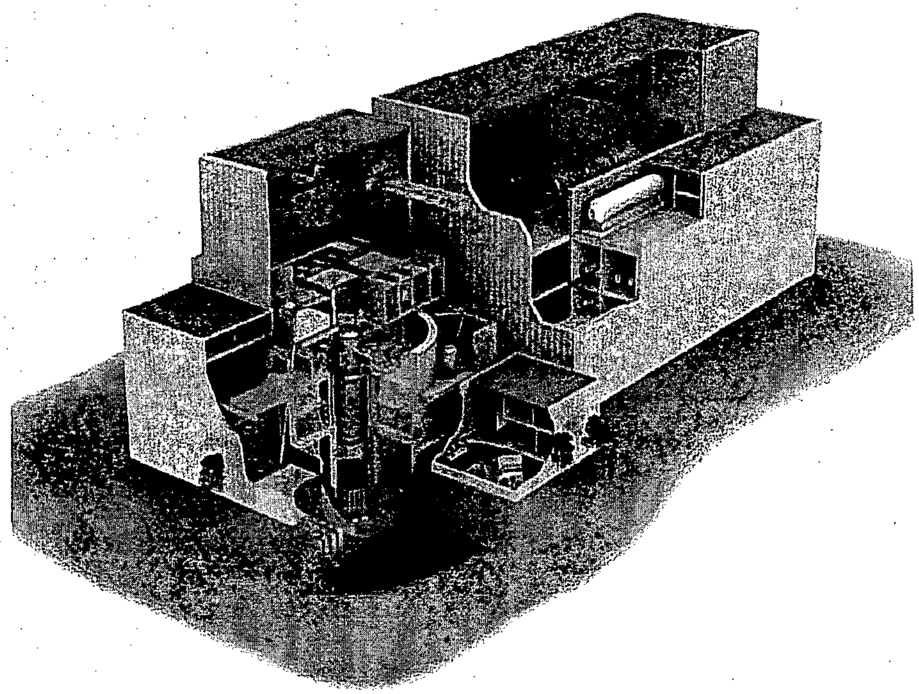
Discussion/Committee Questions

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 16

- Acronyms:
- DCD: Design Control Document
- RAI: Request for Additional Information
- TS: Technical Specifications
- COL: Combined License
- SRP: Standard Review Plan
- SL: Safety Limits
- LCO: Limiting Condition for Operation
- SR: Surveillance Requirement
- STS: Standard Technical Specifications
- RPV: Reactor Pressure Vessel
- RCS: Reactor Coolant System
- GDCS: Gravity Driven Cooling System
- ECCS: Emergency Core Cooling System
- RWCU: Reactor Water Cleanup
- SDC: Shutdown Cooling
- DBA: Design Basis Accident
- IC: Isolation Condenser
- PCC: Passive Containment Cooling
- VRLA: Valve Regulated Lead Acid

ESBWR - Overview
DCD Chapter 16
Technical Specifications

Advisory Committee on Reactor Safeguards



Dan Williamson
November 15, 2007

GE Hitachi Nuclear Energy

Chapter 16 Presentation Content

- Overview of ESBWR Generic Technical Specifications (TS) and Bases
  - ESBWR TS Development Philosophy
  - Differences from Prior Technical Specifications
  - ESBWR TS COL Applicant Information Items
- Summary

ESBWR TS Development Philosophy

- BWR/6 Standard Technical Specifications (NUREG-1434, Rev 3.1) Utilized as the Basis for Standard Content / Numbering / Form & Format
  - Standardization With Existing Technical Specifications
  - Included Latest Approved Generic Changes (TSTFs)
  - Completion Times and Surveillance Frequencies Generally Consistent with NUREG-1434
- ESBWR-Specific Safety Analyses and Systems Evaluated to Meet Criteria of 10 CFR 50.36

Differences from Prior Technical Specifications

- ESBWR Passive Design
  - Reduction in Systems Credited in Event Mitigation
  - ECCS Inoperability Actions
  - Role of Regulatory Treatment of Non-Safety Systems
- Three (of Four) Electrical Divisions Required
  - Two Divisions Satisfy Safety – Third Provides Single Failure
  - ESBWR TS Assure All Required Divisions Are Associated With the Same Three Divisions
  - All Safety Functions Satisfied With Any Two Divisions

ESBWR TS COL Applicant Information Items

- COL ***Applicants*** Provide Site-Specific Closure
  - Similar to Standard Technical Specifications Optional Provisions and Site-Specific Details
  - Examples:
    - Site Description
    - Staff Qualification Standards Employed
    - Effluent Reporting For Single vs Multi-Unit Site
    - Chemical Hazards Protection for Control Room
  - Completed at COL Application
  - Indicated With "[...]" in ESBWR TS

Summary

- ESBWR TS Standardized Based on ESBWR Design
- ESBWR TS Support COL Application Completeness and Technical Sufficiency
- GEH Is Working With the NRC Staff to Address Remaining Open Items

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Protecting People and the Environment

Presentation to the ACRS Subcommittee

ESBWR Design Certification Review

Chapter 13 "Conduct of Operations"

November 15, 2007

Purpose

- Brief the Subcommittee on the staff's review of the ESBWR DCD application, Chapter 13
- Answer the Committee's questions

Review Team for Chapter 13

- Lead Project Manager
  - Rocky D. Foster
- Lead Technical Reviewers
  - Richard Pelton
  - Daniel Barss
  - Albert Tardiff

Outline of Presentation

- Applicable Regulations
- RAI Status Summary
- SER Technical Topics
- Open Items
- COL Information Items

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 13

Summary of Regulations and other Review Guidance

- 10 CFR 50, 50.34 (f)(2)(xxv) and 50.47(b)(8)
- 10 CFR 52.47, 52.48 and 52.78
- 10 CFR 55
- 10 CFR 73.55 and 73.1
- NUREG-0654/FEMA-REP-1, NUREG-0696, 0718, 0737, and 0814
- SRPs 13.1-13.6.2 and 13.6.4-13.6.6
- Reg. Guide 1.101
- Reg. Guide 5.XX series

RAI Status Summary

- Original number of RAI's – 43
- Number of RAI's resolved – 6
- Number of Open Items – 39
  - Emergency preparedness
  - Detection aids
  - Unattended openings
  - Special security areas/vital components

SER Technical Topics & COL Information Items

- 13.1 - Organizational structure to be consistent w/ human system interface
- 13.1 Organizational structure to be addressed by COL applicant
- 13.4 - "Operational Programs" is consistent w/ SECY-05-0197
- 13.4 - Operational programs to be addressed by COL applicant

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 13.2 and 13.5

SER Technical Topics & COL Information Items

- 13.2 and 13.5 - Training program development plan and operating procedures development plan incorporate the appropriate human factors elements and are consistent with the SRPs
- 13.2 and 13.5 - Interface with Chapter 18, "Human Factors Engineering"
- 13.2 - Interfaces with NEDO-33275, "ESBWR HFE Training Development Implementation Plan"
- 13.5 - Interfaces with NEDO-33274, "ESBWR HFE Procedures Development Implementation Plan" and NEDO-33276, ESBWR HFE Verification and Validation Implementation Plan"
- 13.2 Licensed and non-licensed staff training programs to be addressed by COL applicant
- 13.5 Operating procedures program to be addressed by COL applicant

Emergency Preparedness Technical Topics of Interest

- EP is mostly programmatic – includes facilities, equipment, personnel and training
- Design certification – limited to non-site-specific features that are technically relevant to the design (usable for multiple units/sites)
- Standard design may include various design features, facilities, functions and equipment [e.g., technical support center (TSC)]
- DCD satisfies TSC size/location/displays/power
- COL applicant will address emergency action levels (EALs)

Open Items

- Backup power supply for communication equipment (move to 13.6)
- Address TSC (electrical building) 100-year winds/floods
- Provide EP ITAAC (RAI 14.3-150)
- Radiological protection to TSC communication staff (outside TSC)

COL Information Items

- Provide a emergency plan
- Identify OSC (and communications)
- Identify Emergency Operations Facility (EOF) (and communications)
- Provide onsite decontamination capabilities

Physical Security Technical Topics of Interest

- Many security features are being identified through voluntary security assessments
- Resolution of issues mainly focused towards credit for design features
- Examples are doors, cabinets, power supplies and testing and maintenance of features identified
- Correction of previously made assumptions

Open Items

- Accommodation of detection aids in the design
- Identification and design of unattended openings
- Identification of special security areas and location and design of unique physical protection measures for vital components
- Resolution planned through a new topical report to address all Open Items

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 13.6

COL Information Items

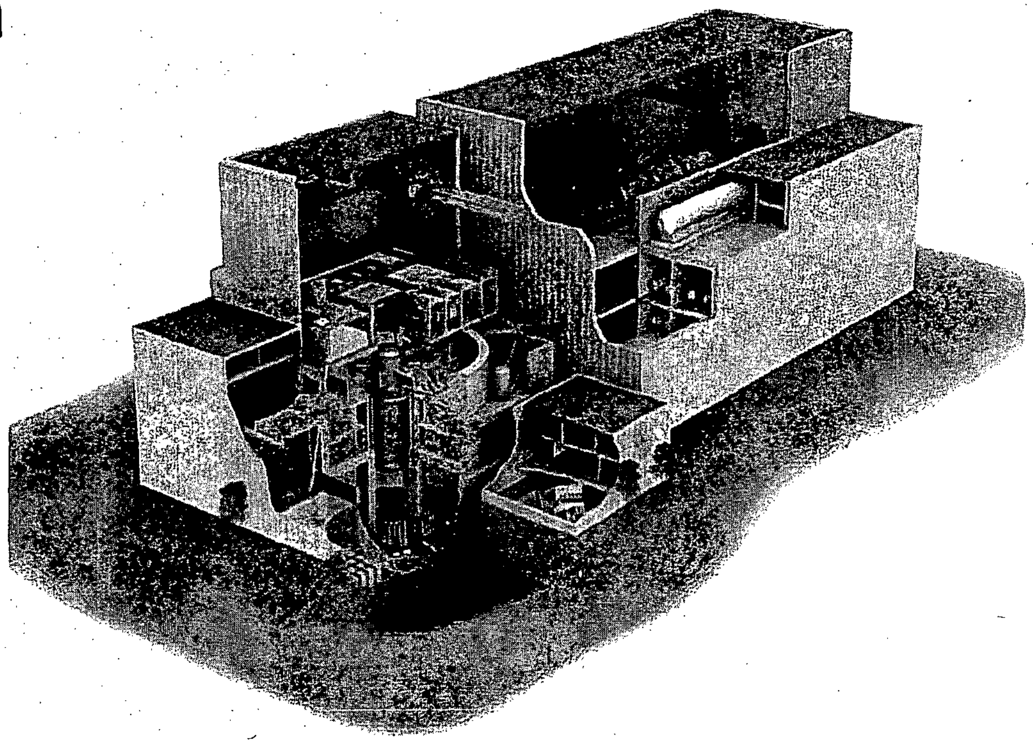
- Final design considerations for access controls, power supplies, unattended openings, alarms of unique features and administrative controls for unique features
- COL information items ensure transition of the unique security features identified in the ESBWR design

Discussion/Committee Questions

ESBWR DCD Chapter 13
Conduct of Operations

Advisory Committee on Safeguards

J. Alan Beard
November 15, 2007



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Presentation Content

- Chapter 13 – Overview Of Conduct of Operations
  - ➢ Organization Structure
  - ➢ Training
  - ➢ Emergency Planning
  - ➢ Operational Program Implementation
  - ➢ Plant Procedures
  - ➢ Physical Security
- Summary

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Chapter 13 Overview – Conduct of Operations

- Chapter 13 Provides Information Relating to Operational Plans for ESBWR
  > It Provides Operational Plans Such That Combined Operating License (COL) Applicant's Organization Will Operate the Plant in a Manner That Protects Public Health and Safety
- The COL Applicant Referencing the ESBWR DCD Will Provide the Detailed Operation Plans

Section 13.1 – Organizational Structure

- The Organizational structure will be consistent with Human System-Interface (HIS) design assumptions

> Discussed in Chapter 18, Human Factors Engineering

- COL Applicant to demonstrate their organizational structure is consistent with ESBWR Human Factors Engineering design requirements and 10 CFR 50.54(i)

Section 13.2 - Training

- The Training Program Development for Licensed Operator Training and Non-licensed Operator Training Programs Are Addressed in Chapter 18
  - > Section 18.10, Training Program Development
  - > Section 18.12, Design Implementation
  - > Section 18.13, Human Performance Monitoring
- Results of Industry Operating Experience Are Incorporated Into Training and Retraining Programs
  - > e.g., NUREG-0737, Lessons-learned From Post TMI
- COL Applicant Will Provide A Description Of, and the Schedule for the Training Program for the Licensed Operator Training Program and Non-licensed Operator Training Program

Section 13.3 – Emergency Planning

- Emergency Planning Is Not Within Scope of the ESBW Design
- Design Features, Facilities and Equipment Necessary for Emergency Planning Are Considered in Design Basis of the Standard Plant

> Technical Support Center (TSC)

- In Accordance With NUREG 0696, Functional Criteria for ERF
- Includes Requirement for Safety Parameter Display System (SPDS)
- Environmentally Controlled
- Reliable Voice and Data Communication System

> Emergency Operations Facility (EOF) and Operational Support Center (OSC) Is Not Within the Scope of ESBWR Standard Plant

- COL Applicant is responsible for Identifying Its Details and Communication Interfaces for Inclusion in the Detailed Design

Section 13.4 – Operational Program Implementation

- The COL Applicant Will Describe and Provide Implementation Milestones for Operational Programs As Defined By NRC SECY-05-0197 And Regulatory Guide 1.206

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Section 13.5 – Plant Procedures

- The COL Applicant Will Develop Administrative Procedures That Provide Administrative Control Over Activities That Are Important to Safety for Operation of the Facility
  - > For Example:
    - Operating and Maintenance Procedures
    - Radiation Monitoring
    - Handling of Heavy Loads

Section 13.6 – Physical Security

- Section is Classified as Security Related Information - and Withheld From Public Disclosure Under 10 CFR 2.390
- Provides Description of Some of the Key Elements in the Physical Security of the Plant
  - >Lighting, Communications, Barriers
  - >Much of the Design Material Relating to Physical Security is Safeguards
  - >Industry Has Proactively Reviewed the Physical Security Design
  - >Documented in Separate Safeguards Submittals

Section 13.6 – Physical Security (cont)

- Implementation of the Physical Security Program is the Responsibility of the COL
- Contains Sufficient Description to Support the Tier 1 Entries for Physical Security
- Passive Plants Simplify the Physical Security of the Plant

Summary

- The COL Applicant Referencing the ESBWR DCD Will Develop The Detailed Operational Plans
- GEH Is Working With the NRC Staff to Address Remaining Open Items

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UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Presentation to the ACRS Subcommittee

ESBWR Design Certification Review

Chapter 10
Steam and Power Conversion System

November 15, 2007

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10

Purpose

- Brief the Subcommittee on the staff's review of Revision 3 of the ESBWR design certification application, Chapter 10, Steam and Power Conversion System
- Answer the Committee's questions

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10

Review Team for Chapter 10:

- Lead PM
  - Eric Oesterle, Senior Project Manager
- Lead Technical Reviewers
  - George Georgiev
  - Robert Davis
  - Jorge Hernandez
  - Yamir Diaz Castillo

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10

- Applicable Regulations
- RAI Status Summary
- SER Technical Topics
- Open Items
- COL Action Items
- Discussion / Committee questions

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10

Summary of Regulations and other Review Guidance

- 10 CFR 52 Subpart B – Standard Design Certifications
- 10 CFR 50 applicable sections and appendices
  - Appendix A, General Design Criteria
  - Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants
  - Appendix G, Fracture Toughness Requirements
- 10 CFR 100, Reactor Site Criteria
- GDCs: 2, 4, 5, 14, 34, 35, 44, 45, 46, 60, 64
- Reg. Guides: 1.26, 1.29, 1.33, 1.37, 1.50, 1.56, 1.71, 1.115, 1.123
- SRPs: 10.2, 10.2.2, 10.2.3, 10.3, 10.3.6, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.4.6, 10.4.7
- Other guidance (generic communications, NUREGs, and SECY's)

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10

RAI Status Summary

- Original RAIs: 50
- RAI's resolved: 46
- Open Items: 4
- Open Items to be discussed later in the presentation

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10 – SER Section 10.2.2

<u>Turbine Generator design</u>

- Key Features
  - Electronic overspeed protection system
  - Digital I&C

- COL Items
  - None

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10 – SER Section 10.2.2

- Open Item 10.2-18: Electronic-only turbine overspeed trip system
  - Issue:
    - Staff requested applicant to address diversity and potential impact to safety-related equipment
  - Staff evaluation:
    - Proposed design is already in use in industry
    - Turbine is favorably oriented per RG 1.115
    - Missile probability is reduced with monoblock design
    - Triple and redundant system meets the intent of the turbine overspeed protection in SRP 10.2
  - Status:
    - Resolved

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10 – SER Section 10.2.3

<u>Turbine Rotor Integrity</u>

- ESBWR turbine rotor fabricated from high quality, high toughness, vacuum treated NiCrMoV low alloy integral forging
- Turbine rotor is subject to preservice and inservice nondestructive examinations which ensure an acceptable level of structural integrity

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10 – SER Section 10.2.3

Turbine Rotor Integrity (continued)

- ITAAC specifies that COL holder provide an evaluation concluding that probability of turbine missile generation, P_1, is less than $1x10^{-5}$
- ESBWR turbine generator is favorably oriented
- For favorably oriented turbine generators, SRP 3.5.1 specifies that probability of turbine missile generation, P_1, is less than $1x10^{-4}$

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10 – SER Section 10.2.3

Turbine Rotor Integrity - Conclusion

- ESBWR turbine generator meets the requirements of GDC 4 with respect to use of rotor materials with acceptable fracture toughness, adequate design, and the requirements for preservice and inservice inspections
- Staff has reasonable assurance that the probability of rotor failure with missile generation is low
- No Open Items
- No COL Items

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10 – SER Section 10.3

Turbine Main Steam System

- Key Features
  - System begins at the seismic interface downstream of the MSIV up to the turbine stop valves and bypass valves
  - No safety-related functions (main steam isolation system is addressed in Chapter 5; MSIVs addressed in Chapter 3)
  - MSIV leakage path to condenser is seismically analyzed and provides reliable power sources (and/or fail safe design) to active components
- COL Items
  - None
- Open Items
  - None

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10 – SER Section 10.3.6

Steam and Feedwater System Materials

- Materials used for the Class 2 steam and feedwater systems are the same as those used for Class 1 steam and feedwater systems and meet the requirements of ASME Section III
- Fracture toughness meets the requirements of ASME Section III for Class 2 components
- Only carbon steel and low alloy steel ferritic materials are used in Class 2 steam and feedwater systems
- The DCD does not specify use of Class 3 components in the steam and feedwater systems

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10 – SER Section 10.3.6

Steam and Feedwater System Materials

- Fabrication and welding of steam and feedwater systems meet the requirements of ASME Code, Section III and conform with the guidance of RG 1.50 and RG 1.71
- Cleaning and cleanliness controls conform with the guidance of RG 1.37

Flow Accelerated Corrosion (FAC) of Class 2 and non-Code Class systems

- Turbine main steam system (TMSS), feedwater and condensate systems are potentially subject to the effects of FAC
- Operating experience and recommendations of Generic Letter 89-08 and NUREG-1344 are applied to their design and operation
- All susceptible Class 1, 2, 3 and non-Code piping will be subject to an augmented inspection program to monitor materials degradation due to FAC

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10 – SER Section 10.3.6

<u>Open Items</u>

- List materials specifications and grades for Class 2 Steam and Feedwater systems in DCD Tier 2, Section 10.3.6.
- Revise DCD Tier 2 Section 10.3.6 to include discussion of RG 1.50 and preheat requirements
- Include discussion, in DCD, regarding design attributes to mitigate FAC in ASME Code, Class 2 piping and non-Code Class systems
- Code Stamping and ANI review of Class 2 portion of TMSS system (RAI 3.2-1 S04)
- There are no COL Action Items

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10 – SER Section 10.4.1

Main Condenser

- Key Features
  - Condenser supports and anchors are designed to withstand SSE to provide a hold-up volume for MSIV fission product leakage
- COL Items
  - Applicant will provide threshold limits and procedures to address chemistry excursions (addressed in DCD Tier 2 Section 10.4.6)
- Open Items
  - None

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10 – SER Section 10.4.2

Condenser Air Removal System

- Key Features
  - 2 mechanical vacuum pumps (start up)
  - 2 steam jet air ejectors (operation)
  - Exhausts to
    - Off gas system (OGS) (operation)
    - Turbine building compartment exhaust (TBCE) (start up)
- COL Items
  - None
- Open Items
  - None

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10 – SER Section 10.4.3

Turbine Gland Seal System

- Key Features
  - Sealing steam is normally provided by main steam or extraction (Auxiliary boiler can be used at all loads if needed)
  - Two 100% capacity exhaust blowers maintain a vacuum in the gland steam condenser and direct noncondensable gases to the TBCE
  - Releases are continuously monitored by the exhaust radiation monitoring system (ERMS)
  - High radiation and flow alarms provided in the control room
- COL Items
  - None
- Open Items
  - None

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10 – SER Section 10.4.4

Turbine Bypass System

- Key Features
  - Full load rejection or turbine trip capability with no SRV lifting and no reactor trip
  - No single failure can disable more than 50% of the installed bypass capacity
  - Failure of TBS lines does not impact essential systems
- COL Items
  - None
- Open Items
  - None

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10 – SER Section 10.4.5

<u>Circulating Water System</u>

- Key Features
  - No safety design basis
  - Provides sufficient cooling water to accommodate a full load rejection without exceeding condenser pressure turbine trip setpoint
  - Isolates on a Turbine Building condenser area high water level signal
- COL Items
  - None. However, there are portions outside the scope of the DCD and interface requirements which the COL applicant must address
- Open Items
  - None

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10 – SER Section 10.4.6

Condensate Purification System

- Purifies and treats condensate to maintain reactor feedwater cleanliness
- Conforms with the guidance of RG 1.56
- No Open Items
- Discussions are currently ongoing regarding use of EPRI BWR Water Chemistry Guidelines

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10 – SER Section 10.4.7

<u>Condensate and Feedwater System</u>

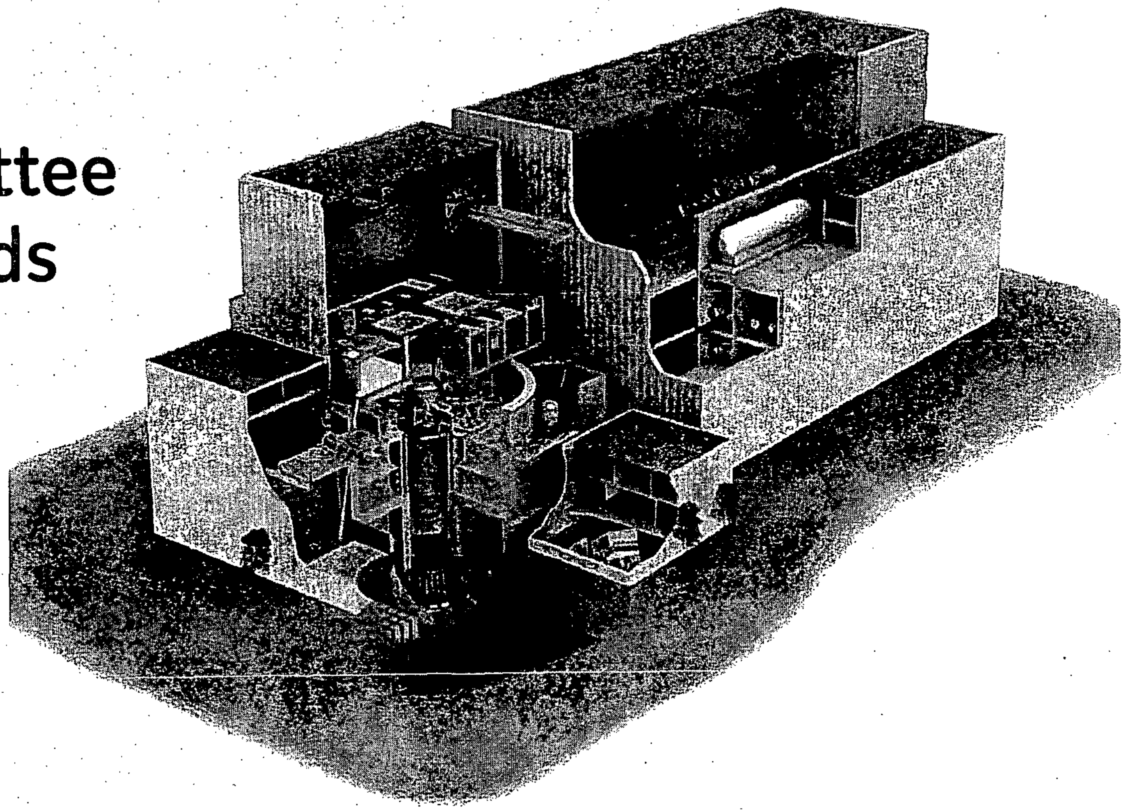
- Key Features
  - Four FW pumps and four condensate pumps (3 in service, 1 standby)
  - Coincident logic and redundant controllers and input signals reduce spurious trips
  - Flow control is via FW pump adjustable speed control (normal operation) and via low flow control valve (low power)
- COL Items
  - None
- Open Items
  - None

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10

<u>Discussion/Committee Questions</u>

ESBWR DCD Chapter 10 Steam and Power Conversion System

For: Advisory Committee on Reactor Safeguards



Gary M. Anthony

Nov. 15th, 2007

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Presentation Content

- Chapter 10 Overview
  - > Design Parameters
  - > Equipment Overview
  - > Turbine and Generator
  - > Turbine Main Steam System
  - > Feedwater and Mitigation of Flow Accelerated Corrosion (FAC)
  - > Principal Design Features
  - > Power Cycle Schematic (DCD Figure 10.1-1)
  - > Enhanced Design Features
- Summary

Design Parameters

- The Content and Level of Detail used in DCD Chapter 10 Considers the Guidance in NUREG-0800, Standard Review Plan, Sections 10.2 to 10.4.7.
- The Turbine, Generator, and Power Cycle Systems Do Not Perform or Support Any Nuclear Safety-Related Functions.
- The Standard ESBWR BOP Parameters are Summarized in:
  - DCD Section 10.1 which describes the principle design features and lists the corresponding design parameters in Table 10.1-1.
  - DCD Section 10.4 describes the cooling water requirements.

Equipment Overview

- The ESBWR BOP is Based Upon a Very Conventional BWR Power Plant Cycle ~20% larger than large BWR 6
- Chapter 10 Presents the Equipment Required to Condense Unused Steam into Condensate and Convert That into High Quality Feedwater in a Purification Subsystem. (Filters and Demineralizers)
- The Water is then Heated with Extraction Steam Through Low and High Pressure Feed Water Heaters and is Fed to the Reactor.
- Steam is Generated then Transported to the Turbine and Converted to Electrical Energy from Thermal Energy, Wet or Excess Steam is Exhausted Back the Condenser.

Turbine and Generator

- One Double Flow High Pressure Turbine and Three Double Flow Low Pressure Turbines (G.E. 6F52).
- Turbine Rotors Utilize Integral Forgings (Monoblocks) to Minimize the Probability of Missile Generation (pre-tested to 120% of rated speed).
- GE has a Long History with this Design Replacing the Old Shrunk on Wheel Style. **(~1992, >4 Million Operational Hours)**
- Turbine Last Stage Blades are 52" Long and have been fully Shop Tested.
- A Standard Design Synchronous Generator with Water Cooled Stator Windings and a Hydrogen Cooled Rotor Rated at 1933 MVA (~1600 MWe Gross).

Turbine Main Steam System

- Transports Steam from the Nuclear Boiler System to the Turbine Inlet.
- System is Nonsafety-Related.
  - Built as a Quality Group B: Designed, procured, Installed, Tested, Inspected and "N" Stamped to ASME Section III, Class 2 Requirements.
  - Designed to Seismic Category II Requirements.
  - The BWR MSIV Leakage Control System has been replaced with the NRC approved Isolated Condenser Method which has been retrofitted into some of the operating fleet.

Feedwater

- The standard Plant Design Incorporates 7 Feedwater Heaters, 4 Moisture Separator Reheaters (MSRs), and Multiple Extraction Points.
  - > Three low pressure heaters are located in each condenser neck.
  - > The system contains an open feedwater heater / tank that provides reserve inventory for mitigating Abnormal Events.
  - > The MSRs have standard high efficiency chevron-type moisture separators that are used to improve steam quality and increase thermal efficiency.
  - > Reliable steam seal designs are instituted to contain radioactive gases and steam.
  - > Materials are selected for >60 year life.

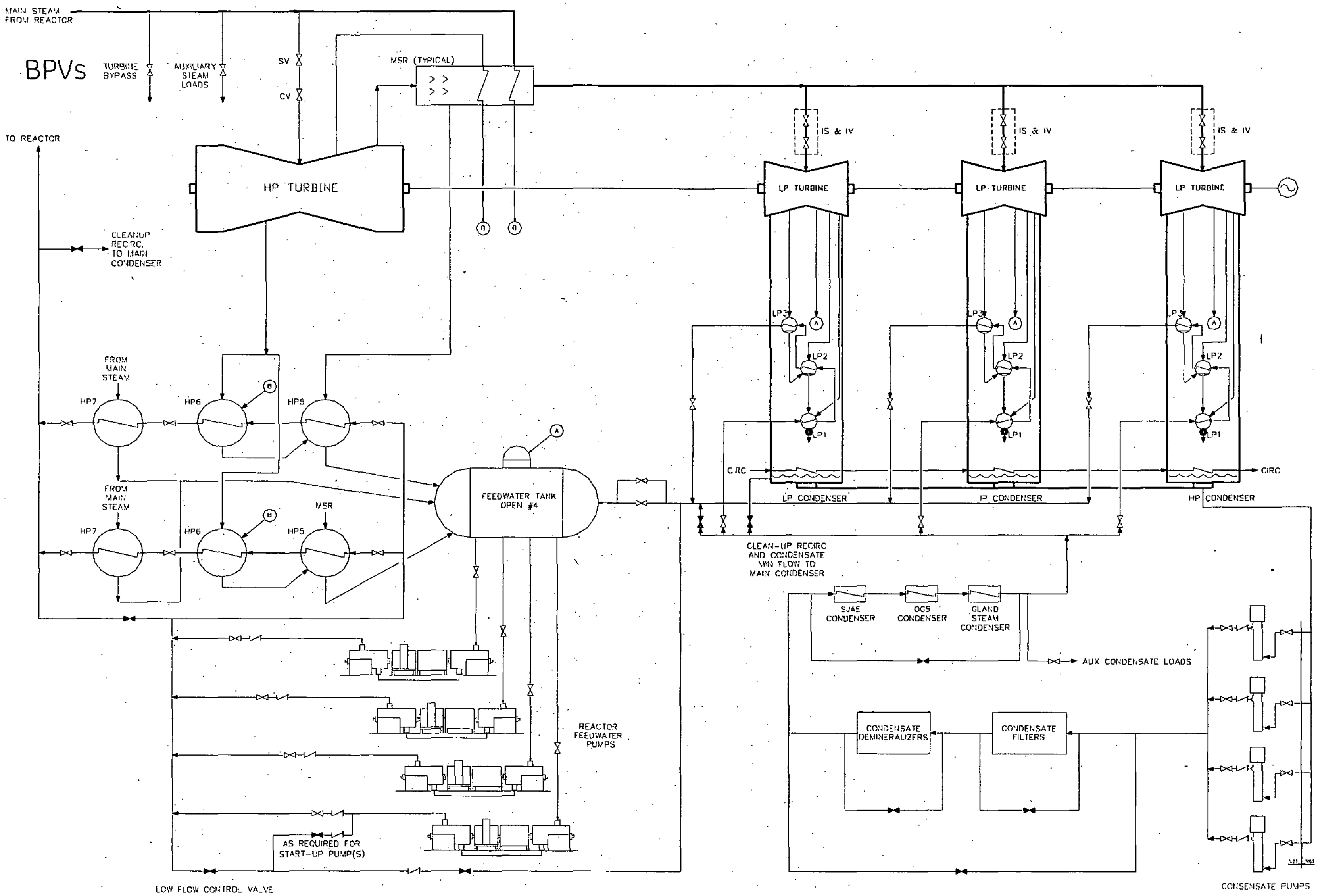
Feedwater and Mitigation of Flow Accelerated Corrosion (FAC)

- Applicable operating experience and recommendations provided in NRC Generic Letter 89-08 and NUREG-1344 are applied to the system design and operation.
- Systems potentially affected by FAC are analyzed from actual plant design data to determine where increased wall thicknesses or FAC resistant materials must be used to meet the 60-year design life. (e.g.: EPRI CHECKWORKS™ or equal)
- Basic piping design principals ensures process flow velocities are limited.
- Internal Study was completed on Class 1 MSL and FW piping. **(MSL >> 60 years, FW >60 w/ P22 pipe and O_2 control).**
- An augmented inspection plan is implemented based on EPRI recommendations (NSAC-202L).

Principal Design Features

- The Standard Main Condenser is a Water-Cooled Surface Steam Type made with Corrosion-Resistant Materials and Robust Spargers.
- Turbine Bypass System is Designed with Full Bypass Capability (110% Design) to Mitigate Abnormal Events.
- Loss of Grid (Island Mode), #4 Open FW Heater Sizing, Spare FW and Condensate Pumps for Increased Reliability (Fewer SCRAMS).
- Flexible Circulating Water System and Heat Sink are Site Specific (Including Series or Parallel Flow Condenser Options).

Power Cycle Schematic (DCD Figure 10.1-1),



Enhanced Design Features

- Integral Forgings (Monoblock) to Reduce Turbine Missile Probability and are Favorably Oriented to the Reactor Building and Control Building.
- Adjustable Speed Motor-Driven Feedwater Pumps using Variable Frequency Drives Reduces Dose (by Elimination of Steam) and Improve Maintainability.
- The Gland Seal Steam Evaporator has been Eliminated (Seals are Back on Normal MS), Improving Reliability and Reduce Maintenance Dose Through Simplification.
- The Turbine Utilizes a Fully Electronic, Redundant, Fail Safe and Testable Overspeed Protection System.
- Single Failure Proof System Designs.

Summary

- DCD Chapter 10 Provides a Description of ESBWR Standard Plant Design Features.
- The ESBWR BOP is Designed with Flexibility and can be Sited Anywhere the Design Parameters are met for the Cooling Water Systems (one basic design).
- This is a Standard Heat Cycle for Electrical Power Conversion (SV, CV, CIVs, NRVs, Extraction Steam, HP/LP Monoblock Turbines, Tube Condenser).
- The Design Incorporates Best Practices & Incorporates Many Industry Lessons Learned (Spare Pumps, Large #4 FW Tank, 110% BP, Island Mode, FAC Early Reviews of Materials, and MSR Designs)
- All of this is to Increase **RELIABILITY** (less BOP initiating transients), Longer Plant System Life, Good Cycle Efficiency, and Equipment Availability through On-Line Testing and Maintenance.

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UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Presentation to the ACRS Subcommittee

ESBWR Design Certification Review
Chapter 9,"Auxiliary Systems," and
Section 6.4, "Control Room Habitability System"

November 15, 2007

U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Presentation to the ACRS Subcommittee

ESBWR Design Certification Review
Chapter 9,"Auxiliary Systems," and
Section 6.4, "Control Room Habitability System"

November 15, 2007

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 and Section 6.4

<u>Purpose</u>

- Brief the Subcommittee on the staff's review Revision 3 of the ESBWR design certification application, Chapter 9, "Auxiliary Systems," and Section 6.4, "Control Room Habitability System"

- Answer the Committee's questions

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 and Section 6.4

<u>Project and Technical Review Team</u>

- Lead PM
  - Dennis Galvin, Project Manager
- Lead Tech. Reviewers
  - Syed Haider (6.4)
  - Jorge Hernandez (9.1.1 - 9.1.5)
  - Chang Li (9.2.1-9.2.8)
  - David Shum (9.3-1, 9.3.3, 9.3.6 - 9.3.8, 9.3-12, 9.5.4 - 9.5.8)
  - Yamir Diaz-Castillo (9.3.9 - 9.3.11)
  - George Thomas (9.3.5)
  - Edwin Forrest (9.4.1 - 9.4.8)
  - Raj Goel (9.4.9)
  - Robert Radlinski (9.5.1)
  - Amar Pal (9.5.3)
- Secondary Reviewers
  - Benjamin Parks (9.3.5)

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 and Section 6.4

Outline of Presentation

- Applicable Regulations
- RAI Status Summary
- SER Technical Topics of Interest
- Open Items
- COL Action Items
- Discussion / Committee questions

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 and Section 6.4

Key Regulations and Review Guidance

- 10 CFR 52 Subpart B – Standard Design Certifications
- 10 CFR 50.34(f), 50.48(a), 50.62, Appendix A, GDC
- 10 CFR 20, 20.1101(b)
- GDCs: 1, 2, 3, 4, 5, 13, 14, 17, 19, 23, 26, 27, 34, 38, 44, 45, 46, 60, 61, 62, & 63
- Primary SRP Sections: 5.4.7, 6.2.2, 6.3, 6.4, 9.1.1- 9.1.5, 9.2.1 - 9.2.3, 9.2.5, 9.2.6, 9.3.1- 9.3.3, 9.3.5, 9.4.1- 9.4.4, 9.5.1, 9.5.3 -
- Regulatory Guides 1.13, 1.29, 1.39, 1.52, 1.78, 1.115, 1.117, 1.140, 1.189, 1.194, & 8.8
- Industry Standards: ANS, ANSI, ASHRAE, ASME, ASTM, IESNA, ISA, & NFPA
- Other guidance (generic communications, NUREGs, and SECY's)

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 and Section 6.4

RAI Status Summary: Chapter 9

- Original number of RAIs = 216
- Number of RAIs resolved = 150
- Number of Open Items = 66

RAI Status Summary: Section 6.4

- Original number of RAIs = 14
- Number of RAIs resolved = 0
- Number of Open Items = 14

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 and Section 6.4

9.1 Fuel Storage and Handling
- 9.1.1-New Fuel Storage
- 9.1.2-Spent Fuel Storage
- 9.1.3-Spent Fuel Pool Cooling and Cleanup System
- 9.1.4-Light Load Handling System (Related to Refueling)
- 9.1.5-Overhead Heavy Load Handling System

9.2 Water Systems
- 9.2.1-Plant Service Water System
- 9.2.2-Reactor Component Cooling Water System
- 9.2.3-Makeup Water System
- 9.2.4-Potable and Sanitary Water Systems
- 9.2.5-Ultimate Heat Sink
- 9.2.6-Condensate Storage and Transfer System
- 9.2.7-Chilled Water System
- 9.2.8-Turbine Component Cooling Water System
- 9.2.9-Hot Water System
- 9.2.10-Station Water System

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 and Section 6.4

9.3 Process Auxiliaries

9.3.1-Compressed Air System
9.3.2-Process Sampling System
9.3.3-Equipment and Floor Drain System
9.3.4-Chemical and Volume Control System
9.3.5-Standby Liquid Control System
9.3.6-Instrument Air System
9.3.7-Service Air System
9.3.8-High Pressure Nitrogen Supply System
9.3.9-Hydrogen Water Chemistry System
9.3.10-Oxygen Injection System
9.3.11-Zinc Injection System
9.3.12-Auxiliary Boiler System

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 and Section 6.4

9.4 Heating Ventilation and Air Conditioning
- 9.4.1-Control Building HVAC System
- 9.4.2-Fuel Building HVAC System
- 9.4.3-Radwaste Building Heating, Ventilation and Air Conditioning System
- 9.4.4-Turbine Building HVAC System
- 9.4.5-Engineered Safety Feature Ventilation System
- 9.4.6-Reactor Building HVAC System
- 9.4.7-Electrical Building HVAC System
- 9.4.8-Drywell Cooling System
- 9.4.9-Containment Inerting System

6.4 Control Room Habitability System

9.5 Other Auxiliary Systems
- 9.5.1-Fire Protection Program
- 9.5.2-Communications System (presentation deferred to Chapter 7)
- 9.5.3-Plant Lighting System
- 9.5.4-Diesel Generator Fuel Oil Storage and Transfer System
- 9.5.5-Diesel Generator Jacket Cooling Water System
- 9.5.6-Diesel Generator Starting Air System
- 9.5.7-Diesel Generator Lubrication System
- 9.5.8-Diesel Generator Combustion Air Intake and Exhaust System

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 – SER Section 9.1.1 – 9.1.2

<u>New and Spent Fuel Storage</u>

- SFP capacity - 20 yrs plus one full core offload
- RB buffer pool capacity – 60% RPV core
- Storage racks and liner embedments are Seismic I
- Impact to racks from dropped objects prevented by interlocks and safe load paths (9.1.5)
- Liner designed to withstand impact of one fuel assembly

<u>Open Items</u>

- Impact, thermal-hydraulic, and criticality analyses
- Liner structural analysis
- Neuron-absorbing panel monitoring program

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 – SER Section 9.1.3

Fuel and Auxiliary Pool Cooling System

- Safety-related passive cooling (heatup and boil for 72 hours without makeup)
- Nonsafety-related active cooling
- Performs risk significant functions (LPCI, SPC)
- Other capabilities (alternate SDC, drywell spray)

Open Items

- Basis for not providing safety-related atmospheric cleanup
- 72-hour analysis for the buffer pool and SFP w/o makeup
- Basis for post 72-hour makeup rate (200 gpm)
- Performance criteria for normal operation and for functions credited in PRA
- Level instrumentation elevation relative to TAF

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 – SER Section 9.1.4 – 9.1.5

Light and Heavy Load Handling Systems

- RB and FB cranes are single-failure-proof
- Cranes, refueling machines, and IFTS are designed to withstand SSE
- Applicant commits to NUREGs 0554 and 0612, and applicable ANSI standards
- IFTS is similar to the BWR-6 design

Open Items

- Provide details of the ability of the system to hold the load (carriage)
- Detailed description of standards applied to specific components
- Seismic classification of new fuel stand

COL Action Items

- COL applicant will provide heavy load listings, fuel handling procedures, maintenance manuals, safe load paths, QA program description, inspection and test plans, personnel qualification program descriptions.

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ESBWR Design Certification Review
Chapter 9 – SER Section 9.2.1 – 9.2.10

<u>Review of the Water Systems</u>

- Based on SRP Sections 9.2.1 – 9.2.6
- Passive Design
  - Excluding review guidance that applies only to safety-related portions of the systems
  - Level of detail
- RTNSS determination
- ITAAC inclusion

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ESBWR Design Certification Review
Chapter 9 – SER Section 9.2.1 – 9.2.10

Open Items

- Drawing details
- Radiation monitoring for the PSWS
- Procedures for avoiding water hammer in PSWS, RCCWS, and CWS
- Classification of Makeup Water System as RTNSS

COL Action Items

- COL applicant will develop provisions to preclude long-term corrosion and fouling of the PSWS Procedures for avoiding water hammer in PSWS, RCCWS, and CWS
- COL applicant will provide the design of the station water system

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 – SER Section 9.3.1, 9.3.3, 9.3.6 - 9.3.8 and 9.3.12

<u>Process Auxiliary Systems</u>

9.3.1	Compressed Air System
9.3.3	Equipment and Floor Drain System
9.3.6	Instrument Air System
9.3.7	Service Air System
9.3.8	High Pressure Nitrogen Supply System
9.3.12	Auxiliary Boiler System

<u>RTNSS</u>

- These are non-safety-related and non-RTNSS systems

<u>Open Item</u>

- GEH has not addressed that failure of the Auxiliary Boiler System as a result of a pipe break or malfunction of the system would not adversely affect safety-related systems or components.

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 – SER Section 9.5.4 - 9.5.8

Diesel Generator Support Systems

9.5.4 Diesel Generator Fuel Oil Storage and Transfer System
9.5.5 Diesel Generator Jacket Cooling Water System
9.5.6 Diesel Generator Starting Air System
9.5.7 Diesel Generator Lubrication System
9.5.8 Diesel Generator Combustion Air Intake and Exhaust System

RTNSS:

- These are RTNSS systems

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 – SER Section 9.5.4 - 9.5.8

<u>Open Items</u>

- No ITAAC for each DG supporting system
- COL applicant's responsibility to ensure availability and reliability these systems

<u>COL Items</u>

- COL applicant to establish procedural controls to ensure a minimum fuel oil capacity is maintained onsite.
- The COL applicant shall describe the material and corrosion protection for the underground piping portion of the fuel oil transfer system

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 – SER Section 9.3.9 - 9.3.11

The following systems are non-safety related:

Hydrogen Water Chemistry System (optional)

- Injection through the Condensate and Feedwater System (CFWS) to help mitigate corrosion and for recombination of dissolved oxidants.
- COL Applicant will determine if HWCS is to be implemented.

Oxygen Injection System

- Injection through the CFWS to suppress corrosion and corrosion product release.
- COL Applicant will provide a description of the oxygen storage facility.

Zinc Injection System (optional)

- Injection through the CFWS system for reduction of corrosion films and radiation fields.
- COL Applicant will determine if ZIS is to be implemented.

Open Items

There are no open items for any of these systems.

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ESBWR Design Certification Review
Chapter 9 – SER Section 9.3.5

Standby Liquid Control System

- Reviewed using SRP 9.3.5 and 10 CFR 50.62
- Accumulator-driven, passive system
- Direct injection to core bypass

Open Items

- System performance-related ITAAC
- Leak detection and monitoring

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ESBWR Design Certification Review
Chapter 9.4 HVAC Systems

Control Room HVAC (9.4.1) and Habitability Systems (6.4)

Reactor Building HVAC System (9.4.6)

Other HVAC Systems

- Fuel Building
- Turbine Building
- Electrical Building
- Radwaste Building
- Drywell Cooling
- Containment Inerting

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Control Room HVAC (9.4.1) and Habitability (6.4)

<u>Technical Feature</u>

- DCD Rev. 3 replaced air bottle system with a safety related fan and filter unit supply air system

<u>Open Item</u>

- Post Accident EFU Adequacy and Operation
  - Quantity of Air Supply
  - Air distribution, mixing, flow paths, and temperature
  - Carbon Dioxide Levels
  - Power Supplies

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Control Room HVAC (9.4.1) and Habitability (6.4)

Technical Feature

- Passive Heat Sink – The mass of concrete walls absorbs Control Room Heat to maintain acceptable temperatures post accident.

Open Items:

- Temperature vs. Time in first 72 hours.
- Assumptions used and a formal heat transfer analysis
- Margin considerations
- Surveillance requirements.

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ESBWR Design Certification Review
Chapter 9 - Reactor Building HVAC System

Technical Features

- RBHVAC isolates on accident initiation
- CONAVS system not credited post accident
- No standby gas treatment system

Open Items

- Assumptions on mixing used to reduce source term of reactor building releases
- Testing of reactor building leak rates
- Monitoring, controlling, and processing releases

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ESBWR Design Certification Review
Chapter 9 – Other HVAC Systems

<u>Systems</u>

- Fuel Building, Turbine Building, Electrical Building, Radwaste Building, Drywell Cooling, Containment Inerting

<u>Technical Features</u>

- Non Safety Related
- Isolated on accident initiation

<u>Open Items</u>

- RTNSS operation and impact of post accident temperatures on equipment

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 – SER Section 9.5.1

Technical Summary

- Deterministic fire protection program meeting the intent of enhanced fire protection criteria put forth in SECYs 90-016, 93-087 and 94-084
- System also provides a Seismic I, but non-safety related backup source of makeup water following a design basis accident
- Plant features reduce fire risk – barrier separation of redundant divisions, inerted containment, no RCP lube oil systems, less active equipment, fiber optic cabling, and digital control systems

Exceptions to Guidance

- Protection in main control room complex and safety related computer rooms is reduced – based on reduced fire risk for new reactors
- Diesel generator (non-safety related) protection does not meet guidance

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ESBWR Design Certification Review
Chapter 9 – SER Section 9.5.1

Open Items

- Include COL Action Items for post-fire safe-shutdown circuit analysis and final fire hazards analysis
- Identification and treatment of fire-induced spurious actuations that could impact safe shutdown
- Identification and treatment of credited post-fire operator manual actions

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ESBWR Design Certification Review
Chapter 9 – SER Section 9.5.1

COL Action Items

- Provide design description of site-specific fire protection equipment
- Provide design and certification details for fire barriers
- Provide fire hazards analysis compliance review and site-specific fire hazards analysis
- Provide provisions for manual fire fighting and smoke control
- Provide proposed license condition for making changes that impact fire protection program
- Provide details of the QA program for fire protection
- Provide implementation schedule for fire protection program

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ESBWR Design Certification Review
Chapter 9 – SER Section 9.5.1

<u>Loss of AC Power</u>

- Post-fire safe shutdown does not require AC power – offsite or onsite
- Shutdown is primarily achieved with the isolation condenser system which does not require AC power
- Analysis assumes one train fails due to the fire – system function is still performed

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 – SER Section 9.5.1

<u>Fire Fighting</u>

- Safe shutdown does not depend on fire fighting
- Detection and suppression systems do not rely on AC power to perform their functions
- Battery-powered fixed and portable emergency lighting is provided
- Fire hazards analysis evaluates access for manual fire fighting for each area of the plant.

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 9 COL Action Items

SER Chapter 9 COL Action Items

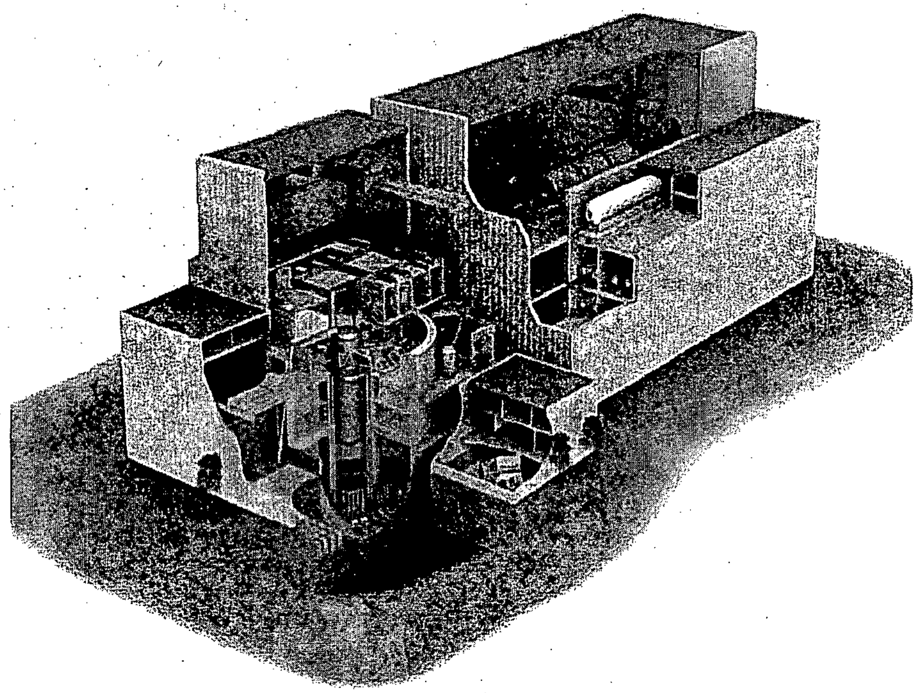
- Light and Heavy Load Handling Systems
- Water Systems
- Diesel Generator Support Systems
- Process Sampling System
- Hydrogen, Oxygen and Zinc Injection Systems
- Fire Protection System
- 37 Items in DCD Rev 3, 26 Items in DCD Rev 4
- Resolution of COL action items expected in the context of DCD Rev. 4 and 5 updates

ACRS Subcommittee Presentation ESBWR Design Certification Review Chapter 9 COL Action Items

Discussion/Committee Questions

ESBWR - Overview
DCD Chapter 9 & Section 6.4
Auxiliary Systems and Control Room Habitability

Advisory Committee on Reactor Safeguards



Michael A. Arcaro
John Gels
November 15, 2007

GE Hitachi Nuclear Energy

Presentation Content

- Chapter 9 – Overview of Auxiliary Systems
- Chapter 9 - Design Features
- Section 6.4 – Overview of Control Room Habitability
- Section 6.4 - Design Features
- Summary

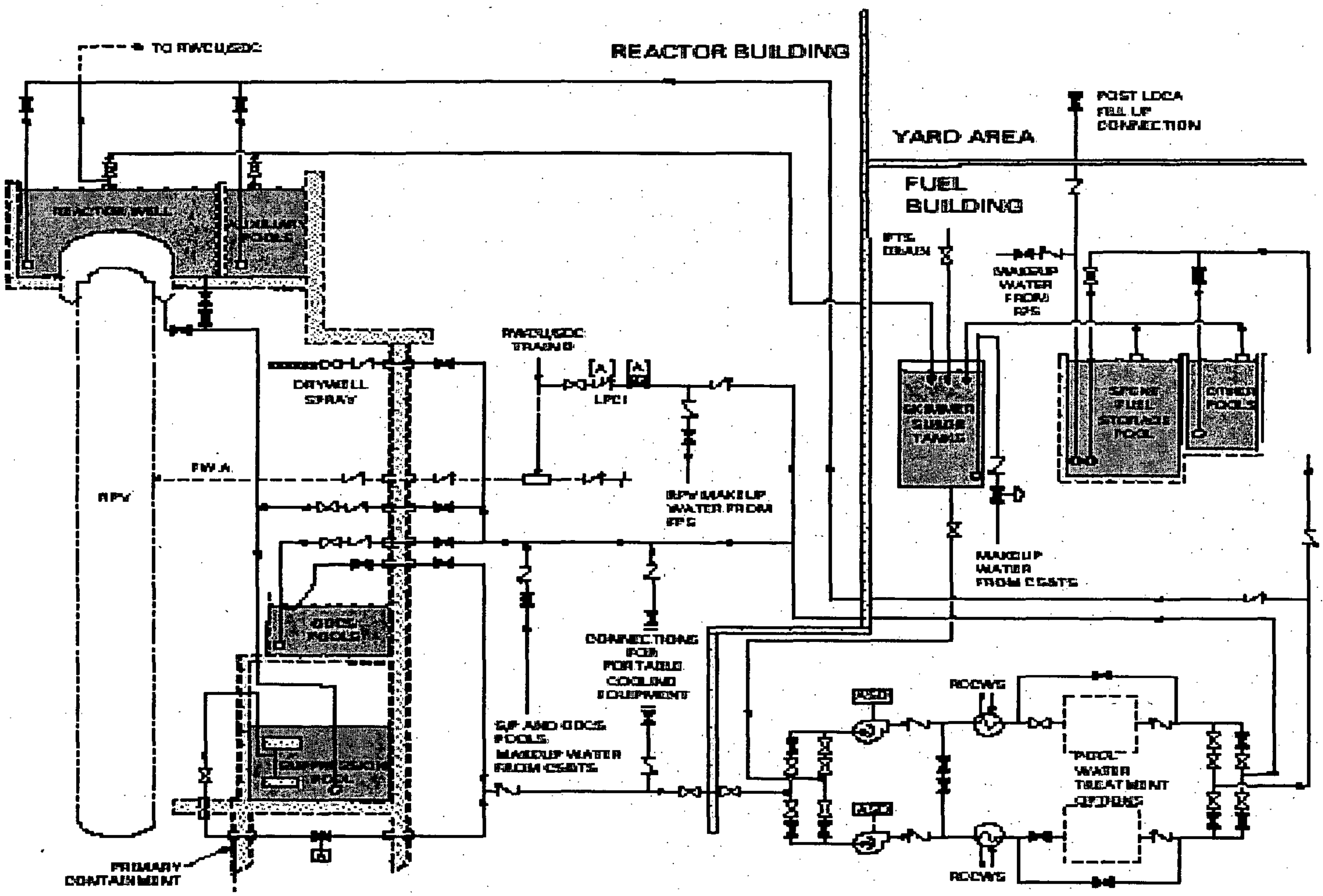
Overview of Chapter 9 - Auxiliary Systems

- Chapter 9 Provides Description Of:
  - > Auxiliary / Support Systems Required to Support Operation of ESBWR Under Normal, Transient, Shutdown and Emergency Conditions
    - – Such As Service Water; Cooling Water Systems; Fire Protection; Heating, Ventilation, and Air Conditioning; and Lighting
  - > Systems Required to Perform and Support Nuclear Safety-Related Functions and Functions Related to Regulatory Treatment of Non-Safety Systems (RTNSS)
- The ESBWR Incorporates Design Features Similar to Those Auxiliary and Support Systems Utilized in Past BWR Designs

Section 9.1 - Fuel Storage and Handling

- Provides Description of New and Spent Fuel Storage:
  - Fuel Building
  - Reactor Building
- The Reactor Building / Fuel Building is Seismic Category I and Designed for Natural Phenomena Such As Tornadoes, Tornado Missiles, Floods, and High Winds
- The Fuel Storage Racks Provided in the Spent Fuel Pool (SFP) in the Fuel Building Provide for Storage of Irradiated Fuel Assemblies Resulting From 10 Calendar Years of Plant Operation Plus One Full Core Off Load. The Fuel Storage Racks in the Reactor Building Buffer Pool Deep Pit Can Hold a Minimum of 154 Spent Fuel Assemblies
- Fuel and Auxiliary Pools Cooling System (FAPCS) Provides Spent Fuel Pool Cooling

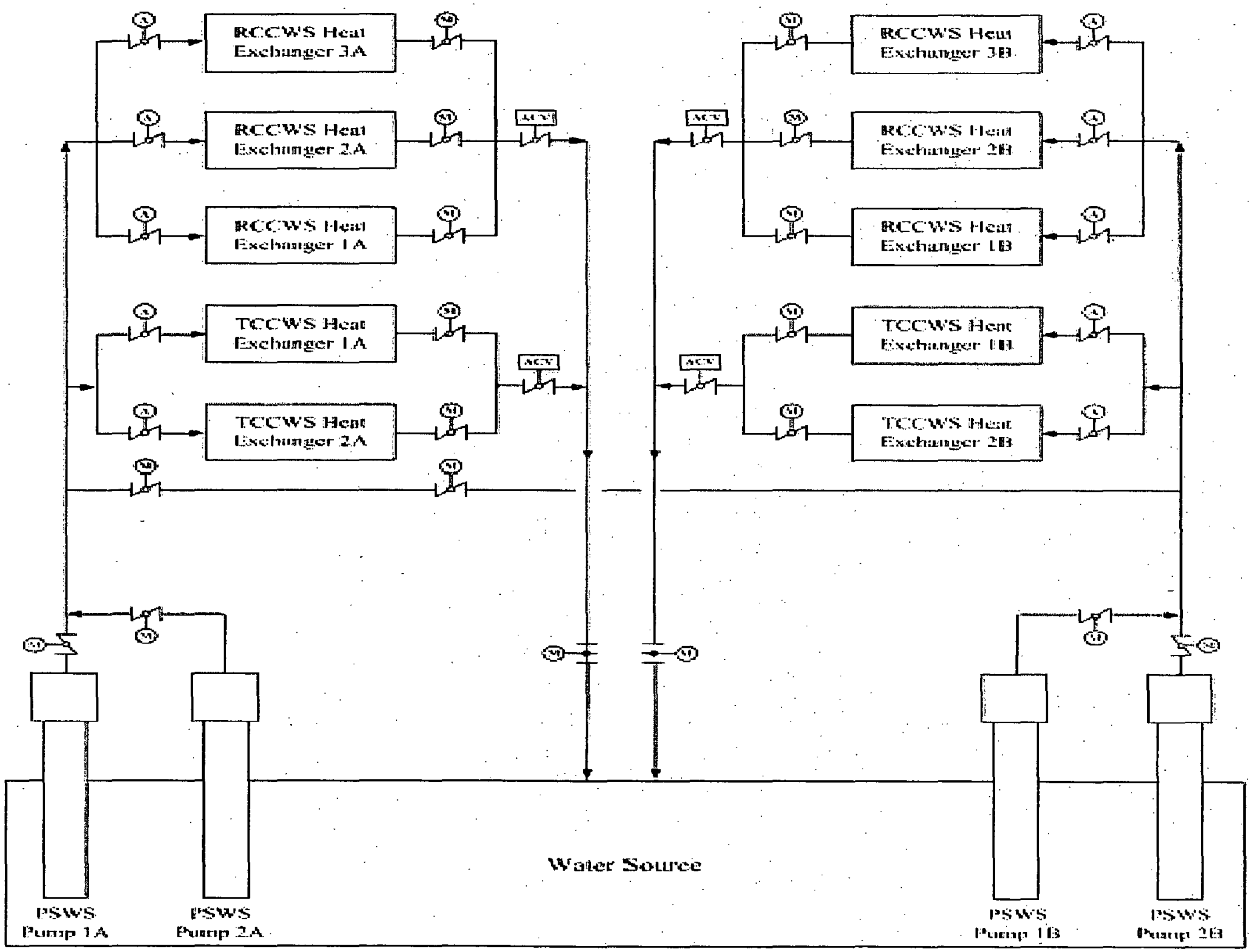
Section 9.1.3–Fuel & Auxiliary Pools Cooling



Section 9.2 – Water Systems

- Provides description of:
  - > Plant Service Water System (PSWS) and Reactor Component Cooling Water System (RCCWS)
    - –Performs Nonsafety-Related Functions
    - –RTNSS function to provide post 72 hour cooling
      - Redundant Trains
      - Physical and Electrical Separation of Trains
      - Seismic Requirements
      - Ability to Withstand Category 5 Hurricane Missiles and Flood Protection
  - > Other Nonsafety-Related Water Systems such as:
    - –Turbine Component Cooling Water System (TCCWS)
    - –Chilled Water System
    - –Condensate Storage and Transfer System

Section 9.2 – Water Systems - PSWS



Section 9.3 – Process Auxiliaries

- Provides Description of:
  > Compressed Gas Systems

  –Instrument Air System (IAS)

  –Service Air System (SAS)

  –Containment Inerting Systems (CIS) (DCD Section 6.2)

  –High Pressure Nitrogen Supply System (HPNSS)

  - CIS and HPNSS Provides Nitrogen Gas for Instruments and Valve Operators Within Inerted Containment
  - Compressed Air Operated Components Having Safety-Related or RTNSS Required Functions, Have Safety-Related Accumulators or Are Fail-Safe

  > Other Process Auxiliaries such as:

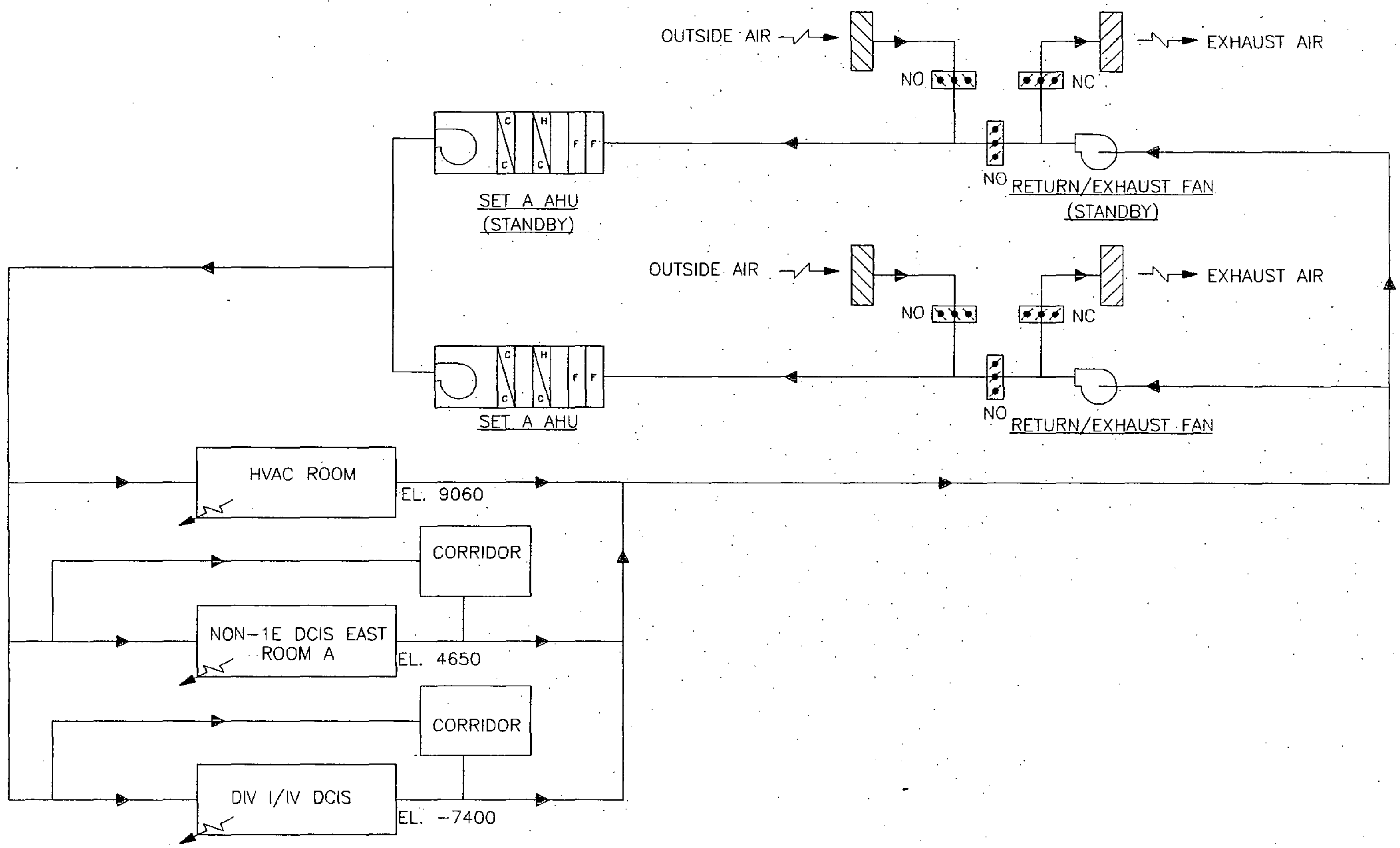
  –Process Sampling System, Equipment and Floor Drain System, and Standby Liquid Control System

  –Hydrogen Water Chemistry System (HWCS)

Section 9.4 – Heating, Ventilation, and Air Conditioning (HVAC) Systems

- Provides Description of:
  - > Control Building HVAC
  - > Fuel Building HVAC
  - > Radwaste Building HVAC
  - > Turbine Building HVAC
  - > Reactor Building HVAC
  - > Electric Building HVAC
  - > Drywell Cooling System

Section 9.4 – Heating, Ventilation, and Air Conditioning (HVAC) Systems



Control Building General Area HVAC Subsystem (CBGAVS)

Section 9.5 – Other Auxiliary Systems

- Provides Description of:
  - > Communication System
  - > Lighting System
    - – Artificial illumination for rooms, spaces, and outdoor areas of the plant
  - > Support Systems for Plant Investment Protection (PIP) Diesel Generator (RTNSS) that includes
    - – Fuel Oil Storage and Transfer System
    - – Jacket Cooling Water System
    - – Starting Air System
    - – Lubrication System
    - – Air Intake and Exhaust System
  - > Fire Protection System
    - – Detection, Notification, Annunciation and Suppression of Fires

Appendix 9A – Fire Hazards Analysis

- Provides Description of:
  - > Fire Hazards Analysis for distinct areas such as
    - –Reactor Building
    - –Fuel Building
    - –Control Building
    - –Turbine Building
    - –Yard
  - > Safe Shutdown Equipment and Evaluation to Confirm Sufficient Number of Safety-Related Safe Shutdown Systems Remain Available During and Following Design Basis Fire to Achieve Hot Shutdown and Maintain Safe Shutdown

Appendix 9B – Summary of Analysis Supporting Fire Protection Design Requirements

- Analysis Associated With Fire Protection Design Decisions and Requirements
  - –Fire Containment System
  - –Fire Types
  - –Fire Barriers
  - –Transient Combustibles
  - –Cable Trays

Chapter 9 – Design Features

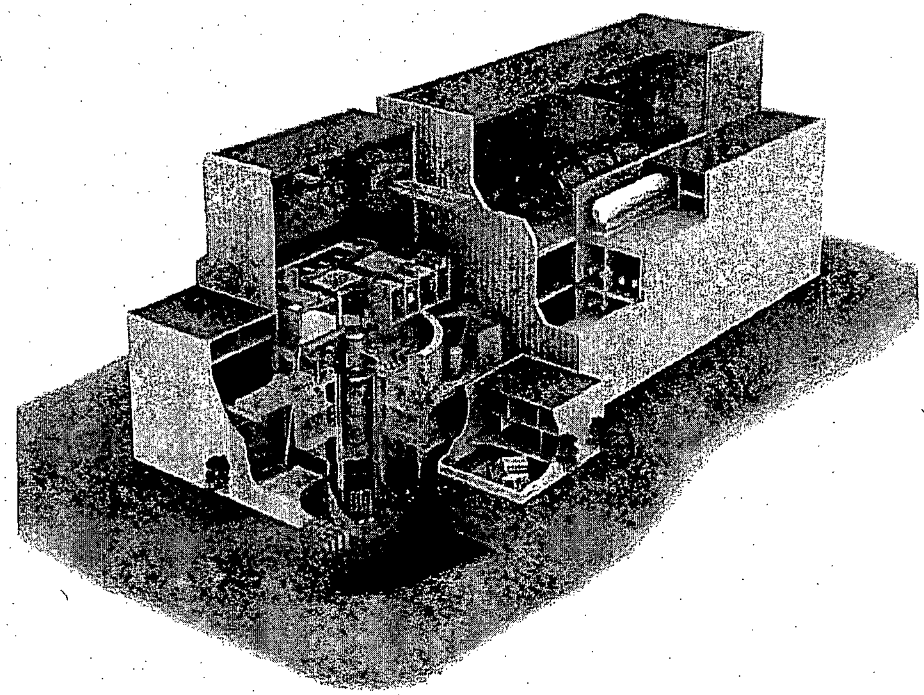
- Some Significant Auxiliary Systems Design Feature Differences From Past BWR Design:
  - Plant Service Water System Is Nonsafety-Related (NSR) and Has RTNSS Functions to Provide Post 72 Hr Cooling for RCCWS and Cooling Support for FAPCS
  - Reactor Component Cooling Water System Is NSR and Has RTNSS Functions to Provide Post 72 Hr Cooling to the Nuclear Island Chillers and PIP Diesel Generators
  - Chilled Water System Is NSR and Has RTNSS Functions to Provide Post 72 Hr Cooling for HVAC and Provide Cooling Support for FAPCS
  - High Pressure Nitrogen Supply System Does Not Perform Any Safety-Related Function Other Than Provision for Safety-Related Containment Penetrations and Isolation Valves

Chapter 9 – Design Features (Cont'd)

- Some Significant Auxiliary Systems Design Feature Differences From Past BWR Design (Cont'd):
  - > PIP Diesel Generator Auxiliary Systems Have No Safety Design Basis and Have RTNSS Functions for Post Accident Monitoring, FAPCS and Support Systems
  - > Eliminated the Standard Hot Water Heating System Design (DCD Rev 4)
  - > Without AC Power During the First 72 Hrs Into an Event, There Is No Active Heating, Ventilation, and Air Conditioning
    - –Passive Cooling Is the Primary Mode for Control Building Habitable Area
    - –No Major Equipment Heat Loads
    - –Isolation Dampers Fail Close for Reactor Bldg, Fuel Bldg, and Control Room

ESBWR - Overview
DCD Section 6.4
Control Room Habitability

Advisory Committee on Reactor Safeguards



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November 15, 2007

GE Hitachi Nuclear Energy

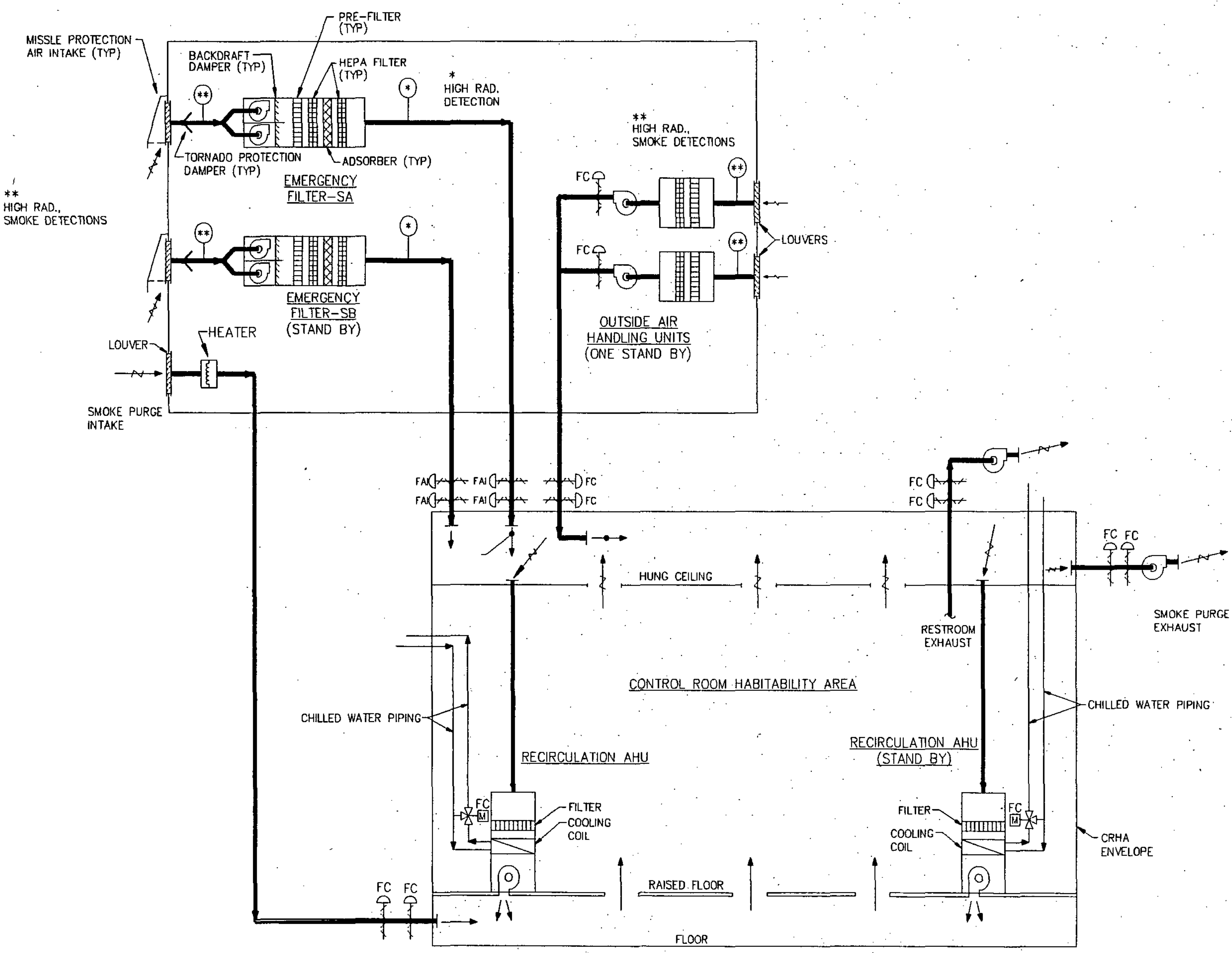
Section 6.4 – Overview of CR Habitability

- Section 6.4 Provides Description of Systems Required for Control Room Habitability:
  - > Control Room Habitability Area (CRHA) HVAC Subsystem (CRHAVS)
  - > Radiation Monitoring Subsystem (RMS)
  - > Control Room Lighting System
  - > Fire Protection System (FPS)
- ESBWR Design Features Ensure Control Room Operators Can Remain in the Control Room in a Safe Condition Under Accident Conditions

Section 6.4 – Design Features

- Some Significant Control Room Design Feature Differences From Past BWR Design:
  - Control Room Habitability Temperature Control Is Provided by Passive Heat Sink. The Heat Sink for the CRHA Is Designed to Limit the Temperature Rise Inside the CRHA During the 72 Hr Period Following a Loss of Normal CRHA Cooling
  - CRHA Boundary Envelope Structures Are Designed With Low Leakage Construction
  - CRHA Is Contained Inside a Seismic Category I Structure (Control Building) and Is Protected From Wind and Tornado Effects, External Floods and Internal Flooding, From External and Internal Missiles and From Dynamic Effects Associated With Postulated Rupture of Pipe

Section 6.4 – Overview of Control Room Habitability



Summary

- Chapter 9 and Section 6.4 Provide Description of ESBWR Auxiliary and Control Room Habitability Systems
- GEH Is Working With the NRC Staff to Address Remaining Open Items