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ABWR Subcommittee

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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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ABWR SUBCOMMITTEE

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WEDNESDAY

NOVEMBER 5, 2014

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ROCKVILLE, MARYLAND

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

COMMITTEE MEMBERS:

MICHAEL L. CORRADINI, Member

RONALD F. BALLINGER, Member

DENNIS C. BLEY, Member

CHARLES H. BROWN, JR. Member

HAROLD B. RAY, Member-at-Large

STEPHEN SCHULTZ, Member

JOHN W. STETKAR, Member

DANA POWERS, Member

DESIGNATED FEDERAL OFFICIAL:

MAITRI BANERJEE

ALSO PRESENT:

JIM ANGLES, NINA

BRET BRICKNER, NINA

EVANS HEACOCK, NINA

SCOTT HEAD, NINA

BILL MOOKHOEK, NINA

STEVE THOMAS, NINA

JIM TOMKINS, NINA

NRC STAFF:

LUIS BETANCOURT, NRO/DNRL

ATA ISTAR, NRO/DE/SEB2

YONG LI, NRO

SHEILA RAY, NRR/DE/EEEB

DIEGO SAENZ, NRR/DSS/SRXB

TOM TAI, NRO/DNRL

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

(8:30 a.m.)

CHAIR CORRADINI: Okay, this meeting will come to order, please. This is a meeting of the Advanced Boiling Water Reactor, ABWR, subcommittee for the ACRS. My name is Michael Corradini. I am chairman of the subcommittee.

ACRS members currently in attendance are Ron Ballinger, Dennis Bley, John Stetkar, Dana Powers and Steve Schultz. We will expect a few others to be joining us presently. We also have Ms. Maitri Banerjee as our designated federal official for the meeting.

As announced in the Federal Register on October 22, 2014, the subject of today's briefing is various sections of the COL application submitted by Nuclear Innovation North America, or NINA, for the South Texas Project's Unit 3 and 4 and the staff final safety evaluation report.

This will include Chapter 9 auxiliary systems, Section 8.2(s) that addresses the STP response to Bulletin 2012-01 to design vulnerabilities and electric power systems issued by the NRC on July 27, 2012 and STP evaluation of potential Part 21 issues by GEH containment loads potentially exceed limits with high suppression pool water level in the ABWR design.

The rules for participation in today's meeting were announced in the Federal Register notice on October 22nd that stated that portions of the meeting could be closed to the public to discuss proprietary information.

I'll just add, parenthetically, that we don't think that will be the case. But I leave it to GEH -- I leave it to --

Them too. If you want to say that.

CHAIR CORRADINI: -- to NINA to alert us if a topic like that comes up, that we have to postpone it and close the session.

Yes, sir.

CHAIR CORRADINI: We have a telephone bridge line open for members of the public and stakeholders to hear the deliberations. To minimize disturbances, this line will be kept in a listen-in only mode until the end of the meeting where we will provide about ten minutes for public comment.

My understanding is there are a couple people from the public on the line that are listening, and we'll come to them at the end of the subcommittee meeting. We'll check on those members at that time to get, at the close of the end of the subcommittee meeting, to hear their comments and questions.

As the meeting is transcribed, I request that participants in this meeting use microphones located throughout the room when addressing the subcommittee. Participants should first identify themselves and speak with sufficient clarity and volume so that that can be readily heard.

Also, please silence all cellphones, pagers, iPhones, iPads and all appropriate appliances. Don't be like Tom Brokaw last night on CNN. We will now proceed with the meeting, and I'll call upon Tom Tai, of NRO, to begin the presentation. Tom?

MR. TAI: Thank you, Chair Corradini. Good morning. My name is Tom Tai. I'm the Lead PM for South Texas. We're here to present Chapter 8 and Chapter 9.

Chapter 9 was a Phase 2 to Phase 4 transition except 9.1 and 9.1.2. So we'll be focusing our presentation on 9.1.1 and 9.1.2 and highlight what we changed for the other sections.

Sam Lee, our branch chief, he's not here today, so if there's any questions of Sam then I guess I'll have to take it for him. This is the last but one subcommittee meeting for South Texas.

CHAIR CORRADINI: Second to last.

MR. TAI: Second to last. And how many --

hopefully we'll finish it off with Fukushima, then we are done. So I'm really looking forward to that. So that you. That's all I have.

CHAIR CORRADINI: So, Scott, you're going to lead us through this today?

MR. HEAD: Yes, sir.

CHAIR CORRADINI: Okay, it's all yours.

MR. HEAD: Well, we appreciate the opportunity to brief the ACRS on these topics today. The first one, as Tom said, we're going to go over Chapter 9 and focus on the spent fuel racks.

Attendees, myself, Steve Thomas, will do the briefing today on this but then we'll go to Jim Engles and Jim Tompkins. Also today, from Holtec, we have with us Chuck Bullard, Bret Brickner and Tao He to assist us if there are any questions that come up in that area.

The agenda, we're going to go over the Chapter 9 status. We'll talk about our new fuel rack departure that we took. And then Steve will go through the spent fuel rack design analysis and we'll cover the COL items and conclude.

With respect to Chapter 9, we're going to cover the spent fuel rack storage or new and spent fuel storage. And a presentation back in October of 2010 we, in essence, covered the rest of Chapter 9. And so this really is going to be focusing, you know, our presentation, at least is going to be focusing on spent fuel racks, okay?

It's one of the interesting things of this review is early on, as we were going through the review, recognizing that there would be a review regarding the new fuel storage racks and the spent fuel racks, those that had refueling experience at STP asked the question, why are we licensing new fuel racks?

We don't use those anymore at 1 and 2 for a very good reason. It incurs an extra fuel movement that we've eliminated at 1 and 2. And for efficiency reasons, cost-savings and otherwise, why don't we go ahead and embark upon a departure to remove the new fuel racks from the licensing basis.

And so we've done that. And so fuel will basically move from whatever inspection it goes through into the spent fuel pool and we won't be licensing new fuel racks with the STP 3 and 4 licensing basis.

So that's the gist of the departure. And it was cost-savings and it's just a recognition of how we really move fuel in today's world.

MEMBER STETKAR: When you did that, Scott, though, it -- I guess I didn't appreciate how small the fuel pool is, the spent fuel pool, until I started thinking about this. Correct me if I'm wrong.

It said that the current capacity of the racks, the plant capacity of the racks, is 2,380 fuel assemblies, which is a little bit more than 270 percent of the reactor core --

MR. HEAD: Correct.

MEMBER STETKAR: -- which, if you refuel a third of the core at every outage, plus the third of the new fuel, plus space for one full core offload, gives you about four refueling outages before you need to start putting fuel in dry casks. Is that right?

MR. THOMAS: It's ten years.

MEMBER STETKAR: Yes, so it's after the fourth --

MR. THOMAS: Ten years maintaining full core discharge capability.

MEMBER STETKAR: Yes. Yeah, okay.

MR. HEAD: And that aligns with our future strategies as well and the country now are going through it. So that was acceptable to us.

CHAIR CORRADINI: Well put.

MR. HEAD: Okay.

MEMBER STETKAR: I just wanted to make sure I had the math right. I mean -- okay.

MR. HEAD: Okay, so that's the Tier 1 departure that we took. And I believe the next slide we've got, I'm going to turn it over to Steve to, just to give a briefing on the spent fuel racks that were used.

MR. THOMAS: All right, thanks, Scott. My name's Steve Thomas. I'm the engineer/manager on STP Units 3 and 4.

As stated in the design certification document, Chapter 9, the spent fuel racks are procured equipment items. The racks themselves are not described in the DCD. Instead, there's a set of requirements that the supplier of the racks is required to satisfy, you know, when that equipment is designed and analyzed.

So although we haven't procured the hardware yet, we have selected a vendor, Holtec International, to perform the design and analysis of the spent fuel racks.

Holtec has been supplying spent fuel storage equipment for well over 20 years and has designed, analyzed and licensed similar equipment to what we're describing today for many utilities. In a few of the more recent spent fuel projects Holtec's projects are shown on this slide. Let's go to the next slide.

So STP 3 and 4 spent fuel racks are proven designs, similar to many others, equipped with Metamic neutron absorber, and the racks are designed for a 60-year life. Spent fuel storage racks have a minimum capacity, as mentioned earlier, just over 270 percent of the reactor core, as required by the design certification document for a total of 2,380 storage locations.

And the spent fuel racks are free-standing and self-supporting, also, as specified in the DCD. All the spent fuel storage racks have been designed to meet the stress limits and have been analyzed in accordance with requirements of ASME Section III, Division 1, NF.

And free-standing modules are stable against tipping and overturning under postulated safe shutdown earthquake events for the plant. The racks are also designed to provide natural circulation cooling through the racks, such that the coolant temperature in the rack structure itself never exceeds 100 degrees Celsius.

Racks are designed for a maximum fuel enrichment of 5 weight percent if you account for integrated gadolinium in the fuel and 2.95 weight percent enrichment without gadolinium in the fuel, maintaining a reactivity of less than 0.95, again, as required by the DCD.

MEMBER SCHULTZ: Steve, just one question.

MR. THOMAS: Yes, sir.

MEMBER SCHULTZ: Why is the design life of the racks 60 years? You'll have to utilize them. If the life of the plant's 60 years you'll have to utilize the racks, the spent fuel pool, for some time after the plant closes.

MR. THOMAS: That's a good question, but I think that probably -- first of all, of course, we're licensing the plant for 40 years, although we're designing the plant for 60-year life.

The surveillance coupon program extends out to 60 years. I would imagine at that time we would have to do something else with the racks which would be primarily offload the spent fuel into dry cask storage.

MEMBER SCHULTZ: Is there a limiting design feature associated with 60 years?

MR. THOMAS: Not really. Probably the criteria would be the condition of the Metamic after 60 years, and that's why we have coupon surveillance programs for that period of time for the design life of the racks.

MEMBER SCHULTZ: Thank you.

MR. THOMAS: Holtec performs a whole pool multi-rack dynamic analysis using a Holtec proprietary code, DYNARACK. Again, this has been used on many previous applications. One of the interesting aspects of the STP 3 and 4 spent fuel racks is the safe shutdown/earthquake that these racks have been analyzed to.

DCD requires a safe shutdown/earthquake with 0.3 G ground motion. The site-specific earthquake is about 0.13 G, so they are designed for the DCD requirement which is considered higher than the actual site-specific safe shutdown/earthquake.

Also in the ABWR, the racks are located at a relatively high location in the reactor building so the building response creates an additional seismic demand. This is probably one of the more challenging aspects of this particular design.

And even though the racks are a very similar design which has been used many times in the industry, a few of the features, structural features of the racks, are a little bit more substantial than what you might normally see.

CHAIR CORRADINI: That's because of where they sit vertically?

MR. THOMAS: It's where they sit in the reactor building.

CHAIR CORRADINI: Sorry.

MR. THOMAS: It's --

CHAIR CORRADINI: I meant vertically within the --

MR. THOMAS: -- the elevation in the building. So these particular racks to have slightly thicker cell walls, a thicker base plate, bumper bars at the top of the racks to distribute the rack-to-rack impact loads during a seismic event, larger bearing pads to accommodate sliding displacements of the racks.

As I mentioned -- did I skip over a slide? I think --

CHAIR CORRADINI: Jim might have.

MR. THOMAS: Okay.

CHAIR CORRADINI: Maybe you could use it.

MR. THOMAS: Okay. So the racks are 17 by 20 rows, which is a very large rack, which give them a large aspect ratio to give them more stability against tipping during an earthquake. And then we've added a fifth foot on the base plate in the center of the rack, again, to accommodate higher loads.

CHAIR CORRADINI: But the concept is, besides the bumper bars, is that they're free to, in an event, slide around a bit?

MR. THOMAS: That's correct.

CHAIR CORRADINI: Okay.

MR. THOMAS: They're free, I think, six degrees of freedom and they can slide back and forth, tip and --

CHAIR CORRADINI: Okay.

MR. THOMAS: -- complete freedom of motion.

CHAIR CORRADINI: Thank you.

MR. THOMAS: There's the one I skipped over. It's showing you the layout of the rack. All seven racks are identical, 20 by 17 racks. Again, these are probably a little bit larger than the standard racks to provide a larger aspect ratio against tipping.

The rest of the analysis has been a pretty typical analysis in terms of criticality, thermal-hydraulic evaluation and mechanic accidents. Again, I think the more interesting aspect of this has been the seismic demand on the racks. And that has been the subject of most of the interaction between NINA and the staff.

So, Jim, the conclusion. So again, the

new fuel racks have been eliminated from the design. New fuel is going to be stored in the spent fuel racks after fuel inspection. Of course, fuel is placed in the spent fuel racks before it's moved into the core anyway.

Spent fuel racks meet all the NRC requirements for new and spent fuel, as described in the DCD and the SRP. And all the COL items in Chapter 9 are met on the particular design and analysis. Any questions?

MEMBER STETKAR: A couple. You said ten years. You really mean eight years, before you need to start rating it -- or nine or something. You can't really meet ten years time in the fuel pool.

MR. THOMAS: I've done the math a couple of times, and ten years is the number, I think, that I have come up with.

MEMBER STETKAR: Well, if I take, you know, change out a third of the core, right?

MR. THOMAS: I don't think it's exactly a third every time.

MEMBER STETKAR: It's a little bit less, isn't it?

MR. THOMAS: A little bit less.

MEMBER STETKAR: If it's a little bit less you might make it with the extra spaces. I haven't done all of the spaces. So maybe you just -- maybe you just make it to ten years. So, okay. I'll give you the ten years because I didn't do the math with every single slot.

Question -- this doesn't have anything to do with the -- it does, a little bit -- the design of the racks. There's, in the FSAR it says the bottom of all pool gates are sufficiently high to maintain the water level over the spent fuel storage racks to provide adequate chilling and cooling.

I couldn't find -- I looked but I didn't look very exhaustively for elevation drawings of the fuel pools. And I know you increased the thickness on the bottom of the racks by a half an inch, so they're up a little bit higher.

If I drain the water in the bottom of the pool to the bottom of the gates, bottom of the slots, how much water is above the top of the fuel?

MR. THOMAS: I believe it's approximately four feet.

MEMBER STETKAR: Four feet? Okay. Thank you.

MR. THOMAS: Thanks.

MEMBER STETKAR: I asked that question of one client one time and the answer was minus 10 centimeters because they had re-racked their pools and done things and never asked any questions, so 4 feet is a good margin. Thanks.

MR. HEAD: All right, Mr. Chair, that concludes our presentation.

CHAIR CORRADINI: Any questions? Are you going to move on, as I have, or are you going to move on to --

MR. HEAD: Yes, sir. I think that's the plan. We'll just stay up here and --

CHAIR CORRADINI: Keep on going?

MR. HEAD: Yes, sir.

CHAIR CORRADINI: Okay, then, good.

MR. HEAD: Okay, on topic --

CHAIR CORRADINI: So are --

MR. HEAD: I'm sorry, go ahead.

CHAIR CORRADINI: Onto the respond --

MR. HEAD: Yes, sir.

CHAIR CORRADINI: Okay.

MR. HEAD: Okay, I've got to probably pull this closer.

CHAIR CORRADINI: Here. Okay. Go ahead.

MR. HEAD: Okay. All right, yes, this

presentation will concern the NRC Bulletin 2012-01. Attendees are myself, Steve is up here still. Bill Mookhoek is with us today, our licensing supervisor, and, I'll just mention, Bill is a former supervisor out at 1 and 2. And you'll be seeing more of him in our discussions with respect to Fukushima.

Jim Tompkins is here and Evans Heacock is here. Evans has been here a couple of times, briefing ACRS. But he was here, he was here closing out the Chapter 8, ACRS meeting a number of years ago. And we'll be talking -- he'll be leading our presentation.

Again as background, you know electrical system, open phase, so (I) open phase solution, detection, protection and COLA changes that were required as a result of this in our solutions.

Just a little background, the Bulletin regarding the Byron event was issued in July of 2012 between the Bulletin and further work, you know, the industry and NRC identified a couple of other loss of phase issues that have occurred.

One was in back of South Texas Project in 2001. The industry embarked on an extensive effort in response to this issue, and that response is ongoing right now. And in terms of addressing, coming up with solutions and actually testing the solutions, the potential solutions that are out there.

That industry response is really not scheduled to be concluded until the 2016 or 2017 timeframe. And so, basically, we're in a situation that, earlier this year, our review of the 3 and 4 application appeared to be on a path to be concluded by September of this year.

And so here we were, you know, NRC was expecting us to address this issue. We felt we needed to address this issue. But we really were going to be in a position where we had to define the response before the entire industry issue has unfolded and been concluded.

And so the NRC defined, basically, a first that if STP could come up with a resolution to this issue that encompassed what that solution would ultimately look like, then they would move forward with our review. And that's, in essence, what we've done here today.

Our proposed design includes detection, control room alarm, an automatic response to the open phase of it, and I think NRC felt that it was important that that solution also be immortalized in Tech specs. And we've also done --

MEMBER BLEY: Good. Are you going to maybe talk more about the automatic response at all?

MR. HEAD: Absolutely. That will be here. But I want to preview, though, for the ACRS that this is not an automatic response to an open phase event. This is an automatic response to the symptoms of the open phase ----

MR. HEAD: -- that would be cinched on the 4160 bus and the protection is to protect the motors. And so, and that allowed us to readily put that protection into technical specifications because it ends up being the relays that we're, that we've already gotten in Tech specs, like the under voltage, integrated voltage.

And so it allowed a Tech spec-related solution. It allowed an automatic response that's hitting the target, which is protecting the motors. And, at the same time, it allowed the control room to know that this issue has occurred because of the detection.

So it is, it really is, we think, an appropriate and, we think, I'd say appropriate response to this issue, and that's what we'll be talking about today in more detail.

So I'm going to turn it over to Evans. And I'll say he has briefed the ACRS before and has been responsible for a lot of the design you'll be seeing today.

MR. HEACOCK: Thank you. Again, my name is Evans Heacock. I have presented Chapter 8, probably in 2010 timeframe. And I'm also a member of the IEEE Standards for Nuclear Power Engineering Committee/subcommittee for, just write a lot of the standards for the nuclear power industry.

I've also been working as the electrical lead for a number of years for STP 3 and 4, responsible for a lot of the way the electrical distribution system looks for 3 and 4.

I'd kind of like to go over just a high level, real quick, to refresh your memory on the Byron event. It was offsite power supply circuits were rendered inoperable by the single phase open circuit that was undetected by surveillance.

Again, they dropped a phase on the high side of their SATs, Station Auxiliary Transformer. The design of the electrical power system did not take into account the possibility of a loss of a single phase between a transmission network and the onsite power distribution system. From that standpoint, being able to detect a single open phase on the secondary of the plant.

MEMBER BLEY: Haven't -- two things.

Since you're on the IEEE Committee -- and I don't know the answer to this. I've just been digging in to this stuff myself recently. Has protection for open phase convention, the sequence -- current sequence will reaches. Been around in other industries for a long time.

MR. HEACOCK: You could say that there -- yes some theories --

MEMBER BLEY: I mean, the theory's been around for over a hundred years.

MR. HEACOCK: But actually, protection for single phase, negative-sequence type occurrence and voltages has been out there for a while. It has not been a item that has been -- it's not like it's a large concern because it doesn't occur very often.

It also depends on your distribution system of what you're trying to protect. Now if you have, as we've seen with the Byron event, if you have a lot of motors you may want to put in protection for that sort of a scheme. And if you don't have a lot of motors then you don't need to detect because it's not as severe on systems that don't have a motor, besides the standpoint that you may lose those particular loads.

But, yes, it's been out there. And

that's, when you start looking in for the protection relays, it was obvious though. That's been out there and there's been a number of papers out there.

MEMBER BLEY: For a long time, yeah. I knew about the papers. I didn't know how wide spread it was. And in your first bullet, were things really rendered inoperable?

MR. HEACOCK: I think it was --

MEMBER BLEY: That's part of the problem. They were rendered inoperable.

MR. HEACOCK: Well, actually, if you look at it from the standpoint -- and this is going like you're going based on what I understand of the Byron event and the paper is that you ended up, started -- the plant started tripping motors, safety-related motors due to over current, due to the lost phase.

So, in that respect, yes, things were rendered inoperable because they were not able to start or have motors be able to continue to run on the distribution system.

MEMBER BLEY: Okay.

MR. HEACOCK: And also --

MEMBER BLEY: By the way, we're having a meeting on this in two weeks, so then the more general topic of --

CHAIR CORRADINI: And the offsite could be considered inoperable.

MR. HEACOCK: Yes, that's true too.

CHAIR CORRADINI: The offsite circuit would be considered inoperable if --

MEMBER BLEY: By definition, but --

CHAIR CORRADINI: Yes, I knew there was something inoperable, but go ahead.

MR. HEACOCK: Okay. Should we go to the next slide?

MEMBER BROWN: Can I ask a question relative to that? The Byron event, if my memory serves me correctly. I did look at the bulletin. Now I've forgotten what I read. It was literally one of the transmission lines that went --

MR. HEACOCK: Yes.

MEMBER BROWN: -- into the plant that --

MR. HEACOCK: Yes.

MEMBER BROWN: -- came apart and, therefore, you didn't have one of the phase voltages --

MR. HEACOCK: Yes, I dropped a --

MEMBER BROWN: -- in Plants 1.

MR. HEACOCK: -- an insulator broke on the feed to transformer and dropped C Phase which open circuited the feed. But when that phase dropped it did not actually hit the ground and trip out the feed to it, so it stayed in there.

MEMBER BROWN: Okay, I got that part. Now my question is, that's a fairly clear indication. I mean, you lose AC, Phase 8 -- you know, VA/CD, AB --

MR. HEACOCK: Right.

MEMBER BROWN: -- whatever the combinations are. But I didn't see in any of these analyses or the other ones where if you had an open circuit, an open -- let me backtrack.

Your main power transformer is three individual transformers.

MR. HEACOCK: Yes, sir.

MEMBER BROWN: Not a multi-legged transformer.

MR. HEACOCK: Right.

MEMBER BROWN: So if you had an open phase in the transformer that transmission will, in Phase AB, BC, CA -- it's still there.

MR. HEACOCK: Yes.

MEMBER BROWN: And your, excuse me, part of your reference in your protection scheme was you had these voltage relays that are detecting --

MR. HEACOCK: Negative sequence.

MEMBER BROWN: -- the -- well, you --

MR. HEACOCK: Negative sequence.

MEMBER BROWN: That's all the way down the stream, but you have, at least the way I've got it, you had a voltage relay -- excuse me, voltage detection on the input to the main power transformers.

MR. HEACOCK: You don't necessarily have -- now most plants do not necessarily have --

MEMBER BROWN: You talked about it, and you already had five.

MEMBER STETKAR: You've committed to monitoring that voltage on the --

MEMBER BROWN: That's right.

MR. HEACOCK: It is -- it is --

MEMBER STETKAR: -- 45 side of those transformers, so you certainly --

MEMBER BROWN: And --

MR. HEACOCK: Yeah.

MEMBER BROWN: And it was used in some of your discussions relative to how you protected stuff.

MEMBER STETKAR: Alerting the operators.

MR. HEACOCK: Well, looking from a standpoint of what's going on from the three phases, yes, you can actually look at -- I don't think that's what you're referring to because --

MEMBER STETKAR: So, Charlie, follow up on how you now get balanced three-phase voltages that will never alert you to that condition.

MEMBER BROWN: Well, that's my point.

MEMBER STETKAR: Right.

MEMBER BROWN: I mean, if you have -- and I have anything in the other papers either where we address, literally, a transformer's primary opening up as a line separating the it with that environment.

MR. HEACOCK: It would be, and I guess I'll say if from a high level. There would be no difference from a standpoint of an opening up in the transformer or dropping a line into the transformer.

MEMBER BROWN: And also it depends somewhat on whether your Y Delta Y, whatever it is --

MR. HEACOCK: Right.

MEMBER BROWN: You all happen to have a Y input, so.

MR. HEACOCK: But Y Delta for the main power transformers, yes, sir.

MEMBER BROWN: Right. Now the other question, are these ground neutrals or are they ungrounded neutrals?

MR. HEACOCK: On the high Side, they're typically grounded.

MEMBER BROWN: Okay.

MR. HEACOCK: Second, since they're Delta, they do not ground.

MEMBER BROWN: I got that.

MR. HEACOCK: Yeah. On the reserve auxiliaries the primary and secondaries are grounded. The secondary has a ---

MEMBER BROWN: Well those are --

MR. HEACOCK: High resistance.

MEMBER BROWN: Well, the UATs are Delta on the inputs.

MR. HEACOCK: Correct, the Delta on that, and then are grounded on the secondaries too.

MEMBER BROWN: Yes, on the -- okay, so it is a grounded neutral arrangement?

MR. HEACOCK: Yes.

MEMBER BROWN: Okay. I'm just asking because there's a different response based on what you see --

MR. HEACOCK: Yes.

MEMBER BROWN: -- with or without a grounded neutral.

MR. HEACOCK: Right, right.

MEMBER BROWN: And I didn't see a specific discussion and your diagram didn't indicate whether those were or not.

MR. HEACOCK: Yeah, I couldn't remember if I put those in there but, yes, those are grounded, all secondaries.

MEMBER BROWN: Okay, high resistance grounded?

MR. HEACOCK: No, not high resistance, a little more of a low resistance.

MEMBER BROWN: Low resistance grounding? Okay. What's the voltage of your main generator?

MR. HEACOCK: It's 27 --

MEMBER BROWN: 27? And your input to the -- the output of back of the main transformer?

MR. HEACOCK: What's that?

MEMBER BROWN: The main transformer, secondary is?

MR. HEACOCK: The main transformer?

MEMBER BROWN: Yeah.

MR. HEACOCK: The main transformer's going to be 27.

MEMBER BROWN: That's input.

MR. HEACOCK: Now the high side is 345.

MEMBER BROWN: The high side's 345? What's the -- oh, I'm sorry. Yeah, right. I got the 26. What's the output of the UATs?

MR. HEACOCK: The UAT is --

MEMBER BROWN: One of them's 13.8?

MR. HEACOCK: 13.8 -- two of them are dual lining 13.8 4160 and then the last one's 4160.

MEMBER BROWN: Yeah, and the other one's 4160. Okay. All right. I couldn't read the diagram. It was all blurred.

MR. HEACOCK: Sorry about that.

MR. THOMAS: The one today or the one we sent earlier?

MEMBER BROWN: No, well, it was the one that was in the package.

MR. THOMAS: No, no. That was a copy of -- if you look at the RAI it's clearer. There's one ----

MEMBER BROWN: I did look at the RAI, but I couldn't read it.

MR. THOMAS: Okay.

MEMBER BROWN: So --

MR. HEACOCK: Okay.

MEMBER BROWN: -- I blew it up. I transferred it and blew it up and it got --

MR. HEACOCK: Still got --

MEMBER BROWN: -- got blurry.

MR. HEACOCK: Still got worse.

MR. THOMAS: All right.

MR. HEACOCK: Okay. Let me --

MEMBER BROWN: Thanks. I was just trying to calibrate myself.

MR. HEACOCK: Sure. I'd like to go over the rest of this distribution system. We kind of explain, for those of you all that are not familiar with the STP 3 and 4 electrical distribution.

And what we have is, of course, we have 345 kV switchyard. The 345 kV switchyard then has three separate feeds into the plant -- back feed through the main transformers that you see over on the left side. You see those three transformer sets set up that way mainly because --

MR. THOMAS: Doesn't want to.

MR. HEACOCK: Okay. I need to --

MR. THOMAS: All the way over there.

MR. HEACOCK: Here we go. Over here. Three separate transformers that make up a bank. And it's a Y Delta transformation. The other two feeds, which are going to be through RAT A and also RAT B, RAT B being the normal feed back into the Class 1-E, Division 3 Bus.

And the main transformer is just back feed through in the UATs, the main feed for Division 1 and

2. This is the normal lineup for STP 3 and 4.

I'd also like to pretty much state that we -- the reason why we had that, that's over here, off the generator, we have a generator circuit breaker. And so that whenever we have a fault on the generator, if we have a reactor trip, the generator circuit breaker is what opens and not the feeds, the transformer -- the breaker's out in the switchyard. So we have immediate -- basically immediate power of those buses.

And as Charlie has -- we talked about RAT, that we do have a Y Delta for the main transformers and a YYY shell form type transformers for reserve auxiliary transformers, both RAT A and RAT B.

And this is the normal feed for the stations down there. And, of course, each division has its own diesel generator. One of the other things you'll see on here is that Units 3 and 4 have a combustion turbine generator that basically we do lose offsite source and it also can be as an offset source for 30 days in accordance with Tech spec, should we lose an offsite source.

And we also have a cross-tie between the units so that we can actually bring power in and distribute power in negative directions within STP 3 and 4.

And one of the main things that we always have to do is STP always has to have a feed through the main transformers and a feed through either RAT A or RAT B. If we do not have the main transformers available to us then that actually will -- the we'll have to enter an LCO condition for that loss of that source.

RAT A and RAT B cannot be used as separate independent powers for offsite source from EGD-17.

CHAIR CORRADINI: Say that slower.

MR. HEACOCK: Okay.

MEMBER BLEY: Say it differently.

CHAIR CORRADINI: And differently. They can be used, but in Tech specs they'll -- they won't -- you can't take credit for it.

MR. HEACOCK: You cannot take credit for it.

MEMBER BROWN: You don't have independent sources. Is that --

MR. HEACOCK: They're not considered independent sources. RAT A and RAT B are not considered independent sources for an offsite system. You can use them both, yes. But based on the space requirements we could not use them as separate sources to meet Tech specs.

Any general questions on the distribution?

MEMBER BROWN: I had one little nip. What's all the other breakers are shown in one form and then there's that one with the bright red in it. Is that supposed to send a signal of some kind?

MR. HEACOCK: This one right here?

MEMBER BROWN: Yeah.

MR. HEACOCK: Well, where we had, when we originally drew this we actually showed the 13.8 and non-safety's and the 4160s. The 13.8 was all the bright reds, so you would have seen more. We condensed it to fill the, switch our configuration ties.

So really that bright red one's just showing that that's the, a tie, a breaker that's normally closed for power from the CTG if it's ever called upon to power the 13.8, the 4160 bus, that CTG-3 through that transformer.

MEMBER BROWN: Okay. But the whole figure would have had red circuit breakers as part 13.8?

MR. HEACOCK: Late -- 13.8, right.

MEMBER BLEY: Right, red is associated with 13.8.

MR. HEACOCK: 13.8, right.

MEMBER BROWN: And green is associated with 4160.

MR. HEAD: 4160.

MEMBER BROWN: Okay.

MR. HEAD: In this particular drawing what we tried to -- we took that section out and put the switch yard in. So that's why we didn't have room for the whole --

MR. HEACOCK: Yeah, and you'll just see a little note there, says 13.8 kV loads.

MEMBER BROWN: And red.

MR. HEACOCK: And, yes. Okay? That's all.

CHAIR CORRADINI: Excellent.

MR. HEACOCK: Okay, for -- can we just --

MR. HEAD: That or you drive.

MR. HEACOCK: All right. I wondered what you were asking for. Okay, a couple of important aspects of the STP 3 and 4 design relative to an open phase condition is again, like this slide basically repeats what we just described.

We held it up there just so that we wouldn't -- but this is here for your reference later on. So I'm not going to go back into detail on this particular slide.

The STP 3 and 4 licensing approach for this is that we have defense and death type set up on this.

We have the detection. We're doing to set up a detection of an open phase, an alarm in the control room, on all transformers on the main power transformers, reserve auxiliary A and reserve auxiliary B.

As part of that we'll end up, we have added Inspection, Tests, Analysis and Acceptance Criteria, ATAAC, of course, for the open phase detection alarm within our submittal. And then also, as a big part of our defense in depth on this we've added protection for the Class 1-E 4160 buses with negative sequence voltage relays.

These relays, upon sensing a high enough negative sequence voltage will open up the supply breakers. It'll trip each one of those supply breakers on the 4160 bus which then will cause -- the loss of voltage going into that bus will cause another relay to drop out and start the diesel generators. And the diesel generators, of course, will then pick up a load.

MEMBER STETKAR: When during this discussion do you want to get into technical issues of whether this will actually work?

MR. HEACOCK: We'll go into it --

MEMBER STETKAR: Well you want to finish the whole discussion and then enter into that or --

MR. HEACOCK: We can do it that way if you'd like. We have a couple more.

MEMBER STETKAR: Why don't we do that then?

MR. HEACOCK: We have a couple more that gives a little bit more technical information --

MEMBER STETKAR: Okay.

-- on the relays and such.

MEMBER STETKAR: Yeah, a little bit more technical --

MR. HEACOCK: Okay.

MR. HEAD: That was a preview, by the way.

MEMBER STETKAR: Yes, I understood that.

MEMBER STETKAR: This is here. We want to talk about whether or not the system will actually work. So I hope you're prepared to discuss that.

MR. HEACOCK: Yes.

MR. HEAD: Absolutely.

MR. HEACOCK: Yes. Okay, so we're open phased deficient. An alarm, like we said, we're going to put the system on the high side of the main transformers and the reserve auxiliary transformers.

Should a condition occur the condition will be alarmed in the control room which then the procedurals will direct the operators to the proper response.

MEMBER BROWN: Have you worked those out yet?

MR. HEAD: No.

MR. HEACOCK: No.

MEMBER STETKAR: Do you have any idea how much time is available for that operator response?

MR. HEACOCK: I will probably defer that to our talk on our technical because --

CHAIR CORRADINI: Say that again? That's a first.

MEMBER STETKAR: No, that's fine. That's fine.

MR. HEAD: Well, it's sort of depends, you know, if --

MEMBER STETKAR: It sort of depends. I was just --

MR. HEAD: If all this happens and Diesel has started --

MEMBER STETKAR: We'll --

MR. HEACOCK: Yeah, I think it's all related. So when you talk about time to respond part of that protection will show.

MEMBER STETKAR: We'll get to it in the detail stuff.

MR. HEACOCK: Yeah.

MEMBER BROWN: Why don't we -- let's just stay here for a minute. Relative to my earlier question, if you had an open phase on the primary site of the main transformer, this particular circuit becomes inoperable. Does that -- this would not detect anything. If it was an internal open phase --

MR. HEACOCK: Now, wait, it still will.

MEMBER BROWN: On the high voltage side?

MR. HEACOCK: Yes, sir.

MEMBER BROWN: No just a minute. If I've still got, coming in -- where -- I don't where you're -- are you detecting inside the transformer?

MR. HEACOCK: What you're detecting for these open phase detections -- there's a couple different schemes out there. There's one developed by EPRI and there's one developed by a company called PCS 2000.

What they're premise are looking at is the loss of phase and what it causes from a standpoint of imbalances within the circuitry that's being sensed from a current standpoint or a --

MEMBER STETKAR: Okay, wait a minute. Let me -- hold on. You said Current.

MEMBER BROWN: Now that's why I, yeah.

MEMBER STETKAR: He said Current.

MEMBER BROWN: I understand that. I understand that. And that's one of questions I've had, is why did you get -- because if you lose an internal transformer then obviously you're going to have a change in the current levels in the various phases.

MR. HEACOCK: Correct.

MEMBER BROWN: And so that it's really not just a high voltage, it's not just a loss of voltage. It's a combination voltage/current.

MR. HEACOCK: Current.

MEMBER BROWN: And their relationships and that's calculated within the --

MR. HEACOCK: Right, within an -- right.

MEMBER BROWN: Okay.

MR. HEACOCK: Within either one of the relays. So you're looking at --

MEMBER BROWN: You didn't talk about current in your RAI, at least I don't remember that, so --

MEMBER STETKAR: Yeah, you characterize these things as voltage relays.

MEMBER BROWN: That's right.

MEMBER STETKAR: Looking at phase differentials --

MR. HEACOCK: Now I think -- not these. These are not -- this would be with the ITAAC. When we look at the ITAAC. When we look at the ITACC that's a little different for the open phase detection alarm is a little different that the protection scheme. The protection scheme is voltage.

MEMBER BROWN: Well then you're talking about the negative sequences?

MR. HEACOCK: Right.

MR. HEAD: That's right.

MEMBER BROWN: And that's a downstream on the 4160?

MR. HEACOCK: Correct.

MEMBER BROWN: Yeah, I got that. I'm just trying to get back -- I'm trying, along with John and Dennis, trying to walk through this thing piecemeal, at the lead-in. And, you're right. The RAI talks about nothing except voltage relays and had, didn't say anything. And I'm sitting here thinking, hold it --

MR. HEACOCK: Well, let's --

MEMBER BROWN: This whole circuit becomes inoperative if it's an internal open circuit within the main transformer, which does not have any couplings since it's three individual transformers.

MR. HEACOCK: Okay, what we did not -- we did not want to get into too much detail on what scheme we would use for the open phase detection.

MR. HEAD: That's what the ITAAC is for. That was --

MR. HEACOCK: Yeah.

MEMBER STETKAR: Well, but see in terms of understanding whether or not this provides adequate protection, it's important to understand how that relaying actually works.

MR. HEACOCK: Okay

MEMBER STETKAR: Because if it's simply measuring phase-to-phase voltages it's not going to work for all fault phases.

MR. HEACOCK: That's correct. It would not.

MEMBER STETKAR: If it's measuring voltage and current then it may very well. So getting into that level of detail without designing the actual relay itself is quite important, at least, I think, from what you're hearing, for us to understand whether it's doing to work.

MR. HEAD: So, John, can I ask you just, are we -- is the question we're focusing on right now the detection?

MR. HEACOCK: Yes.

MEMBER STETKAR: Yes.

MR. HEAD: Okay, so the detection is -- we have not selected the detection system we're going to use.

MEMBER STETKAR: You're waiting for the industry solution to be defined.

MEMBER BROWN: But, Scott, it's in your RAI. You talked of voltage relay.

MEMBER STETKAR: That's right.

MR. HEACOCK: It's only characterized as voltage.

MEMBER BROWN: Okay, you need to say detection, and how you did it. You talked about voltage relays. No, that -- I'm just not --

MEMBER STETKAR: They're not called power relays or they don't mention it?

(Simultaneous speaking)

MR. HEACOCK: And I still think we have to go back and not brush up, but we will. We were talking about the voltage relays that were primary for protection. That should have been --

MEMBER STETKAR: Voltage relays are mentioned in both places.

CHAIR CORRADINI: So before you guys start arguing about what you said or didn't say let's just

--

MEMBER STETKAR: Let's just end it.

CHAIR CORRADINI: -- let's just get back to what the ITAAC says. And then if you were to, at least in my mind, I think what the members are asking is if you were to try to satisfy ITAAC the principle in which you would go about it, so that they feel comfortable that it actually would succeed.

MEMBER STETKAR: Right.

CHAIR CORRADINI: So can you go back to describing what are possible ways to detect, so that we're clear about it?

And then also, the second part of that, for me, would be is it specified in the ITAAC enough that there's confidence that what you think, when you think you have the way to solve it, it's specified so that staff understands it and feels comfortable about it because I guess these guys didn't catch it.

MR. HEACOCK: Okay.

MEMBER BROWN: Maybe we'll feel better too ----

(Simultaneously speaking)

MR. HEAD: Yes, the answer to your question is yes, the staff work -- sorry, go ahead.

CHAIR CORRADINI: No, go ahead, Steve.

MEMBER STETKAR: My comment was maybe we'll feel better about it in two weeks when we have a meeting on this in more detail.

CHAIR CORRADINI: Otherwise you guys are doing this and the preview but --

MEMBER STETKAR: But today is today.

CHAIR CORRADINI: -- we won't feel better then either.

MEMBER STETKAR: So we were hoping to get a preview of what you're doing and planning to address with us.

CHAIR CORRADINI: Well, look at it this way. You guys are the pioneers on a number of things that I could identify about it.

MR. HEAD: Absolutely. And we've enjoyed all of it.

CHAIR CORRADINI: That is a positive answer.

(Simultaneously speaking)

MR. HEAD: But the strategy that I talked about at the very start was, in essence, don't select this detection system right now. Build an ITAAC so that when the industry solution is developed and defined and approved by the NRC, by the operating fleet, that will be there for us to use.

And that' really -- remember, we said voltage or current or whatever. The ultimate issue here is that by the time we design and install this system it will have been defined and used. And the ITAAC covers that. It stipulates that it has to meet the expectations that the staff has for it.

So we've postponed this decision to non-safety related component, it's detection only. And I say the operating fleet has to go through their process. And that'll be there for us when we close the ITAAC.

So that's the theory behind why we're here right now. And that's why the protection side and the Tech spec side is so important, is that that had to be defined a little more, obviously, clearer with the actual relays, with the actual set points and the appropriate tech specs.

So it's a two-phase approach but one of them actually does come later. And that was per discussions, NRC, is, no, don't define that right now because that's still working through the operating fleet right now.

MEMBER BROWN: Well, that's all find good. I don't have a problem with that.

MR. HEAD: Okay.

MEMBER BROWN: It's, when I look at it, if I look at it and try to say, okay, I'm going to have a Tech Spec, I've got an ITAAC. Well, that I would have expected to see -- some type of point about oh, okay, what are the modes under which I can lose that phase.

Okay, is it just the loss of the line coming in? Is it the -- you know, how many modes do I have to go through to show that I -- to result in the losses of the phase on the input side of the main power transformer.

MR. HEACOCK: Yeah.

MEMBER BROWN: Didn't stop. So I had no problem with going that way, I don't think. But until you started talking about hey, yeah, we're going to have -- it's not going to be just a voltage relay across the two phases.

You obviously have to have some other methodology to know if there's some other mode. But that mode, I guess, wasn't clear to me. I don't know if anybody else saw it but I certainly didn't, relative to the approach you're taking.

I don't have any problem with not defining the actual details. It's just you've got to define the modes under which you can get to the open phase to ensure you're Tech specs or your ITAAC covers all of those in terms of their possibilities, that's all. Didn't see it.

The negative sequence detection, that one was much more clear in my own mind.

MR. HEACOCK: Right, right.

(Simultaneously speaking)

MEMBER BROWN: And I got that.

MR. HEAD: That's another one that -- right, but that's only one that Tech spec applies to.

MEMBER BROWN: I got that. But you also don't want to lose -- I've got the idea that I've lost part of my input. I mean, there's a lot of ramifications.

MEMBER STETKAR: That's why I asked the earlier question about how much time is available because it did load flow studies with simulated faults, open phases out of --

MEMBER BROWN: We, they had light and heavy load.

MEMBER STETKAR: Well, and whether or not the generator was running.

MEMBER BROWN: Yeah.

MEMBER STETKAR: Or the back, just back-feeding it through the transformers. And in the case where you're just backfeeding it through the transformer, you never triggered the negative sequence voltage relays on the 4 kV busses. You're relying on the operator alarm to actually separate those busses manually.

MR. HEAD: I got you.

MEMBER STETKAR: And the question I had when I asked about what's a time window is, well, when are you backfeeding those busses? You're backfeeding those busses when you're in an outage.

MR. HEAD: Right.

MEMBER STETKAR: You're running RHR pumps, you have some amount of load on those busses. So then a question is, well how long can those loads operate under this condition before the motors start to get into trouble.

And that defines the time window for the operator need to separate to actually separate those things when they get this alarm.

MR. HEACOCK: Right.

MEMBER STETKAR: So have you thought about that?

MR. HEACOCK: Yes.

MEMBER STETKAR: I mean, is that time window minutes?

MR. HEAD: No, it's --

MEMBER STETKAR: Is I hours? Is it days? What is it?

MR. HEAD: It's indefinite.

MR. HEACOCK: It's indefinite.

MEMBER STETKAR: Hmm?

MR. HEACOCK: It's indefinite.

MEMBER STETKAR: Indefinite? But it's a variable, I think.

MR. HEACOCK: Well, mainly, yes, and you're right, it's somewhat variable. We'll probably get into this, more of your discussion if we want to go the next one real quick.

MEMBER STETKAR: Okay.

MR. HEACOCK: If we go there. Go one more. Go one more.

CHAIR CORRADINI: So just to summarize, so at this point everybody's on the same page, that from an ITAAC standpoint, this has yet to be determined. And your approach is to essentially base it on what the entry has to do for the current operating plants, and adopt that under the assumption that you can detect it from all various modes?

MR. HEACOCK: Yes.

MEMBER STETKAR: Detection.

MR. HEACOCK: Detection, correct.

MR. HEAD: And that that process could still evolve. That was the other reason for not, you know, defining that in much detail. It could evolve, which we, maybe even hearing the, you know the evolution today there's evolution possible.

But by the time we close the ITAAC the industry will have had an acceptable solution for the detection portion.

MR. HEACOCK: Several sections.

MR. HEAD: sitting there all along will be out safety relate, you know, detection -- I mean, not detection but actuation and the Tech specs associated with the relays that we're going to talk about.

MR. HEACOCK: Well, to answer your question, I meant, again, Charlie, about --

MR. HEAD: Go ahead.

MR. HEACOCK: Because there's different schemes that will detect different types of modes. Not all of them are equal.

MEMBER BROWN: Okay, I just didn't see them explicitly.

MR. HEACOCK: No, we did not -- you're correct. We did not put those in explicitly.

MEMBER BROWN: Well, if they're not in there explicitly how do you expect them to be covered

-- if they're not explicitly covered in the ITAAC?

MR. HEACOCK: Well, in the ITAAC, from a standpoint of what we're trying to detect in the end is, I think we were fairly explicit. I think that detection scheme that will be ferreted out by the industry in the end will be adequate to detect what it is to detect on the various modes.

MEMBER BROWN: Okay. Tight-lipped, okay.

CHAIR CORRADINI: Noted.

MR. HEACOCK: Okay, for the open phase protection which we'll get into a little bit more in the conversation for Mr. Stetkar's questions is that we are adding Class 1E negative sequence voltage relays to protect the three Class 1E busses that is designed to protect the motors from overheating due to unbalanced voltage currents.

The relays will monitor the negative sequence voltage for each phase. And there's three relays per bus with a two out of three trip logic. And the reason for that is to help reduce various actuations.

MEMBER BROWN: When you say bus, let me make sure I understand. If I look at the 4160 switchboard, there's obviously a Phase A, Phase B, Phase C. I presume that means 1 Phase relay on each phase?

MR. HEACOCK: These relays are 3-phase relays. So it's actually measuring between A, B and C as all of us.

MEMBER BROWN: Oh, so all three of them do that?

MR. HEACOCK: Mm-hmm.

MEMBER BROWN: Oh, okay. All right.

MR. HEACOCK: Yes, instead of an undervoltage scheme which it could be an A and a B and C.

MEMBER BROWN: Oh, I understand why you have to measure all of them. Otherwise you're not going to get your --

MR. HEACOCK: Right.

MEMBER BROWN: -- negative sequence calculation which is just, what, the summation of the vectors, vector sum of the voltages.

MR. HEACOCK: Voltages, right. Great. like it. Okay. Actually, one of the things -- this is just one of the ones where we started looking for what kind of relay we could use and it had several criteria that I wanted to look at.

One of them was will they exist in the

industry due day, which we found one produced by AVD. It's a safety-related -- they actually produce these still, safety-related.

And these have been around since the 70s, this particular undervoltage -- excuse me, negative sequence voltage relay has been out since the 70s so, it can be produced as safety related. It can be bought safety related today.

And this is very similar too. You know the same company that makes all of the undervoltage relays for the safety related degraded under-voltage detection.

So when we started looking at this, some of the questions, what we needed to look at was where was an appropriate value to set the relay at. And we came up with looking at industry papers and a design of what STP 3 and 4 would be from the motor standpoint, loading wise is that we could tolerate a 5 percent balance continuously and without any kind of adverse consequence.

And then we had the design time of three seconds. And that was there to allow motors from tripping on over-current. We tried to, we're really trying to be the motor's tripping out over current, look for, you know, with this, some voltage balance so that operators don't have to go out and do anything manually for those motors that had tripped on over current.

MEMBER BLEY: And what convinces you that that's a short enough time for more severe cases?

MR. HEACOCK: When I look at, there's a comparison of motors and the thermal protection typically on motors today and what I, well, I went ahead and looked at since STP 3 an 4 is not procured,

I looked at 1 and 2 and I look at the motor, thermal damage occurs for that and looked at protection schemes. And most all those motors were 3 seconds of above.

MEMBER BLEY: Is that right? Okay. So you're talking about a normal overload applied to the motor based on its load. And it draws additional normal -- assuming you're in balanced operation, you're drawing more current in all three phases.

And I guess the three to five percent is a number I'm familiar with. See, I'm not uncomfortable with that myself. That's fairly common, I guess my understanding is but --

MR. HEACOCK: Yes. It's fairly common. And I would go into what we looked at from a standpoint of three to five. That's what we're suggesting, is NIMA MG1 has specifications about how much negative sequence current/voltage a motor can withstand. Part of that's based on loading, motor loading.

MEMBER BLEY: Oh, but that -- okay, I've got a phase unbalance now coming in, okay, and because of that, the negative sequence tends to try to slow everything done. The motor, it's a reverse direction. It's not going the same direction as a positive sequence ----

MR. HEACOCK: Correct.

MEMBER BLEY: -- or a current.

MR. HEACOCK: To some degree.

MEMBER BLEY: So when you try to slow it down, you've got your load. It's going to try to draw more current, but it's going to be an unbalanced current, also.

MR. HEACOCK: Yes, it's something else but the bigger, the bigger part --

MEMBER STETKAR: It's a lot heating.

MR. HEACOCK: It's a bigger part.

MEMBER STETKAR: No, I understand that, but it's unbalanced --

MR. HEACOCK: Right, there is some slowing. You end with an increased slip because the motor is not able to produce the same thing that it feels to keep the motor up to speed.

MEMBER STETKAR: Right but it's also imbalanced which --

MR. HEACOCK: It's unbalanced.

MEMBER STETKAR: -- which makes some difference.

MR. HEACOCK: But, like he was saying, really, the biggest part is heating on a motor.

MEMBER STETKAR: Heating is a big deal.

MEMBER BROWN: I'm well aware of that.

MR. HEACOCK: Yeah, but you're right. It does have some effect on the ability of the motor to maintain speed. It will slow it some.

And what we'll end up doing is after we've looked at, and we did a number of cases, as I stated earlier. We did a number of ETAP (Electrical Transient Analyzer Program) analyses to see what the different values a negative sequence voltage would be on the bus with varying conditions.

From a standpoint of the reserve auxiliary transformers, every time we opened a phase on the high side based on the transformers we planned to procure we ended up with a very, very high negative sequence and voltages on that -- 5, 20 percent typically.

And then we also did some various studies too to look at what happens if we have a diesel generator while online testing it to see what the effects were.

Actually, sometimes the diesel generator, depending on what the load was and what the output of the diesel was you may or not pick up, if once you start coming close to the load on your bus with your diesel it'll actually mask the open phase because it sees a lower impedance and it's not drawing from the system.

But once you bet high enough above 20 percent or so, you'll see that negative sequence come back in. So we looked at a number of different conditions.

The other one is the backfeed. One of the ones we looked at was the backfeed from the mains. If we were shut down and we had an open phase the negative sequence voltages were in around the 2 percent range which is way below. And we can run, definitely, in accordance with --

MEMBER STETKAR: That's just because of the Y Delta, right?

MR. HEAD: Yes.

MR. HEACOCK: Correct. Because that Delta recreates. Right.

MEMBER STETKAR: That's right.

MR. HEACOCK: All right, and of course all this will be looked at in the end when we look at, do our final set point. And, of course, with the set point control program. We'll go back and reevaluate these with the actual distribution system.

And our nominal set points will be set so that we don't exceed the 5 percent, 4-1/2 percent in 2.5 seconds, 2-1/2 seconds. So, John, have we answered your --

MEMBER STETKAR: That's the -- yeah, the discussion about the fact that, again, you haven't bought your motors yet, but the survey that you did, at least, gives my confidence that at least the way they're characterized now those relay -- if you don't get to the relay center you're basically saved. The mores will allow you --

MR. HEACOCK: Correct, right.

MR. HEAD: We'll be happy, but we'll also have detected it.

(Crosstalk)

MEMBER STETKAR: What I'm saying is, yes, you've detected the condition out here. But I was concerned about getting into a situation where you had a severe -- and severe is not well-defined term.

You had a severe open phase condition out there on the high side of the transformer and got into a fairly large imbalance that's still not detected by the undervoltage relays that could hurt the motors and now had a time window for the operators. They needed to know that within -- pick a number. Is it seconds or minutes or whatever --

MR. HEACOCK: Yeah.

MEMBER STETKAR: -- that they actually needed to manually trip those feeds. And your discussion about at least your survey, the motors, gives me some confidence that that time window, if it exists at all, is very long.

MR. HEACOCK: Yes.

MR. HEAD: So to circle back and answer Dennis' question, we haven't written the procedures but we have walked through the different scenarios that we think would exist and the operators in the control room would face along the lines of I've got an alarm but a diesel hasn't started.

I'm shutdown. Okay, I need to go find out what's going on. I need to address the symptoms. I need to dispatch operators to find why am I in this situation. I need to go back to computer readouts and find out -- you know, something's going to be unveiled.

But because we're protecting the operators, the time requirements are not -- it's an instance.

MEMBER STETKAR: It's still, though, the detection of the condition, I still think is important because --

MR. HEACOCK: Absolutely.

MEMBER STETKAR: -- electrical systems tend to be a lot smarter than the people who analyze them and faults tend to be even smarter than electrical systems themselves so that, carefully thinking about that detection relaying scheme out there is really important, I think.

MR. HEACOCK: Yes.

MEMBER STETKAR: That's why I think Charlie and Dennis and I were kind of honing in on exactly what sort of notion do you have out there.

MR. HEACOCK: Well --

MEMBER STETKAR: Because it can't be a simple voltage monitor.

MR. HEACOCK: No, it's not. It's not a simple -- it's got to be a combination or --

MEMBER STETKAR: Yeah.

MR. HEACOCK: -- or a current by themselves. And EPRI has come up with something totally different than PCS-2000.

MEMBER BLEY: Yes, and I guess we'll probably hear more about that in two weeks. But --

MR. HEAD: Yeah, well somebody's over here so I'm going to say something. No, I'm saying I want to introduce Bill Mookhoek. He wanted to, I think, expand on something I said or correct it. One or the other.

MR. MOOKHOEK: Again, my name's Bill Mookhoek. I'm the Licensing Supervisor and kind of the Operations input right now for STP 3 and 4. One of the things we looked at, and it concerned me, is when we looked at the bulletin and the way it was written, it was focused at the high side of the transformers.

And when we looked at protection, I mean, you get a problem on the low side of UAT, your detection system may not pick it up. That's why we put protection down where it needed to be to protect the equipment.

Now one of the things we looked at is what happens if those relays on the E-bus actuate, strip off the load, start the diesel, but I haven't had an alarm? Again, that's indication for an operator that he's got an abnormal condition and he needs to go look.

So detection on the high side is not complete and, you know, the final word on anything because we'll have the relays on the E-busses which will also generate alarms if they actuate as well as the detection on the main power transformers and the reserved auxiliary transformers.

MEMBER STETKAR: Well, the only problem is, from an operational perspective, you've got those relays picked up, you aren't -- you have no idea.

MR. MOOKHOEK: You don't know why.

MR. HEAD: You don't know why. All you know is you have it. But at least I have a diesel supply in the bus and loads.

MR. MOOKHOEK: Yeah.

MR. HEAD: And now I've got time to react to what was the condition because the plant, at that point, is protected.

MR. MOOKHOEK: The plant is protected from licensing safety related basis. It's not all clear what's going on on the 13.8 kV supply to your reactor cooling pumps and your, whatever else is fed from that, those buses, right.

MEMBER STETKAR: Right.

MR. MOOKHOEK: You think the water pumps picked up? I don't remember. 13.8?

MR. HEAD: Those are 13.8, three water pumps, 13.8, plus they have --

MR. MOOKHOEK: First water pumps, feed water pumps --

MR. HEAD: Yes, sir.

MR. MOOKHOEK: Reactor -- reactor internal pumps.

MR HEAD: Internal pumps, yeah.

MEMBER STETKAR: Reactor internal pumps, those things, smaller motors.

(Cross talk)

MR. MOOKHOEK: But that was one of the reasons we looked at putting stuff down on the E-busses because it protected all the way from E-Bus out to the grid.

MR. HEAD: Just also remember some of the buses, like the feed water pumps are going to have a variable speed drive on them. And also with the reactor internal pumps too. So they won't have quite the same effect.

MEMBER STETKAR: Yeah, those will --

MR. HEAD: So they're going to be somewhat isolated from the event. They'll still have this effect on increased currents possibly, but no current shifts kicking in.

MEMBER STETKAR: But thinking about it, from --

(Laughter)

MEMBER STETKAR: -- an operational perspective there still could be some strange things going on out on the 13.8 kV side --

MR. MOOKHOEK: Absolutely.

MEMBER STETKAR: -- that, you know, you get a BUS shed and a diesel start and strange things happening on the 13.8 kV side, it isn't necessarily a good day in the control room, right.

And I think you're right. Monitoring on, whether it's the low side of the UATs or at least somewhere in that circuitry would certainly be beneficial to the operators. But --

MR. MOOKHOEK : Well, when you take a look at what happened on STP Unit 2, I mean, that condition had one of the breakers out in the switch yard, one pole didn't close.

But you had a diesel -- you had the main generator timing out on negative sequence which is a long time delay. But you had that going on. You wound up starting to lose circ water pumps which caused them to manually trip the plant.

But in our case, the way we're designed, we would also be -- may or may not get a trip on the E-bus and shift to the diesel. But we would still expect that those, the generator would still be timing on a negative sequence.

MR. MOOKHOEK: The generator would see the negative sequence.

MR. HEACOCK: Yes. But you can have --

MR. MOOKHOEK: But then the generator breaker's going to open up --

MR. HEACOCK: Yes.

MR. MOOKHOEK: -- and you're still going to have the fault though.

MR. HEACOCK: You may still have a fault but at that point you'll wind up recreating voltages because you don't have loads. The loads are going to break.

(Simultaneously speaking)

MR. MOOKHOEK: All that gets worked out. But I'm not saying it's going to be the panacea but at least there's enough indications there to tell an operator something's wrong. But there is protection there for the equipment you have to have for safe shutdown.

MEMBER BLEY: Right. Well, I take it we're not just talking procedures. We're talking maybe a new training module.

UNISON: Oh, absolutely.

MEMBER BLEY: It's just this tricky stuff.

MR. MOOKHOEK: The training has occurred in the industry do far based on just the Byron event.

I mean, your people --

MEMBER BLEY: Yes, but if you only focus on that it's you guys, say. You're missing a whole variety of other odd conditions that can be, let go.

MR. HEAD: But there are loss of phases that will end up in reactors trips and a lot of stuff going on. I have a diesel running now that's protecting the safety layer loads. And so that's the essence of --

MEMBER STETKAR: Yes, my other point, as far as the operators are concerned, there is a lot of other stuff.

MR. HEACOCK: Yes.

MEMBER STETKAR: There could be a lot of other stuff.

MR. HEAD: From a timing standpoint, I have a diesel running, protecting my motors.

I'll get to that after I've got the plant stable, I've got the turbine building in a condition I want it, and then I'll go investigate why my diesel started. It may give me a hint, early on, why I'm in that condition. But that's stable. That's an expected condition that I can go take care of, you know, in an appropriate time frame.

MR. HEACOCK: This is to kind of, also

give you a little bit of reason why the motor's tripped. The motor on Unit 2, the circ water, did not trip on an over current. It tripped on negative sequence current imbalance.

This actually was a current balance relay that tripped that motor out, those particular motors. When one went, then the other, and that was because of voltage imbalances which starting drawing a current, higher currents on two of the phases compared to the third.

MEMBER STETKAR: But that was a particular motor protection relay for --

MR. HEACOCK: Right.

MEMBER STETKAR: -- because it's a big motor.

MR. HEACOCK: It's a big -- that's right. It's a large investment and you want to protect it. Right.

MEMBER BLEY: Here's a just something to think about --

MR. HEACOCK: Sure.

MEMBER BLEY: -- there's a little point of difference between what you were saying, Scott, and what the gentleman -- I forgot your name. But you were saying --

MR. MOOKHOEK: Bill Mookhoek. It won't be the first time.

MEMBER BLEY: Well, you got your diesel running and everything looks good, but when the loads go away it looks good up above. So you might be ready to, well, hell, let's put it back where we got it.

MR. HEACOCK: No.

MEMBER BLEY: No, no, we'd never do that.

(Crosstalk)

MR. MOOKHOEK: I point you to Brunswick when they had their fire -- or, I'm sorry, Robinson, when they had their fire. When they tried to reconnect stuff.

MEMBER BLEY: People get smart, you know.

MR. HEAD: I expect not only our procedures but our -- I mean, that alarm is in place there will be steps that you have to take.

MEMBER BLEY: Oh, no. Not if you have this alarm --

MR. HEAD: Right.

MEMBER BLEY: -- and you know what was going on. That's different than looking up and saying hey the voltages look okay.

MR. MOOKHOEK: But that's the message about that alarm, had better --

MEMBER BLEY: Be clear.

MR. MOOKHOEK: It had better be clear and perhaps because of your configuration which is different than Byron, just focusing on the particular high side of a particular transformer might not be the appropriate alarm scheme for South Texas. I think that's a bit of the message also.

MR. HEACOCK: Okay.

MR. MOOKHOEK: What the solution for one particular plant, fixing that particular problem might not necessarily be the solution for every one.

MEMBER BLEY: That is correct.

MR. HEACOCK: Correct. That's correct. It varies. STP 3 and 4 design is different than a lot.

MR. MOOKHOEK: Yes.

MEMBER BLEY: Yes.

MR. HEAD: So have we given you at least the perspective that this meeting in two weeks will be successful?

(Laughter)

MEMBER STETKAR: Two weeks is broader. I understand better -- I understand, Charlie, and I think we understand better the fact that the detection relaying out there on the 345 kV side is not simple voltage reading.

And I was reading the same thing. I saw voltage, voltage, voltage. As we were discussing, I'm reading back through the words now and more carefully seeing where I was -- where I see voltage relaying and it -- I can't guarantee it but it seems to be more carefully associated with the 4kV busses.

MEMBER BROWN: The only place I saw that kind of negative sequence approach, not in the input, primary side of the main transformer, it was just strictly a reference to voltage and totally -- I said, I don't know how in the world can you do this. You're losing part of the message.

And, you've answered, the point and said you're going to do it -- you're not going to ignore the other pieces.

MEMBER STETKAR: Right, I was going say, you have to some how figure out current.

MR. HEAD: Yeah, you have to find that. That's a big inventory and that's what PCS is actually, their design is looking at current. They're looking at balance both from a loaded and a transformer that's unloaded eventually can detect based on current, open phase.

MR. MOOKHOEK: Okay.

MR. HEAD: And the same with EPRI, EPRI

design does the same thing but a little differently.

MEMBER BROWN: Does -- this may be a dumb question because I'm just, I don't work these 345 babies, never have. But on the input side of these grids have a lot of -- your shifting reactive current around all the time.

MR. HEAD: Yes.

MEMBER BROWN: And does the -- I mean, when you measure current you're measuring current.

MR. HEAD: Right. It's reactive.

MEMBER BROWN: That's the sum -- it's written but do a vector sum, that's what you get when you read it out. But reactive current can really provide a disturbance if you've got an unbalance in the line layout of what you're getting.

MR. HEAD: Right.

MEMBER BROWN: Is there -- can stuff come from the grid that reflects in, that screws up this from a reactive standpoint? Your real load's going to be your real load, okay. It is what it is.

MR. HEAD: Right. And it's measuring a summation that is there. Most of it's going to be saying it's looking at, are all my phases still loaded, even somewhat --

MEMBER BROWN: But does it look for a

balance in that current?

MR. HEAD: No, it's not looking for a balance. It's looking for all three phases. And also it could be referenced to a neutral, seeing, looking at which one of these current, these phases loaded similarly or, and do I have, and what's my neutral current's looking like too. So they --

MEMBER BROWN: Primary ground -- I asked you if the secondaries ground. You said yes. Does the -- I presume the primary --

MR. HEAD: The primary on the mains --

CHAIR CORRADINI: Primary on the mains.

MEMBER BROWN: The primary grounds also, right?

MR. HEAD: On the mains, no, because it's a Delta.

MEMBER BROWN: Right.

MR. HEAD: But on the reserve auxiliaries

CHAIR CORRADINI: Oh, you're right -- I'm sorry.

MR. HEAD: Yeah, reserve auxiliaries have it. But most of those have reference to the high side. And those are grounded. Those are solidly grounded on the high side.

MEMBER BROWN: Okay.

MR. HEAD: All right?

MEMBER BROWN: Well, I don't whether it's all right or not, I just --

(Laughter)

If it's okay, let's move on, yes.

CHAIR CORRADINI: Okay, let's move on.

MEMBER BLEY: Has this been factored into your PRA?

MR. HEAD: Let's go to COLA changes, okay, and I'll answer that. The open phase detection alarm has been added to our COLA Section 8.2, Offsite Power Systems.

The negative sequence relays have been added to the 8.3 Onsite Power Systems. The relays have been added to the Tech specs and they come with the same surveillances that other relays like that would come with in terms of periodicity and type of test.

There's a site specific ITAAC for the open phase detection and alarms that is in the COLA. And no other changes to the COLA is required at this time.

CHAIR CORRADINI: They're reading their RAI. I'm just trying to catch them up a bit.

MR. HEAD: Okay. All right, so there are no other COLA, no other changes to the COLA are required at this time. So, no, this has not been -- we have done sensitivity studies with respect to these relays, okay.

The do not rise to the level of requiring the PRA to be changed or either from a, you know, 10 percent aspect. If you think about it logically, that's what you would expect. These are sitting there and then what they would cause is a diesel actuation.

So they really don't have an impact. But we did look at that too, for us to be able to submit to COLA we had to assess that.

We also did a sensitivity analysis, PRA analysis. To answer the question that was, is bothering us from the initial event is there were some conditional probabilities with respect to the Byron event.

And we really felt it was important for us to be able either for the public, with NRC, or ACRS to recognize that ABWR, with the design we have described today, is not going to be in the same situation from a conditional core damage probability standpoint. So we did a study to conclude that or to understand that ourselves,

MEMBER BLEY: We've heard some arguments that, gee, the chance that these things go wrong and separate you from power when they shouldn't increases the risk substantially. So we wouldn't really want to do this sort of modification.

MR. HEAD: On the 4160?

MEMBER BLEY: Yeah.

MEMBER STETKAR: But you just switched it to diesel, so.

MEMBER BROWN: Yeah, you just kind of switched to diesel. So there's no adverse consequence per se. So that --

MEMBER STETKAR: Scott --

MEMBER BROWN: I'm sorry.

MEMBER STETKAR: As I read through the RAIs I don't think -- correct me if I'm wrong -- the sense that I got was that there was an initial attempt to try to quantify this in the PRA.

And the staff started asking a lot of questions and you basically negotiated a semi-quantitative, mostly qualitative conclusion -- semi-quantitative being the fact that there, you've identified five events.

And you argue that it's roughly a thousand reactor years' worth of experience. And so, therefore, the frequency is 5 times 10 to the minus 3, that you would get an open phase condition. And the worst impact of that would be shedding of the loads and starting the diesels, which is small compared to the normal loss of offsite power, if you will. Is that a more appropriate characterization of the extent of the risk assessment?

MR. HEAD: That's the way it ended up. Yes, sir.

MEMBER STETKAR: Okay.

MR. HEAD: When we first PRA update -- or not update -- when we provided that insight in one of our RAI responses we felt it was important that this design be reflected and understood from a PRA standpoint.

We really didn't mean for it to go into an in-depth review. I mean, we had the sensitivity information. We needed to make the Rev.11 change. But we did want to make a statement about this design is not the same that -- you know, this is the event to one of our reactors, the design.

And that's what we wanted to -- but we didn't really want to embark upon a detailed review and so we did back off to a quantitative -- or qualitative discussion which we could have made initially, okay.

And it speaks to what Evans has talked about today that between the offsite sources, the backup systems we have -- RCIC, the CTG -- had all that available to us, we ought to recognize that impact.

MEMBER STETKAR: The reason that I started down the path on challenging the time window for operator response was specifically focused on a question about whether or not the vulnerability during plant shutdown, when you are relying only on RHR, whether that had been carefully thought.

Because a lot of the other semi-quantitative, semi-qualitative arguments are all focused on power operations, the redundancy in terms of high pressure cooling mechanisms, independence from AC power, alternating AC power sources for things that do depend on AC power.

And I started to think about, well, okay, all of those arguments make a lot of sense. And then is there a much higher vulnerability when the plant is on shutdown cooling, you know, RHR cooling.

And I think your discussions about the ability of the motors to withstand conditions above the negative sequence voltage relay settings is what has to build confidence for those, for that kind of configuration, so.

MR. HEAD: And I guess I would add that there --

MEMBER STETKAR: And I didn't see any discussions in the shutdown stuff in the semi-quantitative/qualitative stuff.

MR. HEAD: But obviously during shutdown your time frames are different.

MEMBER STETKAR: That's true.

MR. HEAD: And in this case we would expect the alarm and we're going to react to it. That may mean, ultimately, we'll switch to another rack or something that, to make sure that --

MEMBER STETKAR: No, sure. Yes, there are options but also during shutdown you may have stuff, more stuff out of service.

MR. HEAD: Sure.

MEMBER STETKAR: I mean, the other rack might not be there.

MR. HEAD: And I'm sure that, having gone through all the shutdown safety that 1 and 2 goes through, that this is now added to that as something that you have to be aware of, and certainly would be, at 3 and 4.

MEMBER STETKAR: Good.

MR. HEAD: So did I answer your PRA question?

MEMBER STETKAR: I'm sorry.

MR. HEAD: Okay, then I think that -- did I? I think that's our, probably our conclusion. Open phase detection alarm, enhanced the already robust design that described today.

We have an ITAAC that will ensure the open phase detection, however that evolves. An alarm meets design requirements and then we have Tech specs surveillance that ensure these relays are there as other relays are in the, covered by text books.

CHAIR CORRADINI: Other questions from the Committee? Okay, thank you very much.

MR. HEAD: Thank you.

MR. HEACOCK: Thank you.

CHAIR CORRADINI: We're a bit ahead of time. So I guess it would be best to take a break because we're next scheduled for an hour with the staff discussing. So let's take a break now and we'll come back at 10 o'clock.

(Whereupon, the above-entitled matter went off the record at 9:49:58 a.m. and resumed at 10:02:40 a.m.)

CHAIR CORRADINI: Okay, why don't we get started? Okay, so the staff is going to begin with the Chapter 9. Luis, are you --

MR. BETANCOURT: Yeah.

CHAIR CORRADINI: -- going to kick us off?

MR. BETANCOURT: Yes.

CHAIR CORRADINI: Okay, go ahead.

MR. BETANCOURT: Thank you so much. Good morning. My name is Luis Betancourt. I am the Chapter PM for Chapter 9 auxiliary systems.

Today the staff presentation will be to discuss the phase four SER for STP. Today at my side I have two other technical reviewers who will be presenting with me today.

I have Diego Saenz who will be providing the criticality evaluation of the spent fuel racks as well as Ata Istar who will be presenting the structural and seismic evaluation.

This slide provides a list of the staff reviewers that contributed to the safety evaluation subsections 9.1.1 and 9.1.2 on the new spent fuel racks. We've got people from structural, SRSB, materials as well as a consultant from the National Lab.

As NINA provided in their presentation earlier today, back in 2010 staff provided our presentation to the ACRS of Chapter 9, sections 9.1.1 and 9.1.2 which relates to new and spent fuel racks which were still under evaluation. So today's presentation will be focused on 9.1.1 and 9.1.2.

This slide provides a highlight of how the confirmatory items as well as open items that resulted from the phase two review where all 32 items, confirmatory items, have been confirmed and closed, as well as the 3 open items have been all resolved and closed.

Some of the significant changes that happened since Revision 2, we added in the SER Sections 9.1.1 and 9.1.2. And there have been some provisions that were primarily to document the closure of the open items, confirmatory items as well as the, to address some of the Agency comments.

Now to talk about 9.1.1. In this Tier 1 departure, the applicant eliminates the use of the new fuel vault and specifies that the new fuel will be stored in the spent fuel storage racks.

However the DCD still requires the COL applicant to satisfy COL items 9.1 which relates to the criticality analysis and the fuel storage, 9.2 which relates to the impact analysis on new fuel storage and 9.5 which relates to the new fuel inspection standard.

The staff found the COL 9.5 is satisfied because the staff actually requested an RAI, for the applicant to provide additional information on the New Fuel Inspection Stand Seismic Capability Evaluation. The staff found that it was acceptable because it's actually the fuel stand will be anchored at the top and at the bottom of the fuel pool. And the other COL items will be addressed in the spent fuel racks.

In order to provide supplementary information in the FSAR the applicant provided a Holtec report, HI-2135462 to provide the assigned information including criticality, thermal-hydraulic analysis, seismic and mechanical assistance in order to address the following COL items.

Diego will be talking today about COL items 9.1 and 9.3. Ata will be talking about COL items 9.2, 9.7 and 9.4. 9.5 was related to -- or 9.8. 9.8 requires the applicant to provide a thermal-hydraulic analysis that evaluates the spent fuel racks designed to provide sufficient flow of air and to prevent nucleate boiling.

The applicant used a methodology that has been used and approved by the staff in other applications so the staff found it acceptable. So with that I conclude my part of the presentation and I will hand, give to Ata.

MR. ISTAR: Thank you very much. And prior to starting to my presentation I would like to recognize Samir Chakrabarti, who's the lead for this --

CHAIR CORRADINI: You have to speak up please.

MR. ISTAR: -- who is the lead for --

CHAIR CORRADINI: Talk into the microphone. Just don't hit it with anything because it explodes in our recorder's ears and makes his life difficult.

MR. ISTAR: I'm sorry. Once again, good morning. Before I start my presentation I would like to recognize Samir Chakrabarti who, as the lead for this project won't be able to be here and make the presentation. I'm taking his place and he's, luckily on vacation.

And I would like to also recognize other members -- Yong Li, sitting on my left, who's another structural engineer that basically performed the mechanical accident evaluations, and Richard Morenta, who's the consultant from BNL.

And also I'd like to recognize the NINA and Holtec members who provided responses to our questions in a very, very timely manner, especially Scott and Chuck. I do thank you for that.

And going back to Slide 8 which serves as the background and review scope, the applicant provided the Holtec report which is HI-2135462.

Right now it's Version 2 of that report which provides structural design information and the seismic structural analysis and mechanical accident evaluation of freestanding spent fuel racks for ABWR fuel at South Texas Project.

Staff review includes seismic structural analysis and design as well as mechanical accident and, of course, methodology and assumptions used for the spent fuel racks. Next page, please.

The applicable regulations and guidance for this review includes 10 CFR 50, Appendix A, General Design Criteria No. 2 and NUREG 0800 SRP 3.8.4, Appendix D. Next page, please.

Highlights of the staff review, the staff reviewed Sections 1, 2, 3, 6 and 7, of the Holtec report, basically the 1, 2, 3, 6 provides the design codes and standards, drawings, allowable levels, materials, structural, seismic evaluations. And Section 7 provides the mechanical accident evaluations for the freestanding spent fuel racks.

And staff issued 34 RAIs, basically they are additional information, clarifications and some issues that I'll be discussing on the next slide. And I will elaborate further on those.

And there were some clerical issues such as units were not consistent throughout the report, that which was taken care of later on by Holtec.

Interactions with the applicant include three onsite audits and public conference calls over a six-month period. And staff identified several issues pertaining to the analysis and design which subsequently resolved. Next page, please.

The major structural reviews which I will go through one by one, some of them. And starting with the first one, modeling of a fuel assembly, the applicant or the Holtec staff used a proprietary program, a computer program called DYNARACK to model the spent fuel pools.

As you know, they're a 17 by 20 array spent fuel racks and there are 7 of them in the spent fuel pool. And this is a proprietary code that, during the review of the DYNARACK model, the staff identified that the lump masses for the fuel assembly was at the -- five lump masses were modeled vertically and they're equally spaced.

And it was not, the staff was not clear whether those uncoupled masses were acting properly during the dynamic events. So the objective of the dynamic model is to adequately capture the dynamic characteristics of the free-standing spent fuel racks under seismic loading conditions and whether these uncoupled modeling would provide the additional impact loads within the fuel racks.

So the applicant agreed to put additional stiffness values within the masses which, I think there are -- 56 horizontal springs in octagonal directions were added to the model.

And there were a series of runs made from very flexible spring constants all the way to very, very rigid constants. I think there were 13 runs made. And finally there is, a graph was drawn, Load versus Spring Constants, changing spring constants, and there were variation on the impact loads.

And additional rattling forces were identified and applied in the structure. That resolved the issue that satisfied the staff's concern.

The second one is the rack-to-rack impact load estimation. Rack-to-rack impact load, again, it was in the DYNARACK model and there were two springs at the perimeters of the fuel racks.

And the staff had a concern about that stiffness is used rack-to-rack impact, whether the applicant underestimated the spring constant. And, consequently, the loads will be, will not be, come up with conservatively.

So the applicant agreed to perform a sensitivity analysis, increasing the spring values 20 percent and 50 percent and provided a graph showing that, as the spring constant goes higher, the loads were kind of numbing early, you know, in a diminishing way.

So the applicant used a higher load that was determined from this sensitivity analysis to qualify the racks. And that was kind of a modeling issue from the DYNARACK models.

The third one is calculating shear stress factor which is a design issue during the review of design calculation of the rack. The staff find out that a cross-section of the overall cells was used to calculate the shear stresses, but the -- which is the entire cross-sectional area.

But it's effect, I think the staff pointed out that effective shear area needs to be used, and the applicant agreed upon that and revised the calculations accordingly. And during this revision the welds at the base were, needed to be increased somewhat.

And the fourth one, buckling evaluation, which is, again, a modeling issue. During the design calculation the applicant performed a compressive -- had a model, ANSYS model, which applied compressive loads on the cells to determine the stresses and buckling of the cells.

And the staff had a concern that whether the height were chosen to be 4.8 inches is good enough to characterize that buckling behavior there.

So, referring back to this Theory of Elasticity book, which was written by Timoshenko and Goodier, and there was a section related to this similar condition which is simply support at both ends and had height and base ratio calculation and a graph showing that what would be the ultimate height for this condition.

So the applicant agreed to use that approach and calculated that height from 4.8 inches to be raised up to 10 inches. So we made it better and compressive strength, buckling issue with higher height still met the allowable stress values. But the buckling had better results out of its ANSYS run.

And going back to sizing the bearing plate, to commit a direct displacement, this is another issue that the staff was, a design issue that staff was not able to find out any discussion or calculation related to the bearing pad that the pedestals are sitting on.

And distributed loads throughout, that bearing pad hit evenly, so that issue was brought up to the attention of the applicant and out of this discussion from 2-inch thickness of the pad it was increased to 2-1/2 inches to make sure that enough rigidity was there and the distribution of the loads from the pedestals are evenly distributed on the concrete pad. And also from this the pads' dimensions were increased as well.

And, No. 6, Analysis, Methodology of Mechanical Accident, originally the applicant performed the energy balance methodology on three different mechanical accident conditions.

Those are basically two deep-drop cases and one shallow-drop cases. Shallow-drop cases at the edge of the rack and two deep-drop cases, one at the pedestal and one is away from the pedestal onto the base.

So looking at the hand-calculations and balance method the staff was not convinced that that will be the worst drop. And the applicant agreed to perform a timely analysis for those conditions. And they've performed for those three cases. And comparing to the results against energy balance against LL Stein, LL Stein had a higher stress value.

So this is kind of a methodology of a mechanical accident that resulted between the staff and the applicant.

And lastly, a postulation of scenarios. And as I told you earlier, the deep-drop cases, one of the deep-drop cases were performed at the center of the rack which this whole design had five pedestals.

And the applicant kind of ignored the --one of them were in the middle and four of them were at the corners -- ignored the one in the center and performed the drop-cases based on, at the center of the pad which is not a realistic condition.

So the staff asked them to perform a deep-drop case away from the pads at the edge of the fuel rack. And even that provided higher stress values. And that will be the realistic condition for the South Texas Project, ABWR design.

And the applicant, again, revised the drop-case scenarios accordingly and it's finally accepted. And last page, please, Sheet 3.

CHAIR CORRADINI: Ata, before you move on --

MR. ISTAR: Yes? Sorry.

CHAIR CORRADINI: Thanks for your thorough discussion, especially on each of these areas. The question I have, I think it may be apparent, but was this the first staff review of the DYNARACK methodology?

It seems as if you've identified a number of different analysis features that I would have thought may have been addressed in previous reviews.

MR. ISTAR: Well, the applicant made a very good presentation about the DYNARACK.

And it was, just to give you a little bit, background on that, DYNARACK has been used for quite a bit of time. I can't remember, but it has been used with other fuel rack analyses and has been accepted by the NRC staff in the past.

CHAIR CORRADINI: That's what I had thought. But I was --

MR. ISTAR: Yes, but --

CHAIR CORRADINI: -- trying to understand ----

MR. ISTAR: We were --

CHAIR CORRADINI: -- the methodology, the development to here.

MR. ISTAR: Yes, exactly. We really wanted to look into this, more detail and the behavior of the fuel racks during a seismic event needs to be correct.

So how we can improve those things, and I think one of the issues was the coupled masses on the fuel rack was modeled. And we want to make sure that that elasticity of the fuel racks are really -- they're all moving in the same path and the same impact loads are applied along the fuel racks.

So that's one issue that will be identified as a concern. And of course we had a higher rattling force based on that but still meet allowable of the requirements for that.

But, again, going back to the other analysis, whether those considered this kind of issue or not. I don't know. But this is what we identified and as well as in the rack-to-rack impact, that spring values. We believe that they made it lower than what it's supposed to be.

As you know, as the spring values go higher the impact loads will go higher.

CHAIR CORRADINI: Exactly. And is it right to conclude that the purpose of, the major purpose of your onsite audits was to get into the calculations ---

MR. ISTAR: Yes.

CHAIR CORRADINI: -- to make sure you had the opportunity to dig into what had been done and have an opportunity to review it and make your detailed comments and evaluations?

MR. ISTAR: Exactly. Exactly as I said earlier and I would like to thank again to the staff of Holtec, they were open to that. And the originator of the program, he made us numerous presentations during the audit on specific issues that we asked him, which really helped the audit. Presentations really helped us to understand the details of the program.

CHAIR CORRADINI: Thank you. Thank you.

MR. ISTAR: And finally, in summary, I would like to conclude that the information provided by the application is adequate and acceptable to determine the structural, free-standing fuel storage racks in accordance with the NRC guidance and regulations. I thank you.

MR. BETANCOURT: Questions? Okay.

MR. SAENZ: Okay. I'd first like to highlight some of the requirements for criticality that are applicable to this design or most applicable to this design. First is the 50.68(b)(4) requirement that requires for spent fuel pools that do not credit soluble Boron, the K effective that spent fuel rack loaded with the maximum fuel assembly reactivity must not exceed 0.95 at 95 percent probability, 95 percent confidence level.

There's also a Tech specs requirement 4.3.1.1 that requires the standard cold core geometry, K infinity, be maintained at or below 1.35.

And there's administrative requirements that for fresh fuel without gadolinia has a maximum of fuel U-235 enrichment of 2.95 and for fuel (with gadolinia) up to 5 percent Uranium-235 enrichment there are lattice design limits on the number of gad rods, the gad rod locations and the gad rod loading. Next slide.

So to highlight a few features of the design, there's no new fuel racks, as was already mentioned in the applicant's presentation. There's only spent fuel racks. There's seven 17 by 20 storage racks. The new and spent fuel can be stored in any location within the spent fuel storage racks.

And then there's the fuel lattice requirements are such that even for fuel with gadolinia it is most reactive fresh so the applicant did some sensitivity studies to confirm that and also the NRC staff did a confirmatory analysis to confirm that.

The applicant used Metamic as the fixed neutron absorbing material. Are there any questions on that? Okay.

So to summarize, the Staff find that the STP spent fuel rack design protects against criticality with the use of a geometrically safe configuration given appropriate analysis methodology was used, appropriate abnormal conditions were analyzed, and margin exists between the regulatory limit and the maximum calculated K effective, which the maximum calculated K effective including abnormal conditions, and biases, and uncertainties was .9167, so that had margin to the regulatory requirement of .95.

MEMBER BALLINGER: In one of the documents you talked about a surveillance program that involves corrosion coupons and measuring neutron attenuation. How is that going to be done? --- the corrosion part I understand, but the neutron attenuation, I didn't see anything discussing method.

MR. SAENZ: Okay. So, those details of the coupon program were done by two different reviewers. They're in the room. I don't know if they'd like to address this specifically.

CHAIRMAN CORRADINI: They don't look very willing. Please identify yourself.

MR. YESHNIK: Andrew Yeshnik. Can you hear me?

CHAIRMAN CORRADINI: A little closer.

MR. YESHNIK: I'm Andrew Yeshnik from the Materials and Chemical Engineering Branch, and the coupon program does have neutron attenuation testing as is in the Holtec reports, and it should follow the QA program that Holtec has, so it should be accounted for.

MEMBER BALLINGER: That doesn't answer my question. How are they going to measure the neutron attenuation?

MR. SASTRE: My name is Eduardo Sastre. I'm the reviewer for neutron absorbers.

CHAIRMAN CORRADINI: Talk a little bit slower.

MR. SASTRE: My name is Eduardo Sastre. I'm the reviewer for neutron absorbers. So, your question is what tests are they going to perform in the neutron absorbers?

MEMBER BALLINGER: Yes, what method. Yes.

MR. SASTRE: I don't think we covered which specific test. Our requirement was that they were going to test it.

MEMBER BALLINGER: Okay. Can we get an answer to that?

CHAIRMAN CORRADINI: Holtec might know.

MEMBER BALLINGER: Yes, I just read the Holtec report. It doesn't say how they're going to do it.

CHAIRMAN CORRADINI: So as I suspected, you may have to go get that answer off ---- there we are. Sorry. Sorry.

MR. RICKNER: I'm at the bottom. My name is

Bret Rickner from Holtec International. I'm a criticality analysis expert for the last 10 years. The coupons are tested initially when they're batched, and they do neutron attenuation measurements. They also do chemical analysis and weight measures, so whatever tests were done initially when they batched the coupons they repeat those tests because they have to compare it to the baseline.

MEMBER BALLINGER: Okay.

MR. RICKNER: Typically, we stick them in a reactor beam.

MEMBER BALLINGER: Okay, so that's what I'm asking. How ----

MR. RICKNER: That's the neutron attenuation part.

MEMBER BALLINGER: Okay. Okay, got it.

CHAIRMAN CORRADINI: Thank you.

MEMBER BALLINGER: Thank you.

MR. BETANCOURT: Any more questions?

CHAIRMAN CORRADINI: Any other questions? Okay. This team is off, the next team comes. Bring on the electrical engineers, or electrical engineer. Excuse me.

MR. BETANCOURT: Let's start with the form presentation. Good morning, again. My name is Luis

Betancourt. I am the Chapter PM and for Section 8.2S which evaluates the applicant's solution regarding the NRC Bulletin 2012-1. I want to make a side note. Section 8.2 was there because we wanted to avoid any further editing to Chapter 8 which has already gone through the ACRS and is now Chapter 8.2S. However, on the staff evaluation we needed to include the evaluation of the tech specs related to the sequence relay, so because of that we needed to amend Chapter 16, so Chapter 16 we took it from Phase 6 and now it's back in Phase 4.

With that being said, as part of the Staff Review Team we got our engineers over here, we have Danny Martinez who also participated in the review. We have people from the tech specs which are in the back, as well. There were some questions about regarding PRA so we've got Marie Pohida to answer those questions. And we also have I&C Staff who evaluated the set point methodology. So with that being said, I will now give it to Sheila.

MS. RAY: Good morning. My name is Sheila Ray. I'm in the NRR Electrical Engineering Branch. So, this first slide talks about the Byron open phase event. I think we've covered that sufficiently, but I do want to highlight that manual actions were necessary, and this issue has a potential for common cause failure, so we did evaluate for the new reactors and the operating fleet. Next slide, please.

This slide provides some information on our history. There was a special inspection at Byron. We issued an information notice followed by a bulletin, and based on the responses we issued a summary report.

Furthermore, in October of 2013, NEI provided an NSIAC approved industry initiative to address the issue. And then Staff issued two RAIs to the applicant. Next slide.

So, the Staff position for the active plants consists --- it's a three pronged approach, as you heard from the applicant. It's automatic detection, alarm in the control room, and automatic mitigation. And, furthermore, we ask the applicant to provide training for plant personnel and procedures. Next slide.

So, to begin with the detect and alarm piece of it. So, as I stated before, the Staff position requires automatic detection, and alarm in the control room. And NINA has indicated that there's automatic detection on all three phases of the main power transformer and the reserve auxiliary transformers.

MEMBER STETKAR: Sheila, does --- I know

that the Staff is reacting to the event that happened at Byron. Does the proposed detection scheme for the high side of the main power transformer and the high sides of the reserve auxiliary transformers in this particular plant specific design solve the real issue?

MS. RAY: In terms of detecting and alarming for the open phase?

MEMBER STETKAR: That's correct. That's what I'm ----

MS. RAY: Yes, we believe so.

MEMBER STETKAR: You believe that. So, any potential over ---- open phase in the power supplies to the safety buses will be detected and alarmed.

MS. RAY: Well, let me add two more points. There is a tech spec for approval offsite sources, and that gives us some reasonable assurance. And also ---

MEMBER STETKAR: Let me ask you, will an open phase on the high side of the unit auxiliary transformer be detected and alarmed in this particular design?

MS. RAY: So ----

MEMBER STETKAR: It's a yes or a no.

MS. RAY: Yes.

MEMBER STETKAR: It will? Okay.

MS. RAY: So, I haven't seen the analyses on these because as the applicant has stated, we are ---- we don't know the full details of the design for the detect and alarm, but ----

MEMBER STETKAR: Well, excuse me. They said that they are going to monitor on the high side of the main power transformer, and I know where that is. I could see that, it's out here. I'm asking you whether or not this design will detect and alarm an open phase on the high side of a unit auxiliary transformer, which is peculiar to this design? Did you look at that and did you think about it in your review of the detection for this design?

MS. RAY: Not particularly that exact scenario.

MEMBER STETKAR: Okay. Why not?

MS. RAY: Because we felt that the detection and alarm on the high side of the ---- you're detecting at the source.

MEMBER STETKAR: No, I'm detecting at the high side of a unit auxiliary transformer, which is the supply to the safety bus. It is a different design from the Byron plant. I am asking you whether ----- did you think about whether or not the proposed design will detect an open phase on the high side of a unit auxiliary transformer, and if not, why not?

MS. RAY: No, we did not.

MEMBER STETKAR: Okay. Why not?

MS. RAY: Is there ----- maybe I would like to refer to -----

CHAIRMAN CORRADINI: Yes, you can call for a life line.

MR. GOEL: This is Vijay Goel. Because basically we are concerned about the overhead conductors, and the high side of the isophase bus.

MEMBER STETKAR: I will go back to ---- let me be the class clown for the moment. I'll go back to my previous statement that electrical systems are a lot smarter than the people who analyze them, and electrical faults are a lot smarter than anything you can assume about them. So, if you didn't anticipate a fault, I can say I can anticipate a fault on the high side of a unit auxiliary transformer. Now Charlie, I'll end up being the technical guy.

MEMBER BROWN: If you look at what --- I'll just springboard back to the RAI and the other discussions, the technical information that was provided. The way I view it, it's only --- they only did the main power, and they only take the negative sequence. And in my understanding, and NINA can correct me if I'm wrong, anything that occurred upstream of the 4160 volt say at the unit auxiliary transformers would be protected based on the negative --- that's --- I'm looking for heads shaking up and down. They presumed that they didn't have to do anything on the primary or the UATs because they had the negative sequence protection system on all three phases, on all the 4160 volt buses. And did I phrase that properly?

MR. HEAD: Yes, you did.

MEMBER BROWN: Okay. So, I'm not saying it's right or wrong, but I don't ---- right now I didn't have a basis for saying it wouldn't work.

MEMBER STETKAR: Yes, I don't know whether it would or not. I have ---- you'd have to think about it. But what I'm probing the Staff is, did they think about that and ask whether or not the existing ---- the combination of the alarm ---- the detection and alarming ---

(Background noise)

MEMBER BROWN: Excuse me, pardon the interruption.

MEMBER STETKAR: --- kV level, and the protection scheme down at the 4 kV level, whether that combination would, indeed, solve problems of open phases at the 27 kV level.

MEMBER BROWN: The difference the way I view it is where the fault occurs on the primary of the UAT. If it's an open line talking relative to the bus that he's referring to, that gives you one response. But this is a delta primary side, not a Y side which you end up in some circumstances with an open delta transformer configuration which still provides voltage downstream.

Now you get phase shift differences in the currents that you get, the voltage coming in is what it is, but they didn't talk about that.

MEMBER STETKAR: Right.

MEMBER BROWN: So, I just don't know whether ---- how that would work.

MEMBER STETKAR: And I don't know either. I mean, I haven't thought through it. I'm asking whether the Staff ----

MR. HEACOCK: Yes, I'm Evans Heacock. Let me weigh in on your question of detection on the UAT. No, we did not look at detection on the UAT. However, as Charlie has stated, if you have an open phase on the high side of the UAT that will manifest itself as larger negative sequence voltages down on the 4160 buses themselves. And the protection -----

MEMBER BROWN: Yes, but you still haven't ---- you have an open delta configuration. You're going to get power transfer to all three phases on the Y side.

MR. HEACOCK: Not the same.

MEMBER BROWN: It's going to be unbalanced. I'm not arguing about that.

MR. HEACOCK: Now, the delta on the high side gives you a little difference than a delta on the secondary with a Y delta. If you lose one phase on the high side, you lose multiple phases ---- your two phases actually go low, you end up with a lower voltage on two phases on the secondary ----

MEMBER BROWN: Yes, but it's not zero.

MR. HEACOCK: No, it's not zero.

MEMBER BROWN: Okay.

MR. HEACOCK: I'm just saying it's lower. And that's actually -----

MEMBER BROWN: I don't disagree with that.

MR. HEACOCK: Yes, you've got your voltage, you've got your under voltage would actually see that, and also the negative sequence.

MEMBER BROWN: Okay. Now, the phase difference would remain the same, 120 degree phase difference. Now, the currents would be different.

MR. HEACOCK: Currents ---- well, you're

--- I've got do summations in my head. There are some that will give you a phase difference. And on that particular one, I'd have to go back and think. I can't remember off the top of my head. I think you have some phase difference but it's not significant. But you do have ----- you still end up with negative sequences because your voltage ----

MEMBER BROWN: I don't disagree with that. You're in a ---- you've now got an unbalanced current situation so you will get negative sequence currents.

MR. HEACOCK: Yes, that's what I'm saying, you do have negative sequence ----

(Simultaneous speech)

MEMBER STETKAR: Because they're only picking up voltages. You should -----

MEMBER BROWN: That's -----

MR. HEACOCK: Yes, you can have an increase on negative sequence.

MR. HEAD: So, Evans, would you repeat the undervoltage aspect of that? You say --, it will be more than --. Don't we believe that we would actually have an undervoltage actuation? You can't hear me right now? Okay, I'm sorry. Don't you believe we'd have an undervoltage actuation?

MR. HEACOCK: Yes. From the standpoint of what Scott was asking, yes, that's what I was stating earlier. You would end up with two phases that were low, and that the undervoltage scheme for STP 3 and 4 would actuate.

MEMBER BROWN: I have to go back and try to do the math, how far it would be. Open deltas are funny things. I mean, you can support roughly 50 ---- if you do the classic analysis and you have an open delta situation occur, you can supply roughly 57 percent or so of the load that you normally would have seen otherwise if you had all three transformers. And it's not two thirds, in other words, because of the differences that you get phase wise. So, I mean, it's just not clear to me how big those voltage differences would be based on the way you're utilizing the ----- how your criteria for set points. I just -----

MR. HEACOCK: Right.

MEMBER BROWN: Because you didn't do an analysis ---- nobody ---- there was no analysis for that.

MEMBER STETKAR: You've actually looked at it though, Evans?

MR. HEACOCK: I have looked at a ---- when you have an open phase on the high side of a delta Y transformer, the high side being delta which we're talking about -----

MEMBER STETKAR: Yes. That's right, yes.

MR. HEACOCK: I have looked at those, yes.

MEMBER STETKAR: You have.

MR. HEACOCK: Yes.

MEMBER STETKAR: And you do get -----

MR. HEACOCK: Low voltages on two phases on the secondary.

MEMBER BROWN: But not an open in the bus but, I mean, an open in the actual transformer itself.

MR. HEACOCK: Yes, it could be anywhere.

MEMBER BROWN: Okay.

MR. HEACOCK: Anywhere that disconnects the signal phase.

MEMBER BROWN: All right. I've got to think about that.

MEMBER STETKAR: Have to think about it.

MEMBER BROWN: Yes. All right. The answer is you've done ---- right now the right answer, not the right answer, the answer you're giving is we do it on the high side of the main power, we do it on the negative sequence, anything that happens in between the output of the main power transformer and the 4160 volt bus is covered by -----

MEMBER STETKAR: The 4160 volt bus, that's get back to the earlier question, the 13.8kV feeds and the 27, you know, would the operators know what's going on, but ----

MEMBER BROWN: Exactly.

MEMBER STETKAR: ---- the more important part of my probe is how carefully did the Staff actually think about the electrical system at this plant when you wrote the RAIs, because the ----- just because the issue was prompted by a particular fault at a particular plant with that plant design, you know, are you trying to fit every plant in the world to do that such that if everybody in the world simply monitors the high side of what they call their main power transformer, that's going to solve everybody's problems. And it sounds like that's the approach you took.

MS. RAY: That is the approach the Staff has taken.

MEMBER STETKAR: Okay. And that's certainly not an adequate approach in the grand scheme of Staff reviews of these designs. On the record, in my personal opinion.

CHAIRMAN CORRADINI: But just to put that in context, what NINA is proposing given that the detection scheme has to be designed and is common amongst current operating plants and new plants, given that, what they're proposing in terms of detection looks reasonable. You're worried about the whole review process.

MEMBER STETKAR: I'm worried about the fact that this particular design because the ---- if I can go from 345, the Y delta, delta Y, as I get down to the safety buses, perhaps this particular design with the detection out on the Y side of the 345, and if indeed an open phase on the delta side of the 27 ---- of the UATs, if that's protected against by the protection relaying then the detect at the 345 with the ultimate protection at the 4kV may indeed solve the problem for this particular design.

CHAIRMAN CORRADINI: But you're more worried about the generic review on all possibilities.

MEMBER STETKAR: Exactly. And if the staff haven't probed that, if they're failing open on this particular design, it's not clear how carefully they're thinking about the overall issue.

CHAIR CORRADINI: From the report, and the applicant has looked at this, but, absent the --

MEMBER STETKAR: No, but, from, no, from our oral presentation today, they said they've thought about it.

CHAIR CORRADINI: Yes.

MEMBER STETKAR: Nobody --

MEMBER BROWN: But they didn't do any -- they didn't do --

MEMBER STETKAR: I understand that.

MEMBER BROWN: -- an analysis where they determined what the negative sequence currents are.

MEMBER STETKAR: Right.

MEMBER BROWN: Well, what the negative sequence voltages are, and whether they would be covered for that UAT --

MEMBER STETKAR: By the relays.

MEMBER BROWN: -- by the relays, and the 4160 volt bus.

CHAIRMAN CORRADINI: Okay, just since we have this nice discourse amongst each other, I want to make sure. NINA, so did you guys hear what Charlie just said?

MEMBER BROWN: No, they were chatting.

MR. HEAD: Yes, sir, but I didn't absorb it.

CHAIRMAN CORRADINI: Okay, can you repeat it? Because he's characterizing what you did. I want to make sure that's the appropriate characterization. Can you repeat it Charlie?

MEMBER BROWN: Okay. Alarm on the main

power input, negative sequence relays on the 4160 volt bus. There's no open circuit detection relative to the UATs input.

You didn't do any analyses for an open circuit on the UATs to see what the negative sequence voltages would be, and if the voltage, you know, your negative sequence sensors would take care of that.

There's another part of this question now that is --

MEMBER STETKAR: Equipment lightly loaded, heavily loaded, unless there's --

MEMBER BROWN: -- for the lightly loaded -- so, but you've thought about the thing, but you didn't analyze it. That's, that was what I got out of the comment a few minutes ago. I'm not saying it’s right or wrong.

I'm just saying it doesn't, there's a disconnect right at the input on the primary side of relays.

MR. HEAD: The negative phase sequence relays, they are there for whatever. However it occurred.

MEMBER BROWN: The point is whether -- okay.

MR. HEAD: No matter how it occurs, they

are there and will protect the motors.

MEMBER BROWN: But is the response different at that point relative to it is on the main power transformers?

MR. HEAD: I guess what I'm --

MEMBER BROWN: I just don't know.

MR. HEAD: -- the scenario I'm hearing is the possibility that we've addressed a maybe, I'll call it the switchyard phenomena, but there's some internal failures that you're -- the motors are protected with the 4160s, but maybe this detection scheme that the industry is headed towards won't detect those.

MEMBER BROWN: Something in between.

MR. HEAD: Something in between, and I think the intro was that that's not as likely a failure as you have from a cable or, you know --

MEMBER BROWN: On a bus standpoint, he just said that they, because a bus is not like a cable coming in from a transformer.

MR. HEAD: Exactly. And so, you know, that --

MEMBER BROWN: But I'm thinking of the transformer. A transformer failure, itself, internal, as opposed to a bus failure.

MR. HEAD: And I have to agree, sort of.

MEMBER BROWN: I agree with the bus.

MR. HEAD: Okay. I think those sort of failures have ways of being identified other than this alarm, because obviously, the alarm isn't, but through the entire scenario, the motors are protected, regardless of how it happens.

CHAIRMAN CORRADINI: That's your ultimate objective.

MR. HEAD: Yeah.

CHAIRMAN CORRADINI: That's what I want to make sure.

MR. HEAD: Yes, sir. That is our ultimate objective.

MEMBER BROWN: Are all the 13.8 loads protected, as well?

MR. HEACOCK: No.

MR. HEAD: No.

MEMBER BROWN: No? So you haven't, I noticed that. That you had not worried about those.

MR. HEACOCK: Well --

MR. HEAD: Because they're nonsafety now.

(Simultaneously Speaking)

MEMBER BROWN: There was nothing done relative to those, other than the open phase on the input to the main power transformer.

MR. HEAD: Right, there's --

MEMBER BROWN: The alarm.

MR. HEAD: No, sir. There is, at this point in time, not a business case for us to do that.

MEMBER BROWN: That's fine. Okay, I got the answer.

MR. HEAD: Okay, and Evans is going to also clarify some.

MR. HEACOCK: This is Evans Heacock, and I just want to, on the 13.8 motors, yes, those are considered actually part of our protection scheme would be, include a current unbalance relay, similar again to what we have for (Units) one and two to protect those motors for this particular event.

MEMBER STETKAR: That's what we say for the circ water pump motors --

MEMBER BROWN: Okay.

MR. HEACOCK: Okay.

MEMBER STETKAR: -- for the event that actually happened there, they were protected, because they're big --

MEMBER BROWN: Because you have a current unbalance set up.

MEMBER STETKAR: Yeah, and they worked.

(Simultaneously Speaking)

MEMBER BROWN: A different protection scheme.

MR. HEACOCK: A different protection scheme, correct.

MEMBER BROWN: All right.

MR. HEACOCK: But there's one in place. There will be.

MEMBER BROWN: Okay.

MEMBER STETKAR: But it's a --

MEMBER BROWN: But it's not --

MEMBER RAY: -- it's at the individual load level for the --

MR. HEACOCK: Right.

MEMBER STETKAR: -- big motors rather than shedding the whole bus --

MR. HEACOCK: Correct.

MEMBER STETKAR: Yeah.

CHAIRMAN CORRADINI: Okay, I got that. I think their staff has another point to make.

MS. MARTINEZ: Yes, just a quick clarification. My name is Tania Martinez-Navedo from the electrical engineering branch. The staff position in the slide focuses particularly on the failure that occurred and was defined in the real time. So it was the loss of an off-site power line.

And that's the reason why it was focused on detection on the high side, rather than inside, in the circ pumps of the plant.

CHAIRMAN CORRADINI: Yeah, I think we've got that. I think what the members are saying is, since you're going through all this effort, you might as well be somewhat comprehensive to make sure that it's not just what you saw, but what could occur in other ways.

MEMBER STETKAR: When the next one happens that is not that particular failure in that particular design, we'll have another bulletin and we'll have another --

MEMBER BROWN: But even, I believe, after the bulletin was issued for that one event, staff uncovered about four or five additional events over the last ten years that were not the same.

CHAIRMAN CORRADINI: Okay. Thank you. Okay, Sheila, we're right on track.

MS. RAY: And I just also wanted to mention that there is an ITAAC for the alarm detection scheme.

CHAIRMAN CORRADINI: That, I think we wrung out of the applicant earlier. Thank you.

MS. RAY: I think we've covered this one. So the next piece is the mitigation scheme, which, as we've talked about, is the negative sequence relays.

And this is for protection of the Class 1E 4160 volt loads. All right, so next slide.

So the staff finds the mitigation scheme acceptable, since it protects the Class 1E loads and we've audited the simulations and analyses to show the detection scheme will work and identify an open phase and protect the loads.

Furthermore, there is a tech spec for the negative sequence relays that the applicant has discussed. So next slide. This is regarding the training and the procedures.

The applicant will be developing training as well as procedures for maintenance and testing for the monitoring system. Next slide. And the staff finds this acceptable, since training will be developed.

And also, there will be maintenance and testing procedures, as well as calibration and troubleshooting procedures. So next slide. Sorry.

CHAIRMAN CORRADINI: Oh, don't worry about it.

MS. RAY: That was me.

MEMBER BROWN: They'll just get you.

CHAIRMAN CORRADINI: You do that once more, and he goes nuts.

MS. RAY: I'll do my best.

CHAIRMAN CORRADINI: That's right. We've made a request for a generic action item to get rid of these microphones, but it proceeds through the NRC evaluation process.

MS. RAY: I understand.

CHAIRMAN CORRADINI: I could be dead.

MALE PARTICIPANT: But in that way, we know that he's woke up, so.

MEMBER STETKAR: Does it need to go through ACRS?

CHAIRMAN CORRADINI: Huh?

MEMBER STETKAR: Does it need to go through ACRS?

CHAIRMAN CORRADINI: God help us all. Anything that's initiated here dies. Go ahead, sorry.

MS. RAY: This slide is a bit repetitive from the applicant. They have discussed FSAR updates as well as the tech spec on the negative sequence relays. And furthermore, as I mentioned, there is a specific ITAAC to verify the detection alarm scheme.

Next slide. So in summary, the applicant has provided information for a scheme to detect alarm and automatically respond to an open phase event. And the staff finds this issue acceptable. Questions, comments.

CHAIRMAN CORRADINI: Additional questions for Sheila? Okay, thank you very much.

MS. RAY: Thank you.

CHAIRMAN CORRADINI: We'll move on to --

MEMBER BROWN: Part 21.

CHAIRMAN CORRADINI: -- Part 21. NINA's back up. I can at least finish you off.

MR. HEAD: Ready?

CHAIRMAN CORRADINI: Ready.

MR. HEAD: So, yes. I appreciate the opportunity. We were asked to discuss this issue that's been recently identified regarding suppression pool water level. And, move on to the next slide. And, you know, obviously Steve Thomas, and Jim, and myself will lead this presentation.

Just from a background standpoint, in March of this year, GEH identified a potential Part 21 associated with the assumptions used to calculate ABWR hydrodynamic loads.

In essence, the suppression pool level used for the development of the hydrodynamic loads might not have been conservative. The analysis, the original analysis was done at the tech spec high set point level.

However, following a feed water line break, that level was increased, and that increased level was not originally, was not considered in the original analysis.

The original potential Part 21 documentation indicated that the access tunnel was the issue, the structure that was most likely to be impacted.

And then I'll just note that here, the final GEH report concluded that there was no substantial safety hazard and no impact on the tech spec, and was not reportable.

Just some technical background. During a LOCA, the suppression pool is subject to the following hydrodynamic loads, many of which we've discussed with ACRS in previous meetings.

Pool swell, condensation oscillation, and chugging. Pool swell is really an air phenomena, and the impact of this higher pool level would really be seen more in the condensation oscillation and chugging loads related loads.

These loads can impact the suppression pool walls and the structures. And the suppression pool water level increased, level increases the extent of the hydrodynamic pressure loads on the suppression pool walls and submerged structures.

CHAIRMAN CORRADINI: Since we're not talking electrical, and this kind of stuff, I kind of understand a little bit of this, can I ask --

MR. HEAD: Yes, sir.

CHAIRMAN CORRADINI: -- so the identification of this as a, I'll use the word mistake, was a change in elevation of what amount? Less than a foot, I remember.

MR. HEAD: No, sir. It ends up about three feet.

CHAIRMAN CORRADINI: Oh, I thought it was a foot.

MR. HEACOCK: No, it's --

MEMBER BROWN: A meter.

MR. HEACOCK: -- maybe a meter.

CHAIRMAN CORRADINI: A meter. Okay. So it was one of something. I said the wrong measure. And this is just a miscalculation, or a --

MR. HEACOCK: An assumption.

MR. HEAD: It's an assumption. When the analysis was done, and here's the water level you'd be starting with.

CHAIRMAN CORRADINI: Right.

MR. HEAD: Okay? Well it turns out, while chugging and condensation oscillation loads are still occurring, the water level may have increased another three feet or a meter.

CHAIRMAN CORRADINI: Oh, okay.

MR. HEAD: And so you have additional water that's either hitting stuff, you know, impacting the walls or impacting the --

CHAIRMAN CORRADINI: Okay.

MR. HEAD: -- tunnel. So that's the phenomena that's going on.

CHAIRMAN CORRADINI: Remind me one other thing. The initial nominal water level is what?

MR. HEAD: 7.1 meters.

CHAIRMAN CORRADINI: Okay.

MR. HEAD: That's the high expect level.

CHAIRMAN CORRADINI: Or the initial water level inside of it?

MR. HEAD: Right, in the tech spec.

CHAIRMAN CORRADINI: Tech spec, all right, 7.1.

MR. HEAD: But due to the accident analysis, it could be higher than --

CHAIRMAN CORRADINI: Right.

MR. HEAD: -- after --

CHAIRMAN CORRADINI: Right.

(Simultaneously Speaking)

MR. HEAD: After the feed water line break, obviously the water is --

CHAIRMAN CORRADINI: Okay.

MR. HEAD: -- going to go down in the suppression pool area.

CHAIRMAN CORRADINI: Thank you.

MR. HEAD: So after this, after the initial report, NINA requested Toshiba to evaluate the impact of this assumption for STP 3&4. And Toshiba performed a conservative analysis that concluded that the increase of about one meter that it does increase for about one meter for the feed water line break LOCA.

And their conclusions are, which we've received obviously, is that the most, for the most limiting load combination, there is no significant effect on the containment structure.

It's a one, less than a one percent increase in stress. Okay, you can go to the next one. This is it. With respect to the access tunnel, which was mentioned in the initial GE report and discussed in a subsequent report, we noted that it's not analyzed in the DCD, and will be designed later as part of the detail design of the plant.

We did ask Toshiba, though, with respect to the Japanese plants and the tunnels that exist over there what would the impact be with respect to them, and also, it's a gain of less than one percent increase in stress loading on those tunnels. Our actions --

CHAIRMAN CORRADINI: So --

MR. HEAD: Sir, go ahead.

CHAIRMAN CORRADINI: -- can I ask you this -- different question. Maybe you're not prepared for it, but I'm just trying to think. I'm just, I want to rid myself of phases and --

MEMBER BROWN: I'm going to do a vector up here and we'll --

MR. HEAD: That, I can do.

MEMBER STETKAR: You'll notice, by the way, Mike, that we did not use a human being's name, and the jargon of the, Joe's correlation in any of that discussion. It was strictly focused on technical things.

CHAIRMAN CORRADINI: Well, when it's linear and easily analyzed, I guess so. Okay, so what I didn't understand though is the one percent, a 15 percent change in the level is causing a one percent change in the various loads.

That would imply to me, though, that in the chugging phase, a lot of the structure is still above, that could be impacted is still above where the water is hitting. I'm trying to understand if this is like the washing machine, I've got a chugging action, why I only have a one percent effect.

MR. HEAD: Well, because chugging, or condensation oscillation, is not the only load you assume on the containment.

CHAIRMAN CORRADINI: So it's a small part of the load, regardless?

MR. HEACOCK: Yes.

MR. HEAD: It's a small part of the load, regardless.

CHAIRMAN CORRADINI: Okay, fine.

MR. HEAD: Okay? And so the one percent for the containment, that's what we were pretty much expecting, given it's really just additional mass that you're adding to the seismic analysis. And all the other loads --

CHAIRMAN CORRADINI: Mm-hmm.

MR. HEAD: -- all those combinations are already there.

CHAIRMAN CORRADINI: Okay.

MR. HEAD: It's essentially ten percent of seven percent of the total load combination. It's actually about .7 percent increase.

CHAIRMAN CORRADINI: Say it again, I'm sorry?

MR. THOMAS: For a chugging contribution --

CHAIRMAN CORRADINI: Oh.

MR. THOMAS: -- to the total load is seven percent and it increases by ten percent.

CHAIRMAN CORRADINI: Okay, got it.

MR. THOMAS: So you've got a ten percent increase of seven percent.

CHAIRMAN CORRADINI: Okay, fine.

MR. HEAD: So our action is, we submitted the letter to NRC in early September after the GE report came out. And we wanted obviously to review it and make sure we understood what they had done. And we, in our report, we concluded, in our letter, we concluded that it's not a significant safety issue.

The NRC audited the Toshiba evaluation in September. That was done per NINA's request to, you know, understand the work that was done there. And to basically close this issue out from a regulatory perspective, we offered a site-specific ITAAC that was developed, that will ensure that this issue is addressed when we do the final, you know, plant design, and if this aspect is discovered.

And in conclusion, we agreed that there is not a significant safety issue, determined there is not a significant safety issue. And we believe our results are consistent with the GEH evaluation.

CHAIRMAN CORRADINI: Questions by the Committee? Okay. Thanks. We'll have staff come up. Go ahead, you guys can load it up there.

MR. TAI: Okay. Well, slides to lose. Good morning, this is Tom Tai, again. Yong Li is our co-reviewer for this Part 21 issue with Samir. Samir is vacationing, so he is having a good time. And Henry will be joining us shortly.

In first slide is a little background that you, STP already showed to you that GE submitted a potential Part 21 evaluation in terms of 10 CFR 21, 21A. That they identified problem that they think is a concern so they can look into it.

And essentially, it's a tech spec high water level of 7.1 meters. They think it should be higher, because of the flow down, so that would bring it up to about eight meters.

And they think the access tunnel is probably the most vulnerable structure, so to speak, for this particular analysis. And in the final report, in -- are these our slides?

CHAIRMAN CORRADINI: Yes, that's what I wanted to say. Those aren't --

MR. TAI: Are these our slides?

CHAIRMAN CORRADINI: Nope, they're not.

MR. TAI: Oh, of course.

MS. BANERJEE: These are NINA's slides.

CHAIRMAN CORRADINI: NINA's slides.

MS. BANERJEE: Part 21 ACRS presentation?

MR. TAI: And then I press --

MEMBER BROWN: Okay, there you go.

CHAIRMAN CORRADINI: There you go. That's it.

MR. TAI: I knew it was familiar, but I didn't know it was --

CHAIRMAN CORRADINI: You must have realized how low-budget an organization we are.

(Simultaneously Speaking)

CHAIRMAN CORRADINI: Hit the slide show so, hit the slide show button.

MR. TAI: Okay.

MALE PARTICIPANT: F5.

CHAIRMAN CORRADINI: Great.

MR. TAI: Okay. There you go. Now I recognize myself. In August, they find a, GE finally sent us the results of the final evaluations. And they concluded that it is not a reportable, and there is no change of tech spec.

And STP or NINA followed up on September 15, and they gave us their own evaluation with help from Toshiba, using some of the input from the Japanese ABWR plant, and they draw the same conclusion.

I want to bring this one up in here for stakeholders, because I want to make sure that we have talked about the COL application, and I'll get to that later on. GEH is still the original ABWR design applicant. But that design was certified in 1997.

I'm sure you guys had a lot of discussion with AP1000, Vogtle, and Summer. I just want to bring this up. So we are asking STP to address this question, not the ABWR designs for it. Toshiba is the, one of the EPC teams for NINA to support the COL application, and in the future constructions.

And I want to emphasize that, because we had a lot of discussion about ultimate vendor qualification about five years ago. That doesn't make them the owner of ABWR. All that does, all that did was to make sure they are qualified to go buy the design for ABWR.

And we are who we are. Our review, when we first got that notice from GE, almost, like, the day after, we've been engaging STP to find out what the, so that they are aware of that.

And we follow them just to find out what has been, what is going on and what are they doing. So it was a pretty well-coordinated effort. And of course, we don't hear anything for about six weeks.

And when we finally got the results from, or when we expect the results from NINA in September, we have a meeting on September 9 just to go through some of the preliminary findings that they had.

And when they finally submitted to us, I think it was September 15, we did the audit on September 19 on the report that they gave us. We accept the technical presentations. We have some observations, but they are more like editorial quality type.

Because they reported it, if there is not supposed to be a design supposed to submit to us internally. And at the end, we agree with NINA that this is not reportable. But we had a lot of internal discussion.

How do you approve a COL application when you know there is an imperfection in the analysis that they are going to do eventually? So the ITAAC itself will help us out to cover that.

The ITAAC is basically a, I will call that an extension of an existing TON-ITAAC in the DCD in Table 2.14.1 item 14. What that one does, when you do the containment analysis to, using a spill condition, all the internal structures need to meet the design load in section 2.14.1.

That is the DCD ITAAC. The ITAAC that NINA is proposing, to put into site specific, table 3.0, that one basically said that consider a high suppression pool level because of low down.

So we're not imposing any additional load in on the applicant, but it will be a good reminder five years, ten years from now, whenever that is, that when you do the analysis, you won't forget. But that's what I had in mind.

CHAIRMAN CORRADINI: So let me make sure I understand. So you're, let me summarize. The analysis done by NINA, there's not an issue. The ITAAC is there to record it in what fashion? So that any downstream analysis by the COL applicant is not forgotten?

MR. TAI: When you do the final analysis for the containment, based on the as-built, you will use the suppression pool level. The right --

CHAIRMAN CORRADINI: So the ITAAC is just a placeholder to remind everybody?

MR. TAI: That's correct.

CHAIRMAN CORRADINI: Okay.

MR. TAI: Which is not different than DCD ITAAC. Because DCD -- or that you had to do containment analysis to make sure as-built design is consistent.

MEMBER SCHULTZ: Using the as-built as finally designed.

CHAIRMAN CORRADINI: Okay. All right.

MS. BANERJEE: So your design of that thing up there --

MR. TAI: The access tunnel. That thing, yeah.

MS. BANERJEE: Tunnel.

MR. TAI: Conclusion. NINA and Toshiba decide, or conclude, that this one concerned assumption is not a reportable under Part 21, and we agreed. And like we mentioned earlier, because of this concerns that, you know, when you have this potential Part 21, or changes or imperfection, even there is no safety impact, I think it is our duty to make sure that you don't carry over that kind of a problem downstream.

So the ITAAC takes care of that in the third bullet. And because we are adding an ITAAC, or because they are adding an ITAAC and we accept that, we have to make some changes to capture that new item in the

FSAR, in the SER, I'm sorry.

The SER that I expect, that we're revising is part, Chapter Six and Chapter 3.8.4. Referring to the ITAAC is what we plan to do. The last bullet is not, has nothing to do with COL, because this issue is too, weighing very heavy on our mind, management especially.

So we have two applications from, one from GE, one from Toshiba for the renewal of the ABWR. That is in-house and we're probably starting the review sometime maybe next year or the year after.

CHAIRMAN CORRADINI: Say it again, I'm sorry? A bit slower.

MR. TAI: There is AWBR renewal projects.

CHAIRMAN CORRADINI: Oh.

MR. TAI: There are two new projects, one by Toshiba, one by GEH. And they are in-house already for --

CHAIRMAN CORRADINI: To renew the certification?

MR. TAI: To renew certification, which expired in, what, 2012? So we will, our tech staff is planning on asking them, what you do about this type of questions. I think for some of them, it's already done, but --

(Simultaneously Speaking)

MR. TAI: -- but it doesn't mistake an ABWR. That would fix it. And that's all the conversation I have. Any questions?

CHAIRMAN CORRADINI: Questions by the Committee? Okay. Let's do this. I think this would be the appropriate time -- thank you very much, Tom.

MR. TAI: Thank you.

CHAIRMAN CORRADINI: Okay? I think this is the appropriate time to take the public comments, because there are a couple people on the line.

MS. BANERJEE: Yeah, let me go check.

CHAIRMAN CORRADINI: Is there anybody in the audience that wanted to make a comment? They declined. So we'll turn on the -- to allow for, so if anybody's out there on the line, can you please at least acknowledge you're there so we know that the line is open?

(Simultaneously Speaking)

MALE PARTICIPANT: It's not open yet.

MEMBER BROWN: You can't hear any snap, crackle and pop noise, crispy sounds. That's a detailed electrical comment.

CHAIRMAN CORRADINI: Snap crackle and pop, Rice Krispies sounds.

MALE PARTICIPANT: It has nobody's name associated with it as a correlation. So therefore, you can't get full professorship.

CHAIRMAN CORRADINI: Folks are out there, wait a minute, I don't think we have a line open yet.

MS. BANERJEE: Someone is opening the line.

MALE PARTICIPANT: Okay, we hear something.

CHAIRMAN CORRADINI: There it is. Is anybody out there?

MR. SHARP: Hi, yes, this is Phil Sharp GE Hitachi, we heard the presentation there on the Part 21, and at least I have no public comments.

CHAIRMAN CORRADINI: Okay, thank you, Phil. Good to hear from you. Anybody else on the line?

MS. LIANGE: Jilly Liange, GE San Jose. I have no comments.

CHAIRMAN CORRADINI: Okay. Member of the public? Okay. Hearing nothing, that means we have nobody on the line from the public making a comment. We can close the line. And let me go around the room to the Committee members. We'll start with Ron.

MEMBER BALLINGER: Nothing.

CHAIRMAN CORRADINI: Any comments?

MEMBER BALLINGER: No, thank you.

CHAIRMAN CORRADINI: Charlie? Member Brown?

MEMBER BROWN: Nope. I've already exhausted my comments. I won't amplify it.

MEMBER BLEY: Nothing additional from me, thank you.

MEMBER STETKAR: Nothing more.

CHAIRMAN CORRADINI: Dr. Powers?

MEMBER POWERS: I support everything Charlie had to say.

MEMBER SCHULTZ: No further comment.

CHAIRMAN CORRADINI: Okay. Let me not comment about today. I just wanted to thank NINA and their support from Holtec about discussing Chapter Nine. And the very interesting open phase discussion for Chapter Eight supplement.

I wanted to remind the members that this is the second to the last Subcommittee meeting, which has spanned four and a half years of fun. And about 15 Subcommittee meetings, as far as my count has gone.

And so the last one, which will primarily deal with Fukushima issues and primarily mitigating strategies, which will be December the 3rd in the afternoon, is where we're going to wrap up anything, everything.

So I wanted to at least alert the members, we're trying to come up with an internal memo to remind everybody, since I know you have a crisp memory, but I don't, what occurred over the last four and a half years, and the things that will eventually roll into --

MEMBER POWERS: You are amazingly inefficient, aren't you?

CHAIRMAN CORRADINI: Thank you. That's on the record, too. So I wanted to summarize all the pieces of the puzzle, so to speak, so that when we come into the, when we have a final presentation to the full Committee, at least we all have the various issues that we will potentially raise or discuss in the final letter.

That, I'll try to have to the members prior to the December 3rd meeting, so at least you have it to read. Because I know you wanted something to read.

MEMBER BROWN: So December 3rd Subcommittee meeting?

CHAIRMAN CORRADINI: Subcommittee meeting, excuse me. December 3rd Subcommittee meeting. Okay? I really don't have anything else.

MEMBER SCHULTZ: I just have one comment, since you've announced their next meeting on December 3rd for NINA's benefit is that the Fukushima Subcommittee will be having a day and a half meeting, and our Subcommittee week in November on mitigating strategies.

CHAIRMAN CORRADINI: And thank you, because you've actually reminded me of something else. We had one question relative to NINA and how they did their seismic analysis, and the associated certainty. And there'll be a generic meeting on Monday, the 17th, in the afternoon. Morning? I can't remember.

MEMBER SCHULTZ: Morning, I believe.

CHAIRMAN CORRADINI: Morning, that will talk about the seismic uncertainty analysis, and I would encourage the folks that are of interest to attend that, so that we're all on the same page as to where we're going.

Because we had questions of the staff in terms of their uncertainty analysis that was much more generic, which could apply to the analysis that NINA has done. On top of the Thursday, Friday meeting you just mentioned, Steve.

MR. THOMAS: Right.

MEMBER BROWN: And the other Mondays, it's the open phase one, from one to five, B2B8-9, 8-9.

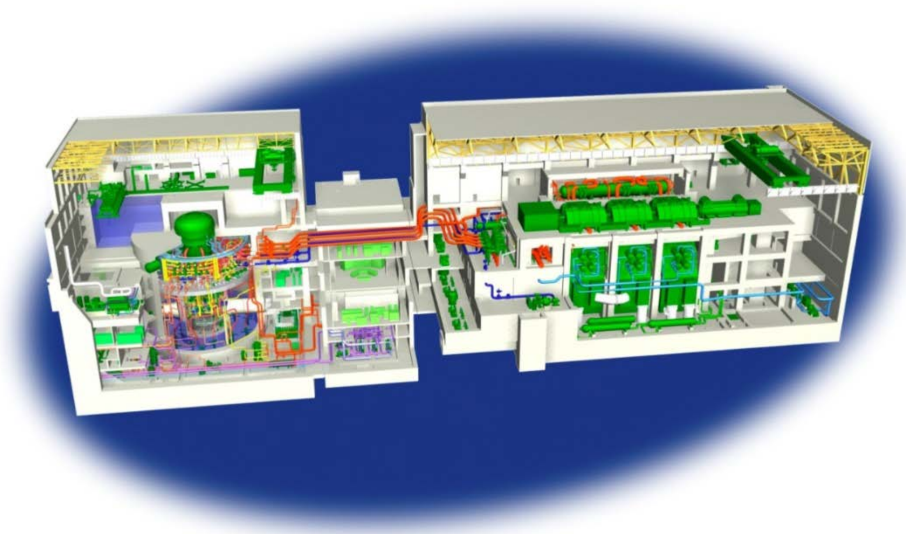
CHAIRMAN CORRADINI: Yeah, so it's just, it's a jammed full week of fun and stuff. Okay? Anything else? Otherwise, we'll adjourn, and thank you all very much.

(Whereupon, the above-entitled matter went off the record at 11:19 a.m.)

South Texas Project Units 3 & 4

Chapter 9, Sections 9.1.1 and 9.1.2

New Fuel and Spent Fuel Storage



Attendees

Scott Head	Manager, Regulatory Affairs, NINA
Steve Thomas	Manager, Engineering, NINA
Bill Mookhoek	Licensing Supervisor, NINA
Jim Agles	Licensing Engineer, NINA
Jim Tomkins	Licensing Engineer, NINA
Chuck Bullard	Holtec International
Bret Brickner	Holtec International
Tao He	Holtec International

Agenda

- Chapter 9 ACRS Status
- New Fuel Rack Departure
- Spent Fuel Rack Design and Analysis
- COL Items
- Conclusions

Chapter 9

- Today's presentation will cover Chapter 9, Subsections 9.1.1 and 9.1.2, New and Spent Fuel Storage
- ACRS Presentation on October 20, 2010, addressed the following:
  - Subsections:
    - 9.1.3, Fuel Pool Cooling and Cleanup
    - 9.1.4, Light Load Handling System (Related to Refueling)
    - 9.1.5, Overhead Heavy Load Handling Systems
  - Section 9.2, Water Systems
  - Section 9.3, Process Auxiliaries
  - Section 9.4, HVAC
  - Section 9.5, Other Auxiliary Systems

ABWR DCD requirement for New Fuel Storage Racks eliminated:

- Tier 1 Departure:
  STP DEP T 2.5-1:
  Elimination of New Fuel Storage Racks from New Fuel Vault
  - Completely eliminates new fuel storage racks and use of new fuel storage vault for fuel storage.
  - Following receipt inspection, new fuel will be stored in the spent fuel storage racks in the spent fuel pool.
  - Eliminates unnecessary fuel handling step.
  - COL Items for new fuel storage are met by the spent fuel racks.

Spent Fuel Rack Vendor: Holtec International

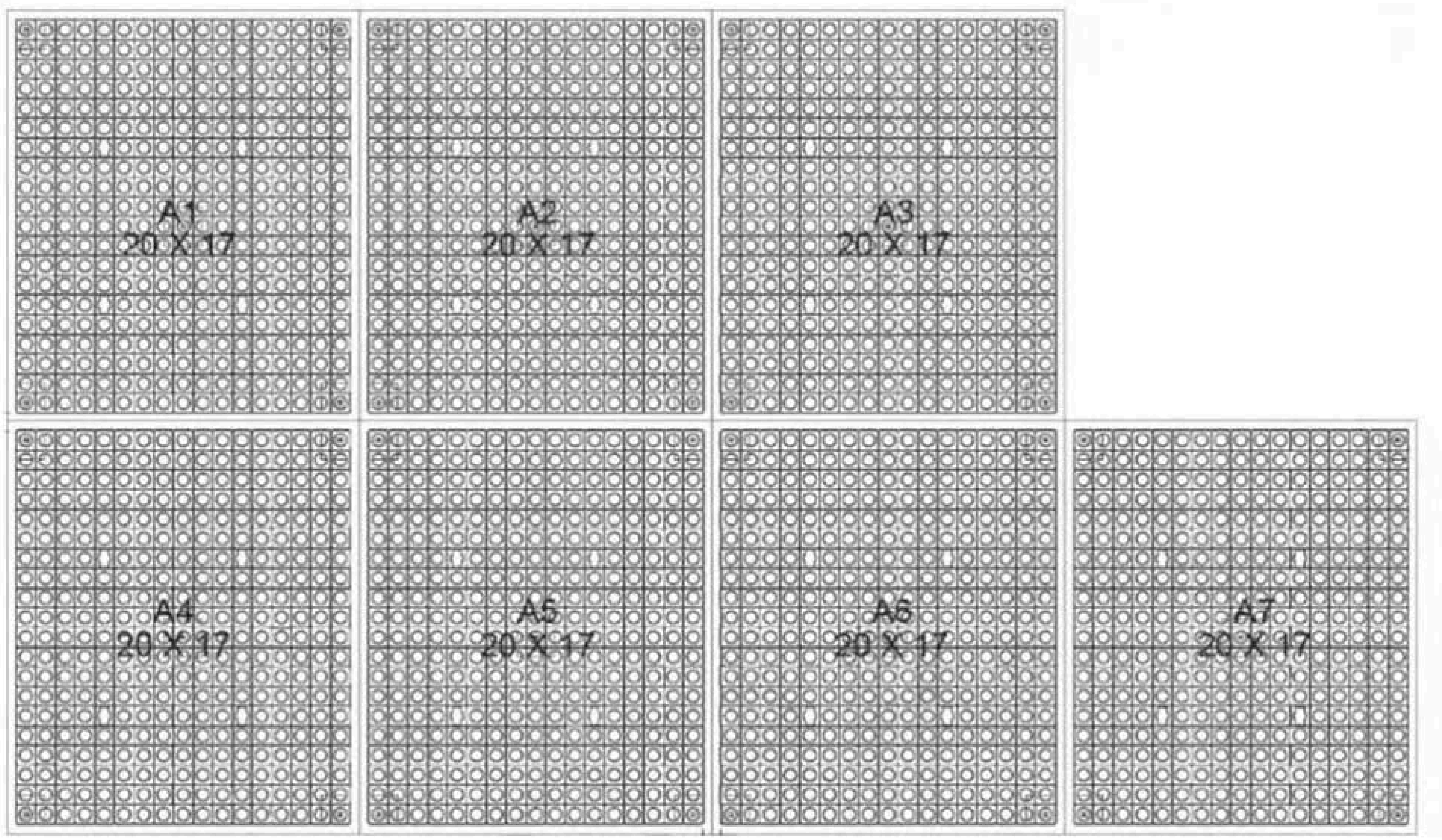
Responsible for SFR Design and Analysis

- Holtec International has been the primary vendor for SFR Design and Analysis during the last 15 years:
- SFR Projects recently completed by Holtec:
  - Palisades Plant (PWR, NRC Approval 2013)
  - US AP1000 Design Certification (PWR, NRC Approval 2012)
  - Beaver Valley Unit 2 (PWR, NRC Approval 2011)
  - Nine Mile Point Units 1 & 2 (BWR, NRC Approval 2007)
  - Cooper (BWR, NRC Approval 2007)
  - Clinton (BWR, NRC Approval 2007)

Spent Fuel Rack Design:

- New and spent fuel stored in the stainless steel-lined concrete spent fuel pool
- Seven (7) rack modules
  - Each module is 20 x 17 cells and has space for 340 cells
  - Total storage capacity is 2,380 fuel assemblies
  - More than 270 percent of the reactor core as required by DCD
- Rack modules are freestanding
- Each storage cell includes neutron absorbing material Metamic™ (B_4C)
  - Metamic™ enclosed in stainless steel sheathing, which holds a single Metamic™ panel
  - Surveillance of sample coupons for 60 year life of plant

Spent Fuel Rack Layout:



Spent Fuel Rack Analysis:

Holtec Report No. HI-2135462:

“Licensing Report for South Texas Project Units 3 and 4 ABWR Spent Fuel Racks,” Rev 2

HI-2135462 incorporated by Reference into STP 3 & 4 FSAR:

Satisfies COL Items for New and Spent Fuel:

- Criticality Safety Evaluation (COL Items 9.1 and 9.3)
- Thermal-Hydraulic Evaluation (COL Item 9.8)
- Structural/Seismic Evaluation (COL Items 9.2 and 9.7)
- Mechanical Accident Evaluation (COL Item 9.4)

Conclusions

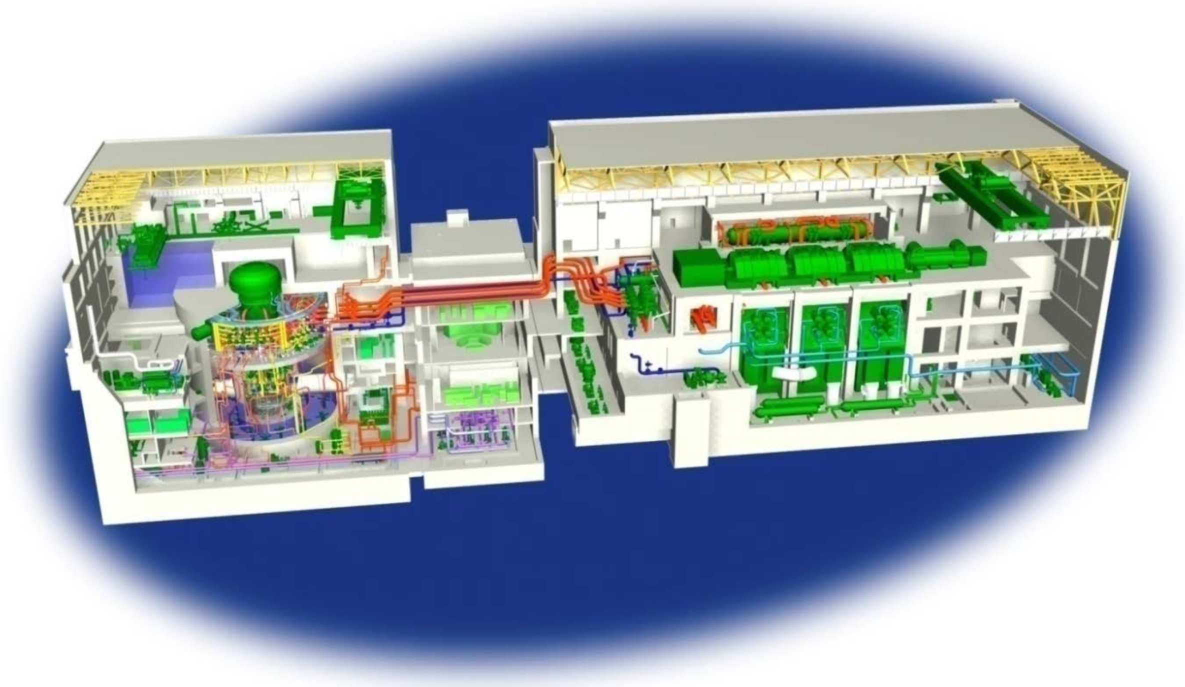
- New Fuel Storage Racks Eliminated from Design
- New fuel will be stored in Spent Fuel Racks
- Spent Fuel Racks meet all NRC requirements for new and spent fuel
- All COL Items addressed

Chapter 9, Section 9.1: Fuel Storage Handling

Questions and Comments

South Texas Project Units 3 & 4

Response to NRC Bulletin 2012-01



Attendees

- Scott Head, Regulatory Affairs Manager, NINA
- Steve Thomas, Engineering Manager, NINA
- Bill Mookhoek, Licensing Supervisor, NINA
- Jim Tomkins, Licensing, NINA
- Evans Heacock, Electrical Engineering, NINA

Agenda

- Background
- STP 3&4 Electrical System
- STP 3&4 Open Phase Solution
- Open Phase Detection
- Open Phase Protection
- COLA Changes
- Conclusions

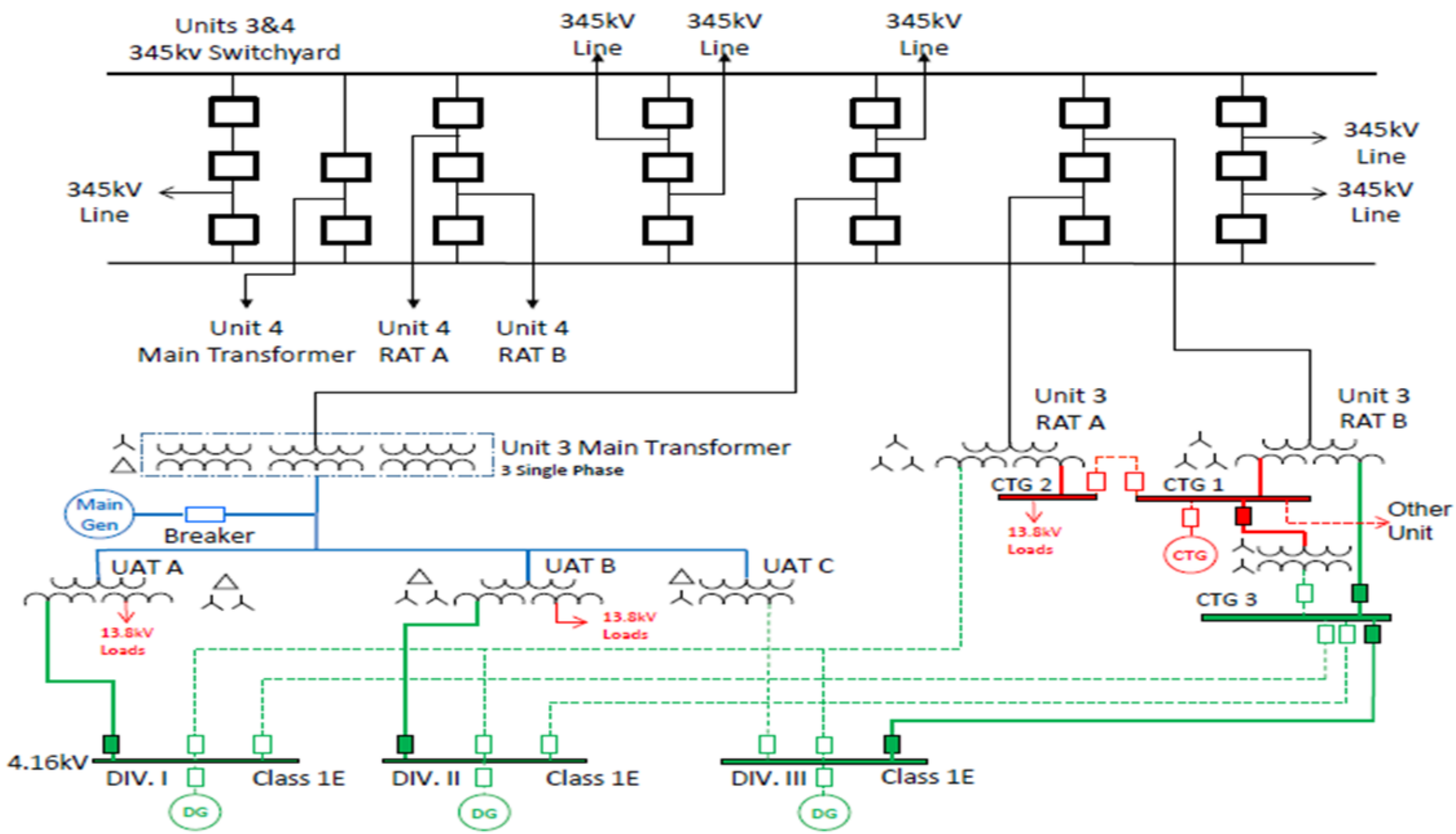
Background

- Bulletin issued July 27, 2012 as a result of event at Byron 2
- Open phase events since 2001 at South Texas 2, Beaver Valley 1, James Fitzpatrick, Nine-Mile Point 1, and a two-phase event at Forsmark
- Industry response
- STP 3&4 approach includes:
  - Detection
  - Control Room Alarm
  - Automatic response to the open phase event
  - Technical Specifications

Byron Open Phase Event

- Offsite power supply circuits were rendered inoperable by single-phase open circuit that was undetected by surveillances
- Design of electric power system did not take into account possibility of loss of a single phase between the transmission network and the onsite power distribution system

STP 3&4 Electrical System



Important Aspects of STP 3&4 Design Relative to an Open Phase Condition

- Three separate offsite connections - Main Power Transformer (MPT) and two Reserve Auxiliary Transformers (RAT) for each unit
- No automatic bus transfer schemes
- Each unit has a Combustion Turbine Generator (CTG)
- Can cross-tie to other unit

STP 3&4 Licensing Approach for Open Phase Condition

1. Detection of Open Phase (and Control Room Alarm) on the high-voltage side of MPT, RAT-A, and RAT-B
   - Inspections, Tests, Analyses and Acceptance Criteria (ITAAC) for Open Phase Detection and Alarm
2. Protection of Class 1E 4.16 kV busses with Negative Sequence Voltage Relays
   - Actuation opens bus supply breakers
   - Undervoltage (UV) relays actuate causing Emergency Diesel Generator (EDG) start and pick up of load
   - Negative Sequence Voltage Relays are added to Technical Specifications (TS)

Open Phase Detection and Alarm

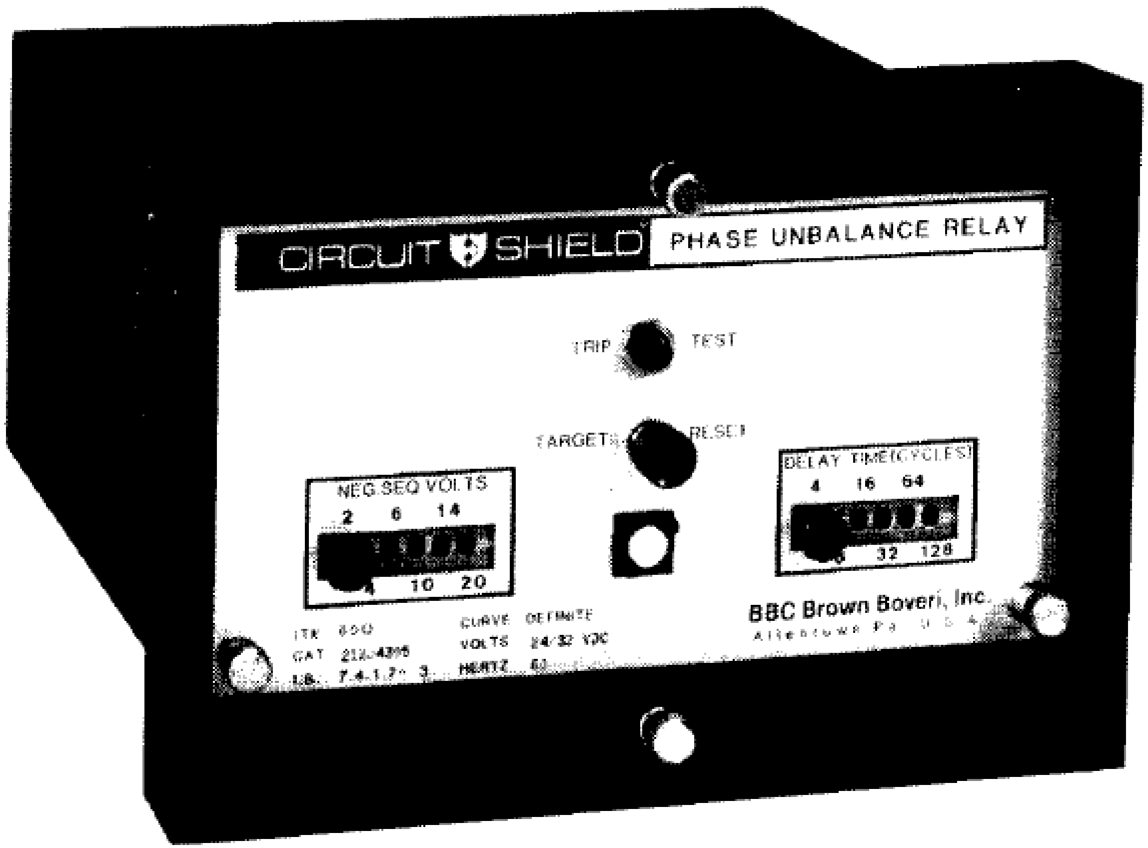
- Detection on the high-voltage side of the MPT and both RATs
- Alarm in Main Control Room
- Procedures will direct the operator response

Open Phase Protection

- Class 1E Negative Sequence Voltage Relays provide protection for the three Class 1E 4.16 kV busses
- Designed to protect motors from overheating due to unbalanced voltage and current
- Relays monitor negative sequence voltage for each phase
  - 3 relays for each bus
  - 2 out of 3 logic

Open Phase Protection *(continued)*

Negative Sequence Voltage Relay



Open Phase Protection *(continued)*

- Design Negative sequence voltage of 5.0%
  - Value at which motors can operate continuously with no adverse consequences
- Design time delay of 3.0 seconds
  - Ensures that relays do not actuate as a result of normal system transients
- Final setpoint and time delay values will be in accordance with Setpoint Control Program
  - Current nominal setpoint values are 4.5% and 2.5 seconds

COLA Changes

- Open Phase Detection and Alarm added to FSAR Section 8.2 (Offsite Power Systems)
- Negative Sequence Voltage Relays added to FSAR Section 8.3 (Onsite Power Systems)
- Negative Sequence Voltage Relays added to TS 3.3.1.4, ESF Actuation Instrumentation
  - Same surveillances as UV and Degraded Voltage Relays
- Site-specific ITAAC for the Open Phase Detection and Alarm
- No other changes to COLA

Conclusions

- Addition of open phase detection/alarm and Class 1E 4.16 kV protection enhance an already robust design
- ITAAC will ensure the open phase detection and alarm meet design requirements
- TS surveillances will ensure negative sequence relays remain reliable for their protective function

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Protecting People and the Environment

Presentation to the ACRS Subcommittee

South Texas Units 3 and 4 COL Application Review

SER Phase 4 Chapter 9 “Auxiliary Systems”

November 5, 2014

Staff Review Team

- **Technical Staff**
  - Diego Saenz, SRSB (Presenter)
  - Ata Istar, SEB2 (Presenter)
  - Samir Chakrabarti, SEB2 (Lead)
  - Huan Li, SEB2
  - Eduardo Sastre, MCB
  - Andrew Yeshnik, MCB
  - Raul Hernández, SPSB
  - Richard Morante (Consultant, BNL)

- **Project Management**
  - Tom Tai, Lead PM
  - Luis Betancourt, Chapter PM

Background

- ACRS presentation on October 20, 2010:
  - Phase 2: All Chapter 9 except Sections 9.1.1 and 9.1.2, New and Spent Fuel Storage.
  - Confirmatory Items / Open Items.
- Today's presentation is focused on Sections 9.1.1 and 9.1.2, New and Spent Fuel Storage.

Staff's Phase 2 Review

SRP Section		Number of Open Items or Confirmatory Items	Status
9.1	Fuel Storage and Handling	3 CI 1 OI	All Confirmed and Closed Closed
9.2	Water Systems	16 CI	All Confirmed and Closed
9.3	Process Auxiliaries	3 CI	All Confirmed and Closed
9.4	Air Conditioning, Heating, Cooling, and Ventilation Systems	1 OI	Closed
9.5	Other Auxiliary Systems	10 CI 1 OI	All Confirmed and Closed Closed
Totals		32 CI 3 OI	All Confirmed and Closed All Closed

Chapter 9 Sections with Significant Revisions Since Phase 2

- Added evaluation of Sections 9.1.1 and 9.1.2.
- Most of the revisions in Chapter 9 were:
  - To document the closure of the open items.
  - To document the closure of the confirmatory items.
  - To address OGC comments.

Technical Topic of Interest: Subsection 9.1.1 – New Fuel Storage

Tier 1 Departure

- STP DEP T 2.5-1: Elimination of New Fuel Storage Racks from New Fuel Vault.
  - This departure eliminates the new fuel storage racks from the new fuel vault, and specifies that new fuel will be stored in the spent fuel storage pool.
  - ABWR DCD requires the COL applicant to satisfy COL Information Items 9.1, 9.2, and 9.5 for the design of new fuel storage.
- Staff's Finding:
  - COL Item 9.5 is satisfied (Section 9.1.1).
  - Other COL items are addressed by SFRs (Section 9.1.2).

Technical Topic of Interest:
Sections 9.1.1 and 9.1.2 – New and Spent Fuel Storage

- Holtec Report No. HI-2135462, "Licensing Report for South Texas Project Units 3 and 4 ABWR Spent Fuel Racks," provides design details of the fuel racks including criticality, thermal-hydraulic, seismic, and mechanical accident evaluations.

COL Items

- COL Items 9.1 and 9.3 – Criticality Evaluation
- COL Items 9.2 and 9.7 – Structural/Seismic Evaluation
- COL Item 9.4 – Mechanical Accident Evaluation
- COL Item 9.5 – New Fuel Inspection Stand Seismic Capability Evaluation
- COL Item 9.8 – Thermal-Hydraulic Evaluation

Structural/Seismic Review:
COL Information Items 9.2, 9.4, and 9.7

Background and Review Scope

- Holtec Report No. HI-2135462, “Licensing Report for South Texas Project Units 3 and 4 ABWR Spent Fuel Racks,” provides structural design information for spent fuel racks including seismic/structural analysis (COL Items 9.2 and 9.7) and mechanical accident evaluation (COL Item 9.4).

Staff review focused on:

- Seismic/Structural analysis and design of racks including methodology and assumptions used.
- Evaluation of racks for mechanical accidents.

Structural/Seismic Review:
COL Information Items 9.2, 9.4, and 9.7

<u>Applicable Regulations/Guidance</u>

- 10 CFR Part 50, Appendix A, GDC 2, “Design bases for protection against natural phenomena.”
- NUREG-0800 (SRP 3.8.4, Appendix D, “Guidance on Spent Fuel Pool Racks”).

Structural/Seismic Review:
COL Information Items 9.2, 9.4, and 9.7

Highlights of Staff Review

- The staff reviewed Sections 1, 2, 3, 6, and 7 of the Holtec report providing details of structural analysis/design and mechanical accident evaluation of the racks.
- Staff issued 34 RAIs.
- Interaction with the applicant included 3 on-site audits and weekly public conference calls over a six-month period.
- Staff identified several issues pertaining to analysis and design, which were subsequently resolved.

Structural/Seismic Review:
COL Information Items 9.2, 9.4, and 9.7

Major Structural Review Issues:

- Modeling of Fuel Assembly
- Rack-to-Rack Impact Load Estimation
- Calculation of Shear Stress Factors for the Rack
- Buckling Evaluation of fuel rack structure
- Sizing of Bearing Pads to Accommodate Rack Loads and Displacements
- Analysis Methodology for Mechanical Accidents
- Postulation of Drop Scenarios

Structural/Seismic Review:
COL Information Items 9.2, 9.4, and 9.7

Summary

- Staff reviewed structural analysis and design of STP spent fuel storage racks, and concludes that information provided by the applicant is adequate and acceptable for determination of structural adequacy of fuel storage racks in accordance with NRC regulations and guidance in SRP 3.8.4, Appendix D, of NUREG-0800.

Criticality Review:
COL Information Items 9.1 and 9.3

Requirements for Criticality

- 50.68(b)(4) regulatory requirement of $K_{eff} \leq$ 0.95 at 95/95.
- TS 4.3.1.1 requirement of $K_{\infty} \leq 1.35$ in SCCG
- Administrative requirements:
  - Fresh fuel without Gd has an upper limit of 2.95% on U-235 enrichment.
  - Fresh fuel with Gd has a U-235 enrichment limit of 5.0% and a lattice design limit on the number of Gd rods, the Gd rod locations, and the Gd rod loading.

Criticality Review:
COL Information Items 9.1 and 9.3

Overview of Design

- No New Fuel Racks, only SFRs.
- Seven 17 x 20 storage racks.
- New and spent fuel can be stored in any SFR location.
- Fuel lattice requirements are such that even fuel with Gd is most reactive fresh.
- Metamic® is used as fixed neutron absorber material.

Criticality Review:
COL Information Items 9.1 and 9.3

Summary

- The staff find that the STP SFR design. protects against criticality with the use of geometrically safe configurations given:
  - Appropriate analysis methodology was used.
  - Appropriate abnormal conditions were analyzed.
  - Margin exists between the regulatory limit and the maximum calculated $K_{eff.}$

Conclusions

- No open technical issues in Chapter 9 review.
- Tier 1 Departure – STP DEP T 2.5-1:
  - COL Items addressed by SFRs (Subsection 9.1.2).
  - Meets all applicable regulations.
- Revision 11 of the FSAR received on 10/21/2014.
- One confirmatory item to finalize the staff’s review of SFRs:
  - FSAR updates on subsections 9.1.2.1.4 and 9.1.6.8.

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Acronyms

- ACRS – Advisory Committee on Reactor Safeguards
- COL – Combined License
- CI – Confirmatory Item
- CFR – Code of Federal Regulations
- COLA – Combined License Application
- DCD – Design Control Document
- DEP – Departure
- FSAR – Final Safety Analysis Report
- Gd – Gadolinium
- GDC – General Design Criteria
- HVAC – Heating, Ventilation, Air Condition
- MCB – Materials and Chemical Branch
- NRC – United States Nuclear Regulatory Commission
- OGC – Office of General Counsel
- OI – Open Item
- PM – Project Manager
- RAI – Request for Additional Information
- SEB2 – Structural Engineering Branch 2
- SER – Safety Evaluation Report
- SFR – Spent Fuel Racks
- SRSB – Reactor Systems, Nuclear Performance & Code Review Branch
- SRP – Standard Review Plan
- SPSB – Plant Systems Branch
- STP – South Texas Project
- TS – Technical Specifications

Backup Slides

Fuel Assembly Lattices

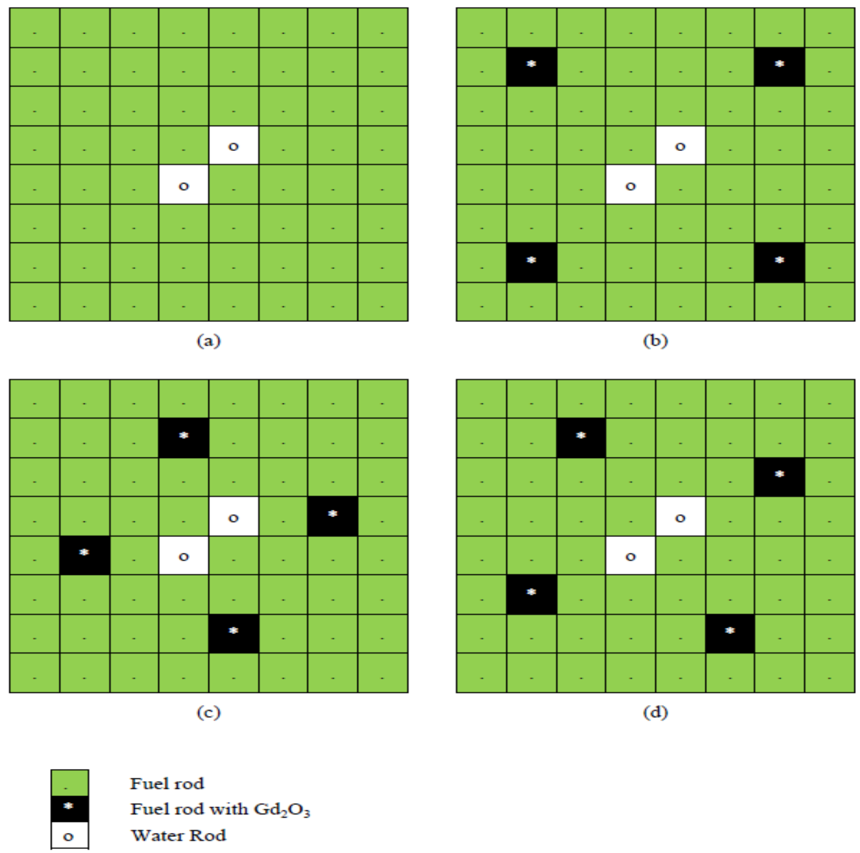

Figure 4.5.1
Fuel Assembly Lattices
(a) Lattice 0; (b) Lattice 4a (4.0 wt% Gd_2O_3); (c) Lattice 4n (8.0 wt% Gd_2O_3);
(d) Lattice 4o (7.75 wt% Gd_2O_3)

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Presentation to the ACRS Subcommittee

South Texas Project, Units 3 and 4

Section 8.2S and amended Chapter 16

NRC Bulletin 2012-01: Design Vulnerability in Electric Power System

November 5, 2014

Staff Review Team

- **Technical Staff**
  - Sheila Ray, NRR/DE/EEEB
  - Tania Martinez-Navedo, NRR/DE/EEEB
  - Craig Harbuck, NRO/DSRA/SPSB
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- **Project Management**
  - Luis Betancourt, Chapter PM, NRO/DNRL/LB2
  - Tom Tai, Lead PM, NRO/DNRL/LB2

Byron Open Phase Event

- Occurred January 30, 2012, at Byron Unit 2.
- Not immediately detected.
- Both offsite and onsite electrical power systems were not able to perform their intended safety function.
- Manual actions were necessary to restore ESF safety functions.
- Presented a potential common cause failure event.
- Therefore, needed to be addressed across the entire reactor fleet.

NRC Staff Actions

- Special Inspection at Byron [ML12087A213]
- Information Notice 2012-03 [ML120480170]
- Bulletin 2012-01 [ML12074A115]
- Summary Report including recommended actions [ML13052A711]
- NEI provided NSIAC approved industry initiative to address open phase conditions (Oct 2013) [ML13333A147]
- Staff issued RAI 08.02-25 and 08.02-26 to STP COL applicant

Staff Position for Active Plants

- Automatic detection of single/double loss of phase events with/without a high impedance fault across all operating modes of the plant.
- Alarm in the control room.
- Automatic mitigation/response to the open phase event.
- Training of plant personnel (operations, maintenance) and provide procedures.

STP 3 & 4 – Design Solution

- Staff Position:
  - Automatic detection of single/double loss of phase events with/without a high impedance fault across all operating modes of the plant.
  - Alarm in the control room.
- STP Units 3 and 4:
  - Automatic detection of open phase and ground faults on high-voltage side of MPT, RAT-A, RAT-B (all three phases of each transformer).
  - Alarm in Control Room.

Staff Evaluation

- Detection to be located on the high voltage side of the transformer(s) that feed offsite power into the plant's electrical distribution system.
  – Given the challenges of identifying and taking sufficient measures of an open phase condition, the staff's position is that detection must occur on the high voltage side of the credited offsite power circuit (i.e. at the source).
- The STP Units 3 and 4, detection and alarm scheme provides indication of the open phase condition under all loading and operating configurations.
- The staff finds this acceptable.

STP 3 & 4 – Design Solution

- Staff Position:
  - Automatic mitigation/response to the open phase event.
  - Protective devices should automatically initiate the disconnection of the offsite power sources whenever the setpoints and time delay limits have been exceeded.
- STP Units 3 and 4:
  - Protection of Class 1E 4.16 kV busses with negative sequence voltage relays.
    - Actuation open supply breakers, UV relays actuate to start EDG and pick up load.

Staff Evaluation

- The staff finds the mitigation scheme acceptable since the negative sequence relay setpoints can identify open phase circuit conditions and actuate to protect the loads on the Class 1E buses, as shown in simulations and analyses.

STP 3 & 4 – Design Solution

- Staff Position:
  - Training of plant personnel (operations, maintenance) and provide procedures.
- STP Units 3 and 4:
  - Training, as well as, maintenance and testing procedures associated with the monitoring system will be developed in accordance with FSAR Subsections 13.2 and 13.5.

Staff Evaluation

- Training will be developed for the operation and maintenance of the monitoring system to detect an offsite power system open phase circuit condition.
- Furthermore, maintenance and testing procedures will be developed and include calibration and troubleshooting procedures to ensure the monitoring system functions as expected.
- The staff finds this acceptable.

Confirmatory Items

- FSAR updates on:
  - Section 8.2.1.24: Open phase detection and alarm,
  - Section 8.3.1, 8.3.1.1.6.3, and 8.3.1.1.7: Negative sequence relays
  - Section 16.4.6.4: TS SRs
- TS SRs (PTS 3.3.1.4) on negative sequence relays
- Site specific ITAAC in Table 3.0-29, Part 9, Section 3.0 to verify detection and alarm components are installed as designed

Summary

- NRC staff has required the new reactor design plants to address the vulnerability identified in Bulletin 2012-01.
- STP Units 3 and 4, has provided information on a scheme to detect, alarm, and automatically respond to a single-phase open circuit condition on credited offsite power circuits.
- NRC staff finds this issue acceptably resolved.

Questions

Acronyms

- COL – Combined Operating License
- EDG – Emergency Diesel Generator
- ESF – Engineered Safety Feature
- FSAR – Final Safety Analysis Report
- ITAAC – Inspections, Tests, Analyses, and Acceptance Criteria
- kV – kilovolt
- MPT – Main Power Transformer
- NEI – Nuclear Energy Institute
- NSIAC – Nuclear Strategic Issues Advisory Committee
- PTS – Plant-Specific Technical Specifications
- RAI – Request for Additional Information
- RAT – Reserve Auxiliary Transformer
- SR – Surveillance Requirement
- STP – South Texas Project
- TS – Technical Specifications
- UV - undervoltage

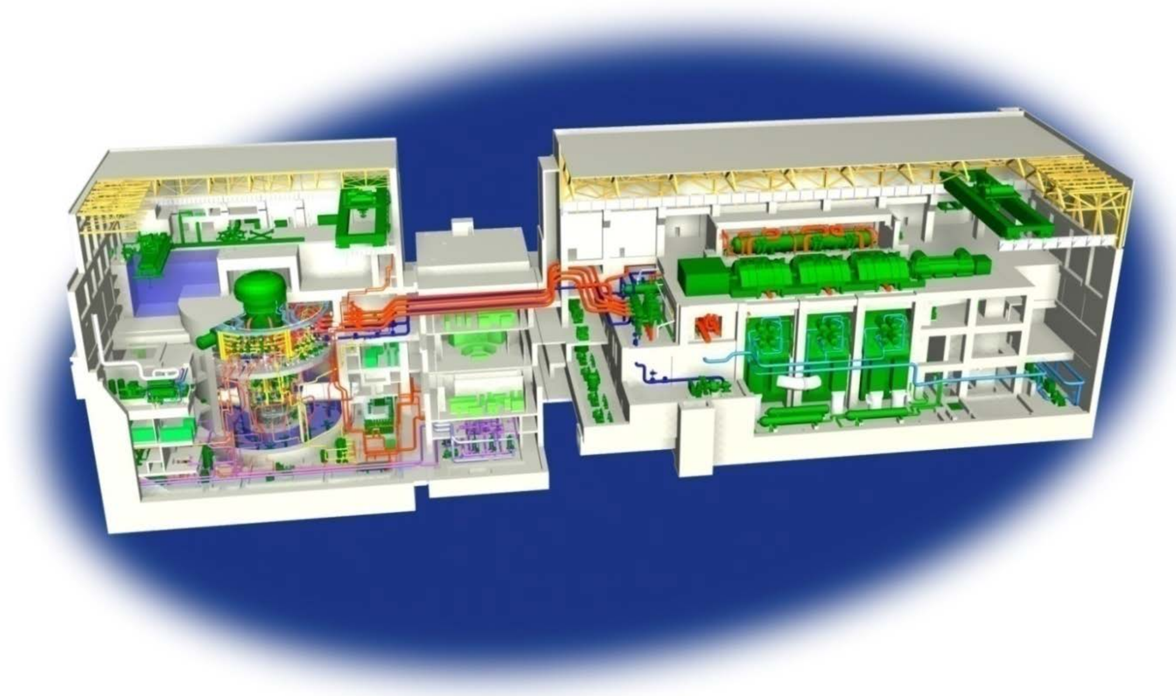
Back-up Slides

Staff Position for Passive Plants

- Detection of single/double loss of phase events with/without a high impedance fault across all operating modes of the plant
- Alarm in the control room
- Training of plant personnel (operations, maintenance) and provide procedures

South Texas Project Units 3 & 4

ABWR Suppression Pool Water Level Assumption Issue



Licensing Background

- On 3/31/2014, GEH identified a potential Part 21 associated with an assumption used to calculate ABWR hydrodynamic loads
- Suppression Pool (S/P) level used for development of hydrodynamic loads
  - Technical Specifications (TS) High S/P Level
  - S/P TS high level could be exceeded for Feedwater Line Break Large Break LOCA
- Access tunnel is internal structure most likely to be impacted
- Final GEH report concluded no substantial safety hazard, no impact on the TS, and not reportable

Technical Background

- During a LOCA, the S/P is subjected to the following hydrodynamic loads in addition to other loads:
  - Pool Swell
  - Condensation Oscillation
  - Chugging
- These hydrodynamic loads can impact the S/P walls and submerged structures in the S/P
- Higher S/P level increases the extent of hydrodynamic pressure loads on the S/P walls and submerged structures

NINA Actions

- After GEH initial report, Toshiba evaluated the impact of this assumption for STP 3&4
- Toshiba performed a conservative analysis that concluded:
  - S/P level increase is about 1 meter above TS high value for the FWLB LOCA
  - For the most limiting load combination, no significant effect on the containment structure (<1%)

NINA Actions *(continued)*

- Access Tunnel
  - Not analyzed in the DCD
  - Will be designed later as part of detailed design
  - Evaluation of Japanese ABWR access tunnels determined load increase is small (<1%)

NINA Actions *(continued)*

- NINA submitted a letter to NRC in early September concluding this is not a significant safety issue
- NRC audited the Toshiba evaluation in September
- A site-specific ITAAC was developed to ensure that the as-built design of the S/P submerged structures and S/P walls consider the effects of suppression pool water level increase

Conclusions

- NINA determined this is not a significant safety issue
- NINA results are consistent with GEH evaluation

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Presentation to the ACRS Subcommittee

South Texas Project Units 3 and 4
Hydrodynamic Loads
Interim Part 21 Evaluation

November 5, 2014

Staff Review Team

- Technical Staff
  - Hanry Wagage (NRO/SRSB/SCVB)
  - Samir Chakrabarti (NRO/DE/SEB2)
  - Huan Li (NRO/DE/SEB2)

- Project Manager
  - Tom Tai (NRO/DNRL/LB2)

Background

- GEH's Interim Part 21 Evaluation
  - On March 31, 2014, GEH submitted a 60-Day interim report notification on an analysis in the ABWR design
    - A potential increase in hydrodynamic loads on containment structures during a postulated LOCA
      - ABWR hydrodynamic load analysis used SP HWL in TS as initial condition
      - Should consider suppression pool level with RPV depressurization during a postulated LOCA
  - On August 29, 2014, GEH submitted final evaluation results concluding there is no significant safety hazard and no exceedance on TS Safety Limit, thus not reportable
  - On September 15, 2014, NINA submitted STP's evaluation with the same conclusion as GEH's

Stakeholders

- GEH – Original ABWR Design Certification applicant. Revision 4 of the ABWR Design Control Document (DCD) was certified by the NRC in 1997.
- NINA – STP Units 3 and 4 COL applicant.
- Toshiba – Part of the EPC consortium supporting the design and construction of STP Units 3 and 4.
- NRC – Currently reviewing the STP Units 3 and 4 COL application.

Staff Review

- Engaged weekly telephone conference for update and assessed potential impact on completed review and ongoing review
- Held public meeting on September 9, 2014, to discuss preliminary assessment by NINA/Toshiba on this issue
- Audited NINA/Toshiba's evaluation on September 19, 2014
- Several audit observations on clarity and quality but no audit finding
- Agreed to a site-specific ITAAC (in parallel to DCD ITAAC in Table 2.14.1, Item 14) to ensure the proper SP water level is used in detailed analysis

Conclusions

- NINA/Toshiba finds the non-conservative initial condition in the ABWR analysis does not result in a significant safety issue and is not reportable under Part 21 and the staff agrees
- Appropriate input data will be used to predict the STP hydrodynamic loads even though there was no safety impact
- Proposed site-specific ITAAC will ensure that the containment walls and submerged structures can withstand the design basis loads considering the effects of a higher SP water level on the hydrodynamic loads during a postulated LBLOCA
- The appropriate section(s) in the STP safety evaluation report will be revised to document the addition of this site-specific ITAAC
- GEH and Toshiba renewal projects will take necessary actions to address this issue