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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

547th MEETING

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THURSDAY,

NOVEMBER 1, 2007

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ROCKVILLE, MARYLAND

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The Advisory Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., William J. Shack, Chairman, presiding.

MEMBERS PRESENT:

WILLIAM J. SHACK	Chairman
MARIO V. BONACA	Vice Chairman
SAID ABDEL-KHALIK	Member-At-Large
GEORGE E. APOSTOLAKIS	Member
J. SAM ARMIJO	Member
SANJOY BANERJEE	Member
DENNIS BLEY	Member
MICHAEL CORRADINI	Member

OTTO L. MAYNARD Member

MEMBERS PRESENT: (cont'd)

DANA A. POWERS Member

JOHN D. SIEBER Member

JOHN W. STETKAR Member

CONSULTANTS TO THE ACRS PRESENT:

GRAHAM B. WALLIS

NRC STAFF PRESENT:

RICH GUZMAN

KAMAL MANOLY

TOM SCARBROUGH

PETER LIEN

DIANE JACKSON

RICHARD LOBEL

DAVE MATTHEWS

CHRISTIAN ARAGUAS

ROWAL TAMARA

NILLICH CHOKSHI

GERRY STIREWALT

YONG LI

LAUREL BAUER

CLIFF MUNSON

TOM SMITH

GOUTAM BAGCHI

NRC STAFF PRESENT: (cont'd)

BRAD HARVEY

JOE HOPE

ALSO PRESENT:

RICHARD PAGODIN

JOHN BARTOS

ENRICO BETTI

DAN PROPONI

MICHAEL CROWTHERS

KEVIN BROWNING

CHARLES PIERCE

DON MOORE

TOM McCALLUM

JERRY DAVIS

RUSSELL BELL

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

(8:30 a.m.)

CHAIRMAN SHACK: The meeting will now come to order.

This is the first day of the 547th meeting of the Advisory Committee on Reactor Safeguards. During today's meeting, the Committee will consider extended power uprate for the Susquehanna Nuclear Power Plant, Vogtle early site permit application, NRC staff's implementation of the lessons learned from the review of ESP applications, assessment of the robustness of new nuclear plants, and preparation of ACRS reports.

The meeting with Commissioner Lyons, scheduled between 10:45 and 11:45, has been postponed to a future meeting due to his unavailability.

A portion of this meeting will be closed to discuss proprietary information applicable to the Susquehanna power uprate. Also, the session dealing with the assessment of the robustness of new nuclear plants will be completely closed to discuss safeguards and security information.

The meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Mr. Sam Duraiswamy is the Designated Federal Official for the initial portion of the meeting.

We have received no written comments or requests for time to make oral statements from members of the public regarding today's session. A transcript of portions of the meeting is being kept, and it is requested that the speakers use one of the microphones, identify themselves, and speak with sufficient clarity and volume, so they can be readily heard.

There are feedback forms at the back of the room for anybody who would like to provide us with his or her comments about this meeting.

Our first item this morning is the extended power uprate for the Susquehanna Nuclear Power Plant, and Sanjoy Banerjee will be leading us through that. Sanjoy?

MEMBER BANERJEE: Okay. So let me provide a little background. We had a meeting on October 9th and 10th of the Subcommittee to hear the presentations of the staff, the licensee, and AREVA. And in these presentations, the subjects that were discussed included fuel-dependent plant response, the applicability of AREVA methodology, containment overpressure, operator training and procedure, human performance, steam dryer integrity evaluations, and power ascension.

In our assessment of the staff SER, and the content of the licensee's power uprate safety analysis report, the PUSAR, there were several requests for additional information, and the specific topics presented at the meeting. The Subcommittee members identified a number of topics that require additional justification and supporting data.

Some of these topics are: validation of the AREVA neutronic methods, benchmarking data supporting the void fraction correlations, thermal mechanical plant response, and of the fuel in particular, impact of bypass voiding, ATWS instability, reconciliation of some confirmatory ECCS-LOCA results and the licensee's calculations, and steam dryer integrity analysis and its methodology.

The Power Uprates Subcommittee will meet again on November 14th, so the story isn't closed yet. We will hear some part of the story here.

And during that meeting the licensee will mainly focus on open topics related to the AREVA methods. This is a core which is going to have AREVA ATRUM-10 fuel, and that has some particular features related to it which is different from the GE-14 fuel that we have handled in other power uprates.

So related to that, the AREVA methodology which is being used to analyze the behavior of the fuel and other aspects of the uprate will again be revisited because there were some items that remained open at the last Subcommittee meeting.

So today we will focus on only some parts of this. One of the most important parts will be the steam dryer, and the various aspects related to that. And less important, but nonetheless relatively straightforward aspect, requires the reconciliation of some ECCS-LOCA calculations that were done by the staff with that -- by the licensee. I don't see a major problem there, but we should hear about that in any case.

It also is unique that Susquehanna does not require containment overpressure credit. So if time permits, the Committee will hear why this hackneyed state of affairs comes about.

Okay. So what we really expect is the staff will give us a revised SE with regard to some of the items, particularly the AREVA methodology, in time for the November 14th meeting. Not just the AREVA methodology, but its applications as well to this EPU.

And we will review it, and there will be a Subcommittee meeting on the 14th, and we will come back to the full Committee, then, in the December meeting with a real recommendation as to what to do. And we hope that we can then write a letter in the December meeting and not in this meeting, which will deal with all of the topics.

So I think with that, I will turn this over to PPL I guess, to give us an overview. And we are going to mainly deal with steam dryer, ECCS-LOCA, and power ascension testing and containment overpressure today. And we will come back and deal with the other topics in the December full Committee meeting. Okay?

As Bill said, some portions of the meeting will be closed. So when we need to close the meeting, we will just close it.

MR. PAGODIN: Good morning, Mr. Chairman, members of the Committee. My name is Rick Pagodin, and I am the General Manager of Nuclear Engineering for PPL Susquehanna. I am very pleased to be here this morning, and I am happy that you are here to hear our presentation. I think it is fortunate for us that one of the first things you are going to hear about is our steam dryer replacement.

This was a decision that did not come lightly for us. I am sure you understand this is a very large project, a very expensive project for us. Our basis for making the decision to replace the dryer was very technical in nature. We did everything we could to analyze the existing dryers, and the bottom line is that we determined they were not sufficient for our extended power uprate application.

We have new dryers that are being assembled right now. They are scheduled for delivery -- the first one is being scheduled for delivery later on this year, and we will be installing that in our spring outage in 2008.

I would like to say that in putting in those new dryers we recognize that we are establishing significant margins, and those dryers -- I think it's indicative of the work that our staff has done. I'm very proud of the PPL men and women on our team that have put their time and efforts into making sure that we do the right things in every aspect of this project, including the replacement of the steam dryers.

So with that, I want to give you just a brief overview of PPL Susquehanna, and then we'll turn right into the dryer presentation.

Susquehanna consists of two BWR-4s currently related at 3,489 megawatts-thermal each, and we produce about 1,200 megawatts-electric. We have a max core flow rate of 108 million pounds per hour. Susquehanna is a Mark 2 containment design with a suppression pool, and we have been in commercial operation since 1983 for Unit 1 and 1985 for Unit 2.

We have done two previous uprates. The first was a four and a half percent stretch uprate, and that's at the same time when we upgraded our core flow to the 108 million pounds per hour. We have also implemented a 1.4 percent measurement uncertainty recapture uprate in 2001.

MEMBER CORRADINI: Can you just remind me what that is? Is that --

MR. PAGODIN: Yes.

MEMBER CORRADINI: -- a recalibration of flows?

MR. PAGODIN: It's basically installation of a different type of flow measurement system with increased accuracy. It allows us to reduce the measurement uncertainty.

MEMBER CORRADINI: And then, up the core power.

MR. PAGODIN: That's correct.

MEMBER CORRADINI: Thank you.

MR. PAGODIN: Okay. This next slide basically shows the changes in some of the key parameters when we implement our uprate. The one thing I will point out that might be a little different, you'll see underneath the core thermal power, for example, the word "constant" under the thermal power, and "variable" under the power uprate power.

The reason for that is that Susquehanna will be generator-limited in the amount of electricity we'll be able to produce. Most of the time we will operate below the new 3,952 power uprate level, and we will adjust reactor power as necessary to adjust for environmental conditions as they affect the electrical output of the station.

So the primary method of increasing our power is by increasing the feedwater and the steam flow through the reactor, and you'll see the numbers there going from 14.4 million pounds per hour up to 16.5 million pounds per hour. And, again, that will vary as necessary to adjust our thermal power.

There is a slight increase in our recirc flow, that is to overcome the increased pressure in our reactor vessel due to the increased power, slight increase in our final feedwater temperature. And you'll see the generator output there goes from the 1,200, which is currently variable -- in fact, we vary from about 1,150 up to 1,210, again, depending on environmental conditions. With the uprate, we'll be at a constant 1,300 megawatts.

Some of the major changes that we either have made or will be making as part of our uprate, one of the first was to install vibration and acoustic monitoring throughout the station, both inside containment and outside containment. We've implemented the enriched standby liquid control boron concentrations, which allowed us to also reduce from a two-pump operation to a single-pump operation. that change to the tech specs and to our plant design has already been approved by the NRC.

We are also replacing our condensate pumps. That's the first step of increasing the total amount of feedwater flow going into the reactor. We will also be replacing our high-pressure turbines. The high-pressure turbines are being replaced in order to increase the flow area and allow for the higher power level.

We are, as I mentioned earlier, replacing our steam dryers. We will also be installing instrumentation on the first dryer replacement, and we'll be going through the details of that replacement.

In order to get the full uprate, we will need to replace our feed pump turbines. Again, the pumps are sufficient; the turbines themselves need to be replaced to spin the pumps a little faster to get the flow that we are required for our full power uprate conditions.

We are also going to be installing new condensate demineralizers and condensate filters to ensure that we maintain the same water quality with the higher flows.

Our implementation schedule currently is planned for the first seven percent of the uprate, seven percent from our current licensed thermal power in 2008. In order to do that, obviously we will install the dryer, and we will install the high-pressure turbine. Those are the two modifications, the major modifications we need to implement, in order to be able to achieve that.

In 2009, our plan is to implement the full 13 percent, again, in multiple steps, but go to the full 13 percent uprate in 2009 on Unit 2, and then return to Unit 1 in 2010 with the second seven percent uprate on that unit.

The reason for the delay in going to the full 13 percent uprate is the need to replace the feed pump turbines and the delivery schedule for that equipment. It also allows us to have a very deliberate, methodical approach to the uprate, where we will have at least a year of operating time at the seven percent uprate before we move on to the 13 percent uprate.

MR. WALLIS: So this brings us to -- that's one of the issues with the steam dryer, is it, that you're going to operate Unit 2 at full power uprate, but Unit 1 is the one that's instrumented?

MR. PAGODIN: Yes. Unit 1 will be instrumented in 2008. We will be using that instrumentation to prove the analysis and design work that we have. The similarities between Unit 1 and 2 make it applicable to both units. And John will go into the discussion of that.

MEMBER BANERJEE: I think we should note that the second stage of the Unit 1 uprate will not have that instrumentation, because when they do whatever they have to do, they are going to destroy that --

MR. WALLIS: So there will be no instrumentation at the full uprate, then.

MEMBER BANERJEE: No.

MR. PAGODIN: There will not be direct measurement instrumentation, but you will still be looking at our steam line strain gauges. So we will still have instrumentation, just not the same direct measurements of stresses on the dryer.

So concluding my portion, I just want to repeat that all of our power uprate safety aspects have been fully evaluated. All of our evaluations used NRC-approved methodology and industry-accepted methods. There were no new design functions identified for safety-related systems, and there are no significant safety system challenges resulting from our power uprate.

So with that, I would like to turn it over to John Bartos, who will be talking about the steam dryer.

MR. BARTOS: Good morning. My name is John Bartos. I'm the Lead Engineer for the extended power uprate project for Susquehanna. The safety analysis and the design work and the preparation of the submittal was done by people that were reporting to me. I had overview responsibility for the engineering work associated with the project, and I am here today to talk about our steam dryer.

Briefly, what I'm going to talk about is I'm going to give you a brief description of our present dryer, a little bit of its history, which is relevant to our decisions. I'm going to describe how we analyzed our -- the current dryer, the dryers themselves at Susquehanna, talk a little bit about our decision to replace the dryer, briefly describe the new steam dryer and the resulting stress intensities at the projected extended power uprate conditions. And, finally, I'm going to describe our plans to instrument the new dryer.

Okay. This is a picture of a current PPL Susquehanna steam dryer. It's a curved hood dryer. It's what GE refers to as a third generation dryer. The first generation had a set of square hoods. That was the first generation. The second generation had a slanted hood, and the third generation has a curved hood.

Now, in the steam dryer, steam enters from underneath the dryer. It comes up in the hood section. Then, it changes direction and goes to a set of chevron vanes. The steam comes out between the dryer banks -- there are six banks -- then curves over the hood and out the steam nozzles. There's two steam nozzles on each side of the dryer. So the changing of the shape of the hoods was meant to streamline the steam flow over the dryers and out the steam lines.

Now, on the Susquehanna dryers, we have had some history of fatigue cracking on the dryers. On Unit 1, after the first cycle of operation, essentially a year and a half of operation, there was a significant fatigue crack along the first inner hood bank, the weld at the edge here. It was a significant crack, GE came in and analyzed -- looked at the crack, did some analysis.

We repaired the crack, and GE proposed a modification. There was a stiffening strip welded along the inner hood here, and we actually instrumented the Unit 1 dryer back in 1985. We installed strain gauges along the patch side. The other side of the dryer, which was symmetrical to this, was not patched, and we put strain gauges there. We installed pressure transmitters on the cover plates on each side of the dryer, and we installed accelerometers on the dryer ring.

We went through a startup. We obtained data, and what the data showed was is that the modification on this patch did substantially reduce stresses. In looking at the strain gauges on the unpatched side, it appeared that there were structural resonances that occurred at low frequencies.

In looking at the pressure sensors that we installed, and the accelerometers, we saw pressure pulses that occurred at low frequencies. The predominant one was at 15 Hertz. There was another one at about 22, and there was another large one at

30 Hertz, and there were several smaller ones around 50 and a little over 80 Hertz. So the patch did work.

One of the things that we did notice also on the strain gauges and the accelerometers on the dryer ring was that at certain recirculation pump speeds we saw the vane-passing frequency. We could see the vane-passing frequency on the accelerometers, and we noticed on the strain gauges that at some of the higher core flows there appeared to be a structural resonance in this panel, and it amplified the recirc vane-passing frequencies. So that appeared in the strain gauge readings also.

MEMBER CORRADINI: Could you just tell me what a vane-passing frequency is?

MR. BARTOS: Yes. Our recirculation pumps, which are large pumps, they are mechanically coupled to the vessel with short piping runs, and also it's hydraulically coupled to the vessel. And there are five vane pumps, so essentially you take the rotation --

MEMBER CORRADINI: Okay.

MR. BARTOS: -- speed, multiply it by five, and you get the vane-passing frequency.

MEMBER CORRADINI: Thank you.

CHAIRMAN SHACK: Did you see that resonance -- the vane-passing resonance in both the stiffened plate and the unstiffened plate?

MR. BARTOS: It actually -- correct me if I'm wrong, Dan, but it actually showed up a little more significantly in the stiffened plate.

CHAIRMAN SHACK: Okay. So you shifted that set of frequencies.

MR. BARTOS: Right. But the strains in general were significantly lowered where the patch was applied.

Also, in 2005 and 2006, we experienced a fatigue crack in a weld. There's a plate which connects the outer bank and the first inner hood bank. There's a plate, and there was a crack in the weld right here. And it occurred in both units. It occurred in I think it was Unit 2 in 2005 and Unit 6 in -- Unit 1 in 2006 -- a crack in the same weld, roughly the same location, and it was a fatigue crack. Again, it was repaired.

Because we had this fatigue crack in '85, we have done fairly significant inspections of the dryer every outage. When the BWR VIP issued their inspection criteria, it was very close to what we were doing. There was only really marginal increases in inspections we had to perform to meet the BWR VIP inspection requirements from dryers.

MEMBER ARMIJO: You did those every outage?

MR. BARTOS: Yes. Okay.

MEMBER SIEBER: When did you start doing that?

MR. BARTOS: Well, all of the outages fall under 1985.

MEMBER SIEBER: Okay.

MR. BARTOS: This is just a schematic of our steam line arrangement and the SRV placement on the steam lines. It is somewhat unique. We have four steam lines. They're not symmetrically placed around the vessel. They are kind of centered around the two sets of the steam dryer vane banks. This represents the steam dryers. We have six banks, three on each side. The steam lines -- we have two steam lines facing each set of steam banks.

The little black dots represent the safety relief valves. They are Crosby safety relief valves. We have 16 of them. On the Charlie and Bravo steam lines, we have three SRVs on each one of those. And there is actually steam flow passing underneath those valves. On the Alpha and Delta steam lines, there is actually a piece of piping, which there is no steam flow that the SRV -- there's five SRVs on each one.

So this is slightly unique. Most plants don't have this. But -- so for these 10 SRVs there is actually no steam flow flowing underneath them.

When we started the -- when we were considering starting the power uprate project, the Quad Cities event -- steam dryer event had happened, and we were paying pretty close attention to it. And we were following the diagnostics that they were going through to try to analyze what with the phenomenon it was that caused that problem.

And they had installed strain gauges on their main steam lines, and they used that as -- they were using that as a diagnostic technique. So one of the first things that we did when we officially decided to go ahead and proceed with the project is we installed main steam line strain gauges on our steam lines.

And they were installed on these short pieces of steam line coming out of the vessel, as close to the vessel as we could get them, but they were upstream of these elbows and all of the SRVs and this dead leg. So on each steam line there are two locations where we installed four strain gauges, so there is eight on each steam line, and 32 total strain gauges were installed.

And the purpose of this was to try to diagnose what was going on, if there was anything going on acoustically in the steam lines, and also we were aware that there was a company -- CDI, Continuum Dynamics, Incorporated -- that had developed an acoustics circuit methodology for trying to calculate and paint a low definition on the dryer for analysis purposes. And that methodology used the input from the strain gauges, so we wanted to collect data for use as input into that methodology at a later date.

Okay. Let's go to the --

MEMBER CORRADINI: Can I --

MR. BARTOS: Sure.

MEMBER CORRADINI: -- ask one question? How do you know where to place the strain gauges? I mean, you said you did eight on four and 32.

MR. BARTOS: Yes.

MEMBER CORRADINI: Do you just put them equally spaced? Is there a methodology for where you put them?

MR. BARTOS: There is. When we did it, Quad Cities had already done this, and CDI had analyzed Quad Cities. And they had benchmarked their methodology to the replacement Quad Cities dryer, which was instrumented.

So when we placed ours, our objective was to try to place our strain gauges as functionally as close to where Quad Cities had placed those. The idea was is to try to -- if we -- if and when we used the ACM, that that methodology and its benchmark to Quad Cities could be applied to us.

MEMBER CORRADINI: Okay. Thank you.

MEMBER BANERJEE: Well, partly also is it -- should you say that you put them where you can?

MR. BARTOS: Yes. We couldn't put them exactly where Quad Cities had placed them with relation to the dryer. There are some physical restraints. Actually, in the CDI methodology for the acoustic circuit model, if you have a deviation from where you've put -- where Quad Cities placed them, you have to take an accuracy penalty in their -- with related -- in relationship to their calculations.

So when you -- if you didn't have them

exactly where Quad Cities placed them, when you calculate the accuracy of the load definition you have to take a penalty for that.

MEMBER BANERJEE: Thank you. Okay.

MR. BARTOS: So going into the project, we -- there were a number of analytic activities that we undertook to try to determine: 1) did we have a phenomenon similar to Quad Cities? And by the time we got the project started, it was determined that the phenomenon that really caused the damage to the Quad Cities steam dryer was an acoustic resonance or whistle that was caused by the -- their relief valve standpipes.

MEMBER BANERJEE: What was the frequency of that?

MR. BARTOS: It was a fairly high frequency. It was about 155 Hertz, but it was actually kind of a broad band.

MEMBER BANERJEE: I'd like you to note that because the phenomena you hear about is at a very low frequency here. It's possibly something different.

MR. BARTOS: So one of the first things we do is we did what's called Strouhal calculations.

Basically, that's a calculation where if you -- on your steam lines, if you have a cavity, you look at the steam flow across the cavity, you look for boundary layer instabilities, like vortex shedding, and at those velocities what would those frequencies be across those boundary layer instabilities?

Then, you look at the cavity itself, and you look -- and you calculate what the acoustic resonance is, and you see if there's a match. And if there's a match, you have the possibility that you may have an acoustic resonance or a whistle on the steam line.

MEMBER BANERJEE: What did you find for your Strouhal frequencies?

MR. BARTOS: That at our steam velocities we should not experience any acoustic resonances in the steam line.

MEMBER BANERJEE: So you should have no vortex shedding.

MR. BARTOS: There's vortex shedding, but it just doesn't coincide with the acoustic resonance of the cavity.

MEMBER BANERJEE: So what was the Strouhal frequency? I didn't ask you about the resonance.

MR. BARTOS: I'd have to look that up. I just don't recall.

MEMBER BANERJEE: Maybe it is worthwhile, because you're going to come up with some different number.

MR. BARTOS: Essentially, you would have to have higher velocities than what we'll see at full EPU.

In addition, we did some scale model testing. Continuum Dynamics, Incorporated did some 1/6 steam line scale model tests. They just mocked up the steam lines. It was a test where they ran air through a scale model mock-up of our steam lines. They mocked up the SRV standpipes, they mocked up the steam line connections for the high pressure coolant injection system, and the reactor core isolation cooling system, and there were some other minor lines that they also mocked up.

In addition, GE did a 1/17 scale model test. This did mock up the steam lines, the top of the dome, and also there was a representative steam dryer in that model. The results of the scale model testing confirmed what we saw in the Strouhal calculations, and it is that we shouldn't have an acoustic resonance.

One thing that they also did show, and it also came out in the Strouhal calcs, is is that the -- this dead leg where the SRVs are located on has an acoustic resonance frequency of 15 Hertz.

MEMBER CORRADINI: So the dead leg is its own whistle.

MR. BARTOS: Yes. Well, potentially yes.

MEMBER CORRADINI: Just a bigger organ pipe.

MR. BARTOS: Yes, it's a bigger organ pipe.

MEMBER SIEBER: Now, all of these scale model tests, the frequencies that you determine there are quite different than the actual plant, right?

MR. BARTOS: The frequencies we saw there were primarily low frequencies. They didn't match exactly to the plant.

MEMBER SIEBER: This is in the scale model?

MR. BARTOS: Yes. Yes, we didn't see any high frequencies coming out of these tests. Actually, the -- especially the 1/16, we picked up the 15 Hertz fairly well. And I think even the GE scale model tests came very close to the 15 Hertz. So --

MEMBER BANERJEE: I think it's fair to say that we don't understand what's going on.

(Laughter.)

MEMBER CORRADINI: It's a very complex organ.

MR. BARTOS: Yes.

MEMBER ARMIJO: Yes. How do you get a frequency from a dead leg, if there's no steam flow passing --

MR. BARTOS: It's passing.

MEMBER ARMIJO: Well, I understand that, but the dead leg part where these --

CHAIRMAN SHACK: It's the jug.

MEMBER ARMIJO: Oh, I see. I see, got it. Thank you.

MEMBER SIEBER: If you make that cavity smaller and smaller and smaller, the frequency should go up.

MR. BARTOS: That's right. The other thing we decided to do, we thought it would be a very direct way to find out whether we actually do have an acoustic resonance in the steam lines, is for a number of years we did a quarterly surveillance where we closed one MSIV, we reduce power, close it. What that does is drives the steam flow up into the other three lines.

So we devised a test where we would come up to a power level right around 80 percent power, close one MSIV, and we would force steam flow -- increased steam flow through the other three steam lines. And we could -- at approximately about 80 percent power level of our current licensed thermal power, we could get the -- an equivalent steam flow through the other three steam lines, which equaled our -- the first plateau that we're going to on Unit 1, which is about 107 percent of current licensed thermal power.

And what we did was we actually went through, closed the Alpha steam line, looked at the other three, opened it, closed the Bravo steam line, looked at the other three, opened it, and we had strain gauges mounted on the steam lines when we did this and --

MEMBER BANERJEE: Can I just interrupt for one --

MR. BARTOS: Sure.

MEMBER BANERJEE: Do we have a little bit more time, because we are running behind time here, after the coffee break, Bill, or should I be sort of ferocious in keeping him to the time?

CHAIRMAN SHACK: No, you can take a little more time.

MEMBER BANERJEE: Okay. So I think you've got five minutes more --

MR. BARTOS: Okay.

MEMBER BANERJEE: -- to finish --

(Laughter.)

-- and go into the closed session.

MR. BARTOS: The results of this testing was is that there are no main steam line acoustic resonances that were listed.

The other thing we noticed in all of these tests are that the dynamic pressures that we did measure, both in the scale model testing and in the steam line main strain gauges, which is really -- the strain gauges measure the pressure pulses in the steam line, is is that those pressures are predicted to increase as a square as the steam flow increases.

MR. WALLIS: These are fluctuating pressures.

MR. BARTOS: Yes, they are, sir.

MR. WALLIS: Because, you know, acoustic noise from something like a jet engine goes at a much higher power up the velocity.

MR. BARTOS: Right.

MR. WALLIS: So you're measuring something.

MR. BARTOS: Yes.

MR. WALLIS: But it's not necessarily an acoustic, sort of turbulent excited pressure.

MR. BARTOS: Yes, sir. What we're measuring are the pressure pulses coming out of the steam line. The pressure coming out of the steam line is modulated, and we're measuring the modulation.

MR. WALLIS: And steady flow, the pressures would go as the square is, too. So, you know --

MR. BARTOS: But we're seeing that the pressure fluctuations are also following the --

MR. WALLIS: Okay.

MR. BARTOS: -- the squared flow rule. And, again, just to reinforce that the -- this dead leg had a 15 Hertz resonance.

When we did that startup testing, these are some waterfall plots, and what they are are for the -- these are individual strain gauge raw data. And what we did for the various power levels, we ran it through a fast 480 transform just to get what the content -- frequency content of the signals were.

So this is a plot of the frequency versus the power that we took the data at versus the strain, the microstrain coming out of the strain gauges. And this one is for the Charlie steam line, which does not have a dead leg. This one is for the Delta steam line, which does have a dead leg.

And just from looking at it, we can make some observations. One is is that there is no -- really, no high frequency content. Most of the content is low frequency, it's primarily 50 Hertz and lower, and the three major peaks are -- the most predominant peak is 15 Hertz. There's about a 22 Hertz, and there's a 30 Hertz peak, and there are some other minor ones.

The other thing to note is is that, if you look at the scale, the scale on this is 0 to .04 microstrains. The scale on this one is 0 to .25 microstrains. And there's a fairly significant 15 Hertz peak which shows up. And what this is indicated is is that this is on a steam line with a dead leg, that there is a 15 Hertz source coming from inside the steam valve. And the dead leg is acting as an energy storage chamber, and is amplifying 15 Hertz peak.

MEMBER BANERJEE: So do you think this mechanism is the same as the 150 Hertz peak that we've seen in the other --

MR. BARTOS: No.

MEMBER BANERJEE: So what is the difference in the mechanism?

MR. BARTOS: This I think -- it's our opinion that this is turbulence and vortex shedding occurring in the steam dome itself. And that turbulence and vortex shedding in the steam dome is modulating steam flow going out the steam lines.

MEMBER BANERJEE: So this is a very different mechanism from the Quad Cities mechanism.

MR. BARTOS: Yes.

MEMBER BANERJEE: I wanted the Committee to note that.

MEMBER BLEY: What kind of strain did they get at their resonant frequency? Was it a lot greater than --

MR. BARTOS: Yes.

MEMBER BLEY: -- what we're seeing here?

MR. BARTOS: Yes.

MEMBER BANERJEE: I don't remember.

MEMBER BLEY: An order of magnitude or just double or something? I mean, I don't --

MEMBER BANERJEE: There's an issue as to whether this strain means anything.

MR. BARTOS: Well, these pressure pulses, if you would project them back on the dryer, would be an order of about a half a pound.

Rico, do you want to --

MR. BETTI: Yes. I think the important difference here is -- Enrico Betti, General Electric. There's a couple of important differences. The magnitude is much lower than the Quad Cities resonance, that's one. But, two, very important is this resonance one is below the steam done cavity resonance. So even though it's in the lines, when that pressure gets into the dry cavity, it doesn't resonate the dry cavity. So it does result in a little less amplification -- it doesn't relate to the pressure.

MEMBER BANERJEE: What is the dryer resonance?

MR. BETTI: It's close to 30 Hertz.

MEMBER BANERJEE: Close. I mean, if you're wrong by a factor of two here, you could hit that, if something happened.

MR. BETTI: We're not wrong with a factor of two, because we're measuring the response in the steam lines, and we have the data.

MEMBER BANERJEE: Right, right.

MR. BETTI: So, therefore, we know the response. And we're not off by a factor of two on our --

MEMBER BANERJEE: So it depends on -- it's flow-dependent frequency. I mean, if you change the flow rate, the vortex shedding frequency will change.

MR. BETTI: Well, no. That's what John's diagram is showing you is that 15 Hertz --

MEMBER BANERJEE: But that's up to what flow rates?

MR. BARTOS: Okay. That's one thing I wanted to point -- the final curve here, there's 107 percent of our current licensed thermal power. It was actually the trace from one of the MSIV closure tests.

MEMBER BANERJEE: And what will be your -- I always get mixed up in these. One hundred seven percent of your current licensed thermal power --

MR. BARTOS: Yes.

MEMBER BANERJEE: -- you are taking it to 114 percent of your current licensed --

MR. BARTOS: Yes, that's the ultimate uprate limit.

MR. BETTI: John, just if I may say -- I think the important thing, Dr. Banerjee, is that this dryer is considerably stiffer, and so it's well below its resonance -- its first mode resonance frequency.

MEMBER BANERJEE: I think the thing which is a little bit unsettling is that the mechanisms identified previously were flow over a cavity, and the vortex shedding from that, which was then causing the resonances. Here the mechanism seems to be vortex shedding from the -- over the dryer itself, which is going and exciting that -- or some other mechanism which is a much lower frequency.

MEMBER SIEBER: Now, the steam lines at Quad Cities are smaller than these?

MR. BARTOS: Yes, they're smaller, and the velocities are much higher.

MEMBER SIEBER: Yes. Significantly smaller.

MR. BARTOS: Yes.

MEMBER SIEBER: Two-thirds of the size?

MR. BARTOS: Well --

MEMBER SIEBER: Roughly. Which means that changes the whole frequency spectrum.

MR. BARTOS: Right.

MEMBER SIEBER: Not only from a frequency standpoint but an amplitude standpoint.

MR. BARTOS: Right.

MR. BETTI: John, just one issue -- I mean, one thing we understand about this is that the distance, though, between the nozzle, which is a significant noise source, and that branch connection, is two and a half wavelengths. So it's well positioned to --

MEMBER SIEBER: To create a resonance, right.

MR. BETTI: To excite that reflection or amp.

MEMBER SIEBER: Okay.

MEMBER ABDEL-KHALIK: If one of our SRVs in the dead leg were to lift --

MR. BARTOS: Excuse me?

MEMBER ABDEL-KHALIK: If one of the SRVs in the dead leg were to lift, would that change the frequency?

MR. BARTOS: No. You would get steam flow through the dead leg, but the -- what you should be concerned there is is that steam flow underneath the SRV dead legs -- or standpipes, excuse me -- that that would resonate and --

MEMBER ABDEL-KHALIK: Wouldn't that effectively change the length of the dead leg, and, therefore, increase the frequency?

MR. PROPONI: This is Dan Proponi, GE. If you open that -- open a valve on the dead leg, a couple of things are going to happen. One is you'll get some flow through that dead leg, and if you went and looked at the other relief valve standpipes that are there, now you have flow across the opening, you have the -- you have created the potential for a resonance. Now you go through that calculation.

Because the valve flow capacity is fairly small compared to the main steam line, main steam flow capacity, that flow velocity is going to be very low, so we wouldn't expect any resonances there. The other thing is you also change the acoustic characteristics of that dead leg, because now you've got an opening in there. It's not a completely closed cavity anymore.

And if you've got anything that's being furthered by the flow across the opening of the dead leg. Now you've brought some flow in. If you've got any type of vortex shedding that would be occurring across a stagnant dead leg, now you're bringing the flow in and you're going to disrupt that sheer layer at the opening.

MEMBER BANERJEE: When you say "vortex shedding" here, I mean, the last time we heard about vortex shedding by flow over cavities, what vortex shedding are you alluding to here?

MR. PROPONI: If you look at the -- if you just picture the simple T arrangement, you've got the flow going across the -- through the main part of the line, and in that layer that's between the dead, non-flowing fluid that's in the side branch, and the flowing main -- flowing fluid in the main body, there's a sheer layer there. And as the flow goes over that, passes over that upstream edge, we'll get a flow eddy in that layer.

MEMBER BANERJEE: That is the usual mechanism which is postulated, right, and that's very well understood, this phenomenon.

MR. PROPONI: Right. And that vortex is

what's going to excite -- could excite the resonance in that standpipe.

MEMBER BANERJEE: So in this situation where the frequencies are so much lower than in the other situations, is it this mechanism which is driving it, or is it something else?

MR. PROPONI: No. What we're looking at there is the effect -- the flow effects and vortices in that outer hood area.

MEMBER BANERJEE: So it's a completely different thing.

MR. PROPONI: It's a completely different --

MEMBER BANERJEE: Right. So let's -- that's why I was asking the question. What vortex are you talking about, and where is it generated? This is not the vortex generated by flow over a cavity.

MR. PROPONI: Right.

MEMBER BANERJEE: This is a vortex which is coming off the hood somewhere.

MR. PROPONI: Right. And --

MEMBER BANERJEE: Or wherever. Just tell us where. I'm just confused.

MR. PROPONI: What GE -- Enrico Betti said that there is a very strong vortex that not -- not in the hood. It's very difficult to excite an excitation in the steam line below the hood's resonant frequency. So it's most likely that it's downstream in the nozzle.

And there, because you have a big flow direction change, you do have strong vorticity in the flow as it enters the nozzle.

MEMBER BANERJEE: Well, this is vorticity -- the vortex line is being stretched, and as the flow comes out it's actually destabilizing? But this a very different mechanism from what you're talking about.

MR. PROPONI: There's a very strong vortex, basically a tornado, at the entrance to the steam line, because of the asymmetrical arrangement of the steam lines relative to the hood plates and curvature of the vessel. The steam flow tends to come down over the center of the dryer, hits that horizontal lower cover plate, splits out, splits flows horizontally into the steam lines, and we get a very strong vortex as the flow enters the steam line.

MEMBER BANERJEE: The reason we are bringing this up right now is when we go into the closed session you'll see it will have some implications on the so-called fudge factors that have to be applied.

MEMBER CORRADINI: So can I ask one question? You're watching time, so if you want us to wait I'll --

MEMBER BANERJEE: Well, you know, I'd like to get into the closed session, because many of these issues we can't talk about freely and question freely right now. So I'd rather -- you can ask a question, but I'd rather get this finished, and then we can be much more free to question.

MEMBER ARMIJO: I'm just missing -- I guess I'm missing the point. Which of these frequencies are causing the fatigue cracks? Is it the 15 Hertz frequency, is that what you believe? Or is it this other lower amplitude?

MR. PROPONI: Well, this particular lower amplitude that we're seeing here is the 15 Hertz. That tall spike is the 15 Hertz.

MEMBER ARMIJO: But that's the one that makes the biggest strain.

MR. PROPONI: Yes, right.

MEMBER ARMIJO: Is that the one that

translates into loads on the dryer that you --

MR. PROPONI: Yes.

MEMBER ARMIJO: Is that what you believe?

MR. PROPONI: Yes, and that's --

MEMBER ARMIJO: With this dryer.

MR. PROPONI: On this dryer.

MEMBER BANERJEE: Every one of these is different. This is what I'm saying.

MEMBER CORRADINI: So a question about the forcing function. You said at the very beginning that your geometry is different, is unique. Aren't all in some sense the -- where the steam lines are going and the SRV placements unique for all of the BWRs, they're not all the same. So the one thing I was curious about is you have a signature here. There's probably another signature at Quad Cities, and one went into this in terms of just comparing.

You're looking at a -- you're looking at a 15 Hertz at some amplitude, but because of your geometry you killed off all of the stuff they see. So are we just seeing a super-position of something they probably have, but because of their other signals you don't see it there? Do you see my question?

MR. BARTOS: They do have a low frequency.

MEMBER CORRADINI: Okay. That's my point is that I probably have some sort of forcing function in this amplitude, but all of their other stuff is so noisy it kind of stacks on top of it.

MR. PROPONI: This is Dan Proponi, GE. You're right. The basic BWR steam dryer -- basic BWR plant configuration is common throughout the fleet from BWR to up through what we're doing on ESBWR, where we've got parallel bank steam dryers, we've got four steam lines, two on each side lined up with the banks. That configuration is common. the basic steam line layout is common.

So when we look at -- and we've instrumented several dryers along the way. And when we look at that, we see a common pattern with the low frequency, this type of -- this type of signature that we're seeing on Susquehanna, and then the high frequency 120 to 230-ish Hertz sharp SRV band-type acoustics. We've seen combinations of that in the various plants.

So we see the same general phenomena. And whether or not a particular plant has really -- it's the high frequency part, the SRV standpipe resonance. Whether or not we see that occurring and then coupling and acting on the dryer, that part is plant-specific, because that's where the specific SRV location on the steam line comes in.

MEMBER CORRADINI: Thank you.

MR. BARTOS: One last thing I'd like to point -- well, two things. One, again, we see that the -- the pressure pulses -- that the microstrains are related to -- they do increase as the square of the flow -- the steam flow through the steam lines.

Two, these are Unit 1. We found this on Unit 2 also. We had very excellent coherence between Unit 1 and Unit 2, both in frequency signature, and also on amplitude. And they looked -- for practical purposes, they look identical. So we have done this on both units also.

Based on this information, and looking back at the 1985 test data, we set out an analysis plan. And this is the plan that we were going to undertake to analyze the existing dryer. Since we have the data on the Susquehanna dryer from 1985, we would like to use that as a benchmark for any analysis tool that we were going to use.

The analysis tool that we selected to use was the CDI acoustic circuit methodology. That methodology had been benchmarked against the Quad Cities instrumented dryer. Looking at that benchmark, it did a reasonable job of predicting the high frequency SRV whistle. But there were low frequency signals on the Quad Cities dryers.

And when we looked at how accurately it predicted those magnitudes, it was fairly apparent that there was a substantial underprediction of those low frequency pressure signals on the replacement Quad Cities dryer. So going into this we expected that the ACM, when we benchmarked it against our 1985 data, the pressure data especially, that it was going to probably underpredict the pressures.

Since we had done this -- 100 of this MSIV slow closure testing to simulate the 107 percent CLTP load steam flows, we had talked to CDI about using that input from the strain gauges in developing the load definition for the dryer. And they responded that they could do that.

So, then, we would then use the ACM, calculate the load definition, calculate stresses, and apply an underprediction factor to that based on our benchmarking. Since fairly consistently in all of the scale model testing, in the strain gauge testing we did both on Unit 1 and Unit 2, and the MSIV slow closure testing we did on Unit 1 and Unit 2, we saw that the fluctuating pressures increased in proportion with the square of the steam flow increase.

We felt that it was reasonable to assume that when you went to the vital EPPU steam flows that we could then scale that using a similar scaling factor. Then, our plan was to instrument -- well, we would try to confirm the analysis with startup testing.

MEMBER BANERJEE: So here the Subcommittee had a large number of issues, but we pulled them for the closed session.

MR. BARTOS: So this I think ends the -- I think go to the next one. I think that's -- okay.

So the benchmarking -- this was the benchmarking plan, and it's pretty simple, straightforward. We obtained in-plant strain gauge, main steam line strain gauge data, at the original licensed thermal power steam flows. We did this during a startup ascension.

We stopped at our original licensed thermal power, obtained main steam line strain gauge data. That data was then input into the CDI acoustic circuit model. That load definition then was given to GE, they put it into their finite element model, and which they calculated stresses.

We then compared strains from the GE finite element model to the measured strains in '85. We also compared some pressures from the ACM model to pressures measured in 1985.

MR. WALLIS: Were these the ones that were off by a factor bigger than two? Is that --

MR. BARTOS: We'll talk about that in the closed session.

MR. WALLIS: You're going to talk about that later? Okay.

MR. BARTOS: This is where we close.

MEMBER POWERS: Let me just try to --

MEMBER BANERJEE: Hold on, Dana.

MEMBER POWERS: -- understand one thing a little better here. You indicated that we don't know what's going on, which may be true. But it seems like from an empirical point of view they've done everything they can think of. They modeled it, they tested it small scale, they planned to test it. I think confirmatory analysis -- I mean, I'm a chemist, I work in a world where we never understand mechanisms.

But they seem to have a pretty decent empirical approach. I mean, do we have to understand the mechanism?

MEMBER BANERJEE: I think you'll see in the next -- the closed session that the program that they're using as the underpinning of this -- of the sort of, if you'd like, scaling from one plant to another, data from one source to another, the so-called ACM computer program, I presume they will talk about that.

There the forcing functions become very important. And if you don't know what those forcing functions are, it is very difficult to run that model in some sense and get anything meaningful.

And we are partly getting into probably a conversation which is best held in a closed session, so let me answer the rest of your question when we go into closed session and see what happens.

MEMBER POWERS: Well, I will certainly wait, but understand that I --

MEMBER BANERJEE: What happens is they have a very significant underprediction to which they have to apply a fudge factor. And whether that fudge factor is applicable -- translates from one plant to another, from one situation to another, one mechanism to another depends on the predictions of this computer program.

So you take the prediction of the computer program, they apply a fudge factor. You don't know what the mechanisms are and what's going on. So how do you know the fudge factor is going to be the same?

MEMBER POWERS: Well, I'd agonize over that terribly if they weren't doing any confirmatory testing.

MEMBER BANERJEE: But they are doing only up to 107, remember.

MEMBER MAYNARD: Well, I think we're going to hear they're going to have data that goes above that, too, but I don't know if it --

CHAIRMAN SHACK: Yes. Let's just move to the closed session and we'll discuss it further, then.

(Whereupon, the proceedings went into Closed Session.)

MEMBER BANERJEE: Back to Bill, and then, if you want, have a coffee break.

CHAIRMAN SHACK: We'll take a break now until 10 of.

(Whereupon, the proceedings in the foregoing matter went off the record at 10:37 a.m. and went back on the record at 10:52 a.m.)

MEMBER BANERJEE: Please come to order.

CHAIRMAN SHACK: We are back into session.

MEMBER BANERJEE: So we are back to Susquehanna, and we will be discussing ECCS-LOCA, and then our staff are up.

MR. GUZMAN: All right. Good morning again. This is Rich Guzman. I'd like to first introduce the members of the Reactor Systems Branch. Diane Jackson is the lead reviewer in the Reactor Systems Branch. This is Peter Lien, who performed the confirmatory calculations as part of our review.

MEMBER BANERJEE: So just to explain to the Committee the issue, are you going to do that?

MR. GUZMAN: I'll try to do that here, Dr. Banerjee.

And so as part of the reactor systems

review, the staff performed confirmatory calculations on ECCS-LOCA to make a reasonable assurance determination that the peak cladding temperature is -- was calculated by the licensee and complied -- correctly and complies with the 10 CFR 50.46 PCT requirement.

There are two items that -- as followup from the Subcommittee meeting. The first action item was to reconcile Appendix K results as represented by PPL's LOCA calculation model EXEM-BWR-2000 against the staff's RELAP-5 model. During the Subcommittee meeting, the general comment from the members was that the confirmatory calculated PCT seemed high from the perspective of the RELAP-5 being a best estimate calculation.

So one of the points, before I hand it over to Peter Lien, that we'd like to clarify is that the staff's RELAP-5 calculation does not entirely represent or qualify as a best estimate calculation due in part to the fact that the input parameters were conservative input parameters. And so that point, and more detail are provided in the upcoming slides.

Peter Lien also talked about some of the major modeling differences between the two, and one of which is the radiation heat transfer input.

The second action item from the Subcommittee, the staff indicated that it would examine the effects of the number of bundles included in the LOCA analysis as representative of the hot channel versus the average channel, and so the action item there was to perform a sensitivity study. That sensitivity study was performed, and it is going to be provided here shortly in the next slide.

That last bullet there, just a reminder that the neutronic methods topics will be discussed during the 14 November Subcommittee meeting.

And with that, I hand it over to Peter Lien to go over Appendix K.

MR. LIEN: Good morning, everyone. My name is Peter Lien from the Reactor Systems Branch. In the Subcommittee meeting, the Committee has interest to know why the PCTs in the licensee calculation and the staff calculation are very close. Now, I'd like to address this question and also touch a little on the subject of Appendix K versus best estimate PCT calculation.

You know, a best estimate calculation involves using the best estimate methods --

MEMBER BANERJEE: I'm sorry. Could you speak up?

CHAIRMAN SHACK: Move a little closer to the mic.

MR. LIEN: A best estimate calculation involves using best estimate methods, and also our best estimate parameter inputs. And the delta PCT between Appendix K and best estimate calculations is typically around, you know, 300 to 400 degree F for PWR and --

MEMBER APOSTOLAKIS: What's the definition of a best estimate?

MR. LIEN: This is another way of saying it's a realistic, you know, calculation and not involving too much conservatisms in the calculation.

MEMBER APOSTOLAKIS: Is there a definition? I mean, their best estimates may be different from your best estimate.

MR. LIEN: Yes, but I search around the literature, and it -- like you said, you know, it's a lot of different saying about best estimate. But in general, people understand, you know, a best estimate is a word, you know, versus, you know, the conservative approach. So --

MEMBER APOSTOLAKIS: I understand that, but --

MEMBER BANERJEE: There is a formal sort of -- we are doing it, which as you know relies on the CSAU methodology, and which is -- basically, you have to find the whole thing, go through finding what are the important phenomena, and then how you should --

MEMBER APOSTOLAKIS: But that's the process. It's a process. When you have the actual numbers --

MEMBER BANERJEE: Then, you use approved code of some sort, like RELAP-5, where you -- the inputs are not conservative.

MEMBER APOSTOLAKIS: How are these decided?

MEMBER BLEY: Is it nominal design values or something else?

MR. LIEN: They had to perform, you know, uncertainty analysis for their inputs. Each value --

MEMBER APOSTOLAKIS: So it doesn't really matter what the best estimate is, because they will do an uncertainty analysis.

MEMBER BANERJEE: That's part of the process.

MS. JACKSON: And the licensee, their licensing one, is the Appendix K calculation. We're doing a confirmatory calculation. The staff's calculation doesn't stack up to say, "It's this code, and these are the certain inputs you put into it." We're looking for a confirmation that we think the licensee's calculation is trending in the right direction or that they have -- that they're putting into -- the proper inputs into theirs.

We're doing ours to say yes, we think we have sufficient information to say yes, their code is correct. We're not clarifying our code to say it is a best estimate. It's kind of more the label that has been put on it, that -- for our calculations. Because we're putting in conservative inputs into RELAP-5, so it's not truly a best estimate. That's the point.

VICE CHAIRMAN BONACA: Did the licensees --

MS. JACKSON: We're not looking for that.

VICE CHAIRMAN BONACA: Did the licensees submit an Appendix K calculation? They did.

MS. JACKSON: Right.

VICE CHAIRMAN BONACA: So, and the best estimate you're using, is it this best estimate approach that the NRC --

MS. JACKSON: No.

CHAIRMAN SHACK: It's using a best estimate code with conservative input.

MS. JACKSON: That's right.

VICE CHAIRMAN BONACA: Which this is not --

MS. JACKSON: Which is --

VICE CHAIRMAN BONACA: -- the best estimate approach that is an alternative to the Appendix K.

MS. JACKSON: Right. We're just doing a confirmatory calculation to see are they in the ballpark.

MR. LIEN: Right. You know, so the difference -- the delta PCT, you know, comes from two sources. You know, one is the method differences, and also the input differences.

Now, look at the licensee calculation and staff calculation. From input point of view, staff's RELAP-5 calculation uses conservative inputs from licensee. That is, you know, same initial conditions, the 102 percent power, 80 percent flow, and also the power peaking factors. And those are the same boundary condition, like ECCS configurations, also the single-failure assumptions. So these are a lot of, you know, conservatisms there.

So, therefore, you know, staff's confirmatory calculation is not a best estimate calculation. And because of this input, you know, this will make the delta PCT much smaller. If you look at the charts, you know, so there is about 400-degree differences from --

MEMBER BANERJEE: Can you just go through the chart from the top down?

MR. LIEN: Yes.

MEMBER ARMIJO: While you're doing that, could you explain which are the staff's numbers, and which are the -- I can see the PPL. Does that -- one side is PPL, the other side is staff?

MR. LIEN: Is staff's, yes. And as I'm talking, 2,200 is our limit.

MEMBER ARMIJO: Right.

MR. LIEN: So PPL's calculation is 1,844 for their --

MEMBER BANERJEE: What is the red calculation there?

MR. LIEN: Okay. I will cover that later

on.

So staff's, you know, number is 1,816, so it is very close to licensee's, you know, number. So Appendix K is -- best estimate is they are like about 400-degree differences, and it is made up of method differences and also the input differences. But because we used the same conservative inputs, so we'll make this delta, you know, PCT much smaller, and narrow it down to the method differences.

So for method difference -- from a method difference point of view, the radiation heat transfer model, there's one major difference between these two calculations among all of the -- you know, the other differences. So to exclude these, you know, differences we request PPL to perform additional calculations, to disable the radiation heat transfer in their large break LOCA calculation, and the result is 2,200 degree of increase in PCT. So this is the red line, you know, you were asking for. So from here, increase like 220 degree F.

MEMBER BANERJEE: And you didn't have radiation in your model.

MR. LIEN: That's right.

MEMBER BANERJEE: So that red line is

comparable with your top black line.

MR. LIEN: Yes. So that will be like 250 degree, you know.

MEMBER CORRADINI: The difference there is -- you said it once and just -- could you repeat it? What's the difference there? Since you're saying their red line and your black line in theory from a -- from a -- included physics is similar, the difference there is their models?

MR. LIEN: Well, the difference is, you know, the correlations, theory equations, you know, and so on. Those are methods.

MEMBER BANERJEE: So that's 400 degrees Fahrenheit?

MR. LIEN: No. This is method differences. But, you know, I just mentioned about the input differences, you know, will cover the lower part of these differences, you know, the conservative inputs.

So that means if RELAP, you know, implement radiation heat transfer, the PCT will go down approximately a similar amount of PCT. So here -- this is -- RELAP, you know, calculation will go down to this range.

So with the same conservative inputs and also radiation heat transfer, they both are, you know, disabled. So delta PCT is around, you know, 250 degree F, so which accounts for the Appendix K and best estimate method differences.

MEMBER BANERJEE: So if you went back to Mike's question --

MR. LIEN: Yes.

MEMBER BANERJEE: -- what are the conservative assumptions made in the licensee's calculation compared to yours at the moment? You are using conservative inputs --

MR. LIEN: Yes.

MEMBER BANERJEE: -- for RELAP-5. But what other conservatisms have the licensee put in, which would explain this 250 degrees Fahrenheit difference?

MR. LIEN: Oh. In that sense it's a calculation, because they have to comply with the appendix K evaluation model requirements. So, for example, they have to -- for example, there are heat transfer coefficient or critical heat flux, you know, calculation, or critical flow calculations, the RELAP heat transfer calculation. They all have to comply with the requirements in Appendix K.

MEMBER CORRADINI: But you would do the same thing with your RELAP-5 calculation.

MEMBER BANERJEE: No, they used --

MR. LIEN: They used the best estimating method, based on their experiment or separate effects.

MEMBER BANERJEE: So that explains it?

MEMBER CORRADINI: That explains it.

MEMBER BANERJEE: All right. Fine.

MEMBER CORRADINI: Thank you.

MEMBER ABDEL-KHALIK: Are you using the same decay heat?

MR. LIEN: No, they are not the same. It was in 1979, you know, the model.

MEMBER STETKAR: And they use?

MR. LIEN: They use a 1971 NS model plus 20 percent. So it's very conservative.

So based on this approach, you know, delta PCT analysis, the staff finds that the confirmatory calculation supports the licensee's calculation. So I just mention that, you know, these 300-, 400-degree differences can be explained by these two parts.

MEMBER BANERJEE: I should mention that the Subcommittee was happy with the efforts by the staff to do confirmatory calculations.

Thank you.

MEMBER CORRADINI: I guess I don't know the background, so because this has been -- this is something that is expected, or I -- your point is that?

MEMBER BANERJEE: No. I think it's not -- you know, sometimes confirmatory analysis is done, and sometimes it's not done.

MEMBER CORRADINI: Oh, okay. That's what I didn't understand.

MEMBER BANERJEE: And, you know, this was a thorough study, and it was done well.

MEMBER CORRADINI: Thank you.

MEMBER BANERJEE: And I think it set our minds at rest with regard to the uprate.

Now, there is still this bundle issue which was brought up which has to be dealt with, and I guess you are going to do that. Go ahead.

MS. JACKSON: Go ahead with the slide.

MR. LIEN: Yes. As I promised in the Subcommittee meeting, with Dr. Said, you know, who mentioned this question, the staff performed additional five, you know, calculations to study the sensitivity of a number of hot assemblies in hot channel. So basically I increased the number of, you know, hot assemblies from four bundles all the way to 382.

So that represents, you know, the top 14 percent, you know, power group, and also it represents almost like 50 percent of the core of these hot assemblies.

MEMBER CORRADINI: Can you say that again slower? What did you do?

MR. LIEN: I increased the number of assemblies in the hot channel.

MEMBER BANERJEE: The rationale, Mike, being that this core is flatter. Therefore, there are more hot channels which are close to each other in behavior. So the bypass through cooler channels is different, if you like, the flow distribution changes. And so the issue arose as to what happens if you have a larger proportion of channels that are sort of hot channels.

MEMBER CORRADINI: That are the hotter -- and at hotter power.

MEMBER BANERJEE: Yes, right. Hotter power. I mean, it's -- that's the simplest way to put the issue.

MEMBER ABDEL-KHALIK: But nevertheless, as you increase the number of channels in that hot channel grouping, you decrease the average --

MR. LIEN: You are right.

MEMBER ABDEL-KHALIK: -- bundle power --

MR. LIEN: Yes.

MEMBER ABDEL-KHALIK: -- within that group.

MR. LIEN: Yes, because of the energy pattern.

MEMBER ABDEL-KHALIK: So going in this huge step from .1 percent to 3 percent of the bundles, you -- how much has that average bundle power decreased between these two calculations?

MR. LIEN: I didn't -- you know, didn't carefully, you know -- I cannot get you the numbers right now, because I can --

MEMBER ABDEL-KHALIK: You know, this puts my mind at ease. But I still think this is not a fair comparison.

MR. LIEN: Yes, but I can -- this figure on the left, if you'll look carefully, these nines are the average bundle of PCT, so it's monotonically decreasing the PCT. That tells you that, you know, the inexperience there.

MEMBER BANERJEE: The PCT is going up, and then going down, right? With the percentage --

MR. LIEN: Yes.

MEMBER CORRADINI: I'm still trying to -- sorry to be slow on this, and I wasn't at the Subcommittee meeting, so I'll ask one --

MEMBER BANERJEE: Then, come to the Subcommittee meetings.

MEMBER CORRADINI: I know that. Thank you.

(Laughter.)

You missed mine.

So just to go through the logic one more time, so you threw more into the hot bundle category and less out of the cooler category.

MEMBER BANERJEE: Average bundle.

MEMBER CORRADINI: Made the energy balance consistent. So what you're essentially doing is looking to see if there is an optimum PCT as you group the total number of bundles?

MR. LIEN: That's right.

MEMBER CORRADINI: Okay.

MEMBER BANERJEE: You get the flow distribution changing.

MR. LIEN: Yes. This is a numerical experiment. And I used the spreadsheet, you know, the computer power, so to make sure, you know, the total, you know, distribution comes up as 1.0 --

MEMBER CORRADINI: So back to Dr. Abdel-Khalik's question, which is -- so going from -- going up by from 4 to 81, another question might be: did you miss something? That's what I think he's asking.

MR. LIEN: No, I make sure the power is conserved, yes.

MEMBER BANERJEE: No, no. But he's saying, could it be 12 or 15 or 18 or something?

MR. LIEN: Yes, because I -- each calculation requires a lot of efforts, you know, takes me almost like two days to --

MEMBER ABDEL-KHALIK: I suspect the worst case will be a lot less than 81, and probably a lot higher than four.

MR. LIEN: But based on the PCT, though --

MEMBER ABDEL-KHALIK: The differences are relatively small. This is -- this is not a major issue.

MR. LIEN: Yes. So from this result, you can see the highest, you know, PCT is -- is around like top 6 percent, and I got, you know, 1,843 degree. So it's about 27 degree increase.

Compared to the margin, and compared to the conservatism we just mentioned in the last topic, you know, I think it's very marginal.

VICE CHAIRMAN BONACA: They had submitted a real best estimate calculation approach, probably that would be down at 1,300, 1,400 degrees Fahrenheit. So I think there's other margin there.

MR. LIEN: So my conclusion is this sensitivity study shows minimum impact, monitoring the hot channel with four assemblies.

MEMBER BANERJEE: So are we done with this topic now? Thank you very much. Again, thank you for being responsive to this.

MS. JACKSON: Thank you.

MEMBER BANERJEE: Thank you.

I guess the next topic --

CHAIRMAN SHACK: We have to stay on schedule for this one, because we do have John Szabo coming at noon to instruct us on financial disclosure.

MEMBER BANERJEE: Oh, my gosh. Okay.

I guess what Bill is saying is that we should hold our questions, if we can. PPL is on with the power ascension and testing right now, according to the agenda, is that right?

CHAIRMAN SHACK: Yes.

MEMBER STETKAR: Sanjoy, can I ask something --

MEMBER BANERJEE: Sure.

MEMBER STETKAR: -- while they're setting up? You mentioned that you're having another Subcommittee meeting sometime here in November.

MEMBER BANERJEE: November 14th.

MEMBER STETKAR: And I'm not. Have you -- did you in the Subcommittee discuss -- you know, I'm a risk assessment guy. When we do risk assessments of boiling water reactors, we typically find that the risk is driven by ATWS and transients, not LOCAs and I don't know about materials.

In the Subcommittee meetings, have you examined their reanalysis of ATWS events and transient responses? In particular, power increase should do things like increase the amount of steam relief demand during an ATWS, during any type of transients, decrease operator response times, and things like that? Is that something you've looked at already and discussed in the Subcommittee? And are we going to have any discussion of those topics?

MEMBER BANERJEE: Well, ATWS certainly is something that will be discussed. Again, I mean, these were already discussed, and there were some questions related to in particular the methods that were used, and what sort of uncertainties there were in these methods and how these should be reflected necessary and penalties on CPR or something.

So let's say typically transients would set the operating limit CPRs, maximum CPR. And if you have some uncertainty in the void correlation, this propagates then through to the calculation of the void reactivity coefficient, which then feeds back into what powers you would expect during ATWS. And this then requires that there be some uncertainty put on the OLM CPR, for example.

And, similarly, uncertainties in some of the neutronics calculations at the higher void fractions can give you even some uncertainty in the SLM CPR, okay, the safety limit CPR. So this has to get clarified, and these things were not very clear at the Subcommittee meeting, and that's why we are doing it again.

MEMBER STETKAR: Okay.

MEMBER BANERJEE: Just to get these things nailed down. And then, for example, bypass voiding, I mean, while it doesn't look like the overpower is doing very much, now there are many more channels at the same sort of power, so that this may not be an issue with, say, current cause, but it has an effect on the stability setpoints when it comes to -- or may or may not, we are waiting to hear about all of this stuff.

MEMBER STETKAR: Thanks.

MEMBER BANERJEE: Should we go ahead? Are you going to --

MR. CROWTHERS: Mike Crowthers, PPL Susquehanna. I want to recognize Jim Williams is up here with me. Jim is a unit supervisor assigned to the power uprate project.

I'm going to talk about power ascension testing, but really only as it relates to the dryer, the follow-on, and the topic from earlier today.

Next slide.

Okay. Hopefully, this presentation will help tie a lot of the discussion together that we have had earlier this morning. The three main elements -- slow, deliberate, defined hold points, defined activity, defined acceptance criteria, all on the way up to the full power uprate.

A lot of monitoring, a lot of analysis, a lot of trending of the data, and there will be some long-term inspections we'll be doing subsequent to -- subsequent cycles after we have implemented a full power uprate on both units.

Next slide.

This is intended to try to give you a sense for how it's going to all play out in time. This is the Unit 1 test plan as it exists today for our spring '08 startup. Not to scale timeline, but this is nominally 40 days at this point in the schedule.

Y-axis is 100 percent of CPU -- CPPU power. So going from zero to 100 percent, and, of course, ending up on Unit 1, as we talked about, we're not at 100 percent on those first cycle.

A couple of key points along the way. We will be taking dryer data as we go up in power. We're not going to wait until we get up to CLTP or the current licensed thermal power to start taking data.

We are going to be taking data as we go up in power, making sure things are, you know, where we think they should be.

We've talked a lot about the MSIV slow closure testing. These two points are those two tests. This test here that's 72.6 percent of CPP power will get us in-flows matching 107 percent of CLTP.

MEMBER BANERJEE: But I thought you were also going to do -- once you get to the 107 percent CLTP license, whatever, you were going to do another MSIV.

MR. CROWTHERS: We're not going to do one up here. We're going to do it here. This second MSIV closure test that's --

MEMBER BANERJEE: Will it take it to 114?

MR. CROWTHERS: It's 113 percent, 114 percent. Right. So we'll do this test here and collect data to validate the test data we've already got at 107 percent. Okay? To monitor -- to assimilate the flows there.

And then, 76 point something percent, we will do the same testing here, and that will get us the steam flows that are equivalent to the full power uprate.

MEMBER BANERJEE: So that scale that you've got there is what -- is 100 -- is 114 percent CLTP.

MR. CROWTHERS: That's correct.

MEMBER BANERJEE: All right.

MR. CROWTHERS: That's correct. So even before we get to Unit 1 at 107 percent, we will have data -- we'll be able to compare that data to the data we have today, and base the dryer design on it.

MEMBER BANERJEE: Yes. But that will also -- you will get data for up to 114 percent CLTP at that closure.

MR. CROWTHERS: Right.

MEMBER BANERJEE: Right?

MR. CROWTHERS: Right.

MEMBER BANERJEE: Not just 107 percent.

MR. CROWTHERS: At the second one. At the second test point there.

CHAIRMAN SHACK: But he'll be able to test his MSIV kind of test with the real -- so we'll have an MSIV 107 and a real 107 to address all of those questions you were raising before about whether MSIV testing is equivalent to the real thing, and then he'll have an MSIV 114 percent test.

MR. CROWTHERS: Correct.

So, then, that first key plateau, then, is what is our current licensed thermal power level, which is shown here, and what we're showing here is we're going to be taking a bunch of dryer data, measuring moisture content. We'll be taking main steam line data, main steam dryer data, and using -- and analyzing that data.

And we've got a whole point in our test program at this point to analyze that data and do a core review as our plant on-site Review Committee, our Safety Review Committee will be reviewing that data, making sure it makes -- everything is where we think it should be, and it's okay go ahead up in power.

Beyond that, then, is really when some of these license conditions start to kick in -- and as staff referred to earlier, where we'll be monitoring data hourly as we go up in power, about one percent per hour is what our typical rate is.

We'll go up 3-1/2 percent to this second plateau where we'll do everything again -- take a bunch of data, do analysis, take moisture carrier data, main steam line data, and then the difference here at this point, once we've gone beyond the CLTP, this 103 percent, this is when some of the interaction with the staff will be directly per the license condition. We'll be providing them information. They will have a chance -- the opportunity to look at it before we go ahead up in power. Again, our on-site Review Committee will also be involved with the review at that point also.

Again, another ramp, one percent per hour, another 3-1/2 percent to 107, do it all over again. That gets us to 107 percent on Unit 1.

When we go to Unit 2 the following year, it will look the same except there will be two more steps to get us up to the full power uprate.

Next slide.

Again, this is --

MEMBER BANERJEE: Now, this is to only what would be 107. Do you have a plan now of where you are -- what you are going to do after that? Because you are still not up to what you call --

MR. CROWTHERS: On Unit 1?

MEMBER BANERJEE: Yes.

MR. CROWTHERS: Yes, that's what --

MEMBER BANERJEE: Okay.

MR. CROWTHERS: After it gets to 107 percent on Unit 1, and there has been a lot of discussion earlier also on this, is we will be taking a lot of data. We will have a lot of data on 107 percent, and this is the point in time where we're going to go relook at our original analysis, look at the structure analysis, look at the stress underprediction factor, and then prior to going to uprate on Unit 2, we'll be submitting a report to the NRC that summarizes what we found and what we learned from all of that data that we collected at 107 percent.

The limit curves, are they adequate? Do we need to address those? Do we need to modify the Unit 2 dryer if that's what the data shows us we have to do before we install it? Is the stress underprediction factor appropriate? All those kinds of questions will get answered at that point in time. And then, provide it to the staff 45 days before we start up on Unit 2.

Okay. Next slide.

Some other things we'll be doing during that same timeframe on Unit 1, we'll still be monitoring moisture carryover per our procedures. We will be, as long as we can get data out of those dryer strain gauges, we're going to take the data. So as much data as we can get, we'll have it.

And then, beyond that, as I mentioned, we'll be doing dryer inspection. So once we get to the refueling outages on the two dryers for two successive -- at a minimum two successive outages after we've been to full CPPU, we'll be doing dryer inspections to see if everything is accessible on the dryers.

Next slide.

Okay. So, in conclusion, really, this bullet applies. We knew the scope is complete. It's measured and it will be heavily monitored. And, you know, it takes the right time to make sure that we're doing the right thing as we go up in power.

It provides for various test plateaus with appropriate provisions for collection and analysis, plant management reviews, and accident reviews, and we do have acceptance criteria and predefined action limits, you know, should we reach those limits.

MEMBER ABDEL-KHALIK: Is there any potential for, you know, loose parts generation as a result of detachment of the instrumentation during operation?

MR. CROWTHERS: I think Dan Proponi --

MR. PROPONI: This is Dan Proponi, GE. We go and specifically design the instrumentation to withstand the operating condition, the operating environment, so we're going through and doing the structural analysis, the flow loading analyses on, say, the instrument mast, the conduit, and the like, making sure that we've gone and tacked down the conduit sufficiently, such that they don't come off.

But, again, that's -- it is a temporary installation. We're not expecting that to last for, say, the extended life of the plant, and that's why we're taking it off afterwards. But we are designing it to stay in place for the full two-year cycle.

MR. CROWTHERS: Okay. That's it.

MEMBER BANERJEE: That's it? Thank you very much. Very clear presentation.

And now a brief presentation on containment overpressure or lack thereof, in terms of requirements, just to bring us up to date on the situation at Susquehanna and why they don't need it.

MEMBER MAYNARD: No good deed goes unpunished.

(Laughter.)

MEMBER BANERJEE: Now, John, you are not going to be able to get through all of these slides.

MR. BARTOS: I think I have four slides. You know, a quick summary of why we don't need it is our pumps have very modest suction head requirements, and we have a lot of head.

(Laughter.)

Well, at least let me show you --

(Laughter.)

Well, let's go back to the requirements. There we go.

The RHR and core spray pumps are the pumps that we're concerned about. They have an RHR -- residual heat removal pump has an MPSH-required five feet. We have a .17 core spray. The requirement is four, and we have 5.75. By the way, these requires are at runout, not the operating condition, so that's a conservative number.

And our calculations include -- the DBA is the most limiting case, and that is because during that case we get strainer filing. This includes strainer filing in our MPSH-available calculations.

The other events, like ATWS and --

MEMBER BANERJEE: Well, what is your buffer here? What is the buffer? Oh, there is no buffer. There is no buffer. Sorry.

MEMBER POWERS: Well, the buffer is actually the hydronium/hydroxide equilibrium.

(Laughter.)

It has zero buffer capacity by definition.

MEMBER ABDEL-KHALIK: Now, all of those numbers are measured from the center line of the inlet port?

MR. BARTOS: Yes, from the center line of the inlet, right there.

MEMBER ABDEL-KHALIK: Okay.

MR. BARTOS: This is a -- this is a sketch of our pumps, you see the RHR, core spray. And I've included the condensate pump. They are all similar design. They're vertical pumps. They're multi-stage pumps. The reason I have included the condensate pump is is that the -- it's exactly the same design pump, same vendor, obviously different stages, and it has essentially different requirements, and it has a different discharge pressure.

But the condensate pump takes suction on the condenser hot well. The condenser hot well has a steam belt pressure, which is a vacuum. This pump operates 24 hours, seven days a week, continuously, without any problems. These pumps are designed to pump saturated fluids.

MEMBER SIEBER: But it is deep in the ground, so it has head.

MR. BARTOS: Yes. But actually, these are actually deeper.

MEMBER SIEBER: Okay. Tell us how deep.

MR. BARTOS: So let's go to the next slide. This is a sketch of the building. This is the reactor building. The RHR and core spray pumps actually sit on the reactor building core, and they actually spin into the basemat.

MEMBER SIEBER: Right.

MR. BARTOS: And the reactor building floor is actually three feet lower than the bottom of the suppression pool. So the -- so in our suction head calculation it's from the suction strainer to the centerline of the pump intake, and there is a substantial head available for that. So that basically is --

MEMBER BANERJEE: And did you change some of the ways you did the calculations to take credit for heat sinks in the containment?

MR. BARTOS: That was in the containment analysis.

MEMBER BANERJEE: Right.

MR. BARTOS: The --

MEMBER BANERJEE: And you didn't --

MR. BARTOS: -- MPSH suction head calculation, that's -- doesn't get involved in that. This is purely a head calculation.

MEMBER BLEY: You did say one thing that has me curious. I know we're looking at a foot and a half excess head, I guess on one of these. You said you accounted for suction fouling.

MR. BARTOS: Yes.

MEMBER BLEY: And what assumptions were in that suction fouling? That seems --

MR. BARTOS: That all non-qualified coatings become available as we go into the suppression pool, and that qualified coatings in the jet nozzle cone come loose and go into the suppression pool and are available for being deposited on the strainers.

MEMBER SIEBER: On the other hand, you have a transport calculation that says --

MR. BARTOS: Yes.

MEMBER SIEBER: -- how much will go to the strainers.

MR. BARTOS: That's right.

MEMBER SIEBER: How much will be held back, how much -- how much goes to the pump.

MR. BARTOS: Correct.

MEMBER SIEBER: I think it's important for Committee members to look at that drawing carefully, to figure out how expensive and virtually impossible it is to change the elevation of these pumps.

MR. BARTOS: These pumps are literally the lowest components.

MEMBER SIEBER: In order to get more suction, you need to drill a hole, and you don't have enough overhead room to do that.

MEMBER CORRADINI: You don't even have enough overhead room to dig down, you said, Jack?

MEMBER SIEBER: No, because when you dig down beyond where the can is, you have to have an equal length above that --

MR. BROWNING: To lift it out.

MEMBER SIEBER: Right, to get the tools in and out.

MEMBER CORRADINI: Oh. I see what you're saying.

MEMBER BANERJEE: So in the containment analysis, you check the temperature, right?

MR. BARTOS: Yes.

MEMBER BANERJEE: And from that temperature, you go up the required suction head. So ultimately, the heat sinks and so on that you use become important, because that determines the temperature of the pool, right?

MR. BARTOS: We use the highest allowable temperature in the suppression pool in our --

MEMBER BANERJEE: Right.

MR. BARTOS: -- head calculation.

MEMBER BANERJEE: So in these containment calculations, did you take credit for heat sinks and things that other people have not?

MR. BARTOS: I can't speak for other people, but we did in our application request a methods change.

MEMBER BANERJEE: Right.

MR. BARTOS: And that was to include passive heat sinks, the metal inside containment, as --

MEMBER BANERJEE: How much affect did that have?

MR. BROWNING: This is Kevin Browning, PPL. Our MPSH calculations are based upon a suppression pool temperature of 220 degrees, which is the design suppression pool temperature. Our peak post-LOCA accident temperatures are on the order of 211 to 211.6 I believe. So our -- what we did relative to the MPSH calculations is base them upon the maximum suppression pool design temperature.

So in that respect, the MPSH calcs are somewhat independent of the fact that we credited passive heat sinks and so forth, because they are actually based upon a higher temperature.

MEMBER BANERJEE: How much affect did that have, the passive heat sink --

MR. BARTOS: It doesn't have a big effect on the suppression pool. The effect is has is on the containment pressurization reactor LOCA.

MEMBER SIEBER: Right.

MR. BARTOS: So that's really where you -- the containment --

MEMBER SIEBER: The condensation takes place.

MR. BARTOS: -- in that calculation. The suppression pool heat-up is a longer term phenomenon, and so -- and that's really what the MPSH calculations are looking at.

MEMBER BANERJEE: But eventually the heat has to go somewhere.

MR. BARTOS: Oh, sure.

MEMBER BANERJEE: Yes. So your -- and was there any changes with the decay heat or any other thermal hydraulic things you adjusted for these calculations?

MR. BARTOS: In the thermal LOCA analysis, yes, we did request permission to use a different decay heat model.

MEMBER BANERJEE: Okay. So I think you have to understand that they did things differently from -- for the containment thermal hydraulics, which ended up with somewhat different -- potentially somewhat -- I don't know what the effect was of this, but in any case they were allowed, and you went ahead with it, and it was within the limits. Fine.

MR. LOBEL: This is Richard Lobel from the staff. I want to make sure that you don't get the wrong impression. Like the presenter is saying, the temperature they used is a very conservative temperature, and it's -- when they're talking about heat sinks, that's for another calculation. When they're doing the MPSH calculation, they're using this very conservative temperature that's based on a limit -- a design limit of the plant. It's not a calculated temperature.

The decay heat value that they change to is the decay heat value that every other licensee uses for these calculations. So they're not gaining any advantage over what you've seen before from other licensees. They had a very conservative decay heat model before, and, like I say, they're just changing to the decay heat model that everybody else is using. It's a 1979 with two sigma decay heat model.

So it's really the reasons that the presenter was saying at the beginning are the reasons they don't need containment credit for containment pressure. It's not some change they've made to the analysis that's giving them -- that is allowing them not to have to use the credit, and --

MEMBER BANERJEE: Containment is not larger in this case as well?

MEMBER SIEBER: It is.

MEMBER BANERJEE: Compared to some of the other things we have seen?

MEMBER SIEBER: It's bigger than a Mark 1, I think.

MEMBER CORRADINI: That's -- I think that's a big thing, too.

MEMBER BANERJEE: Otherwise, what you're saying wouldn't explain it.

MR. LOBEL: At one time, I made a presentation to the ACRS, and one of my slides was a chronology of BWR licensing versus required MPSH. And if you look at this table, you look at the very early BWRs, they have pumps that had very high required MPSH values, on the order of 27, 30 feet, much higher than Susquehanna.

And like the presenter was saying, Mr. Bartos was saying, that's really where a lot of the difference comes from, and the fact that they -- these pumps can pump saturated fluid. The BWRs that have taken credit for containment overpressure have all been Mark 1s, and, in fact, they have been some of the older Mark 1s.

Hope Creek, that just -- whose review I guess is close to being done now, is a Mark 1 containment, and they don't require credit for containment pressure. So it's --

MEMBER BANERJEE: Is that because they have better pumps?

MR. LOBEL: Better pumps, yes.

MEMBER SIEBER: Well, there are some plants out there with horizontal shaft pumps. The only way you can get enough suction pressure is to build a vault down under the pad. A deep draft pump with a vertical shaft is easier to establish the right suction pressure, because all you do is just dig a round hole and line it with concrete and put a casing in there. And you can make those just about as long as you want, as long as you can support the shaft vibrations.

MEMBER BANERJEE: Anyway, thanks. That clarifies a lot of things, actually. Thanks a lot.

MR. BARTOS: Yes, thank you.

MEMBER BANERJEE: Okay. I think we are done. Bill?

CHAIRMAN SHACK: Okay. Thank you very much. It was a very good presentation. Ample discussion I think on the steam dryer and other issues.

As I mentioned, we have John Szabo coming at 12:00 for the members, so --

MEMBER CORRADINI: So do we come back here with lunch, or --

CHAIRMAN SHACK: You can come back here with lunch. You can wait. We start up again --

MEMBER APOSTOLAKIS: How long is Szabo going to take?

CHAIRMAN SHACK: -- at 12:45.

(Whereupon, at 11:38 a.m., the proceedings in the foregoing matter went off the record.)

CHAIRMAN SHACK: We will go back into session. Our next topic is an Early Site Permit for the Southern Nuclear Company for their Vogtle site.

Said, do you want to --

MEMBER ABDEL-KHALIK: Yes, Mr. Chairman, I have a conflict with this particular agenda item. Therefore, I will not participate in the discussions.

CHAIRMAN SHACK: Dana, are you going to be handling the presentation?

MEMBER POWERS: We've got two little tasks concerning Early Site Permits to do today and the first is we're going to do what is then called an interim review of the Vogtle Early Site Permit application. What we're actually reviewing is, of course, the staff's safety evaluation report on that application.

And then we're going to discuss what the staff has done with regard to the lessons learned from previous Early Site Permits. I will say the staff has taut presentation on that subject. With respect to the Vogtle Early Site Permit, the application has two differences from those that we've seen in the past. The first is the applicant has indeed selected a particular plant or location on the site and they have done a complete and integrated emergency plan. So that marks a difference from this application than previous ones.

I think you're all roughly familiar with where the Vogtle site is located, but I will turn it over to Mr. Pierce and he can give us the specifics and details that will be followed by staff presentation on their SER and the open items. The interim level is not surprising to have open items.

Mr. Pierce?

MR. PIERCE: Thank you. Good afternoon. My name is Charles Pierce. I am the licensing manager for the nuclear performance activities at Plant Vogtle. I work for Southern Nuclear.

It's a privilege to be here today. We were with the ACRS Subcommittee last week and basically spent the day with them and went through the material for ESP program. We're going to do the -- today, we're going to a summary of that in about two hours. We're going to spend the first hour and NRC is going to spend the second hour. Is that about correct?

MR. DAVIS: About 35 minutes.

MR. PIERCE: Anyway, we're going to spend a few minute going through that today.

I want to just touch on our schedule which is the -- just at a very high level and just discuss the overall schedule of our project. We elected to begin our work with an Early Site Permit and we thought that that was the right thing to do, given our -- some of our issues we had with the -- looking ahead with some of the work wanting to start early. And also with getting some understanding of the process early before we jumped into a combined operating license.

So we started with an LBA, with an ESP and just recently with that ESP we submitted a limited work authorization to do safety-related work prior to getting a COL to the NRC. And they are looking at that. In fact, we hope to get that authorization with the issuance of an Early Site Permit in '09.

We also intend to submit --

CHAIRMAN SHACK: I have got a question on that. That's really -- you're going to do that whole excavation and backfill under that work?

MR. PIERCE: The excavation is actually done, is considered nonsafety-related and it can be done prior to getting the limited work authorization. The backfill is safety-related and it will -- we will be doing the backfill under that activity as well as putting in the mud mats and the initial rebar for the foundation. That's basically where that activity will stop.

We're looking at submitting a COL application, combined operating license application to the NRC staff in March, on March 1, of 2008. And at that point in time the three major activities that are shown in this slide that will have going on is we'll have an ESP review underway. We'll have an NRC review underway for the COL activity and we'll have a PSC certification process underway which involves our Georgia Public Service Commission where we need a certification certificate of need and we're looking at that coming in late 2008 from the Public Service Commission.

We are -- if everything runs smoothly, we're looking at approximately 39 to 40-month NRC review of the COL application, followed by 48 months of construction. It gives us a start up date for our first unit in January 2016. The actual discussion on whether to start construction or not will be made after we get the PSC certification, assuming we get that.

Just moving ahead real quick, I do have -- we did bring some people here today to answer your questions and make the presentations. Over on the far end, we've got Bob Prunty who is a Bechtel staff member who has supported pretty much all aspects of our ESP work. Jim Davis, who is next to him, he is our Early Site Permit Project Engineer. He heads up all the Early Site Permit Activities.

Tom McCallum, who is next to him, is our Site Development Project Engineer. He heads up site development activities, including site engineering work, so he will be talking about the seismic activity, because that falls under some of his area as well.

And finally, we have Don Moore, next to me, who is our internal Southern Nuclear seismic expert. So he has a lot of experience in seismology and seismic is a rather significant issue in the Early Site Permit. We brought him along to answer your questions as well.

So with that, I'll turn it over to Jim.

MR. DAVIS: Thank you. I'm going to be giving the Early Site Permit overview. I'll turn it over to Tom at the geology section, but just kind of to give you a feel for what is in the application and how it was developed and some of the topics we covered.

First to start off, oversight is 3,169 acre site located on the southwest side of the Savannah River, eastern Burke County Georgia. It's across, directly across the river from the Savannah River site. It is illustrated on this figure. It is about 150 river miles upstream from Savannah, Georgia, and about 26 miles southeast of Augusta, Georgia. This is a six-mile radius on this figure just to illustrate what is in the area.

Next slide gives you a 50-mile region around the plant just to give you an idea of what's in the area where Augusta is located and some of the other small towns around the plant. One benefit to the Vogtle area is that it is a pretty rural area, so we'll talk a little bit about that in a couple of slides.

CHAIRMAN SHACK: Now Augusta is the biggest town in this circle, right?

MR. DAVIS: Right, that is correct. This figure is a new plant layout. This figure, from the application, it illustrates where the new units will go in relation to the existing units. It would be in the West -- the units, that are in black, are the existing. With the orange are the new units with the cooling towers. Also in this drawing, we identify where the new intake structures are going to be and the discharge structure.

The purpose of this figure in the application accomplishes several things, locating where the new units are going to be. We also identify on this figure where the owner exclusion area boundary is, which is the current exclusion area boundary for

Units one and two. Also in this figure we use it for the purposes of illustrating and more conservative EAB around the units that we use for calculations, so that we would have a common distance to the water. We shortened that so we would have a half a mile around the units just for the purpose of the calculation so we know we're bounded on anything that we do..

MEMBER APOSTOLAKIS: So the exclusion area would be the same?

MR. DAVIS: That's correct.

MEMBER CORRADINI: For calculation? I'm sorry, for calculation --

MR. DAVIS: Right, the real exclusion area boundary is the same as Unit two, which is the property that we control. For calculations, we used a common radius around the units. We have a power block circle, let's see if --

MEMBER APOSTOLAKIS: Can you point to the previous figure?

MR. DAVIS: What we had is we developed the power block circle here and then we took a standard dimension away from the power block of a half a mile and drew another line around. For the purposes of just running our calculations, you know, to determine that we had met all of the limits at the EAB, we use that standard formula. Because you can see there are different distances from the units to the EAB.

So regardless of the direction you go or the wind was blowing or anything, we would use a common dimension from this power block circle just for the purposes of our calculation.

MEMBER APOSTOLAKIS: Is that a road on the left hand side?

MR. DAVIS: This right here?

MEMBER APOSTOLAKIS: Yes.

MR. DAVIS: Yes, this illustrates the new access, construction access road that we're going to have and also the road that we're going to develop down for the barge slip. We're going to improve the existing barge slip and develop a road from the barge slip for off-loading of, you know, like components. This is just where we're trying to separate, here is the existing entrance to the operations for Unit One and Two. So we wanted a separate entrance for construction so that you're not mingling those four forces.

MR. McCALLUM: None of those roads are

public.

MEMBER BANERJEE: And the black lines are also roads?

MR. DAVIS: This right here is the, this is Highway 56 spur that goes past the plant.

MEMBER CORRADINI: That's existing road?

MR. DAVIS: That's an existing road, and this is the existing entrance to the plant. The blue is a new construction entrance road. We'll have parking on this and we're going to separate the construction project. That's one of our first goals is to separate from operating units by a fence or barriers. To separate the two.

MR. PIERCE: And just for clarity, when we say is anew , it has not been constructed yet.

MR. DAVIS: This is the plan.

MR. PIERCE: Right.

CHAIRMAN SHACK: Now these modules are rail shippable, but you're going to bring them in by barge so that they're going to be by railroad somewhere, and you'll pick them up and put them on a barge and bring them here?

MR. DAVIS: Well, I believe -- do you want to speak to that, Tom?

MR. McCALLUM: Yes, it's really a decision that the constructors would have to make which way is the best way to ship it and if they are being built in a shipyard, some of the plans we had talked about, they could be put directly on a barge, brought to Savannah River.

Some of the smaller piping modules would be shipped in by truck and some by rail.

MR. PIERCE: One of the possible advantages of moving by barge is that we could go ahead and --

CHAIRMAN SHACK: Put some modules --

MR. PIERCE: Make some of the modules larger and ship perhaps larger modules.

MR. DAVIS: We developed the application following the regulatory guidance, also RS-002 which is processing applications for early permits and we used the AP1000 site interface requirements when we were citing what kind of information we needed to include in the application.

We did have a benefit at Vogtle site being an existing nuclear site. There was a lot of data available from one and two that we could use. In addition, there was a lot of work that was done across the river from us at the Savannah River site, extensive geotech research there that we had available to use as well that helped us.

Specifically, for the Early Site Permit we developed a boring studies, different studies on site for the materials that were there. Also, we had put in monitoring wells and monitored the water table for a year, in addition to the existing wells that were there for the site that were in a monitoring program. Also, we were able to use some of the metadata from the existing site which I'll mention in a minute.

Part of the benefit of picking a particular technology was that we were able to do a conceptual design for things like the intake structure and discharge structure in cooling towers. We knew what we had to interface with, so it helped us to be able to develop more in our application, cover more things and in the initial ESP applications did.

This next slide kind of illustrates how we're kind of different from that first wave of ESP applicants and I'll just cover a couple of items. First of all, we did pick a technology. We picked the Westinghouse AP1000 which allowed us to do more specific analysis with them, and as I mentioned we were able to tie down the locational plants and the location of the intake structure and discharge structure. That helped us have more complete and accurate calculations of how we're going to impact things like the river and the environment as well as calculating our doses at the plant boundary and the LPZ. So that was a benefit from selecting that. And we learned that from looking at the lessons learned from the initial plants that did the PPE and saw where they couldn't reach finality on some of the issues because they couldn't tie down as much. And that led to our decision to go with that, go with that specific technology.

MEMBER BANERJEE: If you make a decision to build this plant, then it would be AP1000?

MR. DAVIS: That is correct. That is our force right now. That is what we plan to do.

By choosing a technology, you don't have to bound as much. You know what that technology effluence would be, how much water it consumed. There's a lot of things you can tie down that you don't have to bound for several different technologies. So that led us to choose that because we could reach more finality, you know, the NRC could do a more complete review. There weren't as many unknowns when you pick a technology.

MEMBER BANERJEE: But if something happens and you change your concept, the system that you build, then you have to redo quite a bit of stuff, right?

MR. DAVIS: We would have to -- that is true. If for some reason we chose to go to something the size of AP1000, then we would have to go in and look at the values that we analyzed for an AP1000 and see if that different technology was bounded or not. If it wasn't bounded, then we could update it at COL studies where we would update the analysis and show how the new parameters, site parameters work acceptable to that site.

MR. PIERCE: But the bottom line is it would be a significant rework on the Early Site Permit.

MR. DAVIS: Yes, it would.

MR. PIERCE: And it would get re-reviewed by the NRC staff as a result of that work. So it would be a significant undertaking by both sides.

MEMBER POWERS: I don't even think about it.

(Laughter.)

MR. DAVIS: We don't want to go there. Something different from the first three applicants the last time on this table is that we elected to go with the complete and integrated emergency plan because we wanted to achieve as much finality as we could and for the Vogtle site we had an existing emergency plan that was matched pretty well with the current regulations so it was easier for us to go there and take that and adapt it to the 3 and 4 Units.

The ESP application has five parts. Part one, the introduction, the site safety analysis report is part two. Environmental report was part three. The redress plan is part four. And emergency plan was part five. Basically, SER covers part two and part five.

We submitted our initial revision zero in August of 2006. We had an LWA-1 requesting that and that basically covered the construction preparation activities and explanation of the power block and the following year, August 2007, we submitted a Supplement 1 to our Rev 2 and we included an LWA-2 request which included placing the engineered backfill and preparation for pouring the nuclear island base slab.

Currently, the regulations have just changed on LWA and we plan to go to the new process and this being LWA just covers the safety related.

MEMBER APOSTOLAKIS: What did you just say?

MR. DAVIS: Under the old rule you had a two-step process of LWA-1 and LWA-2.

MEMBER APOSTOLAKIS: Right.

MR. DAVIS: Most of the things that were covered by an LWA-1 under the old rule don't require an LWA now as the safety-related construction activities that require an LWA review. And what we plan to do in our next revision is move from the old rule to the new rule process so that --

MEMBER CORRADINI: So certain things aren't required.

MR. DAVIS: Right. Things that used to require an LWA-1 no longer require that, so we'll revise our application to be consistent with the new --

MEMBER POWERS: The idea is to focus resources on the safety-related items and not access --

MEMBER APOSTOLAKIS: So you can have an

LWA to work on safety-related items before the COL is approved?

MR. PIERCE: Under -- right, that's correct. We can get an LWA, there are a couple of mechanisms under the rulemaking, on the new rulemaking to get an LWA. One of them is through the ESP process, so we're working our LWA, limited work authorization through the Early Site Permit process.

MEMBER APOSTOLAKIS: And essentially, if the COL is not approved, you're taking a risk.

MR. DAVIS: That's correct, and we have a site redress plan. That's part of having that. If for some reason we weren't granted the COL or, you know, maybe financially there was a problem or something then we'd make commitments in a redress plan to take the plant back to an acceptable state.

MEMBER APOSTOLAKIS: Okay, thank you.

CHAIRMAN SHACK: That's what you need PSC permission for presumably is to make that commitment.

MR. DAVIS: That's correct.

MEMBER APOSTOLAKIS: Which commitment?

MEMBER BANERJEE: To build the plant.

MEMBER BLEY: To get money.

MR. DAVIS: Yes, I think we all --

MEMBER POWERS: Professors are not so much.

(Laughter.)

MEMBER APOSTOLAKIS: We are about money.

MR. DAVIS: Probably the -- Part 2 is the safety analysis report of the ESP and basically it's organized on an FSAR format for the sections required for an ESP. That Chapter 1, which is the introduction and general description. Chapter 2, which is by far the largest section is a site characterization and contains a lot of the information about why your site is acceptable for a new unit.

Chapter 3 we address aircraft hazards. Chapter 11, liquid and gaseous releases from normal operations. Chapter 13 addresses emergency planning and security. Fifteen, passenger analysis. Seventeen, quality assurance. Basically, I'm going to count out, just go through those in a little more detail in a few minutes.

We had six NRC site visits. One was pre-submittal on our application during our initial on our initial boring program. That was in October of 2005. And then quickly after we submitted in August, they had our quality assurance audit which was at our corporate office and then we had four more site visits on technical subjects, which ran through October to January of 2007.

As a result of these visits, we had significant number of RAIs that we responded to, 189. I kind of highlighted the two of the areas that we got the most questions in. Geology and seismic, because it is a big, complicated, technical field that has a lot of data and information. We cover a lot of items in it. And then emergency planning, because it was a new thing. You know, nobody had done what we had done before with a complete, integrated plan. And therefore, we had a lot of questions.

MEMBER APOSTOLAKIS: How much of the seismic analysis that was done for the existing units could you use?

MR. DAVIS: I'll let Don answer that question.

MR. MOORE: The seismic analysis that was done that was done for the Westinghouse designs that are different, the AP1000 is different.

MEMBER APOSTOLAKIS: From the plant itself?

MR. MOORE: Yes, but the plant, technical aspects are similar. They are about 1500, 1600 feet apart. So the properties, the soil properties should be somewhat similar, are similar. But the analysis will be for a different type of design.

MR. PIERCE: And the regulatory process for the analysis has changed from a deterministic process to a more probabalistic process. Is that ---

MR. MOORE: That's correct.

MEMBER APOSTOLAKIS: When was the original analysis done?

MR. MOORE: It was done in the I think late 1970s, early 1980s.

MEMBER APOSTOLAKIS: This is a very different state --

MR. MOORE: Yes.

MEMBER APOSTOLAKIS: The emphasis --

MR. MOORE: Programs that were in use back then were like a program called FLUSH and were using Westinghouse would been using programs such as SASSY. It's a different structure and rational analysis programs.

MEMBER POWERS: More to the point that you would be interested in, George, is that there has been a USGS reassessment with the frequency with which major earthquakes occur in the region. Though intensity is normally roughly the same, the return frequency is higher.

MEMBER CORRADINI: The what? I'm sorry.

MEMBER POWERS: The return frequency is higher. I'm sure they'll get into it.

MEMBER APOSTOLAKIS: You will plan to go back to the seismic later?

MR. DAVIS: That's probably the most slides we got is on geology. We cover more of that. You'll have more opportunities for questions.

MEMBER APOSTOLAKIS: Emergency Planning?

MR. DAVIS: Yes, you have a complete and integrated emergency plan with ITAAC. It was brand new, it's never been reviewed before.

MEMBER CORRADINI: I was going to ask about that to make sure if I understood when you keep on saying that complete and integrated. You mean complete and integrated with taking the two new units and the two that are there together and essentially melding the emergency plan for all four units together?

MR. PIERCE: That's true, but that's not what the term means within the Nuclear Regulatory

Commission. What you're saying is true, that's exactly what we did for our site. But within the context of the Nuclear Regulatory Commission, there's three options on Early Site Permit --

MEMBER CORRADINI: I'm supposed to know this, so you're kind of helping me. Thanks.

(Laughter.)

MR. PIERCE: Okay. There are three options for looking at emergency planning under the Early Site Permit process. One of them is considered to be a --

MEMBER CORRADINI: Major features.

MR. PIERCE: One is major features. The first one is -- help me out, Christian? The first one is --

MR. ARAGUAS: Major impediments.

MR. PIERCE: Major impediments, that's correct. The first one is major impediments where you look at significant impediments to building units at the site. The second one is major features, where you look at some of the major features of emergency planning and address them specifically. The third option is a complete and integrated plan where basically you develop a complete plan for the site at the ESP stage, and we chose that option.

MR. MATTHEWS: Let's be clear. The integrated also relates to with state and local government.

MR. PIERCE: That's true.

MEMBER POWERS: And in this case, it also has to be coordinated, I use the coordinated, with the Department of Energy because of the Savannah River Site.

MR. MATTHEWS: That's true and also you know that, excuse me, this is David Matthews, Director of New Reactor Licensing in the Office of New Reactors. Integrated also with the offsite reviews done by the Department of Homeland Security and FEMA.

MEMBER CORRADINI: Actually, thank you. That leads me to my question, which is so this is a big challenge. Does everybody still know who is on first and do we know who is on first and who is on second as to the coordination of all of this?

MEMBER POWERS: I have no idea what that question means.

MEMBER CORRADINI: FEMA, you mentioned FEMA and Homeland Security. Is it very clear as to where the authority and responsibilities lie, so as you develop this integrated plan? I guess, I was under the impression this is still a bit cloudy?

MR. MATTHEWS: No. It is very clearly articulated and it is administered not only by consistent regulations of both agencies, but also by virtue of a Memorandum of Understanding between ourselves and FEMA. And then we are members of a joint NRC-FEMA steering committee that ensures the close coordination of those activities.

MEMBER CORRADINI: So can I ask one last question? It is kind of taking 30 seconds of their time. So then if something occurs, at what point in the plant boundary does it become FEMA's problem, not NRC's problem?

MR. MATTHEWS: That's probably worthy of a whole, day long meeting associated with the operational aspects of implementing an emergency plan.

MEMBER CORRADINI: So the whole memorandum, I sense that the clarity may be --

MR. MATTHEWS: No, you're confusing response responsibilities and planning responsibilities. Planning responsibilities are clearly articulated as are response authorities. Okay? We usually divide them in two. There is emergency planning and emergency response, okay? And the two, of course, the emergency planning has to lead to effective emergency response, okay? But in terms of division of authority associated with the approvals needed for granting a permit or a license, okay, those divisions of authority are clearly articulated.

MR. MATTHEWS: Okay.

MR. DAVIS: The open items were issued in August, and we provided a response to all 40 open items on October the 15th and I know that they are under review by the NRC staff. Thirteen of those responses required additional information. We were developing either new models, new testings -- there might have been testing associated with our COL program that would support those answers, and we're developing that data and answers and will provide those in the future as it becomes available.

MEMBER APOSTOLAKIS: This is just a listing?

MR. DAVIS: That's right.

MEMBER APOSTOLAKIS: Okay.

MR. DAVIS: There were three items that we feel like we're going to have to have some significant interface with the NRC to reach resolution, not just working through conference calls and meetings and stuff to make sure that we understand the issue and that we can come to resolution on it. I'll just highlight quickly. One is hydrology, resolving the issue on the source of safety-related water and the proposed permanent condition that's in the SER.

The other two deal with the seismic area. One is the need to update the EPRI Dames and Moore Team M and max values and the other was to resolve the issue concerning the need to update --

MEMBER APOSTOLAKIS: I never heard the word before the word safety-related water.

MR. DAVIS: Well, that's why --

MEMBER APOSTOLAKIS: You have special treatment?

MEMBER POWERS: Water that's fed into the safety-related system.

MEMBER APOSTOLAKIS: I understand that, but I mean --

MEMBER POWERS: Why have you not heard this?

Not been listening?

(Laughter.)

MEMBER APOSTOLAKIS: It's usually systems, structures, and components.

MR. DAVIS: The final item, ETSZ seismic zone.

We've already had phone calls on the last item. We had one this week. We've got more scheduled next week to address that and we're committed to work with the staff to reach resolution on these issues.

MEMBER APOSTOLAKIS: M maximum was what, the maximum magnitude?

MR. DAVIS: Yes.

CHAIRMAN SHACK: Intensity, right? It's not magnitude.

MR. DAVIS: I will defer to my expert.

MEMBER APOSTOLAKIS: Is that magnitude?

MR. MOORE: Yes, it's magnitude.

MEMBER APOSTOLAKIS: Right.

CHAIRMAN SHACK: It's Mercali intensity.

MEMBER APOSTOLAKIS: No. Mercali is not used. Mercali is --

MR. MOORE: That is a damage measure at a given location based on an earthquake, but the earthquake is defined by its magnitude and epicenter.

MR. DAVIS: Chapter 2, which I mentioned earlier was the largest section. We deal with geography, meteorology, hydrology, geology and seismic. And I'll just kind of quickly run through those.

Geography and demography are important because we established, as I said in that figure we talked about in a little detail, the site boundaries to determine your release limits. Exclusionary of boundary control, how we make -- where does the public have access and what parts do we control. And also we develop the population distribution around the area for use as input store models and calculations.

MEMBER CORRADINI: Do the models for the population distribution have projections as to growth?

MR. DAVIS: Yes, we project the population based on the latest census data out to 2070.

Currently, there are no open issues in this area. All items have been resolved for this.

2.2 addressed potential hazards in the area of industrial mine facilities, transportation, military facilities. We evaluated Unit One and Unit Two and in addition, we have a Plant Wilson which is a diesel generator plant that is adjacent to the latest site. We've resolved all issues for this area as well.

CHAIRMAN SHACK: Can I ask Mr. Pierce, you keep bumping your papers over the microphone there. That's causing the reporter problems.

MEMBER CORRADINI: Can I ask a question at this point? So is there a criteria based on distance or on industrial activity characteristics at which you must consider some of these things? In other words, are we talking about miles away, chemical plant, past tense?

MR. DAVIS: Yes. Distance within a five-mile radius is the governing -- correct me if I'm wrong -- and then you have to evaluate it for like toxic fumes and explosions.

MEMBER CORRADINI: Within that five-mile radius.

But outside of five miles things then, there's not a consideration?

MR. DAVIS: That's correct.

MEMBER CORRADINI: Thank you.

MR. DAVIS: Meteorology, we had five years of data that we used from the on-site met. towers. We also looked at Augusta Bushfield, which is the national weather service closest to the plant, as well as some regional cooperative stations around the plant site. We used these and developed the max-min temperatures for our analysis.

We also, in this section developed a site-specific diffusion estimate which we used in calculating the doses in Chapter 15.

We had one open item for this area which we responded to and provided the requested information.

Hydraulic engineering evaluates the potential floods, dam failures, storm surges, ice effects, well water events, groundwater impacts and also evaluated the accidental release of radioactive liquids.

We've responded to the four items and specifically in this area we're developing a new model to evaluate the impact to the groundwater conditions after construction which will look at the recharge to the groundwater because we put in new parking lots and new buildings and stuff and how that might affect the flow of groundwater in the future.

MEMBER POWERS: Let me ask a little question about this. What the staff did in their assessments seems to have hypothesized an alternate route for water flow in the post-construction environment. And I presume you've gone through and monitored that hypothesis?

MR. DAVIS: That's correct. We're looking at several different impacts and scenarios with this new model to see how that might affect the groundwater conditions in the flow. Currently, we have the wells and stuff and we've modeled the contours and the direction of flow in the groundwater. And part of the concern was, you know, would that -- would the construction make enough changes to impact that direction. And so we're putting in different scenarios to see how that would be impacted.

MEMBER POWERS: But it's one model with different scenarios or multiple models?

MR. DAVIS: It's one model. One model for the scenarios.

MEMBER POWERS: Thank you. The essential issue is at what point would effluents emerge into the open environment, as I understand it and would that happen before or after reaching the Savannah River.

MR. DAVIS: Right, and I'm going to turn it over to Tom to talk through the geology area.

MR. McCALLUM: I'm going to hit these really fast, just cover the high points and if you want me to stop --

MEMBER POWERS: There are no high points.

(Laughter.)

MR. McCALLUM: Stop me if you want to ask questions and Don will step in and answer the detailed questions, but I'm going to cover these really fast.

This is just the table of contents for the SSAR and describes how the topics are grouped.

Next slide.

I want to cover the program organization and how we got this work done. Southern Nuclear had overall project responsibility for that and for that we relied a tremendous amount on Don Moore. We had managing the details of that work. We had Bechtel in Fredericksburg managing that work doing geotechnical work. Working through Bechtel, we also had William Lettis & Associates, they were primarily responsible for doing the geotechnical and seismological investigations. The primary investigator there was Dr. Scott Linville.

Risk engineering played a role in doing the probabilistic safety hazards assessment and the development of the ground motion response spectra, the safe shutdown earthquake. That was Dr. Robin McGuire.

And Bechtel San Francisco was responsible for the site transfer functions, Dr. Farhan Osterdam, and several others out there. The other group I want to mention on this slide is our ground motion review and advisory panel. We had Dr. Martin Chapman, who is a noted expert at Southeastern Seismology; Dr. Bob Kennedy who is a seismic structural expert. We had Dr. Carl Stepp and Dr. Robert Youngs, who are both seismologists and experts in the probabilistic safety hazards assessment field.

MEMBER APOSTOLAKIS: The PSA at HA, how was it used to determine any design?

MR. McCALLUM: I'm going to go over that in just a minute, if that's okay. But let me -- you bring up a good point. Let me mention that this is not like the old Waverville plant where you came up with a design spectra and went off and made sure the plant was designed to that spectra. The AP1000 already has a design spectra that's set and it's a standard design and that design spectra applies wherever you put it.

What we're coming up with is a site response spectra that you then compare to that design spectra and if you're beneath it, then the assumption is that the plant will be safe in that location. If you have excedences, you will have to go evaluate those excedences.

MEMBER CORRADINI: So you develop the forcing functions, so to speak, and compare it to the generalized forcing functions?

MR. McCALLUM: For the ESP, we came up with a ground motion response spectra called the safe shutdown earthquake at some point. It is a motion at the rock, at the very layer of rock at an outcropping. During the COLA stage, we take that up to the floor response spectra for the plan. That would be compared to the design spectra for the AP1000.

MEMBER CORRADINI: So you go part of the way at this point.

MR. McCALLUM: A little part of the way.

MEMBER CORRADINI: And the logic of stopping there is?

MR. McCALLUM: In an ESP, typically, you're evaluating the site, not the plant, so the layout of the ESP doesn't really take it to an actual floor response spectra for a plant.

MR. MOORE: I just want to mention that what Tom is specifying, we do bring it up from hard rock through the soil profile up to the highest competent layer at our site.

And that highest competent layer is called the blue buff model which is about 90 feet below the surface. And we define the SSE ground motion or what we now call the GMRS ground response spectra. And it is specified at an outcrop of that material. And then for a site-specific evaluation, say AP1000, is at a certain depth and so we have to consider the backfill and the depth of that particular nuclear island for the AP1000 and then we have the site-specific analysis.

MEMBER BLEY: It looks like you'll get into the details of this a little layer?

MR. MOORE: Yes.

MEMBER SIEBER: Hard rock is about a thousand feet under the surface?

MR. MOORE: Yes, the rock is about a thousand feet below, but it there's different types of rock and different shear wave velocities. About a thousand feet or so.

MEMBER SIEBER: It's basically sedimentary above that?

MR. MOORE: Yes.

MR. McCALLUM: This slide, the purpose of this slide is just to point out that these plants are very closely existing units. They're 1700 feet apart. They will actually be within the same protected area under our current plan for constructing these units. They're not miles apart. The geology beneath them is similar.

Next slide.

The first step was doing the geotechnical and seismological evaluations, done by William Lettis and Associates that consisted of quite a bit of research. It was about a year's worth of work looking at the whole area around it including aerial reconnaissance, the investigation of local features, focused on the area close by the plant. Two things I want to point out, in particular, on this slide is the seismic reflection profiles at Vogtle and a geomorphic analysis of river terraces.

One of the things that was noted about the Vogtle site is we do have the Pen Branch Fault running beneath the site. This fault has been studied extensively at Savannah River site and was considered to be noncapable through analyses there. When we started this, we didn't know whether it was on site or not. And Pen Branch Fault has two different types of rock. One side is a sedimentary, Triassic sediment sandstone. On the other side is a crystalline rock. That feature would affect the seismic response to the plant, a rock response to the plant and how it's propagated up.

So we felt it was important that we locate it on site, even though it's a noncapable fault and so a lot of our research was done to locate and determine where that fault was on site, and we'll show you some pictures in just a minute. The general conclusions from this geotechnical and seismological investigation are basically the same as what we have for the existing units, and that is that none of the tectonic features on this site vicinity or the site area are considered capable tectonic sources. The other relates to the top layer of soil. For Vogtle one and two, we had to excavate the entire top 90 feet of soil, due to collapse features and a limestone that has dissolution features in it. That was all removed for one and two, and our plan for Vogtle three and four would be to do the same time, that those features that couldn't relate to liquefaction are all going to be removed as part of plant design.

MEMBER POWERS: You might give them some feel for the magnitude of --

MR. McCALLUM: The magnitude?

MEMBER POWERS: That one line that says we're going to remediate the soil --

MR. McCALLUM: We're looking at, for the power block excavation, his question is the magnitude of that work, of decision to excavate and backfill the holes for the site. We're talking somewhere around 45 million cubic yards of excavation and backfill for the power block areas. Total on site, we're looking at somewhere around seven to nine million cubic yards of earth movement.

One of the reasons the LWA is so critical for our site is to be able to place that backfill over a period of 18 months to two years. It's not a one month effort.

(Laughter.)

I just wanted to point out --

this is an image view of the Pen Branch fault looking from basically standing on River Road, looking to the northeast. We image the fault at four locations on site. We did several miles of seismic reflection and refraction surveys. This was the best image that we were able to attain. The fault itself is this image by this line, to the west is a crystalline rock basin, which starts about this location.

To the east is a Triassic basin is thrust upward about 100 feet above the crystalline rock, so this is the a sandstone base on this side. The location of the plant, if you were to see it in this picture, would be directly above this location. Sixteen units are in this area.

The surface, the layers above this, on this side and on this side are a combination of coastal plain sediments. Basically, it's all coastal plain sediments of different layers and I'm going to discuss that a little bit more later.

This slide, just want to give you a feel for where the site, where the fault is located. This is a vertical projection of the upward of the bedrock expression of that fault and it passes to the west of unit four. The image that you were looking at was if this line --

MEMBER BLEY: I'm sorry?

MR. McCALLUM: The image that you saw in the slide before was basically from this location looking normal to the fault, or normal to that line, looking back to the east. The red indicates where the fault was imaged on each of our seismic lines, and the fault is projected to go across the river and meet up with the projections for the fault at the Savannah River site.

MEMBER SIEBER: It take it the actual area of the units three and four is about fifteen acres?

MR. McCALLUM: Well, it depends on how you define the area. If you're talking about the power block --

MEMBER SIEBER: The plant blueprint, yes.

MR. McCALLUM: It might be a little larger than that when you go out to the security fence. You can define that as your power block.

MEMBER SIEBER: I'm excluding cooling towers and things like that.

MR. McCALLUM: Yes, that's a reasonable approximation. The blue lines that you see on this figure are the bearing layer, the upper surface of the bearing layer, which is the Blue Bluff Marl, at about 90 feet down, and you can see that the Blue Bluff Marl was deformed by the Pen Branch Fault and thrust slightly upward with a maximum depth of somewhere around 60 feet. Next slide.

Next slide basically talks about how we did our PSHA to come up with a rock hazard. We used reg guide 1.165. We looked at the effects of additional seismicity from 1985 through mid-2005. We did an update of the EPRI SOG Seismic Sources, which included a pretty significant update of the Charleston earthquakes and we used the EPRI Seismic Owners Group ground-motion models. This effort basically produced a rock hazard for our site. Next slide.

MEMBER APOSTOLAKIS: What is SOG?

MR. McCALLUM: Seismic Owner's Group, EPRI Seismic Owner's Group.

MEMBER APOSTOLAKIS: Is there a Livermore approach to this?

MR. MOORE: There were two PSHAs. They were developed in late 1980s and the EPRI SOG was the industry's PSHA that was developed for the Central and Eastern US and that is per Reg Guide 1.65. That is an acceptable starting point for your developing a PSHA for your site.

MEMBER BANERJEE: Following this earthquake in Japan, at least in Japan there's a lot of re-evaluation of all this going on. Is there any of this filtering into the analysis here, or any though being given to this?

MEMBER POWERS: Most of that would be on the seismic effect on the plant, not the site.

MEMBER BANERJEE: Because the Japanese review, at least what they were telling us at this quadripartite meeting is also involving the seismicity analysis quite a bit. No, no, the site. Yes, sure.

MEMBER POWERS: How does it relate to the East Coast of the United States?

MEMBER BANERJEE: No, I'm saying what were the -- they have found that they have to take account of at least their finding, I think, that they have to take account of a lot of fairly distant faults and things that they hadn't thought of before. I don't know if this has any relationship whatsoever to this.

MR. MOORE: This is, of course, Japan, that area is very active. It's very similar to California. There are known faults that are actually, you can identify. It's a totally different region and so in the Central and Eastern U.S., we don't have that kind of information and we have a history, but there is no, you know, we're basically looking at, we have some sources like the Charleston source and we have some regional seismicity that we relate. But it's a totally different way of, it's a different type of seismic hazard characterizations, and the Japan activity, they're looking at active faults and we have no active faults within our 200 mile radius.

MEMBER SIEBER: The 1886 seismic event at Charleston still figures in pretty predominately to this site.

MR. MOORE: Correct, right.

MEMBER SIEBER: It's only 100 miles away.

MR. MOORE: That's correct, and I'd like, as Tom pointed out, that we did, based on new paleoliquefaction investigations as Tom said, there was -- it required a significant update which we did under Shack Level 2 process.

MEMBER SIEBER: Have they found liquefaction areas around this site that they attribute to the Charleston seismic event?

MR. MOORE: No, the paleoliquefaction, there is none that are close to the site per se, by what I mean by close, but there is some paleoliquefaction features that go somewhat inland, but not -- but they're all associated -- at least our position is they're all associated with the Charleston seismic source which is located within the coastal area.

MEMBER SIEBER: Right.

MR. MOORE: And we have some models that were developed that had different zones that were considered and given different weights and that was all updated to consider current information.

MEMBER SIEBER: Well, the rock strata that underlies this site is about 1000 feet down.

MR. MOORE: Correct.

MEMBER SIEBER: It goes all the way to the ocean including Charleston, right?

MR. MOORE: I'm not sure I quite understand.

MEMBER SIEBER: That is the underlying structure that runs along the coastal plain all the way to the Atlantic Ocean by Charleston.

MR. MOORE: Yes. I mean it's a coastal plain area and we have a lot of sediments. We have the rock underneath, but at the Vogtle site, we have a Dumbarton Basin which is a localized area.

MEMBER SIEBER: Yes, but there is a connection.

MR. MOORE: Yes, yes, there is.

MR. McCALLUM: This next slide basically

we talked about the PSHA, come up with rock hazards. This tells how we came up with the -- took that rock hazard and developed the properties necessary to translate that to our level at which we're doing a ground motion response spectra. And I'm not going to go through this unless somebody wants to talk about it. I would just be reading the slides.

One of the features that we did have to come up with to do that was to look at the shear wave velocity for the soil above the rock at our site. Rock was located at our site at 1050 feet through a deep boring. The 1050 feet, as you can see in this slide, if we were to transition from the coastal plain sediments into the Triassic Dumbarton Basin and the layer that you see at this location with the slightly higher shear wave velocity, that is what we are calling the bearing layer, that's the Blue Bluff Marl, about 90 feet down. It's about 70 feet thick.

Below this, you have the -- what we refer to is the lower sands. It's fairly densely compacted coastal plain sediment. Above that is fairly nonuniform upper sands feature and that is the soil that we'll be removing and backfilling, we need an engineered backfill to construct the plant.

MEMBER CORRADINI: So, just -- this is very helpful, just to understand. So you said that with your LWA, once you get it, all the material up to where you get this notch in the velocity will be removed.

MR. McCALLUM: That's correct.

MEMBER CORRADINI: And then what did you say was at that location that caused the source velocity or the source excitation to go up? What's there?

MR. McCALLUM: Below this is layers of coastal plain sediments. It's sand and fairly uniform consolidated. Above this is basically a clay layer, part of clay. If you held a piece of it in your hand, if you weren't holding a piece of rock you might say hey, feels like a piece of rock. You hold it next to a rock you say no, it's softer than rock. If you get it wet, it's a little bit soapy.

MEMBER CORRADINI: Okay.

MR. McCALLUM: But it is basically a hard clay.

MEMBER CORRADINI: And the very fact of its density and its rigidity causes the change here?

MR. McCALLUM: Yes.

MEMBER SIEBER: It makes your clothes turn brown.

MR. McCALLUM: It is also the layer that the whale fossil was located in during the Vogtle I and II, if any of you heard of the whale fossil.

MEMBER SIEBER: It's 100 miles to the west, too, that clay layer.

MR. McCALLUM: That clay layer extends over -- there's an --

MEMBER SIEBER: It's close to Georgia.

MR. McCALLUM: Yes. The next step basically, take the rock hazard, move it -- get the properties to the soil and the last step is how do you bring all of that together to come up with a ground motion response spectra.

And the main point here is we use the ASCE 43-05. It's a performed-based approach to bringing this together and the next question is where do you define that input for ESP. And we follow the reg. guides and basically defined it at the top, hypothetical outcropping of the highest competent material. Didn't make any sense to take it up through the upper sands, which can be removed anyway. We defined it basically at the top of the Blue Bluff

Marl. I've got a slide here that will show you a little bit more about that in a moment.

MEMBER APOSTOLAKIS: Is the SSE spectra right now, different from what was used for Vogtle one?

MR. McCALLUM: Yes.

MEMBER APOSTOLAKIS: How different is it?

MR. MOORE: I think that what we are comparing the two, Unit One and Two, was determined on a deterministic approach that was used in the early plant designs. It is a .2 g peak ground acceleration and it has the reg guide 1.60 standard spectra attached to that.

The ground motion that we submitted as part of it, and to go through this process, had at 100 hertz, it was .3 g and if you compare it with the two, these spectra could be a factor of two or higher. Or one and half to two higher over certain frequency ranges.

MEMBER APOSTOLAKIS: What does that tell us about the existing units?

MR. MOORE: I think the existing units have been evaluated in the past for higher ground motion, such as a .3 g. It was evaluated as part of the individual plan examination for external event seismic. And the plant was evaluated for beyond the design its basis and shown to have a significant seismic margin and so I think you cannot base the capacity of a plant just looking at the ground spectra.

But there is a difference, but it is in the difference in the methodology coming up with a design ground motion. Before, as I said, in the earlier plants, then used that deterministic approach, and this, we're now using a probabilistic approach, or at least in the effort of trying to account for uncertainty.

MEMBER APOSTOLAKIS: But even for the old units now, you're using the probabalisitic argument why you don't have to do anything to set up IPE or the PRA did consider --

MR. MOORE: But that was an assessment. That was an assessment.

MEMBER BLEY: They did a margin study. EPRI margins?

MR. MOORE: Yes.

MEMBER BLEY: Yes, it was the old EPRI margins.

MEMBER APOSTOLAKIS: But on the basis of that, you don't have to do anything.

MR. MOORE: That's our opinion at this point in time, yes.

MEMBER BLEY: So it's today an uncertainty event.

MR. McCALLUM: Okay?

MEMBER BLEY: Just curious. Are you planning to do a seismic PRA when you actually get to the plant or have you thought that far ahead?

MEMBER BLEY: There will be a PRA for the plant and it may be the majority of that PRA will be very standard, because everything about the plant, all the electrical buses, diesels, everything will be very identical, basically, between units.

MEMBER STETKAR: What we heard yesterday, the AP1000 folks, said that they're not going to do a seismic PRA. They're just doing a margins study --

MEMBER BLEY: Margins study.

MEMBER STETKAR: And it's going to be bounded basically for all the first five sites, anyway.

MEMBER BLEY: They're doing one for all?

MEMBER STETKAR: One for all, unless

something at a particular site pops up. So no.

MEMBER APOSTOLAKIS: Are you going to do the fire the same way?

MEMBER POWERS: I think we're going to have to move right along to give a chance for the staff to talk.

MR. McCALLUM: This is the ground motion response spectra at the 86 foot depth. The black line is horizontal, the blue line is a calculated fraction of that to determine the vertical.

The next topic we're going to talk about, we've got the ground motion response spectra. This is looking at the geotechnical part of the site, the excavation that we're talking about. These four bullets basically describe the profile below the plant, upper sands. I talked about having to remove those. Ground water, I'll point out ground water in the upper sands is about 55 to 60 feet below grade, so the basement, the bottom level of the container, the AP1000, will actually still be above the water table.

Blue Bluff Marl will be the baring layer. Below that, you've got about 900 feet of coastal plain sediments and then starting at about 1,049 feet, you go into a Triassic terrestrial deposit of sandstone. I mentioned earlier, we plan to completely remove the upper sands.

Next slide.

This is kind of a cartoon that pulls it all together. The part to the right is to scale, basically. It shows the unit three and unit four. It shows a black line that represents our deep boring that went down into actually determine where the contact point between the coastal plain sediments and the Triassic basin occurred. The depth of that boring went down into competent rock, all the way down to 1350 feet.

This does show the two types of rock that are beneath the plant that we had to determine from our seismic survey of crystal rock, the Triassic basin sediment and you can see the marl layers, bearing layer, and it does show roughly the excavation and we're not talking about just excavating directly below a particular -- we're talking about excavating all the way down to the marl for the entire footprint of the connected footprint to the AP1000, plus the 45 degrees zone of influence to make sure that we've got good bearing, sediment is predictable, and we got stable a plant. We don't have problems with interconnections between the buildings.

MEMBER SIEBER: Are there going to be any portion supported by pilings?

MR. McCALLUM: Cooling towers will probably be supported by pilings.

MR. McCALLUM: They'll probably be end bearing pilings into the marl and identical to what we did for one and two. They're on pilings.

MEMBER SIEBER: Do you expect differential shift? Cooling tower basins are not safety-related.

MR. McCALLUM: That's correct. I have not discussed the predicted settlement for any of the cooling tower features. We talked a little bit about the plant and what we expect there, what we saw in Unit One and Two, but I can't answer any questions about the cooling tower sediment.

MEMBER SIEBER: Is this the appropriate time to ask this question? The AP1000 which you discuss here, when it was originally certified, was a hard rock plant design.

MR. McCALLUM: Yes.

MEMBER SIEBER: Piping was ITAAC which means you guys designed the seismic piping and equipment supports and things like that and your

Southern Company is part of this multi-potential owner's group. What seismic acceleration have you come upon that will be satisfactory for you that your site will meet with the structural analysis of the AP1000 will be upgraded to?

MR. McCALLUM: If I understand your question, you're asking basically about --

MEMBER SIEBER: Some number less than one, probably gs acceleration.

MR. McCALLUM: I can't give you a number, but as far as the general process, we, Southern Nuclear, will not be designing any of the piping itself. That will still be done by the Westinghouse-Shaw Consortium and that will be done. There is a foundation, Shaw, Stone and Webster that consortium will be building all the AP1000s and that design will be done for all the AP1000s in the same way.

MEMBER SIEBER: And each one might be different depending on what the site characteristics are, could be.

MR. McCALLUM: Theoretically, if you had a site that had -- that exceeded the design spectrum significantly, theoretically you could --

MEMBER SIEBER: You'd spend it all on

engineering, but you'd save some material dollars.

Piping and supports are not that big of a challenge to design, so I feel confident that the structures that design the equipment inside will still be -- thank you.

MEMBER CORRADINI: Can I just ask -- go back to that picture. So we're looking south.

MR. McCALLUM: The thing is confusing. A little bit about this picture is some people, I took the river and rotated it around.

MEMBER CORRADINI: Thanks. I was going to say it looks like the Savannah River is on the wrong side.

MR. McCALLUM: Well, this is actually looking normal to Penn Branch fault which is actually from Northeast.

MEMBER CORRADINI: Right.

MR. McCALLUM: The river would actually be behind the plant on either side. So I just picked a side to rotate it, and apparently everybody expected it to be on the other side. But it's rotated --

MEMBER SIEBER: The original plant Vogtle will be to the left of those two --

MR. McCALLUM: The original plant Vogtle

will be to the right.

MEMBER CORRADINI: So we're looking normal to the fault?

MR. McCALLUM: You're looking normal to the fault.

MEMBER CORRADINI: Which is actually looking northeast.

MR. McCALLUM: Northeast

MEMBER CORRADINI: Got it.

MEMBER BLEY: Looking on the map, the other map, I can't see a way Unit Four can be closer to the river, so it may be --

MEMBER CORRADINI: It's not. That's all he's saying. Now I hear what he's said.

MEMBER ARMIJO: Better to take the river off.

(Laughter.)

MEMBER POWERS: I am going to move this right along, because this is not pertinent.

MR. McCALLUM: Last slide is just basically to show you what goes on beyond this. This is a picture and again, intended to kind of pull this together.

Where we are at our ESP phase is with the ground reduction response spectra is located here at the top of the Blue Bluff marl. The foundation for the AP1000 will be some 50 feet above that. During the COL phase we will take that motion and move it up to the control point at the bore of the AP1000 and generate a Foundation Input Response Spectrum, based on the ground motion we have here in the ESP phase.

MR. MOORE: Going back to your question, this slide I think captures I believe what you were asking. We're going to do our site -- we have -- we're doing, giving Westinghouse our soil properties and our ground motion and they're going to do a site specific analysis. And our expectation is that when they do the site specific analysis and they've already done some is that they're what we call the instructure response spectral will fall below their certified design instructure design response spectra. And that will be documentation that the AP1000 design envelopes the demand from our site. So that's the process.

MR. McCALLUM: That is basically the end of my presentation.

Back to Jim.

MEMBER POWERS: Mr. Davis, if you could give your conclusions.

MR. DAVIS: Basically, there are very few open items remaining, but there are some associated with the AP, but we provided all the answers to that, so that was just our approach. I don't think there are any more outstanding issues there, so I'll go ahead and turn it over --

MEMBER POWERS: Are there any questions of the applicant himself? The applicant has attempted to describe the site in his application, the open items and what not will be dealt with by the staff. Thank you very much.

Christian?

(Pause.)

MEMBER POWERS: Our electronic conveniences are not being convenient.

MR. ARAGUAS: My name is Christian Araguas. I am the safety project manager in charge of the review of the Vogtle site permit application.

Next slide.

We're just going to go over the purpose of our presentation today is to brief the Full Committee on the status of the staff's safety review on the Vogtle site permit application. Then next we plan to achieve support in the Full Committee's review of the application and subsequent interim letter from the ACRS to the Commission and following that, we plan to address any of your questions.

Next slide.

What I have here on the slide is just the agenda for the meeting, what I plan to cover. First, we'll just go over quickly some of the schedule milestones. I'll cover what we have accomplished already and what are the remaining milestones. Next we'll cover the key review areas without open items and we'll just see there on those slides is basically just laid out the staff's findings are so we can get through those quickly so we can move on to the open items.

MEMBER POWERS: I wouldn't move through those very quickly.

MR. ARAGUAS: Right, and if you have any questions, feel free to stop us. I have the staff here that can address any of those questions in those specific areas. Following that, we'll talk about the areas that have the open items and then we have a presentation from the staff on the review that was conducted for geology, seismology, and geotechnical engineering, and then we will sum with any conclusions and then turn it over to any additional discussion or questions.

So first, we received the Vogtle ESP application on August 15th of last year. The acceptance review was completed on the 19th of September of last year. Following that, we conducted a series of inspections and audits, as you can see, listed there. We covered the majority of the areas in the application. REIs were issued March 15th of this year. Following that, we issued our SER with open items on the 30th of August. More recently, we have received the response of the open items on the 15th, and the staff has begun its review on those open item responses.

Next, these are just some of the remaining milestones I wanted to cover briefly. This is today, obviously, the Full Committee meeting. Following that, we're anticipating a letter from the Full Committee at the end of the month. Next item we have is the advanced issuance of the advanced SER with no open items, which will be provided to the ACRS and just provide some clarification on when we say advanced SER, previously we used to call it the file SER and it is still called that, but what we're doing now is instead of going final with the document, we've decided to give the document to the ACRS, have our meeting. If there are any issues that are brought up, the staff can address those in a followup with issuing a final of that document. It was a little strange previously where we issued a document, call it final, ACRS would have a problem with it, and to have to address those comments.

Following that, we'd expect to have the Full Committee meeting sometime in June, and just to elaborate on that, as Southern mentioned, there is this aspect that they've recently provided the LWA-2 supplements. So what we've decided to do is since we're not prepared to talk about it at this meeting, what we'll do is probably conduct a subcommittee meeting around that time frame so that way we can discuss in detail --

MEMBER POWERS: I don't see why we can't include that in an ordinary subcommittee meeting.

MR. ARAGUAS: Right.

MEMBER POWERS: My expectation will not be an elaborate --

MR. ARAGUAS: Right, and then we'll have the Full Committee sometime in June and then we would expect a letter in July of 2008 followed by the issuance of the final SER, August 6, 2008. And then we would expect that the mandatory hearing and Commission would be conducted, Commission decision will be expected sometime in 2009.

So the first area we covered was as this relates to geography and demography. The staff looked at maps of the site, reviewed the site boundaries. We looked at any plant structures and locations of highways, railroads, and waterways that traverse the exclusion area boundary. In this case, there weren't any that traversed the exclusionary boundary.

So the staff concluded that with respect to site location description, the relevant requirements of 10 CFR part 52 and part 100 subpart B have been met. With respect to the review of exclusionary authority control, the staff determined that SNC does have authority of the exclusion area with respect to activities that are conducted within that area and for any activities that are not related to the plant. And so the staff concludes that the SNC is exclusionary is acceptable and meets the requirements of 10 CFR part 52 and 10 CFR part 100.

Next item for population distribution.

The staff looked at current and future population projections. We looked at the characteristics of the LPZ and with regard to that, the staff concluded that the proposed LPZ and population center distance meets the definitions of part 100.3 and the staff also concludes that the population data are acceptable and meet the requirements of 10 CFR part 100.

MEMBER APOSTOLAKIS: What is the population center distance?

MS. TULL: That's the --

MEMBER SIEBER: Ten and 50?

MR. ARAGUAS: I'm sorry, I couldn't hear you.

MEMBER SIEBER: Ten and 50?

MR. ARAGUAS: For the population center distance, no, that's what the Applicants both described as the closest population center that has a population of --

MEMBER APOSTOLAKIS: Which one is that?

MR. ARAGUAS: It's Augusta. Augusta was the closest which was 26 miles away.

MEMBER APOSTOLAKIS: How many residents are in Augusta?

MR. ARAGUAS: I don't know.

MEMBER POWERS: About 460,000, I think, isn't it?

The complication here is that at various times the Savannah River site has had a working population of 25,000. It doesn't now. But at various times it has so what do you do about that?

MEMBER APOSTOLAKIS: Nearest population area --

MEMBER POWERS: I didn't hear you, George.

MEMBER APOSTOLAKIS: That was the nearest population center then?

MEMBER POWERS: No, it doesn't fit the criterion. It's a complication.

Augusta is the appropriate population center.

MR. ARAGUAS: Right, but I think in the event of the Savannah River site with respect to the regulations, the state that your population center should be outside of one and a half times your low population zone in which case Savannah River was well outside that range.

MEMBER POWERS: It's just a complication of the --

MR. ARAGUAS: One and one third -- low

population zone.

So as I said, the staff concluded that the proposed LPZ population center distance meets that 100.3 criteria and that the staff included population data acceptable to meet the requirements of Part 100.

Next slide.

The staff also looked at in Section 2.2 the nearby industrial and transportation and military facilities. With regard to these, we looked at maps of the site and any nearby facilities. We looked at and considered transportation routes nearby. We looked at any pipelines that ran close to the site and then we looked at what the staff's evaluation for these as potential hazards and how they could -- the evaluation of any accidents from these hazards and the staff concluded that potential hazards associated with nearby transportation routes, industrial and military facilities pose no undue risks to the facility that might be constructed on site. And that was to meet the requirements of 10 CFR 100.21(e).

Next, we looked at aircraft hazards. With respect to these, the only issue that required any further evaluation was an airway that was within the two-mile criteria that you would actually consider additional review and it was about 1.5 miles away from the site. The staff looked at what the applicant had done and then also performed its own independent evaluation and confirmed that there was no threat to -- no hazard associated with aircrafts from that airway.

MEMBER POWERS: For this application, did they consider the increases in air traffic along that corridor through about 2020?

MR. ARAGUAS: I'm not -- Rowal, did you want to elaborate on that?

MEMBER POWERS: 2025.

MR. ARAGUAS: The question was did we look at the population or -- sorry, the number of flights all the way up to 2025 and I don't recall how far we went to.

MR. TAMARA: My name is Rowal Tamara. If they give the projections from 1990 through 2025, the potential flights for the Bushfield Airport, however, we have taken into account these airways only V185 which is within the two miles and we got the data from FAA and we analyzed using that data. So since the Bushfield Airport is away from the ten miles, even if the projections are much higher, it will be within the limits of that limit, 1000 times D^2 which is 287 thousandths, so the projections even if it is projected heavily, it will be much lower than the criterion that will be used.

That's why we did not even -- that will not pose any problems within the limits. That's why we concluded that based upon the probability of V185 under 10^{-9} we have calibrated, therefore there is no undue risk due to the airway 185. That's the conclusion.

MR. ARAGUAS: Dr. Powers, does that address your concern with respect to how many years we looked at it?

MEMBER POWERS: Yes, the challenge we faced at the subcommittee was we had aircraft projections through 2025. We had population rejection to a more reasonable limit, 2070. That population growth was about a factor of four. And one would presume that air flights would be roughly proportional to population. But the point the speakers made is that even if you take that factor of 4, make it 16, you still stay below the criterion and so that it's satisfactory with respect to --

MR. TAMARA: That's correct.

MEMBER SIEBER: Bushfield is about 20 miles to the north of the site.

MR. TAMARA: Around 17 miles.

MR. ARAGUAS: Seventeen, right.

MR. TAMARA: Which is beyond 10.

MEMBER SIEBER: The flight path for runway 36 does go over the site, but it's pretty high up at that point.

It would be hard to get an airplane to crash there.

MR. TAMARA: That's why we have made the calculations because the applicant has considered the total Bushfield flights going to 185. Even that one with -- on that basis they have calculated the probability and concluded that to exceed 10^{-7} it should be around 53,000, so the number was very close. Therefore, it was uncomfortable, therefore we went and looked at it more closely and got the realistic data from V185 and made the confirmation that is much lower than the 10^{-7}. So that's how we concluded.

MR. ARAGUAS: Okay, so the staff concluded that aircraft hazards do not present an undue risk for safe operation of nuclear units at the site and therefore meets the requirements of part 52 and part

100.

Next, in Chapter 11, we looked at doses from routine liquid and gaseous supplement releases and here as well the staff determined that the applicant demonstrated that radiological effluent release limits associated with normal operation of the type of facility that's proposed, go to the site, can be met for an individual located offsite.

And next we looked at physical security. Here, as well, the staff determined that ESP site characteristics would allow an applicant for COL to develop adequate security plans and measures for reactors that it might construct and operate on the ESP site in accordance with 10 CFR part 100.21(f).

Next slide.

With regards to radiological consequences of design basis accidents, this is one of the areas that we reviewed, provided presentation during the subcommittee, but in conclusion, what the staff determined was that the AP1000 rev. 15 design basis accident radiological analysis were shown to meet 10 CFR Part 100 -- I'm sorry, 50.34(a)(1) siting dose criteria and site-specific design basis accident doses were shown to be less than the AP1000 rev. 15 design basis accident doses. Therefore, the site meets the 10 CFR 5034(a)(1) dose criteria for design basis accidents.

Staff also looked at in Chapter 17 the Quality Assurance Manual that the applicant provided and with regards to that we conducted an inspection August 2006 and we conducted our in-house tech. review of the Nuclear Development Quality Assurance Manual and concluded the applicant provided appropriate quality assurance measures equivalent to those in 10 CFR part 50 Appendix B.

Now we'll move on to the areas where we had open items and what we've done is we've highlighted the open items that we thought were significant to mention during today's meeting. The first area was in meteorology, Section 2.3 and just to give you an overview, the staff reviewed the regional climatology, local meteorology, on-site meteorological measurement program. Staff looked at the short-term atmospheric dispersion estimates for accidental releases and we looked at the long-term dispersion estimates for routine releases.

As a part of this review, the staff verified site characteristics associated with the climatic extremes, severe weather and atmospheric dispersion. As you can see what I provided were just a listing of some of the site characteristics that were proposed by the applicant that the staff reviewed.

Next slide.

The staff identified one open item with regards to the review of meteorology. And I'll just read it very quickly. It was provided justification for using a 30-year period of record from 1966 to 1995 to define the AP1000 maximum safety design temperatures. The staff believes these temperatures should be based on 100-year return interval and the basis for this open item was that SNC needs to identify the historical maximum temperature as identified in GDC-2 and the staff feels that implementing the 100-year max temperature which incorporates some normalization and extrapolation of the data is more conservative than their approach of proposing the extreme value for the 30-year return.

And as of recent, just to highlight, we had a phone call last week to discuss issues with the applicant and I think we -- both sides understand -- sort of how to move past this open-item and put --

close out the issue.

Next, moving on to hydrologic engineering. The three key areas that we focused on in this review are floods, low water, and groundwater. We had three -- move to the next slide.

We had three open items that we wanted to mention in today's meeting. First, was open item 2.4-1 and in this area, the Units 3 and 4, the applicant said Units 3 and 4 do not rely on any external water source for safety-related cooling and so the staff in its development of open item 24-1 also created a permanent condition of 24.8-1 which states SNC or Units 3 and 4 are precluded from relying on any external water source from the site for safety-related cooling other than initial filling and occasional makeup.

And the open item reads "alternatively, the applicant may propose a plant parameter such that no safety-related water is required for proposed -- for the proposed plant's elevation of the site other than initial filling and occasional make-up water.

The next open item which was in Section 24-12 deals with groundwater. The open item reads "the applicant should provide a more detailed characterization of the groundwater pathways describing the current and future local hydrological conditions including alternate conceptual models to establish a suitable groundwater evaluation for the site. Alternatively, the applicant can provide design parameters for buoyancy elevation of plant structures. And the basis for this open-item was that -- so that the applicant could demonstrate that the design basis related to groundwater induced loading on sub-surface portions of the safety-related SSCs would not be exceeded.

The last open item in this section relates to Section 24-13 under accidental releases of radioactive liquid effluence in ground and surface waters. The open item here is, as it reads is inadequate number of combinations of release locations and feasible pathways have not been considered. So the issue here was more that the transported radioactive liquid effluence to follow multiple possible pathways and the pathway with the most severe release consequence is of interest to the staff and for the determination of site suitability.

So currently the uncertainty due to spatially and temporally varying characteristics now and in the future can alter the groundwater pathways. So what the applicant has provided so far is they've described a single groundwater pathway to the northwest towards Mallard Pond and the Staff doesn't feel at this time that the dilution data, or doesn't agree with the dilution data and the release points that were provided.

So we feel an alternate conceptual model exists that may lead to migration of radioactive liquid effluent to the west and through Daniels Branch and eventually to the southeast and to the east towards the Savannah River, through the tertiary aquifer, because the communication between a water table and tertiary aquifers.

MEMBER POWERS: I'm still troubled by the wording on this. Not the content, the wording on this and that is the adequate number. Why don't you just say the applicant has not considered a plausible combination of release locations and feasible pathways. Because the numbers says, you know, he's got to come up with five. If there is only one that is plausible, I don't care about the other four. The alternative you pose is certainly plausible. I mean, it seems to me your wording just is troublesome.

MR. ARAGUAS: John, did you want to elaborate?

Okay, we'll move on to the next slide.

Okay, the next area that we wanted to discuss was emergency planning. As Southern stated, this is one of the areas that was unique to this Early Site Permit. The applicant did provide us with complete and integrated emergency plan with ITAC. It's the first time staff has reviewed this under an Early Site Permit.

As part of this plan, the applicant has provided us with emergency certifications, in which case the offsite agencies that are supporting the emergency plan are reviewing them to determine that the E plan is practical and they will participate. And with this review of complete and integrated emergency plans, the staff is providing reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency. The significance of this review is that at the end of this review, we conclude that, we provide reasonable assurance that it closes out the issue of the review of the emergency planning at the seawall stage.

Next slide.

So what I wanted to highlight, sort of a segue into one of the open items, as part of this complete and integrated emergency plan, we review emergency action levels that the applicant has provided. Currently, there is a document in-house that the staff is reviewing, which was NEI 99-01. It is a guidance document for light water reactors for EALs, for light water reactors.

As well, there is NEI 07-01, for the passive advanced light water reactor, EALs, that the staff is also reviewing. The challenge is that the O7-01 review is dependent on the review of 99-01. Where this fits in with Southern's applications, they've referenced 07-01 as the guidance document they followed for development of these EALs. So we're currently in discussions with Southern right now as to how best to move forward, knowing what the review schedule is for completion or for endorsement of 07-01 and how this will impact the overall schedule.

I think right now we're on track with the completion, or the endorsement of 07-01 to be done some time in the January time frame, which right now we feel would support our ability to keep a schedule, but we're concerned that any sort of delays at this point would certainly impact the schedule, so we've been in talks with Southern about how best to move forward in the event that something like that would happen.

MEMBER APOSTOLAKIS: Is our Committee reviewing those?

MEMBER POWERS: 99-01, we have definitely examined. I don't know that we have received the 07-01. Ordinarily we would.

MEMBER APOSTOLAKIS: We will review it at some point or we don't know?

MEMBER POWERS: We could.

MEMBER APOSTOLAKIS: Yes?

CHAIRMAN SHACK: Well, we'll hand it to a cognizant member and he will tell us whether we should or not.

MEMBER POWERS: The challenge the staff see and they are forward-looking here on this issue, it's laudable. You've got to find a way around this.

MR. ARAGUAS: Right.

MEMBER POWERS: This case cannot be hung up by review of these documents by the staff. So good for you for looking ahead and find a way. I think you just cannot count on these things being reviewed and these NEI documents just take forever to get through all the concurrences and reviews and things like that.

MR. ARAGUAS: Right.

MEMBER POWERS: Just find a way to do it. I mean, even if they're perfect, if nobody has any objection, the mechanics are just cumbersome.

MR. ARAGUAS: Right. The challenge that I think we're faced with right now is the staff doesn't want to embark on a review of these EALs, approve those EALs, and then have them be different from what's obviously a waste of time.

MEMBER POWERS: You just don't want to duplicate effort here.

MR. ARAGUAS: Right. The best outcome could be that we could expect that that document is endorsed and we can continue our review.

MEMBER POWERS: Sure.

MR. ARAGUAS: Just the other item of note that I had on here was that some of the ITAC will reflect construction dependent EALs.

That jumps me into the open items. So there was an open item that the staff identified with regards to the EALs, and that's the review and acceptance of the applications EALs, units three and four. It's an open item that we placed in there, not expecting a response, but more so calling out an issue and letting them know that hey, this is something that we're working through and trying to deal with how we move forward. So we felt it was important to call that out in the application and the SER.

MEMBER CORRADINI: Just so I understand, because this goes back to your review of the NEI document review, so when you write something like that up, I don't think I understand. So is it in their court to do something or is this just a placeholder to remember that both sides have got to work together to get something?

MR. ARAGUAS: Exactly. Exactly.

MEMBER CORRADINI: Okay.

MR. ARAGUAS: The other open item we had, which was to discuss whether state and local agencies have reviewed the new evacuation time estimate and provided comments and discuss a resolution of those comments. And the reasoning for this was that because there is a new evacuation time estimate that was proposed, it could have an impact on the off-site agency's emergency plan and so we wanted to make sure that they had coordinated in the event there need to be changes to those emergency plans.

And now that jumps us to our next set of presenters. That's for Section 2.5 and I think the Deputy Director for their organization had some comments he wanted to start with.

MR. CHOKSHI: This is Nillich Chokshi, Deputy Director for the Division of Site and Environmental Review.

I wanted to mention the status of -- you're going to see some more detailed discussion of these issues because there was a lot of interest in the Subcommittee, but -- and to explain the issues, but we are working. This is the status of today. We continue to address and I think as someone mentioned, we have had a continued dialogue and this thing is evolving. You will see some progress on some of the issues, but I just want to alert you that this is, if we come back next month, we might be reporting more details. So we are in the process of reviewing, so just in your deliberations, keep that in mind and I think with that, we'll make a presentation.

MR. STIREWALT: If I could have the next slide. Good afternoon, gentleman, I'm Gerry

Stirewalt. The team that you see outlined on the slide, we're the reviewers that worked on the application and present with me this morning at the front desk are Laurel Bauer and Yong Li.

And in the next slide, indicating that based on the next slide, based on the session that we had with the subcommittee on the 24th, we've sort of directed this discussion today on four primary issues. At that meeting, the key issues were discussed, the open items were discussed and those four that you see outlined here, the first three relate to 2.5.2. The last one relates to 2.5.4. And you might say well, what happened to 2.5.1 and .3. I'll tell you.

We reviewed the information on the Pen Branch and just as Mr. McCallum very properly provided information earlier, the staff concurs that the Pen Branch, even though it underlies the site and because of 3-D geometry dips beneath some of the plants, we consider it to be noncapable, based on the good work that they did.

A single -- and that was in 2.5.1. A single open item in 2.5.3 related to something that we called injection sand dikes. We have a response from them and we are presently in the mode of reviewing that response. So 2.5.1 and .3 are tracking along fine. I will now turn it over, if there are no questions to Dr. Li, who will discuss 2.5.2.

MR. LI: As Gerry just mentioned, the first key item that I'm going to discuss here is updating the Charleston siting source zone. Applicant based on the overwhelming paleotic factual evidence updated the seismic, Charleston seismic zone. As you probably all know, the Charleston seismic zone is the second largest seismic zone east of the Rocky Mountains which has earthquake which was 7.2 occurring 1886.

So the applicant basically updated all important parameters which is important to the PSHA analysis, including the geometry, the maximum magnitudes, and the return interval or recurrence interval here.

So because the average return interval decreased from around a thousand years to 500 years, so the hazard at the Vogtle site was actually increased. And as I mentioned, this update is based on the overwhelming paleotic fracture evidence.

We'll let Laurel, she's our paleoseismologist here explain how to use paleotic faction evidence to update this seismic zone and also related issues.

Laurel?

MS. BAUER: Next slide, please. I'm Laurel Bauer. I did the paleoseismology review. I just put this figure in to show some of the liquefaction features that are related to the 1886 Charleston earthquake.

Next slide.

MEMBER POWERS: And we appreciate this enormously. This is very nice.

MEMBER APOSTOLAKIS: Tell us what we are looking at.

(Laughter.)

MS. BAUER: These are some historical liquefaction features that are on file at the Charleston Museum from the 1886 event. And basically it's just the black and white photographs are showing the sand craters that were created from the liquefaction. And this figure up in the top right corner is a trench that was dug to document liquefaction features in profile, basically. It's really actually difficult to tell, but you can sort of see the sand dike here in the base with the sand blow going off to the right and to the left.

MEMBER CORRADINI: So 20 seconds of tutoring, when you say liquefaction, you mean the shaking motion actually turns the soil to a different consistency and you can tell by looking through the strata?

MS. BAUER: You would have loose, unconsolidated sediments that are -- you've got core pressures that rise as you saturate those sediments and cause pressures that build and they can break through zones of weaknesses and the overlying sediments.

MEMBER CORRADINI: This is what you're looking for.

MS. BAUER: You can see them in profile.

MEMBER CORRADINI: Thank you.

MS. BAUER: It's easiest to see them in profile, but one thing you have to keep in mind is that they are three dimensional.

MEMBER APOSTOLAKIS: So this gray area on the right, what is that on the lower right?

MS. BAUER: The lower right?

MEMBER APOSTOLAKIS: Yes.

MS. BAUER: This is the crater here that's formed, and you see some subsidence here in the center and that is caused by the sand that is being ejected from below and it's pretty typical when you see a sand blow feature. And then you'll have this blanket of sand surrounding the crater, which fines and thins as you go further outward.

MR. LI: So if this pattern actually varied, like here another 300 years later, somebody figured it out and it's material that can be dated, they found this was formed in 1886. That helps them to chase the earthquake history, to extend the earthquake history basically.

MS. BAUER: There are different ways that you can date materials that will help constrain the age of those features, above and below, giving minimum and maximum ages.

CHAIRMAN SHACK: Just coming back, you know, you mentioned Mr. Atkins and his reevaluation of this. It's USGS, right? I mean, does everybody agree with this reevaluation? You know, is this a matter of controversy or uncertainty?

MS. BAUER: There's always some uncertainty that goes along --

(Laughter.)

-- of course, some of that is related to the dating itself, because there are inherent uncertainties there. But I think that it was Telwani and Schaefer who reviewed the data and compiled it in 2001 that looked at previous records, previous documentation of liquefaction. It's pretty, I feel like there is a good amount of data there that can at least be reviewed. So there's always some uncertainty.

MR. MUNSON: I just wanted to -- Cliff Munson, Senior Seismologist. We have 1886 liquefaction features and we also have liquefaction features from four or five previous earthquakes, and that's how we constrain the reoccurrence, how often we get Charleston type earthquakes. So we have these that are relatively new. Then we have ancient ones that go back in time.

CHAIRMAN SHACK: But, you know, I'm dealing with paleoliquefaction and you're telling me 1000 to 500 years. That sort of sounds like round-off error, let's go back a couple of geological ages.

MS. BAUER: The thing with radiometric dating, though, you're going to have an error, but it is not going to be as great as 500 to 1000 years.

Usually around a 50 year.

MEMBER POWERS: Ms. Bauer was kind enough to explain this dating process to me and I find it fascinating, but because of the trapped metaorganics by the sand blows, they can get carbon dating, and for the time periods of interest here, which are less than 30,000 years, you get fairly accurate radiocarbon datings and those --

MS. BAUER: Right, and the abundance of data, the more data you have obviously you can help further constrain those ages.

MEMBER POWERS: Narrow those down, right. Looking at it in detail, you know, as you go back it becomes less clear whether the sand blows are distinct events or not. And so you can get different return frequencies, but they're all substantially less than what was available at the time that the EPRI seismic survey was done.

MS. BAUER: I believe that EPRI estimated a couple of thousand years, but there are four events, including the 1886 event, that go back past 2,000 years with pretty regular intervals of about 550 years. And then for a full 5000 year period, there are six events that include those four and the earlier two events are a little wider spaced.

MEMBER SIEBER: Notwithstanding that, your failure to find a liquefaction area does not mean that seismic event hasn't occurred, right?

MS. BAUER: That's correct.

MEMBER ARMIJO: Yes. You've got to have the right kind of soil, I guess.

MEMBER CORRADINI: Well, you got to be lucky too, because there are hard to find. So the reevaluation, just I understand it, the reevaluation increased the rate of occurrence, but didn't change the estimate of the magnitude. Have I got this right? Or was the magnitude also reevaluated upward?

MS. BAUER: Well, what it did was it constrained, looking at that data helps you to determine and the characteristics of the liquefaction features, paleoliquefaction features, helps you constrain that higher magnitude if the features are similar in characteristic with 1886 features.

MEMBER CORRADINI: Can you try that again, slower? Sorry.

MS. BAUER: If you're looking at paleoliquefaction features and comparing the characteristics for prehistoric earthquakes with, say, the historic 1886 event, it helps you to determine if you see the same number and the same size of features further out from the proposed source.

MEMBER CORRADINI: Thank you.

MEMBER ARMIJO: So if you had a massive blow hole, does that mean a bigger earthquake? Is that as simple as that or is it more complicated?

MS. BAUER: Well, you do tend to see larger sand blows closer to the source, closer to -- within the mizoseismal area, the immediate area with the most damage. And then based on, I mean, if you were to look at consistent sedimentary characteristics further out and the same susceptibility of sediments, then you would tend, you would think you would observe smaller features as you go further from the source and that's generally what you see.

CHAIRMAN SHACK: But this does give you the benchmark again. That's why you work back from the magnitudes with some confidence. Thank you.

MS. BAUER: And the next slide.

So that brings us to our open item, and this open item was related to liquefaction being observed further inland from the proposed source. So the staff requested that the applicant provide further documentation of liquefaction features that had been observed further inland to better characterize those features so we could better analyze the need or not to put that zone, put the source zone further inland.

MEMBER POWERS: I suspect you've got a plot, but maybe not. You're not asking the applicant to acquire data. You're asking him to report data?

MS. BAUER: That's correct. There were some observations done in the '80s of liquefaction features further inland and along some of the rivers that went further inland and within some of those observations, well, within some of those field studies, the observation was made that liquefaction was not found within liquefiable sediments further inland. And so we were asking for some clarification to document that.

MEMBER POWERS: What you're trying to do is to better understand where the seismic center is?

MS. BAUER: That's correct, and if there's a need for that source zone to cover an area further inland.

MEMBER POWERS: Because that would move it closer to the plant?

MS. BAUER: That's correct.

MEMBER POWERS: And create a bigger seismic hazard at the plant?

MS. BAUER: It could, but at the same time I'd like to just say even finding liquefaction further inland closer to the site doesn't mean that the source is in a different location. I mean you would expect to see liquefaction.

MEMBER POWERS: Now the staff in their application considered four different descriptions of the seismic zone and I think, if I understand correctly, gave them a weighting.

MS. BAUER: That's correct. There were four different models.

MEMBER POWERS: And you would -- you're concerned that those models don't span the plausible spectrum here.

MS. BAUER: The concern was there. I mean we wanted to be able to further constrain that source zone and to make sure that they did an adequate --

MEMBER POWERS: Okay, but you're not asking them to generate data?

MS. BAUER: No, and we're not asking them to prove a negative.

MEMBER POWERS: That was our biggest

concern.

(Laughter.)

MS. BAUER: Okay, and on this open item we have received the applicant's response and while the staff is still reviewing it, we've also been in communication with the applicant and we do feel like we're moving close to a resolution on this issue.

MR. LI: As some Member already raised that issue, if you cannot find liquefaction, does not mean there's no earthquake.

So I cut and paste the staff's position from RG 1.165 to reiterate the staff's position on update of earthquake seismic sources. So let me read that. This is the staff's regulatory position. "Another important purpose for the site specific investigation is to determine whether there are new data or interpretations that are not adequately incorporated in the existing PSHA databases."

MEMBER CORRADINI: What does that mean?

MR. LI: Basically, it's still under discussion. If there's no liquefaction evidence, there is still the need for updating the sources based on the latest studies and other relative scientific consensus. That's a point here.

MR. MUNSON: If I could jump in, what we're trying to say by quoting this guidance is the applicant used the EPRI 1986 EPRI seismic source models and since several additional work has been done in the Charleston area since then, they went ahead and updated their PSHA. They updated the Charleston source model because there's new data. The applicant did, right. And that's what we just discussed.

Also, we look at maybe there's not data per se, but there's new interpretations. A professor could come up with a different interpretation, perhaps not based on data, a lack of data has never stopped a professor from coming up with a new --

(Laughter.)

So we just wanted to highlight this quote so that we're looking at, we understand that we could either have new data or a new interpretation. Either of those items would cause us to want to take a look at what EPRI did 20 years ago and see if that still represents the seismic hazard today for our site.

MEMBER CORRADINI: But I guess I am -- maybe Dana has already -- I guess I'm trying to understand. So are you asking them to go interpret -- you're not going to ask them to interpret new scientific data interpretations. That's not what you're asking. I'm still struggling for what -- is there something here that the applicant is to do or just to be up on the literature?

MR. MUNSON: They have to be both. They did update based on the literature, based on new liquefaction data. They did update the Charleston seismic source zone that was originally in EPRI. Now -- and so what you're going to see shortly following is we're going to talk about some other source zones that they did not update and so that's why we have this quoted here.

MR. LI: The next few slides may address your concern here.

MEMBER POWERS: Just -- I should chat a little bit more about this. There was a nice plot in the application, I believe, showing how you would describe this source zone, both in terms of location and magnitude. And it's the product of people looking at the data and having different conclusions on what it means and as pointed out to you that's an evolving thing. As people get insights from other locations, they apply it to this and what not. I know in my examination of it, the Charleston earthquake is an extremely mobile thing. It was not too long ago that it was actually offshore was the seismic zone and now it's onshore and it moves around.

The Agency wants to use the best available interpretation and that's all they're really asking for there because seismology is a very, very active field, somewhat arcane, but very active.

(Laughter.)

And I will point out that the staff has some interesting research going on in that area, especially related to tsunamis. Please continue.

MR. LI: Specifically on this issue that the applicant did not update the following EPRI siting sources. One, the regional seismic sources that encompass the ESP site. Another one is called Eastern Tennessee Seismic Zone.

MEMBER POWERS: Again, recognizing that seismic zones are diffuse in their true location. My understanding that the Eastern Tennessee Seismic Zone, somewhat fell outside the perimeter of interest here.

MR. LI: I'll point to that position that when I show, in the next zone, the off-limit location of Eastern Tennessee Seismic Zone.

So basically, the 1986 EPRI siting source zone were determined by six Earth Science Teams and Dames and Moore is one of the teams which assigned the low weights for the large magnitude earthquakes and also assign low probability of activity to two of the key zones which is surrounding the ESP site.

This is the figure that I was talking about. So you can see the two large zones here. One is the green, one is the blue. That's Dames and Moore source zone. One is called a Cratonic Margin. That one, the team assigned a probability of activity of .12 and also with the maximum magnitude of 6.1 with the weight .8 and 7.2 with weight of .2. What does that mean? Basically, that means that are about 90 percent of chance this seismic zone will not be factored into the monitoring process, because the most time are not active.

And also, even if its active in that 10 percent of chance, you probably only count like a -- because you give the .8 weight for the load and magnitude, so you only count the contribution from magnitude 5 to 6.1. Magnitude 5 is usually cut-off magnitude for the PSHA calculation. So on the same token.

MEMBER CORRADINI: So the same magnitude

is, if I understand what you're saying, is they have assigned a weight of 80 percent that the load value and 20 percent of the higher value. Is that --

MR. LI: Exactly.

MEMBER CORRADINI: Thank you.

MR. LI: Same token for the Southern Appalachian Mobile Belt. It's a probability of activity is .26, which means a 74 chance that it is not going to be active near the seismic source calculation. Very little contribution plus the low end maximum magnitude of 5.6, means 80 percent of chances, you're calculating the contribution between the earthquake with magnitude of 5.0 to 5.6.

MEMBER BLEY: When you say it the way that you have said it, does that mean they're doing like a simulation?

MR. LI: Yes.

MEMBER BLEY: And 12 percent of the time that will include the first one and --

MR. LI: Yes.

MEMBER BLEY: But it could be that they're both in the model, so the overlap between .12 and .26, that fraction of the time they're both included in the model if they did the calculation and they do a lot --

MR. LI: Yes, but the contribution is so small.

MEMBER BLEY: Okay.

MR. LI: And also, just to point out here that it's the Eastern Tennessee site is approximately here. See those scattered seismicity?

MEMBER BLEY: Yes.

MR. LI: That's where the concentration of Eastern Tennessee Siting Zone is.

MEMBER CORRADINI: I don't appreciate that.

MR. LI: That's the ESP site.

MEMBER CORRADINI: I don't appreciate what you just said. I just don't get it. You're saying something is outside the green and because it is outside the green there is a significance? You pointed to the Eastern Tennessee Zone, which is outside the green Cratonic Margin. What is that?

MR. LI: Oh, that's a stack rate issue.

MEMBER CORRADINI: Another zone?

MR. LI: But Dr. Powers asked me to mention the position of ES 10, ESTZ, whatever.

MEMBER CORRADINI: Okay, thank you.

MR. MUNSON: If I could just point out

that, this picture shows the source zones for Dames and Moore that figured, that contributed to 99 percent of the hazard, total hazard of the site. Their source zones for Eastern Tennessee, they have them, but they're not shown in the picture because they didn't contribute to the hazard. That's why they're not shown.

MEMBER CORRADINI: Thank you.

MEMBER BLEY: Could I ask one more question?

MR. LI: Sure.

MEMBER BLEY: On your previous slide, when you said the EPRI seismic source zones were determined by six Science Teams. Dames and Moore assigned low weights to larger values. Never mind, I think I got it.

MR. LI: That is the next slide.

MEMBER BLEY: Okay, I'm a little confused by that discussion.

MR. LI: Okay, because of this low probability of activity --

MEMBER BLEY: Oh, okay.

MR. LI: And also because of the low probability of activity and also because of the low weight on the far end of the magnitude, we got this hazard curve for the 10 hertz, PSAK output of hazard curve. What this curve tells us here, this is Dames and Moore's result. The red curve here. And those blue are other teams, the other five teams' results. So you can see that there is a huge difference here between the red curve and the rest of the other five teams' results. If you choose a reference point around .1 g, you can see the differences around the six five times.

MEMBER CORRADINI: So you are saying they are although they're a highly reputable team outside the norm of the rest of the team and it dragged down the composite value?

MR. LI: Yes, exactly.

MEMBER MAYNARD: What's to say they're not right? I mean you put a number of teams together and you arbitrarily throw one out just because it's not fitting with the norm.

MEMBER POWERS: I think they will continue on and answer that question. I think they'll answer that question in a second.

MEMBER APOSTOLAKIS: What is the green line?

MR. LI: The green line is the total seismic mean hazard with everything -- mean of the 16 plus constant contribution.

MEMBER BLEY: All weighted equally?

MR. LI: Yes.

MEMBER CORRADINI: Why is the mean above it? I don't understand that.

CHAIRMAN SHACK: It is the regional sources plus the Charleston --

MR. LI: Plus Charleston.

MEMBER CORRADINI: And so without the Charleston they were all equally weighted?

MR. LI: Yes.

MEMBER CORRADINI: So I have a ten percent effect. Fifty percent of it is the Charleston. The other percent are five teams and one of the five teams is out of the norm and that's ten percent of that.

MR. MUNSON: No, that's not --

MEMBER CORRADINI: Am I missing something?

MR. MUNSON: You take the regional seismic hazard so you have those six regional risk curves. You had Charleston and then you get the total. I mean you take the average of the six, then you add Charleston to that and then you have the total hazard.

MEMBER CORRADINI: That's what I said, it's the 10 percent effect at best. It's one sixth of 50 percent.

MR. MUNSON: Right.

MEMBER CORRADINI: Okay. So that is -- okay. I as lost there for a moment.

MR. MUNSON: On the left side.

MEMBER POWERS: Moving us along, please.

MR. LI: Our team member, Sarah, did extensive research on the NRC documentation on the seismic source calculation and also not just looking at the NRC related documents, and now the research results, but she also took a look at some other agencies' standards, this one we listed it here. The DOE standard 1020, option 92. Yes. This is a conclusion based on the Savannah River site research which is just across the river from Vogtle site, 11 miles away. And this standard concluded that based on the engineering research. Actually, I'm reading my statement here. "Risk Engineering, Incorporated recommended that Damson Moore seismic source input should not be used to calculate the seismic hazard at the Savannah River site."

MEMBER MAYNARD: Do you believe that that represents Risk Engineering's position for this? Bottom line in the subcommittee meeting, they said that this was taken out of context and wasn't really applicable for what we're doing here, and yet you're using this again, so you're either saying you didn't believe what they said or you're not really factoring in what Risk Engineering --

MR. MUNSON: If I could answer that. We've discovered this statement late in the process. After we had already developed our open item and our issues and oh, by the way, we found this too. So whether it's in context or out of context, we heard that at the ACRS Subcommittee meeting. We're looking at the standard to see maybe there's other statements that support what Dr. McGuire said at the ACRS Subcommittee meeting. We don't know yet. So that process, we're still looking at that.

MEMBER ARMIJO: Let me ask a quick question, even if you took out the Dames and Moore, just took it out of your analysis, what's the impact?

MR. LI: That will increase the hazard at the site because --

MEMBER ARMIJO: By how much? By 10 percent impact? It's not an order of magnitude.

MEMBER APOSTOLAKIS: Corradini asked that.

MEMBER ARMIJO: I guess --

MEMBER APOSTOLAKIS: One sixth of 50 percent.

MR. LI: But we're talking about rock motion and this rock motion can also be amplified with soil layers on top --

MEMBER CORRADINI: So your point, again, you're tutoring me, so I apologize. So this spectral analysis then goes into a calculation that generates that curve.

MR. LI: Exactly.

MEMBER CORRADINI: And you're trying to tell me a six percent or an eight percent, it's an eight percent effect based on this will amplify to a larger than eight percent effect nonlinearly at this clay layer?

MR. LI: Depends on the soil amplification factor for the proper layers, beneath the foundation.

MEMBER CORRADINI: Okay, I'm going to ask you a somewhat provocative question, but you guys are engineers so quickly what does an eight percent effect do on that number? I'm sure you must have already estimated it inside the staff.

MR. LI: We are still debating on this issue. Eventually, sensitivity tests will help us to identify exactly how much contribution we could have based on our soil and the rock, all considered.

MR. CHOKSHI: This is Nillich Chokshi. I think about the point is that what different effects it has on the site, but there are two things here. One is C2 zones affect -- we're doing some calculation for other sites. There should be consistency on how to develop zones, so we want to make sure it's something, it's -- next time we leave you something else and judgment that will be what other factors we take into account for the Vogtle visit matter or not.

So I think it's important to really look at things so we don't change our views from site to site, something which has to be consistent.

MEMBER CORRADINI: So your point is on a regional basis, you want to clear this up?

MR. CHOKSHI: Yes, otherwise I think it will be what will happen is that we agree to comply and the rule will have to -- it's very important. This could be a problem. So - -but I think the other thing I wanted to make a point, I think, Dr. Maynard, we are continuing dialogue, in fact, I already -- Rick

Engineering was a part of the Southern Steam. And understand -- and they're also providing some more information, so that's the reason why on opening, I wanted to say this is -- and we are getting more information to really look at -- and you know, as I understand they are going back to the teams and exploring these questions.

MEMBER MAYNARD: I just would have appreciated it if you would have made that part of your presentation, rather than leaving it the way it was and kind of ignoring that.

MR. CHOKSHI: Yes, it's ongoing right now.

CHAIRMAN SHACK: Especially since Dr. Munson essentially contradicted the lead statement, saying that this was the basis for the staff's question. He said it wasn't. I hear one thing and I read another.

MR. MUNSON: That's correct. These slides were made last minute. We did the analysis, we came across this.

MEMBER POWERS: Let's press onward.

MEMBER APOSTOLAKIS: It is really interesting though that Risk Engineering just says each assigned probability. Shouldn't they just look more into why Dames and Moore assigned probability or they did and it's not here on this.

MR. LI: It's kind of a summary including the DOE standard.

The next issue is the Eastern Tennessee Siting Zone and I think we already more or less mentioned about this siting. We know its location and we know its approximate position relative to the Vogtle site.

Basically, the applicant concluded that no new information has been developed since 1986 that would require significant revisions to the EPRI source model.

Staff's position, staff believes that more recent studies suggest revision to the EPRI source may be warranted because some studies suggest like the larger maximum magnitudes, earthquakes, could be happening in that area. And also, the applicant performed limited evaluations documentation in more recent scientific studies. Staff as Nillich pointed out, staff in the discussing of the significance of the scientific studies to determine if an update is warranted.

The next item originated from 2.5.4. It's a stability of subsurface material and foundation. The general concern is that the applicant performed it, limited borings and tests to characterize the soil properties of the load bearing layers. Blue Bluff Marl, lower sand stratum.

Also, because of that applicant has to rely on results from the Unit One and Two which happened in 1970s to the soil properties such as internal fraction angle, unit weight and shear stress.

I have an example here, list the site specific studies results and design barriers the applicant took from the ESP, from the Unit One and Two, which is 10,000 psf, but the ESP investigation results are between 150 and 4,300 psf. And in addition to the soil dynamic properties, the actual soil profiles also greatly affect the site response analysis and the site sediment analysis and the load bearing capacity analysis. Those are quite important.

And in addition to that, the applicant did not conduct any laboratory tests on soil samples to determine soil dynamic properties. And more specifically, the applicant did not conduct the soil, did not provide a soil reduction curve and damping ratio curve which determines the soil nonlinear property during the sand propagation process.

And those soil dynamic properties will have impact to the GMRS. Also, as we mentioned, it's called an SSE before. Ground motion response background, and therefore this can also impact the fraction susceptibility and the slope's stability, soil structure interaction analysis which will be in Section 3.7.1, eventually.

However, the applicant conducted more explorations and the testing of the subsurface material after the submission of the ESP application as part of the limited work authorization process.

That concludes my presentation.

Christian?

MR. ARAGUAS: Before we move on, I want to make a comment to the statement about the six percent or how much effect it has on the overall result. When we're doing these reviews the intent is to adequately characterize the site. And so whether or not the six percent or ten percent is the fact that it's different that what the staff anticipates. That's our goal, to resolve that and make sure that it is adequately characterized. So that's why I think why we're putting this issue.

MEMBER CORRADINI: I just want to make sure I understand. But your real issue is with the fact that the original EPRI study used it and you feel that that's inappropriate in terms of the -- it was the EPRI study. I can't remember what you said this grouping of 16. Is that the real issue there?

MR. MUNSON: We have -- this is Cliff Munson. We have a 20-year-old model. This EPRI source model that's 20 years old. So we're looking at each of the aspects of the model, what needs to be updated. They did Charleston. They did not do Eastern Tennessee seismic zone. They did not do some of these regional source zones. We just want to take a look at every possible source zone that's affecting the site, what needs to be updated.

MEMBER CORRADINI: Thank you.

MR. ARAGUAS: And now we're on to the conclusion. The comment I want to make very quickly is that the SER as it stands it defers a general regulatory conclusion regarding site, safety and suitability until we issue the FSER at which point all the open items would be addressed.

When looking at the SER that was issued on August 30th, there were 40 open items as SNC stated earlier. There were two permanent conditions and 19 COL action items in total. If you're wondering how that compares to the previous reviews, there were less open items for the previous three, but that wasn't an accurate depiction of there being more issues now. It's just that the staff has gotten better at separating out issues as opposed to lumping them up into one large issue which makes it a lot harder to close out. So for the purposes of tracking these, we've just gotten better at separating things out.

And permit conditions, it's a significant reduction. I think that's attributable to the fact that they've actually referenced a design as opposed to doing the PBE approach that we saw for the previous three. And for the COL action items, I think that's pretty consistent for what we saw for the previous three.

We did receive the open item responses on the 15th of this month and as I stated earlier, we are still evaluating those responses. Staff is also reviewing the LWA-2 supplement that we received on August 15th of this year and then the next interaction we would expect is in June of 2008 with the ACRS on the FSER. That concludes the presentation.

MEMBER POWERS: Any other questions for the staff on this SER?

We're going to in the next presentation actually discuss how the staff utilized lessons learned in preparing this SER which I think is an interesting story in itself. At that point, I'll turn it back to our chairman.

CHAIRMAN SHACK: We're scheduled for a break. WE're running a little late. Can we take a ten-minute break?

MEMBER CORRADINI: You don't want us back here.

CHAIRMAN SHACK: Yes, I want you back here at 3:15.

(Off the record.)

CHAIRMAN SHACK: Dana, we're ready to start again.

MEMBER POWERS: Okay. I think everybody understands the introduction. At the conclusion of the previous three Early Site Permits, the staff and the ACRS agreed, along with several of the applicants, to get together and discuss some lessons learned. A list of lessons learned was formulated largely based on the staff's findings, but with a couple of inputs from the ACRS, and some input from the applicants, as well. And the Commission has asked us, gee, how are they going on the lessons learned? And Christian will walk through in a fairly disciplined fashion what the lessons learned was, and what the staff has done. Now I'll telegraph my appreciation of it so far is that I think the staff's gone farther in many of these lessons learned than I thought they would get at this early of a stage, but I leave you to draw your own conclusions. So with that, Christian, why don't you go ahead.

MR. ARAGUAS: Okay. For the record, again, my name is Christian Araguas, and we'll go on to the next slide.

Okay. Just the agenda for this meeting, we want to cover the background, as Dana already covered, how we got here, and then we'll move on to the identification of these lessons learned, what they are, and then I'll give you a status of where the staff is with these lessons learned, and then we can move on to any questions.

Just some background. The staff has completed its review of three Early Site Permits. Two of those permits have actually been issued. There's one that's still under review by the Commission. And as we discussed earlier, the staff is ongoing in its review of the Vogtle ESP application.

Last year, in September of `06, the staff held a meeting with the ACRS in which we presented the lessons learned from the three reviews that were conducted, and so what I've done for this meeting is just highlighted on those issues that were raised during that meeting, and provided a status update of where we are today with those lessons learned. And so, as you can see on this slide, and I'll just read them off very quickly, I've outlined what those were.

The first that we discussed was a common understanding between the staff and the applicant. The next was the applicability of 10 CFR Part 21, followed by the applicability of 10 CFR Part 50, Appendix B. Following that, we discussed the development of guidance to insure reliability of internet information. And then we talked about the development of improved guidance on electronic submissions of applications. Another one of the issues we discussed was the incorporation of Early Site Permit definitions into staff guidance. In particular, we were talking about site characteristics, Combined License action items, permit conditions, and plant parameter envelope.

Next, we talked about the development of guidance on the review of performance-based methodology for seismic hazards. We also discussed the review of the development study of climate change for the next 20 years. And then we also raised the issue of updating guidance for the review of hydrology based on the reviews that were conducted for the previous three ESPs. And, in particular, Clinton, where we found an issue with the calculation for probable maximum flood. And then last, I will finish up with the development of guidance on the treatment of the high-frequency component of seismic ground motion.

So for the first item that we discussed at the last meeting, and as I stated just a minute ago, we talked about the common understanding between the staff and applicants. And this was more geared towards some of the issues we ran into during the review as far as really understanding what was expected through our guidance from the applicant, and what we received, and sort of the discussions that were held in closing out some of the open items. And, so, where we are today, as I mentioned at the previous meeting, we were in the process of doing these activities, but the first that I want to mention is that we've completed updates to the Standard Review Plan, which is a review of safety analysis reports for nuclear power plants. And that was done March 2007. This is the guidance that the staff follows in doing its reviews for Early Site Permits, for Design Certifications, and for COL applications.

Following that, we issued Reg Guide 1.206, which is the guidance that an applicant would follow in developing its Combined License application. And that guidance was issued June 20th of this year. We also issued the new Part 52 rule making, which went out on August 28th of 2007. And more recently, the staff developed an office instruction for how to conduct an acceptance review for Design Certifications, and Combined License applications on September 26th, 2007. And with respect to that guidance, that was recently implemented in the acceptance review that was done for South Texas project's COL application.

And then we've also held interactions with industry, what we call our design center working group meetings. And in these meetings, we discuss any issues that are anticipated with the upcoming COLs coming in, and those are focused, as I stated, they're design center meetings, so we have separate design centers for the AP-1000, for EPR, and so forth.

MEMBER APOSTOLAKIS: Part 52, I'm not sure it belongs on that list.

MR. ARAGUAS: I think -- yes. Well, it depends on how you look at it.

MEMBER APOSTOLAKIS: Everything else is fine, but -

MR. ARAGUAS: The reason we put that out there, or the reason I thought it was pertinent

MEMBER APOSTOLAKIS: It was contributing to the understanding.

MR. ARAGUAS: Right. There was a couple of areas that we were kind of shaky with the applicants, and that was, in particular, the applicability of Part 21 to ESPs. Also, with the Quality Assurance, we're talking 10 CFR Part 50, Appendix B, and whether or not that applied to ESPs. At the time, it didn't, now it does, and that was clarified by Part 52. These are all the things I have on the next slide.

MEMBER APOSTOLAKIS: Okay.

MR. ARAGUAS: Just furthering along, the two other issues identified, and was confusing at the time was whether or not Part 21 applied, and so the new rule does clarify that. There's actually a table in Part 52 that shows when you apply Part 21 or 50.55(e) with respect to COLs, Early Site Permits, or Design Certifications, so that was the one that was used. The other one was applicability of 10 CFR Part 50. And as I stated, it didn't previously apply, but under the new rule, it does apply to any ESPs that may come in, any future ESPs that may come in. Next slide.

This was the development of guidance to insure reliability of internet information. As Dr. Powers mentioned, we've been doing pretty good on implementing these lessons learned. This is the one area, so far, that we have not addressed to-date. The staff is taking an action to develop guidance as of the comments that were provided from last year's meeting on Lessons Learned, and from the Subcommittee meetings that were held. But, as of now, we're currently applying the previous review methods from North Anna, Grand Gulf, and Clinton Early Site

Permits. Next slide.

With regard to development of improved guidance on electronic submission of applications, this was an issue that came about with the previous three ESPs, in that they would submit Open Item Responses, or RAIs, as large as their application, and would get rejected. And we'd go iteration after iteration, I mean, I think there was in some cases where it would get rejected three or four different times from the -

MEMBER CORRADINI: Oh, you mean it wouldn't go through?

MR. ARAGUAS: Correct. Correct. And not from a review standpoint, but from an electronic submission -

MEMBER CORRADINI: Yes, that's what I thought. Yes, you get this file back from the NRC that says, "I'm sorry, it's over 2 megabytes, can't send it", something like that. The mailman sent it back to us.

MR. ARAGUAS: Yes, the mailman. And, so, the industry the felt that the guidance that was available at the time was not very clear in this area, so the Office of Information Services has done a few things to actually make it a lot easier to succeed in your submittals. And, so -

CHAIRMAN SHACK: It's not really apropos, but I notice they lost all of Public ADAMS.

MR. ARAGUAS: That they have. At the current time, it's not available, but it certainly exists.

CHAIRMAN SHACK: I mean, it's not only down, the files are, apparently, gone.

MR. ARAGUAS: Right.

CHAIRMAN SHACK: I mean, server being down is one thing, missing files is -

MR. ARAGUAS: That is true.

CHAIRMAN SHACK: An applicant might -

MEMBER POWERS: The Committee has not formulated a position on Lessons Learned with respect to ADAMS. I'm not sure that's really pertinent here.

CHAIRMAN SHACK: Just if it was my electronic submission, I'd worry about where it was going.

MEMBER POWERS: Please continue with pertinent.

MR. ARAGUAS: The point being is the guidance -- well, it's been developed, and where we stand with that, and I'll just go quickly through the -

MEMBER CORRADINI: You might rent some space on the service of the applicants. You might have higher probability of reliability.

MEMBER SIEBER: Or join AOL.

MEMBER POWERS: Please continue in pertinent areas.

MR. ARAGUAS: So with regard to the guidance, the staff combined all guidance documents for electronic submissions to the NRC into one document. It issued this document on June 28th of `07, and this was issued in the Federal Register for public comment. We also recently issued Revision 2 to this document on October 4th of this year, and that has also gone out for public comment in the Federal Register. And what I want to point out with this document is it's a living document, as technology changes, the staff will keep updating it to keep up with any new changes. And what I recently just learned is that we're working on Rev. 3, and that should go out some time at the end of the year.

MEMBER BANERJEE: Did you collaborate with any other agencies on this? I mean, there are agencies where this thing actually works well.

MEMBER CORRADINI: Not many.

MEMBER BANERJEE: SNF does.

MEMBER CORRADINI: No, it's all changed.

MEMBER BANERJEE: What were the changes?

MEMBER CORRADINI: The federal government is actually pretty crummy, generally speaking.

MEMBER BANERJEE: Never mind. Carry on.

MEMBER SIEBER: Well, besides that.

MEMBER BANERJEE: So there's the divergence of using this -

MR. ARAGUAS: The next item that attributes to the improvement of the guidance is that we've created a check list for simplifying the PDF document submittal. It's also available on line, and the applicant can go ahead and take a look at that, and make sure that they've done all the correct steps to get their document accepted.

And, more recently, as you'll see on line, as well, which I think this is very helpful, and you'll see that staff has gone and developed video clips that an applicant can go ahead and pull up, and watch, actually walks you through all the steps you need to do to make sure that your document is going to be accepted by the staff.

MEMBER SIEBER: What's a storer and a pre-flight profile?

PARTICIPANT: Adobe.

MR. ARAGUAS: Yes. I'm going to turn that over to our OIS rep, who can elaborate a little bit more on the pre-flight.

(Off the record comments.)

MR. SMITH: I'm Tom Smith, and I'm the person who put together the consolidated guidance document. We do, from time to time, receive requests from stakeholders based on their experience with submitting documents electronically. The video clips were something that we put together, that we thought would assist stakeholders in submitting documents electronically. If, for some reason, you have a request, and you want some -- you find something that's very problematic, when we actually posted the revised guidance, I created a training page, and I put the video clips on that. So if you would let me know if there's something else that you would like, perhaps, we would certainly be happy to entertain that.

MR. ARAGUAS: Can we elaborate on what a

pre-flight profile and -

MR. SMITH: Yes. It's for Adobe, and what it does is, it's for Adobe Version 6, 7, and 8. And it assists people in determining if their files meet certain requirements that is specified in the guidance. And it will give you an idea, if it's correct or not, and what to do to correct it.

MR. ARAGUAS: Does that answer your question?

MEMBER SIEBER: His question.

MEMBER CORRADINI: I didn't ask that question.

MEMBER POWERS: He asked the question.

MEMBER APOSTOLAKIS: He asked the question.

MR. ARAGUAS: Oh, I'm sorry. Okay.

MEMBER APOSTOLAKIS: Christian, I'm just curious. How many people have used the video clips on converting Word Perfect to PDF?

MR. ARAGUAS: That's a good question, and not one I have the answer to.

CHAIRMAN SHACK: Converting Word Perfect to PDF is a keystroke.

MEMBER CORRADINI: Do you need help,

George?

MEMBER APOSTOLAKIS: How many people use Word Perfect outside this agency, outside this agency?

MEMBER CORRADINI: Young people. Sorry.

(Laughter.)

MEMBER CORRADINI: People. I'm sorry. I'm sorry. I'm doomed now. I'm in trouble.

CHAIRMAN SHACK: It's a keystroke, but it produces lousy PDFs.

MEMBER POWERS: Let's go on.

MEMBER CORRADINI: I don't contest the statement, but it produces PDFs.

CHAIRMAN SHACK: That's true.

MEMBER APOSTOLAKIS: We never question the quality.

MEMBER BANERJEE: How many people use Latek?

MEMBER APOSTOLAKIS: What the hell?

MEMBER POWERS: Only grad students.

(Laughter.)

MEMBER BANERJEE: Well, my secretary still does.

MEMBER POWERS: Please continue with pertinent -

MR. ARAGUAS: All right. We're on to the next slide. One of the issues that was raised from the previous reviews, and in particular at the ACRS meetings, was how the staff made its determination of distinguishing between a permit condition, or a COL action item. And if you actually look back at some of the SER with open item ACRS meetings, there was a lot of changes between what the staff called a permit condition, and what ended up being a COL action item. And, so, the lesson learned that was identified was the staff should actually incorporate these definitions in staff guidance, so that for future reviews, any new reviewers that come in can quickly take a look through, and be able to distinguish when something becomes a COL action item or a permit condition. And, so, what the staff has done, has taken these definitions that were previously created, and has put it into the SRP update in Chapter One, an appendix to Chapter One. And that document is currently up with the Office of General Counsel for review.

MEMBER POWERS: I believe the ACRS commented favorably on those definitions.

MR. ARAGUAS: That's right.

MEMBER CORRADINI: Maybe, I should remember this from the last time you were here discussing it, the plant parameter envelope is -- can you remind me?

MR. ARAGUAS: Yes, the plant parameter envelope was a set of design values that the applicant would propose based on a set of seven different designs. And, so, what they would use, they use those values to sort of -- to incorporate into its analysis, and to have a set of bounding values so that when you come in at COL, what you do is you take your actual plant design, and compare it to the design values. And as long as you're bounded by those design values, it would validate your site characteristics that you basically based off of those design values.

MEMBER CORRADINI: Can I say it in reverse fashion, too, to make sure I understand it? So you're saying that there are -- you guys have thought through a set of common site characteristics, and with this plant parameter envelope, if you fit within the envelope, you're golden.

MR. ARAGUAS: Right.

MEMBER CORRADINI: Okay. So, in developing the site characteristics, have you gone

-- I mean, I'm kind of linking off of the discussion we had before about seismic in this region, where the intent I got from the staff was to try to get a regional idea so in case there's another Early Site Permit, you would know better what the seismicity is, and various sources. Is there something that is going beyond just the past three, North Anna, Grand Gulf, and Clinton, where you're incorporating these sorts of things into a general -

MR. BAGCHI: Can I try to explain? My name is Goutam Bagchi. The philosophy is like this, you have a plant, standard design plant. You have assumed certain parameters to design the plant; the seismic load, for example, the response factor, you've used that, assumed that, so that's part of the design parameter. The standard design they use is a design parameter, and when we do a site permit, we do a site characterization so that we can define what those site characteristics are. And it is, therefore, trying to match what was used as a site parameter in the standard design, and what the site will permit.

MR. MUNSON: So, in other words, we don't look at site characteristics for our PPEs. We look at the conglomeration of six or seven different-

CHAIRMAN SHACK: Like megawatt thermal or something like that would be one of the things -

MR. MUNSON: Six or seven designs, different designs that are out there. That's the envelope.

MEMBER CORRADINI: Okay. But I was going in some way a bit opposite, in that I was -

CHAIRMAN SHACK: This is the reactor parameters.

MEMBER CORRADINI: Right. I got that.

CHAIRMAN SHACK: How they interact on the site.

MEMBER CORRADINI: Yes, but I was trying to think of it in a reverse way, when we're looking at, for example, I'm linking what we're just starting on the ESBWR and site characteristics, and a standard design, and what is incorporated into that that the applicant is expecting from the staff or from the NRC. And I'm guessing, initially, you probably looked at North Anna, Grand Gulf, and Clinton, which were the first early ESPs, to try to use those to reflect on whatever -

MR. BAGCHI: No, no, no. Those three Early Site Permits were based on what is called the plant parameter envelope, because they did not choose to select one particular design.

MEMBER CORRADINI: Okay.

MR. BAGCHI: It was a conglomerate of designs, and gleaning from all of those design parameters, they developed an envelope, so that became the plant parameter envelope. If you look at the applications, you're going to find that there are a whole list of plant parameter envelopes, but not all of those are captured in the site permit. What's captured in the site permit are dominant plant parameter values, so that goes into the plant site, Early Site Permit, itself.

MEMBER CORRADINI: Okay. Thank you.

MR. ARAGUAS: One thing I wanted to point out with respect to the PPEs, is that the definitions were put in there, but I would say that that's not so much a concern at this point, because I don't believe we're anticipating anybody else coming in with an Early Site Permit that's going to go with the PPE approach. I think at this point, most will follow the model that Southern has stepped forward in actually selecting a design.

MEMBER CORRADINI: Okay. Thank you.

MR. ARAGUAS: Okay. So now we're on to the next item, which is the development of guidance on the review of the performance-based methodology for seismic hazards.

As you may recall, this was an issue with the review of Clinton, where the applicant proposes new methodology that the staff was not familiar with, so it caused quite a bit of a challenge for the staff to do this review in a timely fashion. So the lesson learned here was for the staff to develop guidance, so that for any future applications that want to come in and take advantage of this approach, there's actual guidance set out for that to be accomplished.

MEMBER APOSTOLAKIS: The lesson is don't surprise the staff.

MR. ARAGUAS: That would fall under the common understanding. Right?

(Laughter.)

MEMBER BANERJEE: You can surprise the ACRS, though. It's okay.

MR. ARAGUAS: We can move on to the next slide. This next item, the review of the development study of climate change for the next 20 years. This was an item that was raised, if I recall, in each one of the ESP ACRS meetings. Even in the lessons learned for the first lessons learned meeting we had in September, and so the staff, in response to this issue, the staff has taken a proactive approach regarding potential climate changes. It's revised the Standard Review Plan, Section 2.3.1 with respect to meteorology to capture the review of cyclical extremes. The staff also used a new approach for the Vogtle Early Site Permit review. And as you can see listed here, these are three examples of how we implemented this new approach.

We considered current scientific thoughts, including the 2007 Inter-Governmental Panel on Climate Change report, we analyzed long-term climate trends surrounding the site, and we issued an open item, as I discussed with you earlier, relating to an adequate period of record for design-basis temperatures data.

We also now contact the American Society of Civil Engineers, as well as the American Society of Heating, Refrigerating, and Air Conditioning Engineers. More recently, our staff has been attending scientific conferences, and we'll plan to continue to attend those with respect to this issue. And, more recently, the staff has proposed to conduct a Hurricane Research Study, and this study will also consider the potential increase in hurricane frequency and intensity.

DR. BANERJEE: Well, why those two societies, rather than meteorologists, and something like that? Sort of sounds like meteorology has more to do with climate change than ASHRAE.

MR. ARAGUAS: That's a good question.

MEMBER APOSTOLAKIS: NASA, too. NASA does it also.

DR. BANERJEE: Yes, whatever.

MR. ARAGUAS: I'll let our meteorologist address that.

MR. HARVEY: Hello. My name is Brad Harvey, meteorologist with the staff. ASHRAE publishes some climatic data that is typically used by HVAC engineers for designing capacities for the systems. And the same with the ASCE, they look at building loads from wind and from snow loads, and so that's why we've been talking.

DR. BANERJEE: That's like the database.

MR. HARVEY: Yes. What they're going to do with the databases they've used, and adjust them for potential changes in climate.

MEMBER POWERS: The one comment I'll make on this is when the ACRS raised this with the first ESP, we were thinking not just in 20 years, but actually for the 60-year, taking the duration of the Early Site Permit, plus the longevity of the plant, if you built it in the very last year of your Early Site Permit. So we were looking a little longer term than that.

MR. ARAGUAS: Right. And I think -

MEMBER POWERS: But I think the actions you've taken cover it. I mean, I don't think it changes anything you would do.

MR. ARAGUAS: Right. And, actually, one of our meteorologists raised that point in the previous presentation I gave, and what -- to address that, what I did was, I just extracted the actual lesson learned. It was documented in the -

MEMBER POWERS: I understand.

MR. ARAGUAS: But you're right, it goes beyond the 20 years.

MEMBER POWERS: Yes. But it seems like -- I mean, you've done the right thing in the sense that the agency is not really intending to become a meteorological research institution. Your hurricane study I think is pertinent not only to ESPs, COLs, but actually your existing plants, because, I mean, we don't know the outcome of that. We do know east coast hurricane frequency is cyclical. The scientific debate is whether the intensity parallels the cycles in frequency or not.

DR. BANERJEE: Is there any plants that are subject -

MEMBER APOSTOLAKIS: The time period is -

DR. BANERJEE: -- to storm surges?

MR. ARAGUAS: Sure.

MEMBER POWERS: Turkey Point.

MR. BAGHI: The Florida coast, and the Gulf Coast.

MEMBER POWERS: In answer to your question, George, about 50 year cycles in east coast hurricanes. It's actually the product of two cycles. We happen to be entering an era where those two cycles are in phase with each other. Periodicity in the Gulf of Mexico is less easily ascertained, but it's about the same. The problem is the historical record for the Gulf of Mexico just isn't as long as it is for east coast hurricanes.

MEMBER APOSTOLAKIS: But you also said

something about the plant. How far into the future do we go, 20 years? If they build it at the end of the 20-year -

MEMBER POWERS: Give a total of 60 years.

MEMBER APOSTOLAKIS: A total of 80?

MEMBER POWERS: No, a total of 60. We only give them a license for 40 years.

MR. BAGCHI: The standard plant design life is for 60 years, sir.

MEMBER POWERS: Oh, okay. So it should be 80 years.

MR. BAGCHI: Twenty, plus sixty, plus another 20 for license renewal.

CHAIRMAN SHACK: So 100 is a nice round number.

MEMBER APOSTOLAKIS: So you're looking at 100-year period.

MR. ARAGUAS: Forty year license, with a 20-year extension for renewal.

(Simultaneous speech.)

MR. BAGCHI: At the end of 20, so 20 is -- you're doing it today, so 20 years for building, starting to build the plant. Their plant runs for 60 years because that's the design life of the plant.

MEMBER APOSTOLAKIS: Is it?

MR. BAGCHI: Yes, sir. Not 40, 60 years, twenty plus sixty, plus another 20 for license renewal.

MEMBER POWERS: So make it 100 years.

MEMBER CORRADINI: Just let me -- I want to understand the second bullet as to the action on there. So is that more for the staff, or for the applicant, or both to stay current on these issues?

MR. ARAGUAS: For both.

MEMBER CORRADINI: Okay.

MR. ARAGUAS: And I think with respect to this, it's actually documented in guidance for the staff to be able to do that.

MEMBER CORRADINI: Okay. All right. Fine. Is there some connection to somebody in industry that is also doing this, so that you can have a conversation with somebody on the other side to be relevant and up-to-date?

MR. BAGCHI: Good question. I -

MEMBER CORRADINI: I mean, it seems to me there ought to be somebody, NEI or EPRI, that ought to worry about that this, so -

MR. BAGCHI: More than that, the Standards

Committee, this would be public consensus standard, and then it would be applicable under the existing public laws. So the issue, when it comes to some point of maturation, so that the Standards Committee can pick it up, that would be the ultimate process.

MEMBER CORRADINI: But the way I see most things, unless you have a person with a name on the other end, nothing happens. So I'm curious who's the group, who's the person at that group that you can converse with on this, otherwise, you may not get anything from the other side.

MR. ARAGUAS: Joe, do you have an answer for that?

MR. HOPE: This is Joe Hope with the staff, another meteorological technical reviewer. I'd say to that that our guide is that we use, we endorse certain standards, such as the ASHRAE and ASCE, and that they're working to update their guidance on any potential research regarding climate change. So if those documents are changed, the industry would be aware of that, as well as us.

MR. BAGCHI: I think there is already an ANS Standards on meteorology. They were out of business for quite some time, now they're trying to formulate some of these groups. We sort of know where to g

DR. BANERJEE: There has been some -- a French plant, right? Which was -

MR. BAGCHI: IIA.

DR. BANERJEE: Yes. To storm surge, right?

MR. BAGCHI: Yes, IIA. It was not just storm surge, it was probably -- I don't want to comment on somebody else's design. It was like a boar coming through the channel. And then there was an additional failure of the dykes, which they considered not so safety-related.

MR. HOPE: One other point I'd like to make while I'm up here is the 20 years was an arbitrary number that was thrown in there. For me, personally, I've been attending these conferences and looking at the research. We're not limited just to 20 years. And, actually, you'll see in our SER, a lot of our site characteristic values are based on 100-year return period.

MR. ARAGUAS: Okay. Next, I will turn it over to our hydrologist to continue.

MR. BAGCHI: Well, I've been called a

hydrologist, and many other things, but I'm really not a hydrologist. It just so happened that I reviewed the three -- well, maybe three and a half, Vogtle's is still continuing, hydrology section of the Early Site Permit applications.

I think that having done the review of those applications using RS-002, we have learned a few lessons, and we tried to reflect that in the updated Standard Review Plan, Section 2.4. As Christian pointed out earlier, we published that on March 31st of this year, most of the sections, 2.4 was one of them. And our revised guidance really reflects some of the things we learned. For example, how to increase the efficiency and timeliness of our reviews, so we do it by hierarchical approach. If a site doesn't have a flooding potential, then we don't spend a lot of time looking at the PMF, or the SASCE, or the hurricane search, things like that, or even Tsunami. We have developed some criteria for that already. And Tsunami is really the next bullet.

We have expanded the guidance to include things like drawn down, erosion, things like that. And after the 2004 huge Tsunami devastation around the world, there was a lot of consciousness about this.

The President's National Tsunami Hazard Reduction Program was being conducted by NOAA, and we are in close coordination with them to insure that the standards used for modeling of Tsunami are those that are going to be applicable to our guidelines, and so forth.

We have participated in Tsunami workshops, international workshops. We are participating currently in developing IAEA guidelines, and they're combining the hydrological and meteorological hazards into one guide.

And then, in the Standard Review Plan, itself, Section 2.4.7, we used to do the ice thickness calculation in a certain way, and now we've changed it, and updated it very substantially. In the case of Clinton, they're going back and forth. Clinton's initial ice thickness calculation was a factor of 2 less than what they ended up with. That's when we updated our ice thickness calculation guideline.

And we also learned one important thing. When we did the safety evaluation of the open items, what we did is incorporate our calculated values as site characteristic parameters. Then it turned out that the applicant doesn't have their calculation to go along with that, so it was an important lesson, that if there is a site characteristic that we're going to site in the site parameter, it must be in their application, in their site, so we learned that. And then we are currently in the process of updating the regulatory guidance 51.5. It's almost 35, 40 years old.

Now our next item is related to ground motion. As you heard from Christian, that our Regulatory Guide 1.208, which is primarily based on performance-based approach of ASCE Standard 43-05, which insures that the frequency of undesirable performance by structures, systems, and components will be a certain amount, which is 10 to minus 5 per year. On the basis of that, we developed guidance to incorporate development of site-specific ground motion spectrums.

It turned out after we did that, we noticed that C and E US, Central and Eastern United States sites, where there are rock sites, high-frequency end of the motion spectrum becomes quite high. Let me show the slide, next slide, please. This is the Regulatory Guide 1.60 entered at .3g, and this was predominantly used by all the certified designs prior to ESBWR, so AP-1000, AP-600, System 80+, CESAR, ABWR, all of those used that spectrum. Although, in case of CESAR as well as the AP-1000, they have slide augmentation they actually consider. But current response spectra are like this, so you can see the high-frequency end, this is called the peak ground acceleration, also, because peak ground acceleration becomes asymptotic at high frequency. If you have a high-frequency oscillator, it's just not going to move, so it's peak ground acceleration, it's peak acceleration is the same thing.

And now we found out that with performance-based response spectrum for soil size, this is the green curve that comes up. So standard designs that are designed that way, how do they s how that they are okay for this site? The trick there, of course, is this end of the spectrum, the low frequency that drives the design of structures, piping, and other components, those are driven by the enriched high frequency end of the Reg Guide 160 spectrum. So it's the slide itself.

We had extensive interaction with -- go back to the previous slide, please. We had extensive interaction with our stakeholders, public meetings, and so forth. There were several industry technical studies. These are done by Electric Power Research Institute. They wrote two White Papers. We reviewed those, and we developed staff position. And our typical approach was to allow use of realistic ground motion effects, such as incoherency, and how that incoherency effect would be implemented in validation, in computer codes. That was established, and now they have two computer codes that are validated. But it's not an unmixed blessing, it turns out that if you do incoherent, consider incoherency effects, the effect of torsion and rocking might increase, and this they have to consider.

The next, and the next. A picture is always very useful to look at. Can I go to the next slide, please. This is an example of a standard design. This is AP-1000. This is the in-structure response spectra, which is incorporated in their DCD as a in-structure response spectrum for a critical location. So people are supposed to then match this response spectrum with what they would get at a specific site. It turns out, if you don't use incoherency effect, you get this kind of exceedance. Not very easy to demonstrate, that you meet the site requirement, that with incoherency effects -

DR. BANERJEE: What do you mean by incoherency?

MR. BAGCHI: When the ground motion is propagated through the site, if you have distances between two points that are greater than maybe 10 to 15 feet, then the ground motion at Point A is different from ground motion at Point B, which is separated by a distance of 10, 15 feet, or thereabouts. Since these two motions are not statistically coherent, hence, the term "incoherency". So you design the structure by considering source structure interaction models, you propagate this motion through the model by considering that the input at one point is different from the input at the other point.

Let's remember that the nuclear island structures are a couple of hundred feet across, so these are large footprint, large foundations that are really subjected to this kind of an effect.

DR. BANERJEE: So you're saying that the foundation at different points will be getting different -- it's not correlated, the driving force.

MEMBER CORRADINI: The whole basement

doesn't do this. It does this.

MEMBER APOSTOLAKIS: Right.

MEMBER POWERS: Right.

MR. MUNSON: And this is especially true for the high frequencies, like the 20, 30 hertz. It's incoherent motion, but around 2 to 5 hertz, you're going to have coherent ground motion, which is going to do damage. This incoherent high frequency ground motion isn't going to damage the structure.

MR. BAGCHI: Of course, that's a point of view that's well demonstrated by this figure. You can see the exceedances are not in the low frequency area. This is 1 hertz, this is 10 hertz, this is 100 hertz, so you can see that low frequencies at this end, high frequencies at that end, and you can see the exceedance is primarily in the high frequency

DR. BANERJEE: But if Jack's point is it's wiggling, then at 100 hertz, and taking 1,000 meters per second as the sound speed, you're still talking about 10 meter wavelength. Right?

MR. BAGCHI: We can only capture so much of frequencies.

DR. BANERJEE: What's the physics then?

MR. BAGCHI: I think what we can do is

consider the shear wave velocity transmission through concrete.

DR. BANERJEE: But is it much lower, the shear wave?

MR. BAGCHI: Yes. Absolutely.

DR. BANERJEE: What is the velocity of the shear waves?

MR. BAGCHI: Well, I was trying to tell you.

MEMBER CORRADINI: Have some pictures of it in the previous thing.

DR. BANERJEE: Okay. That might explain.

MR. BAGCHI: No, aside from -- let me explain this very quickly. In concrete, the shear wave velocity propagation is -- the full wave length is about 86 feet. And if you have four elements within that wave length, then you're capturing that shear wave propagation through the concrete. And they have -- this analysis was probably used -- was done using 20 feet across elements, so it does have the totality of frequencies that we want to capture, or can be captured by concrete structures.

MR. CHOKSHI: This is Nillich Chokshi. I think the ISG which Goutam referred to, is precisely

-- raises that question, that you have to discuss in your models why it's adequate for this kind of motion, that it will transmit the frequencies. So yes, that when you do your structural analysis, that's one of the issues. And, again, it depends on what's of interest to you. If you everything is affected by the low frequency, so it's in that light of here to look at this issue.

DR. BANERJEE: It's a complicated thing.

MR. BAGCHI: Yes, it is. The structural design is dominated by this portion, and you can see what kind of margin it has. And the other components, relay stuff like that, those might be affected by some of these things, and we don't have that many relays in modern nuclear power plants. And there are ways to qualify components. GE, for example, has for years had high frequency driven by the hydrodynamic loads. And they had to develop components that are robust enough to withstand those things.

DR. BANERJEE: Except the steam dryers.

MR. BAGCHI: Well, steam dryers I don't know much about, and I won't go there.

CHAIRMAN SHACK: Don't volunteer any information.

MR. BAGCHI: I won't volunteer.

CHAIRMAN SHACK: Is this going to make it more difficult to have a standardized design? I guess that's the -

MR. BAGCHI: No, no. I think that is an excellent question. ESBWR is doing that.

CHAIRMAN SHACK: Yes, they're changing the spectrum.

MR. BAGCHI: They're changing the design spectrum.

CHAIRMAN SHACK: But, I mean, anybody that comes in with an AP-1000, is he going to have to now sit there and look at the red curve and argue, is this or is this not exceedance, and what components does it affect?

MR. BAGCHI: They actually have submitted a technical report. This sort of thing will be there, and they are going to show calculation of structure loads, calculation of some pipe support loads. They're a factor of 2 less than the dinar from this kind of a high frequency spectrum.

DR. BANERJEE: Then we have over-designed it.

MR. CHOKSHI: Let me -- but, I think your question, I think AP-1000, it's comparing what are the site spectra, which has this exceedances, with their design, and they're going to submit as part of the design certification amendment. And so when the new COL comes in, they will have these reasons, and unless their site-specific spectra still exceed, then they are able to address from a COL basis.

CHAIRMAN SHACK: Okay. So they're not going to change the DCD, but they're going to have a spectra that is a little more bounding for this -

MR. CHOKSHI: In fact, the sudden -- say that that's what they are going to do, when you asked that, the question was asked, that's why they were talking about, they're going with some response analysis and compare. The most likely, I think, outcomes is the design -- most design won't change structures, and things we don't know are not affected by this. And so Westinghouse is looking generically. The idea is to not affect standard design.

MR. BAGCHI: The other thing is that this ISG, Interim Staff Guidance that we have developed, that doesn't require them to do a wholesale re-analysis. It can be done by sampling, by evaluating critical areas. And in some cases, even that may not be sufficient. In that case, they may have to do some simple amendments, simple changes in design.

MR. MUNSON: I just want to point out also that what we're talking about here are mostly rock sites that will transmit these high frequencies. The majority of the sites are soil, and we're not going to see these high-frequency ground motions, because the soil will dampen out these high frequencies, so this is actual site spectra from like a North Anna site.

MR. BAGCHI: That's why in the previous curve, I wanted to show you, the previous one, previous curve. Yes. You see in the soil site, this is what the soil response spectra would look like. In the high frequency end is not going to be a lot of exceedance.

MR. MUNSON: But that blue curve is the rock site.

MR. BAGCHI: That's what people were focusing on, on rock sites where the high frequency was not considered. And, of course, you all know that AP-1000 was done on the basis of this, didn't consider soil structure interaction, but they have to.

CHAIRMAN SHACK: The first ESP we had was North Anna.

MR. BAGCHI: Right. The next one, please. That will be the last of my worthy slides. And, actually, when we were developing the update of the Standard Review Plan, we envisioned that this would be a problem, because we had gone through the North Anna ESP evaluation, and saw how rock site frequency response factor could be higher. And when we did the updating of Standard Review Plan 371, and 372, that's why these comparisons are required.

Then we developed an umbrella process. We didn't lay out all the way how it could be done, because we were still negotiating and reviewing. But it has provided an umbrella process by which people can show these facts or comparisons. So we took it seriously, tried to make sure that the COL application is not impeded. That ends the slide portion of it.

MR. ARAGUAS: And that concludes the presentation on Lessons Learned.

PARTICIPANT: Bill, Russ Bell from NEI wanted to make a comment on the PPE, if that's all right with you.

CHAIRMAN SHACK: Sure.

MR. BELL: Thank you. I am Russell Bell with NEI. Thanks for the -- just a moment. If

Christian - and we appreciate the staff's update of the guidance with respect to ESPs, and definitions, including the plant parameter envelope.

Just motivate it a step up here. We haven't given up on the possibility that applicants may, in the future, was to use the ESP process. Christian mentioned we don't expect that, maybe you don't either, and maybe I don't either, but the potential is there. Remember, the idea of an ESP was to be able to bank a site. Remember that, they put it in quotes all the time, "bank a site for 20 years". You're unlikely -- if you want to do that, you're unlikely to lock yourself into a technology when you don't want to build for several years. So we think the guidance provides for it, the next wave of applicants may have a time horizon that they're not ready to make a technology selection, but are ready to move forward with site characterization and an ESP, and so we think it's possible that there may be further use of that. I just wanted to plant that seed, or leave that seed with the Committee. Thank you.

MEMBER APOSTOLAKIS: We lost the Chairman.

CHAIRMAN SHACK: Any further questions

from the Committee? Well, thank you very much. It was a good presentation. Good answers to my question about the Reg Guide 160 spectrum. (Whereupon, the proceedings went off the record at 4:08:45 p.m.)