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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

AP1000 SUBCOMMITTEE

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THURSDAY

JULY 22, 2010

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ROCKVILLE, MARYLAND

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

SUBCOMMITTEE MEMBERS:

HAROLD B. RAY, Chairman

J. SAM ARMIJO, Member

SANJOY BANERJEE, Member

DENNIS C. BLEY, Member

MARIO V. BONACA, Member

CHARLES H. BROWN, JR., Member

MICHAEL T. RYAN, Member

ACRS CONSULTANTS:

WILLIAM HINZE

THOMAS S. KRESS

GRAHAM B. WALLIS

NRC STAFF PRESENT:

WEIDONG WANG, Designated Federal Official

HOSUNG AHN

GOUTAM BAGCHI, NRO/DSER

PERRY BUCKBERG

QUINTANA LUISSE CANDELARIO, NRO/DSER/RGS2

JILL CAVERLY

TRAVIS CHAPMAN, NRO/DCIP/CTSB

PEI-YING CHEN, NRO/DE/EMB

CHRISTOPHER COOK

STEPHANIE DEVLIN, NRO/DSER/RGS2

THOMAS GALLETTA, NRO/DNRL

BILLY GLEAVES, NRO/DNRL

SUJATA GOETZ

DON HABIB, NRO/DNRL

BRAD HARVEY, NRO/DSER/RSAC

ANN HODGDON, OGC

RAVI JOSHI, NRO/DNRL

REBECCA KARAS, NRO/DSER/RGS1

KERRI KAVANAGH

NRC STAFF PRESENT:

GREG MAKAR, NRO/DE/CIB1

JODY MARTIN, OGC

EILEEN McKENNA, NRO/DNRL

ANTHONY MINARIK, NRO/DNRL

SIKHINDRA MITRA

SUNWOO PARK, NRO/DE

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MALCOLM PATTERSON

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TERRI SPICHER

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SARAH TABATABAI

SESHAGIRI TAMMARA, NRO/DSER/RSAC

BRET TEGELER

DAVID TERAO, NRO/DE/CIB1

BRIAN THOMAS, NRO/DE/SEB1

THEODORE TJADER, NRO/DCIP/CTSB

NRC STAFF PRESENT

MILTON VAUNTIN, NRO/DE/SEB1

FRANKIE G. VEGA, NRO/DSER/RGS1

WEIJUN WANG

MIKE WENTZEL, NRO/DNRL

ZUHAN XI, NRO/DSER/RGS1

ALSO PRESENT:

AMY AUGHTMAN, Southern Nuclear

JOSEPH BRAVERMAN, BNL

CHUCK BROCKHOFF, Westinghouse

TOBY BURNETT Westinghouse

ED CUMMINS, Westinghouse

JOHN DAMM, Bechtel

JOHN DAVIE, Bechtel

MATT EVANS, Westinghouse

DAVID FENSTER, Bechtel

JOHN GIDDENS, Southern Nuclear

JULIE GILES, SCE&G

EDDIE GRANT, NuStart

BOB HIRMANPOW, NuStart

ANTHONY JAMES, ORS

WILLIAM LaPAY, Westinghouse

MIKE LEWIS, Bechtel
DON LINDGREN, Westinghouse

ALSO PRESENT

PAUL LOZA, Westinghouse
MIKE MELTON, Westinghouse
GARY MOFFETT, SCE&G
AMY MONROE, SCE&G
DON MOORE, Southern Nuclear
RICHARD ORR, Westinghouse
AL PAGLIA, SCE&G
DAN PATTON, Bechtel
JEFF PETERSON, Westinghouse
KEVIN PIGG, Southern Nuclear
TONY PILO, Progress Energy
JOHN PREBULA, Bechtel
BOB PRUNTY, Bechtel
THOM RAY, Westinghouse
JASON REDD, Southern Nuclear
APRIL RICE, SCE&G
MARY RICHMOND, Bechtel
TIM SCHMIDT, SCE&G
ROB SISK, Westinghouse
WES SPARKMAN, Southern Nuclear
STEPHEN SUMMER, SCE&G

JOHN TODD, SCE&G

BOB WHORTON, SCE&G

ROLF ZIESING, Westinghouse

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

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

(8:30 a.m.)

OPENING REMARKS AND OBJECTIVES

CHAIRMAN RAY: We'll get started this morning, thank you. The meeting will come to order.

This is the second day of a meeting of the AP-1000 Reactor Subcommittee, a standing committee of the Advisory Committee on Reactor Safeguards. I'm Harold Ray, chairman of the subcommittee.

ACRS members in attendance are Dennis Bley, Sam Armijo, Sanjoy Banerjee, Mike Ryan, Mario Bonaca and Charles Brown.

ACRS consultants Tom Kress, Bill Hinze and Graham Wallis are present, and as I just indicated a minute ago we're hoping that one of our consultants, Professor Stojadinovic, will join us over the telephone line. If he does so I hope he'll announce himself so that we'll know that he's participating with us.

Weidong Wang is the designated federal office for this meeting.

This meeting is part of the ongoing review of a proposed amendment to the AP-1000 pressurized water reactor design control document and review of the associated combined license applications. In the past we've had six of these subcommittee meetings.

This meeting will review - will continue to review the safety evaluation reports on the Revision 17 to the AP-1000 DCD amendment and the Vogtle AP-1000 regs combined license application. In addition the subcommittee has started to review the Virgil C. Summer subsequent combined license application.

It means that we have three different categories of application on the table at one time, and that gets a little confusing for some of us. So we need to try and keep clarity around that. The DCD amendment is distinct and different of course from the referenced COL application which has an ESB and the subsequent COL application which does not.

The presentations today will be in accordance with an agenda that has been revised and is available in the room for today's meeting, and I will make reference to the item numbers in that agenda from time to time.

We'll try and make maximum use of the time and ensure that everybody is able to complete their respective portions and be free to do as they choose afterwards at as early a time as possible.

We will hear presentations from the DCD

applicant, Westinghouse, the Vogtle RCOL applicant as I've indicated, Southern Nuclear Operating Company, which is supported by NuStart, and the summer subsequent COL applicant, South Carolina Electric and Gas, and of course also from the NRC staff.

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

For the agenda item on resolution of ACRS action items that is agenda item #6 on today's agenda, it's presently scheduled for right after the lunch break. The discussion of the action item concerning the reactor coolant system flow measurement will be closed in order to discuss information that is proprietary to the applicants and its contractors. And of course that same provision will affect the bridge line. We'll plan to do that as soon as we resume when we begin that item, so that we can complete it and then open the meeting for the rest of the action item.

I would like very much to scrub the action items thoroughly today if time permits so that we can ensure that everyone is on the same page and understands what is outstanding.

But for the portion of the meeting which is to be closed, attendance will be limited to the applicant, Southern Nuclear Operating Company, NuStart, Westinghouse, South Carolina Electric & Gas, NRC staff and our consultants, and those individuals and organizations who have entered into an appropriate confidentiality agreement with them.

We will have to confirm that only the eligible observers and participants are in the room for the closed portion, and as I indicated, we will not have the telephone line open at that time.

The subcommittee will gather information, analyze relevant issues and facts, and formally propose positions and actions as appropriate for deliberation by the full committee. There will be not conclusions reached by the subcommittee of course.

The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register. A transcript of the meeting is being kept and will be made available as stated in the Federal Register notice. Therefore we request that participants in this meeting use the microphones located throughout the meeting room when addressing the subcommittee, and that they identify themselves and speak with sufficient clarity and volume so that they may be readily heard.

We will now proceed with the meeting. And Westinghouse, Don, is that yours to start?

MR. LINDGREN: It's mine to start, yes,

DCD SECTION 3.7 - APPLICANT

MR. LINDGREN: My name is Don Lindgren. I'm a licensing engineer for AP-1000 licensing, Westinghouse Electric. Assisting me this morning is Richard Orr and Dr. William LaPay.

We are speaking this morning in two sessions on Section 3.7, which is seismic design, and 3.8, which is structures. These two sections have not previously been before the ACRS. So this is the first time we are discussing many of these items. The SDR you received was an SDR with open items, though we are in many cases well past that stage, and in fact we are working to resolve all the open items by the end of this month.

Some of the topics in Section 3.7, 3.7.1 there is seismic input.

CHAIRMAN RAY: Don, may I interrupt you for a second, when we are talking about this subject, we are, am I correct in assuming talking just about seismic relative to the things that are affected by the amendment?

MR. LINDGREN: Well, we've changed the seismic input.

CHAIRMAN RAY: All right, so the amendment does include more than just the shield building for example?

MR. LINDGREN: Yes, because we have changed the number of soil cases, and some other things that have changed the seismic import --

CHAIRMAN RAY: We're thinking about the entire DCD scope when we are talking about seismic?

MR. LINDGREN: Yes, it has impacts on all the structures.

CHAIRMAN RAY: Okay.

MR. LINDGREN: So as I said, seismic design, response vector and supporting media are the items of interest in 3.7.1.

3.7.2, which is seismic system analysis, and in 3.7, that means structures, there is information about the seismic analysis method with soil structure interaction, the floor response spectra, combination of modal responses and seismic interactions. And all of these areas have been impacted by our various changes in some manner or another.

3.7.3 is seismic subsystem analysis, which in 3.7 means mechanical systems and components. And there we also talk about seismic analysis methods, combination of modal responses and analytical procedure for piping.

3.7.4 talks about seismic instrumentation. And we have made no changes in the amendment in that area. And the combined license information is the final section of interest. We have made a timing clarification on one of them. It was something that cannot be done by the applicant; it needs to be done by the COL holder; and that was clarified.

The major changes in 3.7, we extended the design certification which was only for a hard rock site; we extended it to several different soil conditions, what we refer to as soil sites. And different rock sites. We made much larger utilization of 3-D finite element shell models. We addressed the effect of high frequency ground motion. We included the use of a coherency function to address the effect of high frequency ground motion. And we changed and clarified the classification of adjacent buildings.

The original AP-1000 design certification which is DCD Rev.15 is for a fixed base analysis for a hard rock site. That was all that was certified.

The design certification amendment adds

five other rock and soil cases. The AP-1000 certified seismic design response spectra, which is the CSDRS, is unchanged. That is the earthquake motion that goes into the building.

Going to soil sites required that we consider a soil structure interaction evaluation. And we end up with a revised floor response spectra, and we will be providing more information about that.

These are the soil cases. These are kind of simplified descriptions, but just to let you know what kind of things we're looking at, in all cases we assume that that there is rock at 120 feet. So some of these things which go lower than that is just to give you the slope.

So a hard rock site starts off at a sheer wave velocity of 8,000 feet per second underneath the base mat of the nuclear island; that is where we start with these.

A firm rock site is anything that is greater than 3,500 feet per second.

A sort rock site is 2,400 feet per second for the sheer wave velocity increasing linearly to 3,200 feet per second at 240 feet.

We have an upper bound soft to medium soil site with a sheer wave velocity of 14 feet per second increasing to 3,394 feet per second.

We have two more cases. We have a soft to medium soil site, which is a sheer wave velocity starting off at 1,000 feet per second, increasing to 2,400 feet per second. And then finally our soft soil site is 1,000 feet per second increasing to 1,200 feet per second.

DR. HINZE: Could I ask, what is the impact of making this assumption about the hard rock being at 120 feet? What impact does that have on the results?

MR. ORR: That was something that we investigated in the early days, mainly on AP-600. What we found was the assumption of hard rock 120 feet down was conservative, relative to assumptions of hard rock at greater depth. So this was sort of a conservative assumption for the analysis of the nuclear island.

DR. HINZE: So you analyzed that for deeper depths then?

MR. ORR: Yes.

DR. HINZE: Thank you.

MR. LINDGREN: Okay, the soft soil site is the softest (laughter), and so you will see reference to 1,000 feet per second in many cases. If you were here yesterday for Vogtle you saw that there was reference to 1,000 feet per second in much of their presentation on soil conditions. So the 1,000 feet per second becomes an important number.

This is just a typical floor response vector. It happens to be for the - I believe it's the vertical - or is it horizontal - for one of the directions on the reactor pressure vessel support. The solid red line on this is the hard rock certification. So the floor response spectra previously was based upon that and broadening peaks as appropriate and that kind of thing. So you can see that in the range from about 8 Hertz and up the hard rock is still the dominant, the controlling spectra, but particular in the range of 2-3 other softer soil sites have raised the floor response spectra are this location.

And we have several floor response spectra throughout the building that we use, and they have all been adjusted in some manner to another to address the six soil cases.

CHAIRMAN RAY: What's the peak site acceleration?

MR. LINDGREN: It's three tenths.

CHAIRMAN RAY: Three tenths.

MR. LINDGREN: The design certification used 3-D lumped mass model for time history analysis to represent the auxiliary building. The containment internal structure is the shield building and steel containment.

The design cert amendment has changed that to do 3-D finite element shell models for the auxiliary building, the shield building and the containment internal structure as the only significant structure we are still using lump mass for is the containment itself.

CHAIRMAN RAY: Steel containment.

MR. LINDGREN: Steel containment, the pressure valve.

The three main models that are used for soil structure interaction and seismic analysis is an ANSYS NI10 model, an ANSYS NI20 model, and a SASSI NI20 model. The "NI" is nuclear island. The 10 is the approximate size in feet of an element on a side.

SASSI is the program that is used primarily for soil structuring or actions, and the ANSYS programs are used to develop seismic spectra and the like.

We also have an ANSYS NI05 model, which is used for the design of the structures using seismic loads. This permits us a little bit more refinement in some of the more flexible areas, and is really used the design of the structures.

Effect of high frequency ground motion. The seismic analysis and design of the AP-1000 is based on this CSDRS. The dominant energy content in this area is in the low frequency range of 2 - 10 Hertz. We have learned over the years that spectra shapes for central and Eastern U.S. sites show increased amplification in the frequency range above 10 Hertz.

So - no, not don't yet.

We have developed a hard rock high frequency response spectra shape to enveloped site specific ground motion response spectra of several high frequency sites.

This is a comparison. The larger black line is the CSDRS and the lower more rounded blue line is the hard rock high frequency spectra. This is - these spectra are both in our DCD.

We evaluated support structure systems and components using both the CSDRS and the high frequency response spectra as seismic inputs, and then made comparisons of important analysis assumptions.

This evaluation was done - was consistent with the DC-COLA ISG-1 which talked about high frequency ground motion. That interim staff guidance was developed in interactions between the staff and NEI seismic task force. In fact about three years ago.

The evaluation is done on a sampling and screening basis, including building structures, reactor pressure vessel internals, primary components supports, primary loop nozzles, typing and electromechanical equipment.

In addition to doing selected analysis for potentially sensitive equipment which is primarily electronic, sensitive to high frequency motions, that is subject to a screening test. What we do is we evaluate the equipment and make a judgment as to whether or not it could be sensitive to high frequency motion. Obviously large mechanical equipment and the like are not typically, are not considered sensitive. But particularly electronic components. The classic components, the class example is relays. You can get relay chatter from high frequency motions. That equipment will be run through a high frequency screening test as part of their qualification for seismic analysis.

And anything that fails the screening test will be redone, and if we get a different component we will redesign the supports. But we will not in the end have anything that is susceptible to high frequency motion.

Part of dealing with the high frequency motions is the use of what is called a coherency function. In DCD Rev. 15 that analysis is a coherent seismic analysis used to develop the in structure floor response spectra. A seismic ground motion coherency function is being used to reduce the amplifications caused by the hard rock high frequency ground motion. The incoherency of seismic waves has an effect on structures of large dimensions. My layman's explanation is that for these high frequency motions the wave lengths are shorter than the lengths of the base mat, so when you are going up on one side and coming down on the other. We have an incoherency function to reduce the input consistent with that phenomena.

The incoherency of the seismic wave, when that is considered, generally results in a reduction of structural translational responses.

Classification of adjacent buildings --

MR. BROWN: Can I ask one question?

MR. LINDGREN: Yes.

MR. BROWN: Yes, that's good. We have reduced the input.

MR. BROWN: You've used math to reduce the baseline - the location because of the wave length of the ground motion?

MR. LINDGREN: Yes. The coherency function was developed by EPRI for NEI as part of the seismic testing, was discussed in great detail with the staff, and agreed to, and it's included in an NEI document.

MR. BROWN: Has it been used before?

MR. LINDGREN: Yes.

MR. BROWN: It's been used in other justifications or bases?

MR. LINDGREN: Yes.

MR. BROWN: That's all I wanted.

MR. LINDGREN: It's based on - there are a few places where people have put out very large arrays of fairly closely spaced seismic instruments and developed the science behind that. And I believe Mr. Bagchi can answer.

MR. BAGCHI: Good morning. My name is Goutam Bagchi. I was involved in the development of ISG-1. Don has explained very nicely how the coherency functions came about.

But basically phenomenologically it is the scattering of the seismic waves. And it turns out that if you look at points A and B under the footprint of the base mat, point A to point B, there is variation of the ground motion, due to the scattering effect. And that is captured in the coherency function. And this was observed from rock size in California, but we reviewed it very carefully, the staff reviewed it very carefully, and after revision of the function we ended up with one that is considered to be conservative.

So that is what went into the ISG-1.

DR. BLEY: So this is like an attenuation factor based on the results of a much more elaborate set of studies?

MR. BAGCHI: It is not so much an attenuation factor, but it is the scattering effect of the ground motion at the surface. So as the footprint of the base mat you are going to see that different parts of the base mat are receiving not simultaneously the same signature of time history but different.

DR. BLEY: I didn't say my question right, then. I understand the phenomena you are describing, but this coherency or noncoherency function is a simple adjustment based on these elaborate analyses. Is that true? Or is it actually doing the detailed analysis?

MR. BAGCHI: It is frequency dependent, if you look at the function, and it is very different from the effect of Diablo Canyon. You may be familiar with that. It is not the wave passage effect.

DR. BLEY: Okay.

MR. LINDGREN: Thanks.

Classification adjacent to buildings. These are the adjacent nonseismic category 1 buildings. In the original design certification the turbine building was classified as nonseismic. The - over - since we got that design certification the design of the first bay of the turbine has changed. For a variety of reasons. It has become in design certification it was really a lightweight structure that connected the auxiliary building to the main heavy steel frame of the turbine building. And as we continued our design as I said for various reasons we ended up making it more robust. It is now a reinforced concrete structure. It is larger, it contains more equipment, so our previous justification for why it ought to be nonseismic did not work any more, so we changed the classification to Seismic Category II and in our design we basically used the same methods and criteria for Seismic Category II as we do for Seismic Category I.

The remainder of the turbine building is built nonseismic. I will point out that that is nonseismic in NRC space. It is in fact built to building code seismic requirements. But to the NRC, that's nonseismic.

The annex building which is adjacent to the nuclear island - and I have a picture coming up so you can figure out where these things are - is east of the nuclear island. It is a reinforced concrete and steel frame structure, also Category II. That is, a portion of it is. And this area provides access control to the nuclear islands, and has health physics aspects, and HVAC is also located in there.

The remainder of the annex building, which is a low rise single story building that is primarily office space is a nonseismic structure.

Okay, this is a --

DR. BLEY: This is a simpleminded question, I'm a little confused. We are talking about the DCD here?

MR. LINDGREN: Yes.

DR. BLEY: I'm surprised there's an east and a west in a DCD.

MR. LINDGREN: Okay.

DR. BLEY: It's just an arbitrary designation?

MR. LINDGREN: It's an arbitrary designation just so we can talk.

DR. BLEY: Okay, fair enough.

MR. LINDGREN: The turbine building is on the north end.

DR. BLEY: Okay.

MR. LINDGREN: So the right side of this picture is north.

So the red building is the shield building. The big building is the auxiliary building. The yellow is the rad waste building. The darker blue is the Seismic Category II portion of the annex building. As I said this is a multistory reinforced concrete and steel frame structure.

The lighter blue is the portion of the annex building that is only a single story high. It is a lightweight steel frame building. It's more like an office building.

The first bay of the turbine, and FB in this case stands for first bay, not fuel building, is a reinforced concrete structure that is Seismic Category II. The lighter green which is the remainder of the turbine building is a steel frame structure built to building code requirements.

So that pretty much covers the major changes in the DCD. There have also been some changes that resulted from RAI responses and open item responses. But those were the major changes that we put in because Westinghouse had a need to make changes.

There were 15 open items in the SER. These open items are primarily as a result of NRC staff questions about the changes in the DCD. And the largest number of these questions came about as a result of the addition of soil cases. That property gave it a lot of questions and a lot of interest.

We have completed eight of those items since the SER was prepped. At least Westinghouse considers they're completed. We have discussed these with the NRC. We have turned in responses, and are awaiting confirmation that they are completed.

By the way the SER, 3.7 SER, also references a couple of open items in 3.8. So you may come up with a different count.

We had two audits during the month of June to discuss seismic and structural issues and to move forward on the open items. Our goal is that we resolve all these open items by the end of July. That's why you do not see a larger representation of experts here, because they are back in Cranberry working on getting these things resolved.

And you will see, I have a description in the remainder of the presentation which is a description of what we understand the open items are left as a result of those audits and reviews. The description in the SER was written before the audits, so in some cases the question has been narrowed and refined.

The first one is open item OI-WEB1-3.7.1-018. This was a question about free field in-column response spectra. This is one that we believe is resolved and are awaiting NRC confirmation. The way we resolved it was the in-column response spectra at the base mat was plotted for each of the generic sites, and the PGA is above a tenth of a g in all cases.

Open Item SRP3.7.1-SEB1-19 is a question about concrete cracking and damping values in structural modules. This is probably the most significant question we have left to resolve. It is the --

DR. WALLIS: You are going to discuss

that later, are you?

MR. LINDGREN: We can discuss anything you want.

DR. WALLIS: Could I discuss it now then? I was a bit puzzled. It seemed to be that you had a factor of 20 percent or 50 percent which suddenly switched on when concrete cracking was significant, whatever that is. And I didn't know what you meant by significant, and I didn't know why the factors would change in a step, instead of in some continuous way as the concrete gets more cracked.

DR. LaPAY: This is William LaPay. What we do is that at the outset of cracking we recognize that there is a certain amount of lost stiffness. And this is seen to be using FEMA as one of the guidelines. It turns out to be 80 percent of the cracked section. When you have significant cracking it could drop as low as 50 percent. If you have very low loads at all where you don't have any initiation of cracking, that is the full section. That is basically the guideline there.

DR. WALLIS: But how do you know how significant the cracking is?

DR. LaPAY: Because you know the stress levels that you have seen in the stresses.

DR. WALLIS: So you determine the cracking as a response to the stresses?

DR. LaPAY: Yes, it is.

DR. WALLIS: Eighty percent to 50 percent, or is that just an engineering --

DR. LaPAY: Generally we don't see the 50 percent that is significant cracking. We use the 80 percent as a representative. That's industry FEMA use that as a guide. And we can actually determine where the significant cracking is, where the stresses are. That is causing a response. And that's where are judgment lies in that.

DR. WALLIS: Then you change the stiffness accordingly in your analysis when you get that?

DR. LaPAY: Well we find that we don't have to do an iterative process. We can use 80 percent, and after we look at that that's what is representative.

DR. WALLIS: Presumably you do sensitivity analysis to see how much difference this makes and whether it's important or not?

DR. LaPAY: We have some ongoing sensitivity work that is being reported in the OI response.

DR. WALLIS: That's still going on?

DR. LaPAY: Yes.

MR. CUMMINS: This is Ed Cummins, just as a process comment, the idea here is that response to these open items will be brought back to the ACRS at another meeting, so at least in theory we are not trying to address the open items in this meeting. Which is not to restrict you from asking questions.

DR. WALLIS: So this is still to be responded to?

MR. LINDGREN: Yes.

DR. WALLIS: I wasn't sure that it had been resolved.

MR. LINDGREN: No, it has not been resolved. As I said this is probably the most significant question we have left in this section.

DR. ARMIJO: Within this open item, are both the reinforced concrete and the steel concrete structures addressed? Or do they have different concrete cracking damping values? For these two very different types?

DR. LaPAY: The answer is yes, they do have different damping values.

MR. LINDGREN: But this question is only

about the structural modules, right?

DR. LaPAY: Yes, that's a shield building, and that will be discussed at the next one which maybe is in October.

MR. LINDGREN: There are some other structural modules also, which is one of the reasons we're talking about it. So yes, I believe the staff considers that how you treat cracking and damping in reinforced concrete is a better understood, but you can ask them.

OI-TR03-001 is a request to describe analysis assumptions used for the revised shield building design dynamic models, and in particular the analysis assumption is the amount of cracking and damping we used. It's related to the dash 19.

OI-TRO3-005 is one that asks us to justify the .8 stiffness reduction factor for concrete cracking used in the shield building analysis. As I said, this is the third of four of them. The fourth question is actually in 3.8. But there are four very closely related questions that will be basically answered. And as I said we are working on a resolution. We discussed these responses quite a bit at the audits in June, so we believe we have a good understanding on what it's going to take.

DR. WALLIS: When you have done all this you have an improved model, and you make the grid smaller in important regions and so on. Is there any verification of this in terms of experience? It's all theoretically predictions, is it? Or was there any kind of validation by comparison with data?

CHAIRMAN RAY: Well, this sounds to be like it's probably in the domain of discussion with the staff now that --

DR. WALLIS: Oh, it's coming up later, and we are going to get to it later.

CHAIRMAN RAY: I would think so. I hesitate for Don to try and answer this.

MR. LINDGREN: Well, we do welcome questions so you can understand it and be ready for the next time.

(Simultaneous speaking.)

MR. LINDGREN: I have no problem answering a few questions, or actually having these gentlemen answer a few questions. DR. WALLIS: So you are just telling us what you are going to do, is that what it is?

MR. LINDGREN: In some cases. In some cases we are just saying that the question is still open. Where I've answered is one that we think it's resolved. But you notice I don't make any statement about this other than the fact that it is out there.

CHAIRMAN RAY: Well, I do agree that we should convey to them any areas of interest that we have, so feel free to do that.

MR. LINDGREN: Okay, moving on, OI-TR03-032 is a description of the proposed method for using more detailed NIO05 model to evaluate flexible regions. During this - during our - during the staff's review of our seismic analysis and basically comparison of the three models, the ANSYS NI-10, the ANSYS NI-20, and the SASSI NI-20 they observed some differences in responses that they didn't understand, and we could not initially explain adequately. And some of these relate to the flexibility of the model and the flexibility of the structure, and in certain locations we have evaluated it using a more refined model to evaluate the flexible regions. And this question relates to that.

DR. ARMIJO: Could you give an example of flexible regions?

MR. LINDGREN: It's primarily where those doorways and holds in the larger spans.

DR. LaPAY: Let me just address that. This is William LaPay for the person in the corner.

When you look at the response of a floor, sometime when you saw the grid size of 20 X 20 or 10 X 10 you may have missed the center of the flexible where you get the most amplification. Now this is also true of the walls, where you could have it. Now we have done studies, and in most cases we had a node where we had picked that up. But we found that there were some cases, when you get a refined model, that you can pick up those amplifications.

What the staff wanted, and what we really want as well, is that we do not overlook any location that could affect the design. So we qualify with the largest amplification.

DR. ARMIJO: Would you use this particular model for I'll call it a discontinuity between the steel concrete structure and the reinforced concrete structure at those joints where -- it seems very complicated to me, and I just wonder how you treat those?

DR. LaPAY: That's a different issue than the flexibility. That's actually the refinement. That's why we brought in the NI05 model that has a lot of that refinement in there where we have that boundary condition where you may have the extra loads.

DR. ARMIJO: We will hear all about this

in October, I guess?

CHAIRMAN RAY: Well, I'm not sure it's October.

DR. ARMIJO: Sometime this year?

CHAIRMAN RAY: Yes, sometime this year. October I know has got at least one agenda item that will be taking up time then.

MR. LINDGREN: OI-SRP3.71-SEB1-03 is another one that we believe is resolved. We've turned in our final response to the NRC after discussing it with them, and are awaiting their confirmation that we have resolved it. It was a request to demonstrate implementation of the approach of the hard rock high frequency analysis. This was primarily resolved by the staff looking at the analysis at an audit.

OI-SRP3.7.1-SEB1-04 is another one that we believe is resolved and awaiting NRC confirmation. It was a question about containment shell models. The figures in the RAI response have been updated to reflect the corrected seismic model. We believe this addresses the question.

OI-3.7.1-SEB1-06 was a question about use of the NI20 model for flexible regions up to 50 Hertz. It is still being developed and under discussion.

OI-SRP3.7.1-SEB1-08 was a question about model inconsistency, once again how the three models we used initially line up. Differences in the - there were differences in a couple of figures in the technical report that are due to differences in the geometry between the NI10 and the NI20 model at the southeast corner. That's how we resolved this question. That's the explanation.

Open Item SRP3.7.1-SEB1-09 was another question about model inconsistency. You'll see it developing here. It was a request that we review SASSI results and explain how exceedances for the CSDRS based in structure response spectra by the high frequency - hard rock high frequency based in structure response spectra egress.

This was reviewed during the audit. Basically the exceedances of the CSDRS in the hard rock high frequency are addressed as part of the sampling evaluation, our response to ISG-1.

As I said, that is another one that we believe is resolved.

DR. WALLIS: So exceedance is a way of saying that something is bigger than something else?

MR. LINDGREN: What you will find is that at the high frequencies if you use the hard rock high frequency you will find at the high frequencies amplitudes greater than the in floor response spectra, but the thing about high frequency is that there is not a lot of energy there, so it's something that is bouncing back and forth at 20 Hertz, it can't move very far, and that is how we have resolved that question.

OI-SRP3.7.1-SEB1-10 is another one we believe is resolved and we're awaiting NRC confirmation, was a request that we review SASSI results and update figures provided as part of previous revisions to an RAI. This was reviewed during the audit, and the figures have been updated.

OI-SRP3.7.1-SEB1-11 was another request that we review SASSI results and update figures. This was also reviewed during an audit, and the figures have been updated.

OI-24P3.7.1-SEB1-17 is a question about missing mass in mode superposition. This one is, the response is being developed after discussion with the staff. And so it is still an open question.

DR. BANERJEE: And what does that mean?

MR. LINDGREN: I could guess. (Laughter) I wouldn't guess. I could try.

DR. LaPAY: When you do like response vector analysis, you have a mode cutoff. And you don't get the effect of mass for those modes that go beyond that frequency?

DR. BANERJEE: So you just chop it at some frequency?

DR. LaPAY: Well, that's where you take it to a point. But that doesn't meant your responsibility ends there, and you take those loads. You have to adjust for the missing mass, and there are rules in the reg guides as well.

DR. BANERJEE: You redistribute them on the existing modes?

DR. LaPAY: There are techniques you can use; there's more than one that you can choose from. And I'm not going to go into those here. But it's from Reg. Guide 192 is one that you would follow.

DR. BANERJEE: There is some sort of prescriptive method of doing this?

DR. LaPAY: Yes.

DR. BANERJEE: And you didn't do that?

DR. LaPAY: We did that. We had to demonstrate that we have addressed those especially for the response spectra that we had, where you don't have this. You can actually develop the loads with the effective mass, but do those higher modes affect the response spectra? And we had gone through that, and in that OI, demonstrating, and during the audit we did the same, we provided results that the spectra does not change in the area where the response of our equipment is, that we have the proper response spectra that is conservative.

So they have no effect.

DR. BANERJEE: You responded to this, but it's still under review?

DR. LaPAY: It's under review. However we did discuss it during an audit; showed them results. Now it's a matter - I think this has all been put together, and I don't know if it's been submitted, but it's near completion. But we don't have the formal approval on the wording and everything that went into the OI.

DR. BANERJEE: How much mass is missing?

DR. LaPAY: Usually it's not significant. It's up above 33 Hertz, items like that.

DR. BANERJEE: And how much is that?

DR. LaPAY: Maybe 10 percent.

DR. BANERJEE: Okay.

MR. LINDGREN: We haven't called anything resolved unless we have some kind of agreement with the staff.

DR. BANERJEE: This must be fairly

standard stuff. People have to do this, right?

DR. LaPAY: It's standard procedure, yes. However what you have to go through is a process to demonstrate that you have not missed any missing mass. That you have accounted for it, or it's not significant to your response spectra.

MR. LINDGREN: We have a rather large fairly complicated model to do this. And as I said earlier, in the design certification, this was done with lumped mass methods, and so this - the 3-D finite element approach is new in this amendment, so it's the staff doing their job to make sure we do it right.

DR. BANERJEE: The unique feature here is you brought a lot of I suppose water up high, it sloshes around and things?

DR. LaPAY: No, generally the missing mass is down at the base, near the base mat, which is very rigid. And it's of high frequency. And that is where the missing mass will come into play. It's not at the water mass. We know what that is.

DR. BANERJEE: It's sort of a relatively slow slosh, right?

DR. LaPAY: Well, the sloshing mass, yes. That one, what contributes, and what doesn't?

DR. BANERJEE: That was a rather strange

statement to me. It said 60 percent of the water was in a sloshing mode. Well, all the water is in a sloshing mode.

DR. LaPAY: No, it isn't. It is a constrained --

DR. BANERJEE: It's continuous stuff. It all moves. So 60 percent must be a factor that you've put on it.

DR. LaPAY: We've done detailed analysis on that, and there is a part that responds at a very low frequency, and a part that goes along for the ride, and it does participate, but it's what they call constrained, which is a certain depth below, and it just sort of --

DR. BANERJEE: It doesn't contribute. It does something.

DR. LaPAY: It does something.

DR. BANERJEE: So what was the depth to diameter issue?

DR. LaPAY: Do you remember because I don't want to quote it incorrectly here.

MR. ORR: The diameter of the tank is about 80 feet, and the deepest part of it I think is around 30 feet, so it's a fairly shallow tank.

MR. LINDGREN: And there's a large hole

in the middle.

MR. ORR: And the fundamental frequency is .13 Hertz. It's extremely low frequency.

DR. WALLIS: That's for sloshing?

MR. ORR: For sloshing. Sixty percent of the mass is at that low frequency.

DR. BLEY: And what is the other mass doing?

MR. ORR: The other mass is basically staying rigidly attached to the walls. And so it's accelerated by whatever the acceleration is of the walls.

DR. WALLIS: That's at low frequency. At high frequency I would think all the water mass moves with the wall.

MR. ORR: Well, at high frequency it's just very small ripples instead of one huge --

DR. WALLIS: When the building moves the water has to go with it.

DR. LaPAY: The water does not go with it. The 40 percent of the mass goes with the building; the 60 percent goes up and down, sloshing.

DR. WALLIS: At a low frequency?

MR. ORR: Yes, the sloshing frequency is .13 Hertz. The building frequency is between 2 - 3

Hertz.

DR. WALLIS: I would think if you move it quickly enough there is no time for it to slosh, but it goes with the wall.

DR. LaPAY: We aren't moving it that fast.

MR. CUMMINS: Twenty percent of it is that way.

MR. LINDGREN: It's standard design.

DR. WALLIS: Very mysterious.

MR. LINDGREN: Sloshing is well known.

DR. BANERJEE: The mass - I suppose it is frequency. This has been analyzed with water, sort of finite element code of some sort?

DR. LaPAY: We have done that, yes.

MR. ORR: It's been analyzed with a finite element code. It's also been analyzed by hand calculations based on the literature.

DR. LaPAY: And the two match.

MR. ORR: And the literature goes all the way back to TID-7024, which was some of the initial rules for nuclear power plants back then.

DR. WALLIS: And it doesn't hit the roof during this? Because there is a free surface on top?

MR. ORR: There's five feet free board above the free surface below the roof. So it does not impact on it.

DR. BANERJEE: And there's no structures in there? It's just an empty tank?

MR. ORR: There is an inner and outer wall. The tank is around the discharge stack.

DR. BANERJEE: And there is no added mass effect due to the acceleration? Or is that taken into account?

DR. LaPAY: That is taken into account in the analysis where they have pressures for the sloshing.

DR. BANERJEE: And that's - your hand calculation does that in some rough way, and your --

DR. LaPAY: It could be hand calculations, it could be --

DR. BANERJEE: Is this the code that you used for the liquid and the finite element? Is it envisaged sloshing?

MR. ORR: Yes, it reduces the fluid element in the ANSYS computer program.

DR. WALLIS: So this 60-40 division is due to the free surface, the 60-40 division, 60 percent of the water going this way, and 40 --

MR. ORR: Sixty percent is going up and down, and 40 percent is going with the tank.

DR. WALLIS: It has nothing to do with gravity, that's just the free surface.

MR. LINDGREN: Well, that's OI-TR08-007, which we actually believe is resolved, and in fact we didn't change any of those assumptions. Since the original design certification.

So we believe this one is resolved, and we provided additional explanation and reference to what we had done before. I need to go back; I skipped over one.

OI-SRP3.7.1-SEB1-15 is a question about soil structure interaction analyses of the buildings adjacent to the nuclear island.

Now if there are any more questions?

CHAIRMAN RAY: Well, I think that this is helpful. You perceive, I would think correctly, that with this number of open items we basically look to the staff before we would hone in on any issues that we might have. So we look forward to hearing from the staff, and when they are fully satisfied, we'll see if there is any more follow-up from our side.

MR. LINDGREN: Okay, with that, it's their turn.

CHAIRMAN RAY: It is.

DCD SECTION 3.7 - STAFF

MS. SPICHER: My name is Terri Spicer, and I'm one of the PMs for Section 3.7 in the DCD. To my right is rich Mordant who is a contractor from Brookhaven National Lab; Bret Tegeler, who is going to do the majority of the presentation who is the senior staff member who did this review. Next to Bret is Pravin, who is also NRC staff, and Carl, he's also from BNL. And he's our contractor as well.

Brian who will sit over here, he's the branch chief. And it was pretty much a team effort with this review, so you might hear from a lot of different people interacting and answering questions, because it was definitely a team effort.

CHAIRMAN RAY: It's an interesting and challenging area.

You just used the past tense in all of what you said. It sounds like you're done. Is that the case?

MS. SPICHER: Not really. We are moving forward, and what you are going to hear today is basically what Don just did, we are going to do an overview of the big items that were the changes that happened from the original review.

Bret will then go through and give us a summary of the open items and where we started from, so you can kind of see the story, who this was built.

Then we'll go through the details of each one of the open items, and we'll conclude with where we feel we are right now. And I will tell you we do have a path forward for every single one of these open items.

So what Westinghouse said was true as far as we've worked together to audit to resolve a lot of these open items. Hopefully today you will hear that.

CHAIRMAN RAY: Hopefully we will, yes.

MS. SPICHER: Bret.

MR. TEGELER: Okay, good morning, my name is Bret Tegeler. Before I start, while I am giving this morning's briefing, I am very much relying on our team in front of you, namely the support from Brookhaven and the expertise offered by Rich Morante in structural dynamics and Caro Costantino in soil structure interaction.

So with that I'll lead into the description of the changes in analysis from Rev. 15 to Rev. 17. As Don mentioned previously Rev. 15 was a license for a rock site, hard rock site, which would not involve the effects of soil structure interaction.

With the extension of the AP-1000 design to soil sites, namely five different soil conditions now including the hard rock site, this now requires the use of soil structure interaction.

With Rev. 15 the dynamic, the soil structure interaction model, or the dynamic analysis model with a lump mass stick model, that has been - Westinghouse has replaced that model with a much more refined model, the NI-20 model, for soil structure interaction. And so the staff has spent a large amount of time in review of that model and reviewing the details of the use of that model.

CHAIRMAN RAY: On the one - I guess there is one case, the hard rock site that's common to the stick model and the 3-D model, what has been the effect of the use of the 3-D model in structure response?

MR. TEGELER: Mostly the hard rock case was being used to analyze the effect of the hard rock high frequency spectra that Don mentioned earlier. That model is now using seismic wave coherency functions. So that is the primary difference. The Rev. 15 model --

CHAIRMAN RAY: Let me ask my question again because I probably didn't make it clear enough.

Is the in structure response significantly changed as a result of the - for the same foundation conditions from the stick model to the --

MR. MORANTE: I would say yes, yes, there were changes in the in structure --

CHAIRMAN RAY: Which direction, and where and so on?

MR. MORANTE: There were some reductions, and Westinghouse can confirm this, in going to the 3-D finite element model from the stick model, there was some reductions in structure response spectra.

CHAIRMAN RAY: And in what range? A range of interest to the structures, low frequency, high frequency, what?

MR. MORANTE: I don't recall offhand exactly where. It probably was across the frequency range.

CHAIRMAN RAY: Okay.

MR. MORANTE: But they were not significant to the point where we looked at it and said, oops, there is a problem here with the change in the models. Anything that we did not feel was particularly appropriate we would ask them questions about it. But generally there were some reductions in going to the 3-D finite element model from the stick model.

DR. BANERJEE: So the stick model is sort of a lumped parameter description? What - why is it there?

MR. MORANTE: Well, Westinghouse would be better off answering the question. But back in the early 2000's when they were certifying the AP-1000 for a hard rock design the state of the art was pretty much to use stick models at that time for the dynamic analyses for seismic loading. State of the art does change with time, and so when they presented the amendment submitted through TRO3 with extension to soil sites, they made the change over voluntarily from the stick models to the 3-D finite element model.

CHAIRMAN RAY: The reason for my asking the question is, I would expect it to go down, as you said. The question is, did it go up anywhere, and if so, that would be perhaps more interesting.

MR. MORANTE: I cannot answer that question for you at this point.

MR. CONSTANTINO: If I could make a comment?

CHAIRMAN RAY: Sure.

MR. CONSTANTINO: They were all lump mass models, the stick models more of a lump mass approximation.

CHAIRMAN RAY: Simplified, right, now, we understand that.

MR. CONSTANTINO: So you would expect that the high frequencies, there was a big difference because the lump mass can't capture the high frequency. That's why at low frequency the lump masses tend to be higher than the finite element models, but at high frequency the finite element model could capture that response, so you see more correct response typically higher than you would see in the lump mass. That's a typical response.

CHAIRMAN RAY: Yes, as you say.

DR. BANERJEE: That's useful.

CHAIRMAN RAY: If in fact there were an increase in structure response predicted by the 3-D model that would be even more interesting, wouldn't it?

MR. CONSTANTINO: Yes, but there are. At high frequencies, that's one reason why you like the finite element model. You can capture the high frequencies.

DR. WALLIS: Well, maybe any kind of resonance is slightly different than the different model.

MR. CONSTANTINO: Yes, at low frequency they are about the same, but then you get more energy transferred there, since there is no high frequency response.

DR. BANERJEE: Is there a sort of resolution dependence on this then that as you get to finer and finer resolutions with these models you get more and more?

MR. CONSTANTINO: That's right, in ISG space we have cutoffs. At least we should be able to capture 50 Hertz in a model now. And that's relatively recent. Back when I was a young man if we captured 10 Hertz we were happy. That was a long time ago, though.

CHAIRMAN RAY: But the plants are still in service.

MR. CONSTANTINO: Yes, that's one good thing.

CHAIRMAN RAY: Okay, thank you. Go ahead.

MR. TEGELER: All right. So I mentioned that Westinghouse, to address the high frequency effects, they used seismic wave coherency functions which the staff has provided guidance in ISG-001.

So with that I'll lead into a brief

description of our - I mentioned in 3.7.1 seismic design parameters that Westinghouse has extended the design to include a range of soil and rock sites.

In 3.7.2 we mentioned they are now using 3-D shell models for the seismic dynamic analysis instead of the sticks. They are conducting soil structure interaction analysis, and again, using - evaluating the effects of high frequency ground motion on in structure response and in structures.

And 3.7.3, seismic subsystem analysis, there were no changes.

DR. BANERJEE: I don't really understand this coherency function. Can somebody explain this to me? You said, scattering, so it's a sort of diffraction or dispersion of the waste?

MR. CONSTANTINO: Yes, it's really based on a relatively extensive set of recorded ground motions. Not that extensive, but enough to give us confidence on the development of the coherency function.

Really, we take out the wave passage from all of that data, and then look at the response at one point and an adjacent point, and the little differences at the high frequency are what's being captured by the coherency function. As someone said, it's really a noncoherency function. But it's really taking all of the data and then enveloping that, so in fact the coherency function that is being used in all of these calcs is based on incorporating the effects at hard rock sites.

Theoretically if you were at soil site you would get much more noncoherent behavior at the frequencies of interest, but the process that is being incorporated, since you don't want to be looking at deciding how incoherent a given site is we look at the most conservative data that is available, and that is what this coherency function is trying to capture, the differences in time phasing between two results.

DR. BANERJEE: So what is the separation, and what is the --

MR. CONSTANTINO: Well, there are various data, and the separation starts off at 20 meters, 40 meters, 60 meters, 80 meters. So this coherency function really talks about impact of separation distance, as well as - and frequency. So it's really a series of - you could visualize it as a series of curves.

DR. BANERJEE: So you take a cross spectrum and there's --

MR. CONSTANTINO: Yes, the spectral

density.

DR. BANERJEE: Okay, I know what it is. But what is the physical mechanism? That's what I'm looking for.

MR. CONSTANTINO: Where is it coming from?

DR. BANERJEE: Yes, why is it --

MR. CONSTANTINO: If one things of the ground motion as coming up from down deep, kilometers deep, as you get closer and closer to the site, you get scattering due to various discontinuities in the ground. So even though I measure close to the same result at this point, at this point I measure about the same result but the phasing is somewhat different. And that phasing is what's captured in -- phasing differences is what's captured in the coherency function. And then the -- it's obviously - and we have lots of recorded data on this. It's obviously a function of the distance between - if we have a large distance between two recorded points where, for a large base mass for example, you get a big result - big reductions at higher frequencies. Then the question is, how do you capture that in the analysis, which is not so straightforward.

DR. BANERJEE: So the coherency function

sort of drops off?

MR. CONSTANTINO: That's right, as you go to bigger and bigger distances it gets less and less.

DR. KRESS: Is it a multiplier on the acceleration?

MR. CONSTANTINO: Yes. On spectral acceleration, it's a multiplier on the spectral acceleration. And that's why you get this reduction, because you've got to integrate that effect into the building.

DR. BANERJEE: Why do you call it a coherency function? It's usually called a coherence function when you do a cross spectrum?

MR. CONSTANTINO: Well, you've got to decide - I'm not an English major, so it didn't bother me at all whether you call it coherence or coherency.

DR. BANERJEE: Well, it sort of obscures what it is. If it's a clear cross-spectrum, and coherence function.

MR. CONSTANTINO: Well, it is a cross-power spectral density function.

DR. WALLIS: It's an empirical measurement.

MR. CONSTANTINO: That's right. It's all

based on empirical data.

DR. BANERJEE: It seems to me it would be possible to have an ideal soil in which this was coherent.

MR. CONSTANTINO: That's right. That's why we based the analysis in SASSI as a coherent analysis.

DR. HINZE: Are these from the eastern United States?

MR. CONSTANTINO: No, most of them are from the West Coast, China. Very little from the East Coast.

DR. HINZE: Are these from the East Coast?

MR. CONSTANTINO: There was one on the East Coast. But the character, the quality of that data is just really bad. So basically the biggest players in that were in the Western United States and in China. The Chi-Chi earthquake had a lot of data that was incorporated. So all of that played into the development of --

DR. BANERJEE: How well can you transform that into the problem that we are looking at here?

MR. CONSTANTINO: We apply all of that to wherever you are going to be, right? So we took all of the data including the hot rock data, enveloped that so we have a conservative coherency function or however you want to call it.

DR. BANERJEE: All right, you can call it coherency. (Laughter)

MR. CONSTANTINO: However you want to do that, so we make the most conservative assumption to minimize the reductions we're getting.

MR. TEGELER: Carl, it's also important to point out that, we keep talking about in terms of reductions, the use of this function won't necessarily result in reductions everywhere. You can actually get increased rotations now because you are now inducing a rotation of the nuclear island at extreme points, you are getting greater response.

CHAIRMAN RAY: Yes, obviously.

MR. TEGELER: But because empirical components are located near CG you are not really seeing most of that. So it's not - it's not that you are getting a reduction everywhere. So we have to be - in our review we looked at these outrigger locations, and it's just not a reduction across the board.

Okay, this table, I'm not going to spend a lot of time on this. This is essentially where we were at the development of the SE. And we have done this. We have made progress in a number of areas, so I won't spend time on that.

Open item 18 relates to - we asked this question relating to the Appendix S requirement of having point one G at the foundation elevation. The AP-1000 CSDRS for a rock site is already at base naught elevations. And we know that the CSDRS is an increment of point three G. So we know for a rock site we've already satisfied the Appendix S requirement.

Well, with the extension of soil sites, the CSDRS is applied at grade elevation or the pre-surface. So we wanted to make sure that as you - at slightly deeper at the foundation elevation that you will still have or meet this point one G requirement. So that's what this question was. And Westinghouse has responded.

Number 19 we spent a little bit of time on. This is dealing with the assumptions relating to concrete cracking and assumptions relating to material damping, and the dynamic analysis models. This question started out through the shield building review, and the - we are not going to spend a lot of time on shield building here, but this question arose because of the staff's concern that Westinghouse was using an 80 percent or 20 percent reduction in concrete stiffness. And the staff was asking for a justification based on the shield building analysis, why that is a reasonable assumption. So that is what led to this question.

This question actually does extend to the nuclear island since then, because the --

MR. MORANTE: Yes, the latest agreement as far as we understood with Westinghouse as path forward, they've executed a special nonlinear advocacy analysis where they are accounting for concrete cracking in an attempt to demonstrate the level of cracking that occurs, and how much energy is dissipated due to cracking.

In the agreement that we understood for moving forward we asked them also to look at the auxiliary building which is in the model. So we are interested not only in the concrete, in the modules, but also the concrete in the auxiliary buildings, the reinforced concrete sections. So we've asked them to present results from that analysis, also for the number of locations in the aux building, so that they could demonstrate to us the validity of their assumptions.

CHAIRMAN RAY: So let me interrupt for just a second and ask on the phone line if Bozidar is on the line.

He's our consultant, not here with us today, he's on the West Coast.

DR. BANERJEE: It's quarter to 7:00 in Berkeley.

CHAIRMAN RAY: Thank you for that. Anyway this will be an area that I think he especially, but many of us will have interest in following. My initial question for Westinghouse was, whether we were just talking about the shield building today, but obviously that was because I was focused on that element. As you say this applies generally, and so there will be a lot of interest in how this gets resolved.

MR. TEGELER: This is one of the more challenging areas right now.

DR. BANERJEE: It's still an open question, right?

MR. TEGELER: Yes.

DR. BANERJEE: And I suppose the complexity is it's composite structure was very fine. So I don't know how much we can say in open session. Are we allowed to talk about this or what?

CHAIRMAN RAY: Well, it's up to Westinghouse in the first instance to define what the limits are. But the nature of the issue of interest I think is perfectly fine to say that obviously it's a complex structure and to the extent that concrete cracking affects the behavior of that structure as well as others, it's something we want to alert everybody that at the end of the day we want to be well informed about.

DR. BANERJEE: I'm sure we will be very interested in the details on this.

MR. TEGELER: Okay, open items one and five again are related to that same question. So we've move beyond those.

MR. MORANTE: Bret, could I ask about number one though?

CHAIRMAN RAY: Speak up, Rich.

MR. MORANTE: Part of our question here on number one, and I think somebody alluded to this or mentioned it this morning during Westinghouse's presentation, we did ask them to incorporate into TR-03 the details of how they modeled the concrete module section. We also asked them to correlate that, tie it back to test results. So they've done a lot of testing. And I don't think that came out clearly this morning. But we did ask them as part of that to tie it back to their test results.

CHAIRMAN RAY: That's true, and we did get a briefing on the test program that they have. It wasn't in the detail that ultimately we will want to have. But yes, you are right to mention that.

MR. TEGELER: Open items 32 and six related essentially to the same issue, just two different seismic inputs, one for the CSDRS the design basis, and the other one for the hard rock ground motion.

This is - actually Bill did a good job of laying this issue out - staff was concerned that the density if you will of these finite element models was sufficient to capture out of plane response for walls and floors, and to make sure we are capturing any implication of those structural elements and the in structure response vector.

So we've made some progress in these areas, and I think we have agreed in principle with Westinghouse. We are just finalizing our review on that.

DR. WALLIS: Are there some rules of thumb about how fine the grid needs to be to capture what you are looking for? Or do you have to always just try it?

MR. CONSTANTINO: I think there are rules available.

MR. TEGELER: Well, the SRP talks about a 10 percent, if you refine your mesh such that - you keep refining your mesh until your solutions get within 10 percent of one another.

DR. WALLIS: Usually engineers develop some kind of a handbook which says for certain kinds of things you use this formula, and that tells you about how fine the grid needs to be.

MR. CONSTANTINO: Yes, right. Very straightforward.

DR. WALLIS: I would think it's there somewhere.

MR. MORANTE: In this case the NI-20 model in some cases they would be wall or floor sections which are represented by a single element. Obviously they were not going to pick up any amplification in the middle. So it was primarily to address those types of areas where it was obvious they were not getting the amplification that they analyze the NI-05 model using the time history input at the base of the NI-05 to see what type of amplification existed in these areas, because these areas were modeled more finely. So basically this, the results of this analysis augment the floor response vector that they developed from their less refined models. So that was our intent was to get them to take it a step further and make sure they didn't miss any amplifications that might be important for future design of piping systems or equipment that might be mounted in that part of the building.

CHAIRMAN RAY: Okay, that's clear.

MR. TEGELER: Before I go to three, I will just briefly mention that when we reviewed Westinghouse's seismic analysis models, staff did initiate independent confirmatory analysis, both performed by Brookhaven, Carl more specifically. So we did a check of their NI-20 model used for the soil structure interaction analysis, and identified a couple errors through Westinghouse which we believed would have an effect on response, and then Westinghouse agreed to make those model corrections, and have done so, and they essentially even re-ran those models to generate new in structure response vectors for both the CSDRS and the HRHF portions.

The question or open item three relates to just for the HRHF analysis, submit the revised results, and that's what you are seeing.

CHAIRMAN RAY: Okay.

DR. BANERJEE: So did the confirmatory work? Was it done with ANSYS as well or did you use something else?

MR. TEGELER: Yes, we used ANSYS to check the --

MR. MORANTE: Well, there were two parts of confirmatory analysis. One was to conduct totally independent analysis using Westinghouse's SASSI model, and that's where the errors were picked up during that process. The second part was we did take the ANSYS NI-10 and NI-20 models and evaluated the fundamental frequency of mode shape content of those two models and compared them. It was on that basis that we asked them to go in and look at these flexible areas, because we could see that certain areas were not modeled fine enough to pick up the amplifications.

So there were two distinct --

DR. BANERJEE: And the inconsistencies arose because of the resolution in certain areas in the model?

MR. MORANTE: I'm sorry?

DR. BANERJEE: The inconsistencies arose because some areas were not sufficiently resolved in the model, finely enough?

MR. CONSTANTINO: They were basically two separate confirmatory kinds, one was SASSI and one was ANSYS. What Rich was just talking about now was the ANSYS piece. On the SASSI side there were errors in the model.

DR. BANERJEE: Errors in the model?

MR. CONSTANTINO: In the model.

DR. BANERJEE: Or in the resolution in certain errors? It was in the model?

MR. CONSTANTINO: It was in the model that we found errors that had a significant impact on a computed SASSI responses and we asked them to correct that.

DR. BANERJEE: What were the errors?

MR. CONSTANTINO: Well, there were a bunch - there is a detail issue of if you have a beam element which as six degrees of freedom at a node connected to a brick element which has four degrees of freedom in it, how do you handle these two degrees of freedom? What they did was fix those two degrees of freedom, and it turned out it locked the whole SASSI model up to reduce the response. So that was probably the most important of the disconnects we found.

So then there were some other issues that in some parts of the basement it looked like there were areas that were missing. That was more a minor correction. But the connection of six degrees of freedom to four degrees of freedom is a serious issue, has big impact on SASSI response, and that was the biggest thing that came out of that confirmatory calc.

Then from that point on it was a matter of we ran the coherence and incoherent analysis, using two different codes, and then looked at the comparison between those, and that was an important issue, to look at the incoherent results, and try to justify what was acceptable.

DR. BANERJEE: So what was the issue there, I mean looking at them? Why were they different?

MR. CONSTANTINO: Well, I think we know why they were different. But what the result of the analysis they were doing was showing apparently significant reductions at low frequency which subjectively everybody was saying, it doesn't sound appropriate. So what we did was, after these corrections were made, run two different codes and find that in fact there shouldn't be any incoherent effects below 10 Hertz, which is the presumption, and all of the experience we had with the EPRI NEI studies that we evaluated before. So that now is consistent.

So that was a relatively significant finding from our perspective.

CHAIRMAN RAY: Sanjoy, I think you were also asking about the effect of changing the mesh size.

DR. BANERJEE: Yes.

CHAIRMAN RAY: And that had to do with picking up nodes where there would be amplification if you had three nodes on a floor or something like that instead of one you would be able to see amplification of the middle node, where it was missed otherwise. So that was the second thing I think.

MR. MORANTE: Now the NI-20 SASSI model was not modified to account for that effect.

CHAIRMAN RAY: Yes, that was the point I was trying to make.

MR. MORANTE: The basic NI-20 SASSI refinement was retained with the corrections.

DR. BANERJEE: This doesn't pertain to this OI, but when you do get the calculations for the shield building, will you do some confirmatory work as well? I mean this may be the wrong place to ask this, but it sort of is interesting, because you are getting - I think that this was valuable that you did the confirmatory work here.

MR. TEGELER: There currently are no plans to do that kind of work. On the shield building, we do have outside expertise that -- consultants that are helping us with that, and if based on their feedback if any additional analysis were to --

DR. BANERJEE: But you are waiting to see what happens?

MR. TEGELER: That's right.

DR. BANERJEE: Okay, all right.

MR. TEGELER: Number four relates to the ISG and in particular how ISG accounts for screening of components. Westinghouse did not screen in the steel containment vessel, saying that it did not have response to high frequency motion. We found that there was a mode in the closure dome that was 15 - 20 Hertz range --

MR. MORANTE: No, mid-20s.

MR. TEGELER: Mid-20s?

MR. MORANTE: Yes.

MR. TEGELER: And so we asked the question, could this high frequency ground motion input rich in energy in that frequency band excite that closure dome? And so Westinghouse has essentially showed that the design of that, of the closure dome, is controlled by the CSDRS and not the HRHF. So that's - so the end story on that is we were concerned that if the effects of incoherency were used in correctly or implemented incorrectly then you could have a bump out at the base of the steel, in the response structure at the base of the steel containment vessel such that the HRHF would then govern or control that closure dome design. But it turns out their response has indicated that this issue is resolved.

Number eight relates to, again, we took a very hard look at the various responses - at the response comparisons between ANSYS and NI-20, NI-10 and SASSI. And staff noted some inconsistent results at two locations on the aux building, where we felt that the analysis should have been a little closer. Westinghouse has responded that the difference is due to mesh density differences, and treatment of damping in SASSI and ANSYS. And this issue is, while we agree in principle we are still reviewing the details of their response.

DR. BANERJEE: Is that why it's in black, in bold?

MR. TEGELER: I can't tell if it's black.

MR. CONSTANTINO: I don't know if it's

intentional or not. j

MR. TEGELER: I don't know if it's intention or not. But we agree in principle. I think we are just taking a look at it to make sure we are convinced.

Items nine, 10 and 11 all relate to the use of incoherency in the SASSI analyses. So Carl talked earlier about the low frequency reductions which the staff was concerned with. That tripped us into doing our independent confirmatory analysis to make sure that we understood and could essentially validate what Westinghouse was predicting. So through that confirmatory analysis we asked these questions relating to the low frequency reductions and also validation for the high frequency functions.

This issue through our - based on our confirmatory analysis, and the recent RAI responses on nine, 10 and 11, in our view it looks like Westinghouse has implemented the facts of incoherency correctly in accordance with ISG. I don't think we are going to have any problems in that regard.

DR. BANERJEE: Do you recall if we've taken a look at this ISG in ACRS at some point historically?

MR. TEGELER: Do you recall?

MR. CONSTANTINO: I don't think so. I mean we spent quite a bit of time, as Goutam mentioned, looking at the ISG developments based on that NEI EPRI study.

MR. TEGELER: Let me, Carl, if it's okay, if I could back up a little bit into our - I referenced the ISG. With respect to reductions I'm referring to the - there is - as Goutam mentioned there was a lot of EPRI work done, and detailed calculations done using CLASSI and SASSI and different versions of the two codes. And there was guidance provided on how to implement incoherence within CLASSI and SASSI. As part of that study there was actually the test case was actually they AP-1000 Rev. 15 design. It was a lump mass model, and using I believe it was the hard rock function, they were - those results were indicating that below 10 Hertz as Carl mentioned you would not see a significant reduction, say less than 10 percent. When you got up above that range, say above 10 Hertz, you started to see reductions at most 50 percent reductions let's say. Actually maybe even 60 percent at a couple locations.

So using that as our basis for assessing the reasonableness if you will of the new calculation, or the new Westinghouse calc, where in responses to nine, 10 and 11, for low frequency reduction they are showing very small reductions below 10 Hertz, and then above that they are getting about a comparable level of reduction, 50 percent. So based on that observation, and to check that they are using the correct 2007 Norm Abrahamson coherency function, we believe that they are correctly implementing coherency.

MR. THOMAS: Yes, let me add in if I may, Brian Thomas, the branch chief for the structural engineering branch. To respond to your question about the ISG and whether or not the ACRS has had the opportunity to review that ISG, frankly we don't recall it. If that did take place. This was the first issuance of the interim staff guidance for seismic wave incoherency. And truly we don't recall. But we can get back to you on that matter.

CHAIRMAN RAY: Okay.

DR. BLEY: We've had a lot of briefings on other aspects of changes in the seismic program, but I don't think we've heard this before.

MR. THOMAS: Right, okay.

DR. BANERJEE: But how key is it to the sort of revised spectrum if you like, the acceptability of everything, that this production at the high frequency - is it an extremely important factor? It is?

MR. TEGELER: It is important, I think, and you can get reductions on the order of as I said, between comparing coherence, the traditional method Carl was raised on essentially, and now using this, you get a 50 percent difference. So now you can - it's not so much - this is in the higher frequency range, so it's mostly equipment and qualification you are talking about, not so much on the structural side. So it is important, it's an important issue, and I think generically a number of applicants are going to be using this, AP-1000 is the first to come before you using this. But I think you are going to see more of this, so we wanted to make sure that it was done correctly; that it was again, the purpose of the confirmatory work.

DR. BANERJEE: Thank you.

MR. BAGCHI: A little bit of history might help here. The standard spectra, point three G Reg Guide 1.60 type of spectrum, was in place prior to the changes in regulation, 100.2, three and so on. So when the probabilistic size, the hazard analysis, was adopted by the staff and performance based response tests were developed it turned out that seismologists went all the way up to 100 Hertz as opposed to the previous case where the peak ground acceleration became asymptotic at point - at about 33 Hertz or so. Now it goes up to 100 Hertz, and it turns out that very near source earthquakes caused very high frequencies at rock sites, and you may recall from the ESG of North Anna, the 100 Hertz value of the peak ground acceleration from the PSHA which is also the GRMS part of that site, is about point five g. The design basis for that existing unit was about point one g. So that - at that time a lot of discussion started and NEI really initiated this seismic working group. And we all now realize that at 100 Hertz even the ground acceleration may be very high, it will produce a low relative displacement, on the order of maybe a hundredth of a mil, that cannot cause structural damage. It might cause some stuff which is addressed in high frequency effects.

So apparently trying to match the standard design with the particular site which has dropped initiated high frequency would have been very hard without this incoherence effect. So it is important.

DR. BLEY: Goutam, before you leave, and we'll come back to it in a different venue I think rather than this specific one. But it seemed to me that the people doing seismic PRA fragility analysis of equipment, when they look at correlation between the equipment, you are already accounting for something like this in coherence effect by saying that equipment that is separated either quite a bit horizontally or some vertically in a structure are effectively that they independently rather than correlated because of something akin to this kind of incoherence, are we running the risk of kind of double counting this effect in the fragility analysis and in the ground motion?

We can save that for awhile, but I think we need to come back to that at some point.

MR. BAGCHI: I need to think about that.

MR. TEGELER: Thank you, Goutam.

MR. MORANTE: Just one thing I'd like to add: in terms of the structural response we requested Westinghouse to present both coherent and incoherent responses for the structures. And coherent responses were still below the design basis responses. So from the structural standpoint we felt pretty good.

DR. BLEY: That's an important point, I think.

CHAIRMAN RAY: Okay, proceed.

MR. TEGELER: Seventeen, we talked briefly about earlier, dealing with residual or missing mass in modal supervision time history analysis.

CHAIRMAN RAY: I think you need to speak up a little bit more.

MR. TEGELER: Oh, sorry.

This question we talked earlier about, and our consideration of mission mass and these seismic analyses, and explain the differences and similarities between the more recent Reg Guide 1.12 revision and justify those differences.

At our recent audit in June Westinghouse did provide some calculations indicating that their approach, the approach they used and the more recent Reg Guide 1.92 approach resulted in a fairly small differences. And I think we agree in principle on this particular issue or question.

MR. MORANTE: If I could expand on that, the Reg Guide which came out in 2006 is very definitive how to treat missing mass when you are doing response spectrum analysis, or mode superposition time history analysis. Prior to that the typical approach especially for mode superposition time history analysis is, you would include a significant number of additional modes beyond the so called cutoff frequency. And in theory if I included as many modes as there were degrees of freedom I would have 100 percent of the mass participating in the solution. Typically nobody is going to run thousands and thousands of modes. They'll cut it off at some point either at the cutoff frequency which would be where the input goes down to a ZPA ,or they would include additional modes to pick up additional mass effects, effects of mass that participate in modes above that frequency and incorporate them into the solution.

If you look at using that approach there are cases where even if you included twice the number of modes in local regions of response, especially in distributed systems like piping systems, you might still underpredict support reactions.

So the reg guide when it was changed defined a very specific way of dealing with missing mass that takes care of that problem.

Now historically for building type analyses which is what we have here, the effect that we found looking at distributed systems most likely doesn't exist. So Westinghouse's approach was to include a significant number of modes beyond the frequency at which the input spectrum went down to the ZPA. And in the latest audit they showed us comparisons at different solutions, some to different numbers of frequencies, one at the official cutoff which is where it goes down to the ZPA, and another solution where they added many twice as many modes. And the comparison showed no difference.

So on that basis we accepted that, their solution, any mass participating in modes that were not included would have such a minor effect on the overall solution as to be unimportant. So even though they are not following the latest guidance, their approach we accepted as producing accurate results.

CHAIRMAN RAY: Understood.

MR. TEGELER: Open item 15 relates to the effects of the structure soil-structure interaction between the nuclear island and adjacent structures. This question came up actually in support of some of the COLA applicants, some of the COLAs are proposing to use let's say different types of backfill underneath the adjacent structures. So Westinghouse has proposed to deal with that generically through this question.

And so what they are proposing to do is model - explicitly model in SASSI the nuclear island

and adjacent structures and the flow characteristics using a range of properties for the fills, to show that they - to essentially show that for a reasonable engineering fill material that their analysis would bound the COLA applicant, or at the site condition.

So this question Westinghouse, the staff agrees with the Westinghouse approach here, they have, during the June audit they did provide us with results, and we are still waiting on the final - or I guess the draft RAI response that describes those results in more detail.

Open item TR03-007 relates again to this sloshing issue, and we asked this question because of the amendment and the change to the shield building, whether or not these changes would have any impact on the sloshing frequencies and the assumptions related to sloshing mass or convected and inertial mass assumptions in the dynamic analysis models.

DR. BANERJEE: Did you do any confirmatory work either on the first submission on this or after the changes?

MR. TEGELER: Rich did a little bit.

MR. MORANTE: Yes, we did, the 60 percent sloshing mass has been something that we have been a little uncomfortable with for awhile, but

Westinghouse did present revised calculations, I think Richard Orr explained the latest ANSYS analysis which did demonstrate again that about 60 percent of the mass is in low frequency sloshing mode. As kind of a check we did some relatively simple confirmatory analysis where we just used the model of the stick model of the shield building and analyzed it with or without the 60 percent mass that had been excluded because of the sloshing. And we found that the fundamental frequency of the shield building shifts very little and the reaction forces at the base go up only a little bit. So on the bases we've accepted their overall seismic analysis without the 60 percent sloshing mass from the model.

From the standpoint of the detailed evaluation of the structures, of the tank structures, that is covered under 3.8, and I believe there is still some review of that going on.

DR. WALLIS: Just to clarify, as I think about this problem, you shake this thing and there is a pressure grid pushing the water, and it pushes it, and it also pushes it up and down, to keep a constant pressure on the surface. So this 60 percent must be some effective mass. You can't say that some of the water is moving and some of it isn't. It's an effective mass when you integrate over the whole, when you solve the whole 3-dimensional problem.

MR. MORANTE: Right, for vertical response the assumption is 100 percent of the mass.

DR. WALLIS: Well, I don't know, when you actually solve the problem you can figure it out, if you do the continuous 3-dimensional analysis of what's really happening.

MR. MORANTE: Well, that is something that they made, in the vertical direction, that all of the mass just moves with the structure. It's the horizontal modes of the structure --

DR. WALLIS: That some of it escapes sideways?

MR. MORANTE: Some of it, the lower portion just moves like a solid, and the upper portion is, they move it up and down the walls of the tank.

DR. WALLIS: They find relief by going outside, but it's a continuum.

MR. MORANTE: It's that portion of the mass that tells you how much of that mass should you incorporate into the overall seismic model, how much of that should you incorporate. Westinghouse made an assumption that 60 percent could be removed. Our way of dealing with it was to do the simple calculation, when we looked at it with them, without the 60 percent to see what the overall effect is. That 60 percent mass compared to the total mass of the shield building and aux building is a very small percentage. So in the overall response, seismic response, we are accepting the assumption.

DR. WALLIS: Yes, I saw this too, that's so surprising, with all this water, but really it doesn't weight that much compared to the building.

MR. MORANTE: Compared to what we are dealing with.

MR. TEGELER: And so this is essentially where we are at today. I should say that we are still very active reviewing the more recent Westinghouse responses, and I think you are going to hear again from us on how we resolve these issues you've heard about today, and probably one of the more important pieces of the shield building and the concrete cracking.

CHAIRMAN RAY: That's accurate. I think though, at least in my case, the focus on the shield building has gotten broader since we've had this briefing from you and Westinghouse. I guess I lean, and Weidong, I should say as we look to the future, this discussion has gone on and yet has deferred a lot of things that might take time, and the last time around, depending on how closure occurs. Hence we ought to keep that in mind when we are trying to schedule things.

And the ISG that was mentioned, I don't know if it's possible for us to see that apart from this application before we try and reach closure, but it might be a good idea to look and see if that is possible to do. We have a very very full agenda going forward, so I don't know what is going to be possible. But this is an area of very great interest, substantial change having been made, ongoing staff review. I just want to alert everybody that in order to get closure we are going to need something more than just 15 minutes for somebody to say all the open items have been closed.

Okay, any other questions? Thank you.

We are past time a little for the morning break, so we plan to take that, and then we'll plunge into 3.8. We may wind up breaking for lunch a little late. We will after the lunch break have a closed session as I mentioned at the outset to address one of the action items that is to be discussed at that time.

The action items we will give precedence to to make sure that we get as good a review done as we need to before then resuming some other items for the balance of the afternoon.

Okay we will break then until 20 minutes until 11:00.

(Whereupon at 10:24 a.m. the above-entitled matter went off the record and resumed at 10:40 a.m.)

CHAIRMAN RAY: Back on the record. We will now be proceeding with Section 3.8 in the usual order. Let me say though before turning it over to Don that as for this afternoon I've already mentioned item six will be taken up and it'll begin with a closed session and then go to open session.

In looking at where we are and where we're going, and not wishing to cause folks to hang around unnecessarily who have no reason to do so, we have agreed to move the item 11,upcoming ACRS interactions, which involve more than just the matters we'll be discussing in the remainder of the afternoon, to final item six. So it'll be item six then item 11 and then the other items as shown on the agenda.

And that will allow us to have discussion that may be of interest to folks who would otherwise be able to depart.

All right, with that have been said, then, Don, it's up to you.

DCD SECTION 3.8 - APPLICANT

MR. LINDGREN: Okay, once again, I'm Don Lindgren, Westinghouse Electric, AP-1000 licensing. Richard Orr and William LaPay are assisting me again for this section.

Section 3.8, which is the design of Category I structures, is another section which we have not previously presented to the ACRS. It is much the same status as 3.7, that is, we had an audit in June to resolve many of the questions that you will see as open items in the SER. We expect to have all the open items resolved by the end of June.

The sections of interest --

CHAIRMAN RAY: At the end of?

MR. LINDGREN: End of July, yes, excuse me, thank you.

Section 3.8, sections of interest are steel containment, concrete and steel internals, structures, this is internal to the containment. Other Category I structures which in our case is the auxiliary building and the shield building. And foundations, which includes the base mat. Obviously we don't worry about concrete containment in our design.

The Section 3 changes in the DCD from Rev. 15 include the redesign of the shield building. We are not talking about the redesign of the shield building at this meeting; that will be discussed at a later meeting. However we will discuss when the shield building impacts the design of the other structures. The shield building, the stiffness and the mass of the shield building changed somewhat, and that had an impact on the response spectra, the building response spectra for the auxiliary building and the containment.

We - the extension of the AP-1000 structure design sites or soil sites, firm and soft rock sites, did have an impact on the design of the structures, and that will be addressed.

Within 3.8 there is information referred to as critical sections. These were a total of 15 different locations within the shield building, auxiliary building, and base mat that were identified as part of the design certification as critical sections, and they provide information about the design specifically and the design generally. These were updated because of the change in response vector soil cases, in some cases the loads went up because of that, and also our design finalization effort made some changes in those sections.

We also added a settlement evaluation during construction that because hard rock you don't need to worry about settlement; in soft soil you do. So we included a construction sequence limit, added construction sequence limit to address those issues.

One other thing is that we are - there is a design change that is being finalized, and we have a meeting tomorrow to talk about it, for the containment design. This will be discussed at a DCP, and brought to the ACRS as part of the Chapter 23 issue or review.

CHAIRMAN RAY: DCP?

MR. LINDGREN: Design change package.

CHAIRMAN RAY: Okay.

MR. LINDGREN: So it will be brought to the - we have a number of late changes that are being included in Chapter 23 of the SER, and that's how - it does impact some of our stuff, so you'll be hearing me refer to Chapter 23 and the changes they contain.

She section sequence limits. Construction sequence limits are put into place basically so that you do not overstress the base mat and the reinforcement within the base mat during construction by if you have a soft soil and you build on one side of the base mat faster than the other, you have the potential to put some unacceptable stresses and strains on the base mat, so we have a limit, which is prior to completion on both the shield building an the aux building to 82 feet 6 inches. Remember that this is below ground level. Our ground level is 100. Concrete may not be placed above the elevation of 84'0" for the shield building or containment internal structures, and concrete may not be placed above the elevation of 16'6" - 17'6" for the auxiliary building except the structure - one particular structural module can go up to 185.

So what basically this means is they need to go up together at least through the first level. There is a floor at 82'6"", ceiling floor, that kind of knits all the walls together on the first level of the base mat. They do a large effort to strengthen the base mat, make it more rigid, stiffen it up. So we have put those construction sequence limits, and they apply everything but hard rock.

Okay?

CHAIRMAN RAY: Yep.

MR. LINDGREN: Material specifications, we include some material specification changes in the design. We updated the material of the containment shell to reflect how steel is actually made these days. We had an older specification that basically isn't used anymore.

The modules, these are particularly the internal containment modules, the material that structural modules, where it needs to be corrosion resistant, was changed from Nitronic 33 to Duplex 2101. This had to do with the availability of the material and the sizes we needed primarily.

DR. ARMIJO: Could you expand on that a little bit? Both of those points, in the vacuum degas steel, your earlier certified design cited a process you say is no longer available more or less, and you are going to a different technique of getting that, saying steel with the same properties?

MR. LINDGREN: It's still a vacuum-to-gas steel, but the particular specification for the vacuum degassing is what changed.

DR. ARMIJO: But the mechanical properties --

MR. LINDGREN: Mechanical properties are all the same, yes. It's just S-17 instead of S-1, it was that kind of level of detail.

DR. ARMIJO: In the two materials,

Nitronic versus Duplex 2101, are these fundamentally the same?

MR. LINDGREN: They provide the same corrosion resistance. They are stainless steels that provide the same level of corrosion resistance. This was a really due to availability of the material in the sizes in wide plates is why this change was made.

DR. WALLIS: What is the gas you want to get out when you vacuum degas?

MR. LINDGREN: Somewhat oxygen, I think. I'm not sure. Any dissolved gases.

MR. MORANTE: Those leave pretty easily, but sometimes there's oxygen, sometimes other gases.

MR. LINDGREN: We reflected a change in NQA-2 and NQA-1. Basically NQA-2 doesn't exist anymore. It was sucked into NQA-1. So now NQA-1 is cited for packaging, shipping and receiving storage. It's a minor change. It was a change we did make to material specifications.

The concrete material we did increase the specification for the impressive strength of the concrete and the shield building from 4,000 psi TO 6,000 psi. We eliminated some COL information items, mostly because they looked to be redundant to us, or not necessary anymore. We completed the design of they containment vessel adjacent to lodge penetration, so we don't need a COL information item on that one anymore.

The PCS water storage tank inspection we had as a COL information item. It's also as an ITAAC. It doesn't need to be both places, so we eliminated it as a COL information item.

The information is still on what the inspections need to be, it's still within the text of the DCD and the ITAAC, it's been updated to reflect that.

And then also in service inspection of the containment vessel is well covered by NRC regulations and ASME code requirements, so we didn't need a COL information item on that one.

Chapter 3.8 open items, there were 20 open items identified in the SER for DCD Chapter 18. There is one additional RAI that I will be talking about here. Five of the items were identified as confirmatory; 10 of these items have been submitted since the SER was prepared, and we resolved and are awaiting NRC confirmation of that. And two items are placeholder items where we don't believe it's action on the part of NRC. We don't really need to send anything in for them to take care of those action items.

CHAIRMAN RAY: Excuse me, Don. Who joined please?

MR. TUNINSANJA: This is Lee Tuninsanja of Westinghouse.

CHAIRMAN RAY: Thank you.

MR. LINDGREN: Thank you, Lee.

Okay, open item OI-SRP-382-SEB-103 is one that we believe is resolved and we are awaiting confirmation, we have discussed with the NRC. It's already in our final product, and we are awaiting their confirmation. They asked us to address questions about load combinations through the steel containment design including the wind, tornado and hydrogen generated wind loads.

We skipped over one here, didn't we? Okay, we've got one missing.

The AP-1000 containment is not subject to direct wind loads, and we also clarified hydrogen burn loads. These are activities that are not really changed by the coming items. There it is. I got a couple of them switched around.

Details, the NRC asked us to revise our discussion of compliance with regulatory guides 171, 571, 60 and 199. There was not much to do for 171, and 157, those were handled easily. 1.160 and 1.199 were addressed. These dealt with hydrogen pressure loads, load combinations, maintenance rule and anchors, and as a result of this interaction we added a COL information item on maintenance, so we believe this one is now resolved and are awaiting NRC confirmation.

Open Item OI-TR-RAI-TR09-05 is an open item that basically says the final resolution of the open item specified there needs to be reflected in what happens in TR09. So this is really an NRC placeholder.

The OI-RAI-TR09-08, these are details regarding temperature and external pressure loads of the containment. This is one answer that is pending our containment design change. We have a draft to present to the NRC tomorrow.

OI SRP --

DR. WALLIS: Why does the containment get negative pressure?

MR. LINDGREN: When you have an extreme cold weather condition, you chill off the containment.

DR. WALLIS: So it's a weather-induced --

MR. LINDGREN: -- are design changes that we are going to put in.

DR. WALLIS: Purely weather induced. Okay, thank you.

MR. LINDGREN: It is no accident. In addition to the cold weather, you also have to have an additional equipment malfunction such as fans kick on that you don't want on, or loss off AC.

The OI-SRP382-CIV-101 is one that is related to the containment and the external pressure. We - because of our field building and baffle chimney what happens in a high wind as we get more air coming through the baffles, and if you are in Duluth and it's minus 40 out, you have to worry about it cooling off the containment. So we have incorporated the requested information from the staff. We believe this one is actually now resolved and awaiting confirmation. This was actually a question that talks about service metal temperature.

DR. WALLIS: Well, they're still protected by the shield building, isn't it?

DR. BANERJEE: But not the temperature.

DR. ARMIJO: Not the temperature. You've got all that wind.

MR. LINDGREN: You've got cold air coming through there.

DR. WALLIS: You don't feel the wind directly.

MR. LINDGREN: You don't feel the wind directly. What you have is, you have an incredibly large vertical updraft past the containment, and so - it does a real good job of chilling off the containment if you are cold outside.

DR. WALLIS: But the minimum surface metal temperature is still minus 18.

MR. LINDGREN: It's minus 18 - well, you've got boundary layers, and you also have a warmer temperature on the inside.

DR. WALLIS: I wonder if there might be places where it's actually cooler. It's not a uniform temperature?

MR. LINDGREN: No, this is the worst case. It's minus 18 at the worst location.

DR. WALLIS: In the worst place.

MR. LINDGREN: As I said we rely on boundary - and it's measured at the middle of the metal.

We have an RAI-SRP-382-SP-CV01 which came about as a result of an audit of our calculations for addressing external pressure and the metal temperatures, and they asked us about analysis assumptions.

This answer is also pending the containment design, and in fact may just be completely eliminated by that.

These two, you notice that these don't say SEB1 in them, and that is because the structural engineering branch reaches out to other portions of the DCD, the NRC, to get help on these areas that are not their strengths.

DR. BANERJEE: What do you mean by pending design change?

CHAIRMAN RAY: That was before you came in, Sanjoy. He said there is a design change that has been submitted, or you're meeting on it today, will be submitted, and involves the containment pressure vessel.

MR. LINDGREN: Actually what we're doing is, we're putting in a vacuum release system.

DR. BANERJEE: A what?

MR. LINDGREN: A vacuum release system, to use the vacuum release system to establish the external design pressure rather than calculations.

DR. WALLIS: This external pressure of .9

psi, very small and it's comparable just to the barometric pressure.

MR. LINDGREN: Yes, it was - our design pressure was actually 2.9, which was based on a nonmechanistic kind of safety analysis kind of assumption, very conservative assumptions, and then for evaluation of the service limits we evaluated a more credible case, and that's where you get the .9.

DR. WALLIS: I'm just saying that just the barometric pressure itself can change by that much.

MR. LINDGREN: Well, I think it's about .2 or .4 is actually what the barometric pressure would do. And normally there is some air exchange. You have to have some kind of equipment malfunction that isolates everything and turns on the fans or you lose AC power and that kind of thing to actually get these external pressures. But anyway, so we are going to be talking about for ACRS that you will see the containment changes in Chapter 23, at some future date.

CHAIRMAN RAY: Twenty three being the accumulation of design change packages?

MR. LINDGREN: Yes. Okay, moving to

Section 383, which is containment and steel internal structures and the open items there, 383 SEB-1-01, was a request to use a later version of the AISC and 690 code including supplement two and some more recent AWS standards. This is an issue that is still open and being discussed with the NRC.

OI-SRP-382-SEB-103 is -- this ties back to what we talked about this morning, cracking and damping concrete structures, so it will be answered as part of that effort.

That was the fourth one, and I told you were three. I told you about three of them this morning.

OI-SR-383-SEB-1-04 requested a description of how the loads in the modules could be properly transferred from the modules to the embedded bars in the base concrete. So this is a question about connection of modules into what is inside the containment, the mass concrete, and what is in the aux building, the base mat.

That is an item that we are also still working on resolution. On all of these we believe we have a path forward, but we haven't turned in -- we haven't resolved them. We have agreed on a draft.

OI-SRP-383-SEB1-05 is one that we believe is resolved, and we are awaiting NRC confirmation. It requested that we include information on plate thicknesses, that's Tier 2 star information in the DCD. We have included markups of the DCD to show how we will revise these plate thicknesses.

DR. ARMIJO: Those plate thicknesses are related to the containment or the shield building?

MR. LINDGREN: It's the shield building. In that particular one, I believe that is the tension ring. So it's the top of the shield building. There are three-quarter inch plates that provide much of the reinforcement in that area on the outside.

MR. ORR: Don, wasn't it three-eighths, and sort of just modules.

MR. LINDGREN: Is that a module one? Okay, that's a module one, okay, I was confused about that. But there were actually about three of them that they asked for a similar kind of explanation. So it is - has to put the size of the plates in as Tier 2 star information.

Now moving on to 384, which is other Category I structures including the shield building and the auxiliary building, OI-SRP-384-SEB-1-03 was a request that we include more detail with the DCD related to enhanced shield building design and the reason for the removal of certain Tier 2 star information. We're basically putting that Tier 2 star information back in, and providing the information they requested. But this is still an open question.

OI-TR-85-SEB-1-29 was a request that was a question about the computer code we used to deal with the cross-sectional strength of members of all the concrete materials, so it's called a macro - we call it a macro I guess. They did an inspection on this, the NRC did an inspection on this and resolved this issue. We have turned in our final response. This one was also being held up pending - providing a staff information for them to do a confirmatory analysis. That information has now been provided, so we believe this one is now resolved and closed. We are awaiting confirmation from the NRC.

OI-TR85-SEB-1-27 was a question about implementation of 140-40 method for combining - for the combination of three directional seismic load. This is another one where we believe we have agreed in principle, but we are awaiting confirmation from the NRC on this.

Three eight five, which is the base mat, OI-TR85-SEB1-10, there are actually a couple of items involved here. One of them was a request to make the

TR-09-57-85, make them Tier 2 star, provide acceptable information. We thought that was way too much information to make Tier 2 star, and we are developing an acceptable alternative that will include putting more information from the technical reports directly into the DCD and some of it will be Tier 2 star. We have not worked out those details, so I am not showing this today as a result.

OI-TR85-SEB1-35 asks for further clarification in the DCD on the water proofing materials. This shows up as a structural issue because the safety function of the mat of the water proofing membrane in the mud mat is to provide an appropriate friction factor. It's actually a friction factor of .55, and we also have fairly recently added some options as far as the water proofing materials that can be - the selection of water proofing material is a COL decision, COL and constructor decision, and as I said the safety function of it is to provide a friction, proper friction factor. The real function of water proofing which is to keep the water out of below ground levels is not a safety function. So we've added this information.

We believe we have resolved this issue and are awaiting confirmation from the NRC.

CHAIRMAN RAY: Mario, did you want to have any further discussion of that?

DR. BONACA: No, I appreciate the identification of the function.

CHAIRMAN RAY: Okay.

MR. LINDGREN: OI-TR85-SEB1-32 is a question about assumption of uniform soil springs below the base mat. That is an item that is still being discussed with the NRC. We are still preparing our final response to them, and it is still considered to be open.

DR. WALLIS: In this context I was surprised that you had to consider lift up of the nuclear island?

MR. LINDGREN: Yes.

DR. WALLIS: It actually lifts up?

DR. LaPAY: It always moves. It doesn't lift off, but as part of the stability evaluation you have to look at, does it overturn as well as does it slide.

DR. WALLIS: Because of intention?

DR. LaPAY: Yes, because it does have the ability --

DR. WALLIS: The whole thing doesn't move?

DR. LaPAY: No, no, it's like one corner.

MR. ORR: Yes, one corner or one edge.

DR. WALLIS: That's better.

MR. LINDGREN: Yes, the idea of this thing levitating is --

DR. WALLIS: The separation was from the soil. But lift off is something else.

MR. LINDGREN: OI-TR85-SEB-1-37 is another one that we believe is resolved and awaiting confirmation from the NRC. It asks us for additional information on evaluation of stability in the soil friction angle, also related to the friction factor. The DCD information has been added and clarified on this issue.

DR. WALLIS: Do you have a 3-D model or something of how the soil responds to the construction process, and as the load changes? Is there a 3-D model of the soil under the base mat?

MR. ORR: That's the analysis we described in the first slide that we have done, and the analysis of settlement during construction. It includes sort of a model of the soil and the various stages of construction as you go on, the different construction sequences.

MR. LINDGREN: OI-TR85-SEB1-36, speaking of settlement, was asked to include the nuclear island settlement criteria in Tier 1 of the DCD additional settlement criteria, has been added to the Tier 1 table 5.0-1.

OI-TR85-SEB1-17 asks for - talked about further evaluation of construction sequence and limitations needed for stiffer foundation materials. The DCD just changed to make the limitations applicable to all soils except hard rock. When we initially came up with the construction sequence limits we only applied them to the soft soil condition; we have now applied them to everything except hard rock.

OI-SRP-386-SEB1-01 was, evaluate change to COL information item related to containment vessel design adjacent to large penetrations against TRO9. This is another NRC placeholder. There is no activity for us.

Open item SRP-386-SEB1-02d was a question about the consistency between the ITAAC to inspect the PCS water storage tank for cracking, and the guidance in the DCD Section 3847. We revised the ITAAC to clarify it and to make it more consistent with what we have in the Tier 2 description.

And I think we are done.

CHAIRMAN RAY: Okay, any additional questions? Again, I caution everybody that these items are open pending closure, and we will look at the resolution of them. But anything else for the applicant?

Thank you.

MS. SPICHER:

CHAIRMAN RAY: Okay, Terry.

DCD SECTION 3.8 - STAFF

MS. SPICHER: My name is Terri Spicher, and I am one of the TMs for the DCD. To my right is John Ma who is our senior staff member who did the review for Section 3.8. And to his right is Joe Braverman who works for a contractor for BNL who help support this review. And similar to 3.7 it was a team effort, and Brian, the branch chief, who is sitting off the table to the left. And we are all here to help if there are any questions.

We'll go through the same format. John will go through an overview of what the big changes were. He will also go through specifically by what SRP subsections the changes were in. And then we will go through a summary of where we stand with the open items. Okay?

MR. MA: My name is John Ma. The first slide is an overview. The first two items already been discussed in 3.7, so I am not going to talk about it.

The third item is on the shield building, which we are not going to address in this meeting.

The next item is use of additional analysis methods for the design. So since Rev. 15 they added to kinds of methods, response spectra and time history analysis.

The next change is a change in structural steel material and concrete strength.

The next one is a revised stiffness assumption for containment internal structures, from no concrete cracking to 80 percent of concrete cracking.

The next item the revision is required for seismic stability evaluation. This is talking about the nuclear island sliding and nuclear island overturning.

And the last one is elimination of combined license information item.

The next slide, I'm going to tell you in SRP Sections what the changes are. 3.8.2 steel containment, the first changes, they made the calculation update due to extension from hot rock site to range of soil rock site, and this already been discussed in 3.7.

Second item is addressed, revision 15 COLA action item for design of containment vessel next to large penetration.

Third item is delete requirement for in service inspection of containment vessel in accordance with ASEM code Section XI, Subsection IWE. They transferred this responsibility to COL, but the DCD does mention there is a commitment to do such kind of ASME inspection.

The 3.8.3, the first item they removed Section 3.8.3.4.1.2, stiffness assumptions for global seismic analysis. This is one of our major RAIs.

Next item is revised Section 3.8.3.5.7, design summary report. They removed this item originally required by COLA. Now this item can be done by others, like other AE firms.

CHAIRMAN RAY: I don't understand what you just said. It was in the COLA and now can be done by other AE firms. What does that mean?

MR. MA: Originally the design summary report in the DCD required the COLA to address this one.

CHAIRMAN RAY: Yes, and they are the ones who hire the AE, right?

MR. MA: That was originally in the DCD. But now they've removed the wording so the COLA itself doesn't have to do it; other people can do it.

CHAIRMAN RAY: It sounds bizarre to me.

MR. BRAVERMAN: Let me explain that. The DCD, prior DCD revisions had that, an as-built summary report had to be performed, an incident ITAAC for every seismic Category I structure, and it had the phrase, by the COLA applicant. In Rev. 16 and 17 they removed those few words, by the COLA applicant, I believe so that Westinghouse could do it or another engineering firm could do it.

CHAIRMAN RAY: But that is ridiculous. I mean by the COLA applicant in my mind means they can hire an AE to do it. I mean that is silly.

MR. BRAVERMAN: You can ask them. They just removed those guidelines.

DR. BLEY: But the ITAAC stays.

MR. BRAVERMAN: The ITAAC stays. It still has to be done. It just doesn't specify who does it.

DR. ARMIJO: It's a violation in case somebody hires an AE.

CHAIRMAN RAY: They can hire anybody they want as long as they are qualified to do it. Okay, never mind, we're wasting time. I just couldn't understand what you're talking about.

DR. BLEY: Well, I'm just wondering if what it meant was that it had to be done at the time of the COLA rather than later.

MR. BRAVERMAN: It didn't go into the timing.

MR. MA: Maybe Westinghouse can answer that question.

CHAIRMAN RAY: I don't even want to ask it, it's so silly. It just seems to me that if it says by the COLA applicant, obviously they are going to hire somebody to do it, and they can hire Westinghouse or an AE or whoever. Never mind. Sorry I asked. I just couldn't figure out what you were talking about.

MR. MA: The next item is on 3.8.3, revised Appendix 3H, auxiliary and shield building critical sections.

The next item is Revised Section 3.8.3.6, material quality control, special construction technique.

The next item, revised Section 3.8.6.3, concrete placement. Originally they were talking about single placement; now they allow the multiple placement.

The next item, they reduced the height of the pressurizer.

3.8.4, revised 3.8.4.2, applicable code, standards and specifications. This is to extend the welding to two additional areas.

The next item on the shield building, we don't have to address here. Revised design analysis procedure under Section 3.8.4.4.1, seismic category I structures. This is mainly about the shield building.

Next item, revised Section 3.8.4.5.3, design summary report, this is the one we were just talking about; same language. We removed the language by COLA.

The next slide, 3.8.4, item e), they revised the concrete strength to be tested at 56 days instead of ordinary 28 days. And they also increased concrete compressive strength to 6,000 psi in the shield building and also changed the chemical composition and proportion of concrete mix.

3.8.5, revised 3.8.5.4.1, analyses for loads during operation. This is the increase, 20 percent margin for the reinforcement to account for the soil variability in the basement.

The next item is revised 3.8.5.4.4, design summary of critical sections, design approach, revised for one-way slab design to two-way slab in the basement for two bays. The next item --

CHAIRMAN RAY: When you say something like that, isn't there anything more you want to say about it?

MR. MA: We will be later on.

CHAIRMAN RAY: Okay, all right.

MR. MA: Or I can just tell you now. The base mat, originally the design is a one-way slab. But now the particular two bay areas, they changed that one-way slab into design into two-way slab.

CHAIRMAN RAY: Is this an analysis modeling the question --

MR. MA: These are design changes.

CHAIRMAN RAY: Well, okay.

MR. BRAVERMAN: You see the ACI code allows you to design a slab either in one way - what that means is, it's as if you do it with a series of individual beams, because it takes out the loading as individual beams. If you design it as a two-way slab, you are analyzing it as a plate, so it's a bit stronger.

CHAIRMAN RAY: To me it sounds like it's

an analysis question rather than how it's actually built.

MR. MA: The element has it as a plate, but you get member forces like bending moments. So the question is, how do you take out the bending moment about a certain axis, and that's the design aspect.

MR. MA: This is a design question because you analyze, it's a stress, so you can design for example this foundation, I can design into one way action, one way action would be something like this. I put all the weight volume in this direction only.

CHAIRMAN RAY: Okay, so physically it changes.

MR. MA: Physically it changes.

CHAIRMAN RAY: All right, fine, I got it.

MR. MA: I put the physical rebound in this direction. The only direction I only put nominal. Or the temperature.

CHAIRMAN RAY: Got it.

MR. MA: Now I design this plate to work as two way, so I need to design the slab with the reinforcement in two directions. That is the difference.

CHAIRMAN RAY: Thank you, I understand

now.

MR. MA: Item C is revised Section 3.8.5.7, design summary report. This is the same thing; they removed the word, by COLA.

3.8.6, combined license information, revised 3.8.6.1 by eliminating COL information item, because it had been addressed in TR-09.

Item B, revised 3.8.6.2 through 3.8.6.4 with regard to remaining COL information items.

Let's go to next one.

MR. BRAVERMAN: Back it up one.

MR. MA: This is the status at the time when we wrote SER. On 3.8.1, because it is not applicable, we had no concrete containment, 3.8.2 steel containment, we have four open items, one confirmatory item. On 3.8.3 --

DR. ARMIJO: Before you move on, is there anything substantive in those open items on 3.8.2 on the steel containment? Because all we're getting out of here is just reading --

MR. MA: Following slides we'll go to each individual open item.

DR. ARMIJO: Maybe we ought to just go to those. It doesn't really help us.

MR. MA: Okay, the first open item is

SEB-1-02, we asked them to explain whether the design construction and inspection are in accordance with reg guides. Because we did not see they conform with all these reg guides. That is our question to them.

DR. BLEY: And have they responded?

MR. MA: They did respond.

MR. BRAVERMAN: Yes, they have; they're reviewing that now. Actually we had a structural audit as mentioned before, the week of June 28th, and we went actually over all these open items, and some of them were determined to be technically acceptable. Others, we developed a path forward, and subsequent to that we also had a conference call that they had been submitting draft RAI responses. We've gotten back to them, and in four cases the open items have been converted to confirmatory items, and in one case it was resolved.

DR. BLEY: So if it doesn't say that is it fair to assume that you are on at least a path forward?

MR. BRAVERMAN: Yes, in fact as we go through these John will indicate which ones are resolved and which ones became confirmatory.

DR. BLEY: Good.

MR. BRAVERMAN: We can do it at the end;

there is a summary slide.

MR. MA: At the end we have it but not here.

The next SEB1-03 explain why DCD does not include load combinations that combine wind load and design pressure load and tornado wind load with external pressure load; and clarify the hydrogen generated pressure levels.

DR. BLEY: It would help me a lot, because I won't remember them when we get back to the end, to just have 3.8.2, what is the one confirmatory item that you now have on this one?

MR. BRAVERMAN: There's none on this particular slide. If you want we'll mention it as we go through.

DR. BLEY: 3.8.2, on the last page, says there is one confirmatory item.

MR. BRAVERMAN: We are going open what is open as of the SER phase that you have, a confirmatory item that is discussed in the SC is not shown here. These only shown open items at the time of the SE. We didn't think you were interested in something that was previously confirmatory already. The purpose of these slides is to go over open items.

CHAIRMAN RAY: The problem is though that

Westinghouse did basically what you are doing now, and so we are trying to get some added information here and it's not easy. I mean these items they set out basically the same things, although we are glad to have you confirm it, that's fine. But we are trying to get some more information than we already have received. But proceed.

MR. BRAVERMAN: Well, we can expand on individual open items.

CHAIRMAN RAY: I mean your comments have been very helpful, so continue.

MR. BRAVERMAN: Do you want us to expand on any of these? We can right now.

DR. ARMIJO: What I'm looking for is, where does the staff take significant exception to the position taken by Westinghouse? Are you in step? Are there minor issues, or do you have serious issues, and what are they? That's what I'm looking for.

MR. BRAVERMAN: Well, there are several challenging open items, and we can point those out to you.

DR. ARMIJO: Yes, and the ones where there is minor, stuff like that, at least for me --

MR. BRAVERMAN: Well, 3.8.2.0.2 is relatively minor. Because during the last audit they acknowledged they will revise the DCD to indicate that they are in accordance with these regulatory guides.

DR. BANERJEE: So we have this presentation from Westinghouse. I presume that your list is in correspondence with them.

MR. MA: Yes.

DR. BANERJEE: At that point why don't you simply point out, at least for me, which ones are major open items to you, and simply go through this real fast, and list to us what is of concern.

MR. BRAVERMAN: Okay.

DR. BANERJEE: And if there are no concerns, there are no concerns.

CHAIRMAN RAY: It may be premature of course for them to say there are no concerns if they still have something under review. In any event we are just trying to avoid repeating what we just went through with Westinghouse and give us some information that provide your insights.

What Joe has been saying has been helpful, so just continue.

MR. MA: Okay, if that is the case - I think the next one, 3.8.3, the second item, 03, we want them to justify the use of the stiffness reduction factor of .8 for containment internal structure and reinforced concrete structure. Originally they used one, which is assuming concrete, no crack. And now they reduced it to 80 percent of - 20 percent of cracks, so now they reduce it to 80 percent of the original 100 percent uncracked. So we want them to justify the reason for doing that.

MR. BRAVERMAN: And the way they are going to do that is, assuming they continue with the path forward that we discussed, is to use - it was talked about a little bit earlier, but they are going to use an Abacus model, and Abacus has concrete elements that can properly represent cracking of concrete, so depending on the load the extent of cracking, the correct stiffness would be in the model, and compare the response of the nuclear island at selected locations for this Abacus nonlinear model against the same model for doing a linear elastic model where they would simply use the factor of .8, stiffness reduction factor, which was assumed in the design previously. And they are going to look at a response vector at representative locations and they hope to show that it has a negligible effect.

As far as the input to that model --

CHAIRMAN RAY: It has a negligible effect. I was trying to think about what you meant by "it."

MR. BRAVERMAN: They are going to compare floor response vectors at key locations, superimpose one over the other, using the .8 methodology.

CHAIRMAN RAY: Negligible difference between those two methodologies is what you mean?

MR. BRAVERMAN: Right.

And the input to that model would be a time history, corresponding to the envelope of all the soil cases that they have considered in design.

MR. MA: That is the one for response spectra, because that will be used for the piping, equipment, but the other one is we want to know the forces would they reduce or increase, so for the design itself.

CHAIRMAN RAY: Okay, well, I think we all understand that we are looking forward to your completing that review and then we'll take a look at it. But it's important; that's for sure.

MR. MA: The next one is the 04, is how do they transfer the load from containment internal structure down into the foundation. So this kind of new type of construction they use, like they put concrete inside two steel face plates. How those forces will be transferred down into the basement, that's - we asked them how to do that, because this is an unusual kind of connection.

DR. ARMIJO: They showed us in a briefing, I don't know if it was a previous meeting, the details of those connections, those joints, which are pretty robust, but apparently they haven't been analyzed, is that what you are talking about?

MR. BRAVERMAN: Well, these are the modules for inside containment. I don't know if you are referring to the shield building?

DR. ARMIJO: Shield building.

MR. BRAVERMAN: So these are different. This is inside containment.

Also I'd like to add that Westinghouse previously had several options of how to transfer the loads from the modules inside containment to the base concrete. A couple of the methods relied on what we call a direct path of load. So the load from steel face plates would have at the bottom a steel plate welded to it with a mechanical connector, then bars which would be embedded into concrete. That is considered a direct load path. The other design option which we believe they are going to finally eliminate because it has difficulty in demonstrating adequacy relies on the load going from the steel face plate to the studs that are welded to the plate - that's what ties the plates into the concrete, is a series of studs spaced a certain dimension vertically and horizontally. So the load would have to go from the face plate to the studs, then they have bars that pass from the base concrete up into the module inside the stud region. And that's not a direct load path. The load has to go from the plate to the studs to the concrete, and then from the concrete to the bar, and then the bar would pass it down.

DR. ARMIJO: That looks very different from the joints of the shield building.

MR. MA: This kind of connection, this involves in June, during an audit, they present some kind of new type of connection, so the staff is reviewing something new too. It is not really final yet.

MR. THOMAS: Brian Thomas, you are correct. The connections, the shield building itself has an SC connection, which is a module to the RC --

DR. ARMIJO: Right, I had modules confused. There are modules inside that are -

(Simultaneous speaking.)

MR. THOMAS: The shield building also has the module connection to the base mat. So both configurations apply to the shield building. But then it's the modules and the terminal to containment, that detail is still evolving.

CHAIRMAN RAY: Okay.

MR. MA: Okay, the next one.

CHAIRMAN RAY: Brian, was this detail not analyzed as part of the Rev. 15 certification? Is this happening because of the change in the seismic design? Why is this review taking place now that we just talked about, that you just mentioned?

MR. THOMAS: There has been a change in the detail of that connection.

CHAIRMAN RAY: I see.

MR. THOMAS: We questioned the load path, we question things like the sheer friction --

CHAIRMAN RAY: Because of the change, though, right?

MR. THOMAS: Yes.

CHAIRMAN RAY: All right.

(Comments off the record)

MR. MA: The next one, more important one, is the 385-SEB1-32. Currently they assume all the soil is uniform underneath the base mat, and from soil structure mechanics we now - at the edge normally you have much higher reaction than in the middle. So if you assume everything is uniform, you may not be conservative for some areas of the design. So that is why we are asking them to justify their analysis is conservative or adequate. We are still working with them on this issue right now.

And the next important one is --

MR. BRAVERMAN: Westinghouse, as John mentioned, they used constant soil springs instead of finite element representation of the soil. So that constant soil springs under uniform vertical load, you are going to get constant soil pressure. And the question then because this is called the Boussinesq effect in soil mechanics that for a foundation you would tend to have a pressure distribution higher near the peripheral edges, and that couldn't be captured in the uniform soil spring assumption. So we asked them to justify that.

Westinghouse then did a study where they represented the soil using finite elements, like brick elements, and that is the actual way of doing it, and it did show higher loads around the periphery as expected. And so because the loads were not just nominally higher, they were in some cases more significant, they are going back to reevaluate to make sure that this still, the potential margins accommodate that effect.

CHAIRMAN RAY: Joe, is this due to rocking of the structure basically?

MR. MA: No, this is not due to rocking. This is talking about static. It has nothing to do with the --

CHAIRMAN RAY: Seismic?

MR. MA: -- seismic, no. It's a modeling assumption. In their case when they model the - continually, this really continually pressure, because if you assume the elastic spring, you are really assuming the soil besides the foundation, no continuity at all.

CHAIRMAN RAY: It's the edge effect.

MR. MA: It's the edge effect.

CHAIRMAN RAY: Okay, I got it.

MR. MA: In their study in one case we saw a 60 percent increase. So 60 percent is quite a bit.

CHAIRMAN RAY: Okay, I first thought you were looking at rocky, which of course increases the loads tremendously at the edge.

MR. MA: No.

CHAIRMAN RAY: Okay.

MR. MA: The next issue we feel is

important is 27. This is regarding the how do you combine the response from the three directional input of earthquake methodology. And we did not believe they combined the forces correctly. And in the shield building report, they themselves stated if they used this - their 140-40 methodology combination, when compared to the ordinary SRS methodology, it was 16 percent lower.

When I talked to ESBWR people, they said in their case they found 60 percent lower. So it's not the methodology. It's how you apply it that's important. You have to apply it correctly. So we did not feel they applied correctly.

CHAIRMAN RAY: All right. Good.

MR. BRAVERMAN: But again during the audit for the structures in June, we did discuss a path forward. Westinghouse is going to do a study to try to address that, apparently, rather than switching to the correct interpretation of the 140-40 method, they are going to do a study to show they expect that it won't have a significant effect.

CHAIRMAN RAY: I'm going to assume there is a path forward on all issues unless somebody stands up and says, there is no path forward here, and I don't expect you to do that. So go ahead.

MR. MA: There is a path forward.

CHAIRMAN RAY: All right.

MR. MA: Those are the challenging ones. The next one is 3.8.5 foundations. The first one item we are talking about is the computer code. The Westinghouse slide says it's resolved, actually it's only resolved in the NR inspection space. It's not resolved technically. So we are doing our own complementary analysis to see which - this computer code will give you adequate result on that.

CHAIRMAN RAY: Okay.

MR. MA: Because they are using this computer code to design their foundation.

Now the other three items on this slide all become confirmatory. We already discussed with Westinghouse and they submitted something and we think it's okay.

Okay the next slide, the first item still remain open. It has just a placeholder. The second item resolved, becomes confirmatory.

The last slide is as of today how many open items remain.

CHAIRMAN RAY: Excuse me, on slide 14.

MR. MA: Okay.

CHAIRMAN RAY: Inspect the PCS tank for

significant cracking in accordance with - this looks like a construction inspection. It's not an inspection during the life of the structure, I take it, is that right?

MR. BRAVERMAN: That's correct.

CHAIRMAN RAY: Okay, so this is to verify that there is no cracking at the time of construction completion or some point before?

MR. BRAVERMAN: And filling of the tank with water, because that has a significant weight.

CHAIRMAN RAY: I see.

MR. BRAVERMAN: So if deformation or significant cracking would appear, that is the time to find out. And ACI 349.3R has specific provisions on how to do that examination, and what would be acceptable.

CHAIRMAN RAY: Go it, thank you.

MR. BROWN: Why would just one inspection at the time of filling - sometimes stresses like that take some time before they gradually relieve and crack or break something.

MR. BRAVERMAN: That's a good point. This is just one inspection right after construction. There is the maintenance rule, 10 CFR 50.65, and Reg Guide 1.16 which requires examination and inspection of seismic Cat I structures throughout the life. And if you saw the earlier open item on reg guides, I think you may have seen Reg Guide 1.60, so they have committed to that in Reg Guide 1.60, it tells you how to implement 10 CFR 50.65. So they will be monitoring it throughout the life.

MR. BROWN: Okay, thank you.

DR. ARMIJO: Could you go back to the SEB1-35 on this water proofing membrane?

MR. BRAVERMAN: Which slide was that?

DR. ARMIJO: That's slide 12, SEB1-35? The staff is asking for more details on the type and industry standard and all that. What is the staff looking for? What are the requirements for this membrane as far as lifetime, strength, tearing resistance, whatever it is, what's the issue?

MR. MA: The requirement here for structural people is, we want - once you put a membrane in, you do not want to put something with a small coefficient of friction so it will slide. So that is why we require them to have a coefficient of friction at least .55, the value. Because that is the value they design, use that value to analyze the sliding --

DR. ARMIJO: So you don't want it to be a lubricant of some sort?

MR. MA: Right, that is the exact point.

DR. ARMIJO: But as far as the rest of the property, the membrane is there for water proofing --

MR. MA: That is not our --

DR. ARMIJO: Your worry, this open item?

MR. MA: Yes.

MR. BRAVERMAN: But we still look at good engineering practices, and the life expectancy is 60 years. So any steps they take to prolong the life of concrete is also a concern.

And at one point they also even suggested to use crystalline material instead of an actual water proofing membrane, and because of questions we asked -that's like an additive, you put either in the concrete mix or you spray on in the mud mat and then you put the next layer on, so because that is a new technique, at least with our clients, we asked some questions if they could demonstrate the adequacy of that, and I guess Westinghouse then changed their mind and removed that.

DR. ARMIJO: This issue hasn't been addressed before, the potential for sliding due to membranes underneath the base mat? In other plants?

MR. BRAVERMAN: Oh, it's been addressed, because SRP 385 has a provision that you have to do a sliding and overturning stability valuation, sliding included, and show that the factor of safety against sliding is at least 1.1.

DR. ARMIJO: So there are membranes available with a coefficient of sliding friction that you are looking for?

MR. MA: We did ask Westinghouse to submit the data. I'm sorry, not Westinghouse, it was Vogtle. Vogtle wanted to use a type of membrane, so we asked Vogtle to submit the test data. And they sent us the test data that was used on a highway project that to my recollection was a coefficient of friction of about .6 and higher.

DR. ARMIJO: So that is a Vogtle --

MR. MA: That is a Vogtle plant, yes.

DR. ARMIJO: -- a Vogtle COLA issue.

MR. MA: Yes.

DR. ARMIJO: But it's going to get resolved in the DCD.

MR. BRAVERMAN: No, typically for design certification applications they put in the requirement, the criteria, and then the COLA has to provide information to show that the particular type of water proofing system or membrane they pick can achieve that criterion.

MR. MA: My recollection is, originally Westinghouse DCD proposed two type of membrane. Later on they add another one which was used by Vogtle, three. And then later on, I think it was last month we have a telephone call with them, we asked them the type of material you use is ANSYS standard. Finally we said no, we didn't need that one. So to my recollection now it's only two remaining in the DCD, two type of membrane.

DR. ARMIJO: Thank you.

CHAIRMAN RAY: Okay. We were on 15, were we?

MR. BROWN: No, we were finished, I think.

CHAIRMAN RAY: Okay, I don't know if you had finished anything else you wanted to say about 15.

Okay any other questions then for our staff presentation? We're just on time. Okay, hearing none, thank you very much.

We will be adjourning for lunch. And as I said, when we come back, just as a matter of convenience for everybody involved we will at that time start with a closed session so we don't have to have people come in and then leave. And at that time we will address one of the action items that information has been prepared for us for. So I appreciate everybody who is interested in that and should be attending to attend the start of that session which will be at 1:00 o'clock.

We will then also, following review of the action items in open session we will also do the piece on upcoming ACRS interactions again for the benefit of any who would not otherwise have to stay.

With that we will adjourn for lunch.

(Whereupon at 11:52 a.m. the above-entitled matter went off record and resumed at 2:18 p.m.)

CHAIRMAN RAY: We're going to open up the meeting now. This has been a closed meeting. We want to admit members of the public that may be available and want to participate, and we are going to take up the action item list followed by the discussion of upcoming interactions.

Sanjoy, to the extent that you want to pursue that item yourself there is no need for you to do anything more. To the extent that you want to get it captured and maybe pursued by others, if you could write down what you said at the end in a way that we can capture it, I'd be grateful.

DR. BANERJEE: It's basically not my question.

DR. ARMIJO: Harold?

CHAIRMAN RAY: Yes.

DR. ARMIJO: My real question is, this is acceptable to the staff, the methodology and the measurement of a tech spec. Ultimately what is the basis for the staff to accept it? That's all I'd like to know.

CHAIRMAN RAY: Well, perhaps we have a question for the staff, and that's fine. But right now I think if I could read Sanjoy correctly, there is a question that may be answerable from a book, and I'd just as soon get that done that if it's possible to do. And if Graham has questions he thinks we ought to pursue I'm sure he'll put them in his report to us, and we'll see to that in due course.

But I tried to give ample opportunity to pursue the question that we asked, but at some point we've got to move on.

DR. WANG: The line is open to the public now.

CHAIRMAN RAY: Okay, thank you.

Okay, what are we doing now? We are

going to talk about other action items are we?

MS. McKENNA: That was a little confused at this point, because I know you said earlier you wanted to talk about the upcoming interactions.

CHAIRMAN RAY: I was going to do that afterwards. Amy has asked me to talk about something that Mike Ryan was interested in as part of our action items.

MS. McKENNA: Okay.

CHAIRMAN RAY: Mike however has stepped out so I think maybe what we ought to do is - the intent, was it not, to review all the action items, or am I mistaken about that? Is this just all you guys wanted to do right now?

MS. McKENNA: I think it's really your call.

CHAIRMAN RAY: Okay.

MS. McKENNA: As to how you want to proceed. I think it was, we talked about some last time I believe. And whether you wanted to spend time doing this or spend the time doing the other topics.

CHAIRMAN RAY: The answer to that question is, no I don't. We will take up Amy's issue, when Mike is back and he's back now - is Amy here? All right, we are going to provide the response to another question having to do with low level rad waste, then we'll go to item 11 which is the upcoming interactions. Then we'll take up and then I assume a lot of people will scatter out of here, and we'll take up summer.

MS. AUGHTMAN: All right. So Amy Aughtman from Southern, and the action item number that I wanted to try to come back and address today is number 26. We attempted to close this in the June meeting but didn't quite get all the information I think Dr. Ryan was looking for.

So we had understood that request, a forecast of expected rad waste generation. And I don't think we have provided everything that were looking for, and it sounds more like you are interested in how much storage time we will have available in the plant before we have to start storing outside the plant.

DR. RYAN: That's sure part of it, and then it's the longer time horizon.

MS. AUGHTMAN: Right, so just as a quick refresher for everyone, because the Atomic Safety Licensing Board did admit a contention of omission in the Vogtle COLA proceeding we did include some additional information in our FSAR in Section

11.4.2.4.3 that provided options available for disposition of Class B and C waste. Should a disposal facility not be available by the desired time.

So the three options that we provided in the FSAR include storage in the auxiliary building, for a little every year and spent resin tanks, and using two tanks to mix - to limit the radioactivity concentration.

The second option was to use vendor services to process Class A, B and C waste and transfer for storage offsite until a disposal site is available.

And the third option --

DR. RYAN: Where would that storage occur?

MS. AUGHTMAN: Likely at the Waste Control Specialists facility in Texas.

DR. RYAN: Likely, but they are not currently permitted to do that, right? I don't think.

MS. AUGHTMAN: I thought they had been permitted, and --

DR. RYAN: I'm not sure about A, B and C. Maybe some of the lower end waste.

MS. AUGHTMAN: Right.

DR. RYAN: I'm not positive.

MS. AUGHTMAN: I thought they might have been because we have been having discussions with them.

DR. RYAN: Okay.

MS. AUGHTMAN: And I'm sorry my computer died during the time - and then the third option again is if additional storage capacity is needed we would either construct or expand the storage facility onsite or gain access to a storage facility offsite at another licensed nuclear plant, and we do have three other facilities that we operate.

I do want to note that the contention that was in our proceeding has been dismissed since then, so we are no longer dealing with that. But that is the reason why this information was provided in the application.

So as part of that, in addition to providing those options to expand upon what we would do if we built a facility onsite -

(Microphone interference)

CHAIRMAN RAY: Go ahead.

MS. AUGHTMAN: So to I guess show what we would provide if we were to construct a facility onsite, we in the application gave some general design criteria, and programmatic criteria that we would follow or commit to and employ should we have an onsite storage path. And those criteria were based largely on the EPRI guidelines, the technical report number is 1018644. And the title is Guidelines for Operating an Interim Onsite Low Level Rad Waste Storage Facility.

And the final version I think is Rev. 1 of 2009. And I'll talk about later that gets referenced in an NRC regulatory issue summary.

So my read on the staff's SER in chapter 11 is that we provided enough information to give them reasonable assurance that we will have enough onsite and offsite contingent storage capacity for Class B and C low level rad waste to eliminate or at least significantly delay the need to design and build additional onsite storage for Class B and C waste.

Having said all that it seems that depending on what waste management techniques are employed there could be enough storage space available in the plant anywhere form three to 10 years, and that would include storage available in both the auxiliary building and the rad waste building.

So I don't know if that --

DR. RYAN: That is an excellent answer, and I appreciate the reference to the other documents that you have cited from your other material. I'd like to mine the transcript and get all those for sure and take a look, but that is pretty helpful. It's nice to know you have a plan, and I realize this is not a problem of your making to solve. So it's a good reaction. Thank you for the details. It's very helpful.

Mr. Chairman, short of mining the documents for anything else that pops up, there might be a followup question, but I'm satisfied with the answer.

CHAIRMAN RAY: Thank you very much. We will then consider that item to be closed by presentation Amy has made. And Weidong, also, on the one that we heard earlier, flow measurement, just for bookkeeping purposes we will consider that to be closed, but do identify provisionally another one which has to do with a statistical treatment of the data that are used. And it's perhaps not a good wording of the issue, but just take it for that for now.

And so that we make sure that Sanjoy is satisfied, or that we do something else, and then of course if we get other input from our consultants we will treat that at the time.

Okay with that, then thank you Amy, we are going to move to item #11. I've been asked to do this again out of the order shown because there are folks here who are not part of the summer presentation who would like to have the benefit of our discussion with staff on this item. This is a normal updating process that we go through. And Ravi, go ahead.

UPCOMING ACRS INTERACTIONS

MR. JOSHI: I'm going to start with the finished chapter 2, 16 and 17. My understanding that there are no meetings scheduled for the month of August. Therefore what you see on the slide I'm going to be talking about the next interaction that we have with the ACRS will be September 2010, and I think the dates are 20 and 21.

CHAIRMAN RAY: That's right.

MR. JOSHI: What we are proposing right now based on our current progress is we will have DCD chapter 5, 7, 8, 13 and 18.

CHAIRMAN RAY: Right, now I take it that's because DCD Chapter 6 and 15 which you show in October will not be available at that time?

MR. JOSHI: That's correct. So we will be talking about October, which I believe is only a one-day meeting at this point?

CHAIRMAN RAY: It is at this point but we are looking to see if we can get part of another day. I'm sure you can use it if we do.

MR. JOSHI: We can.

MR. BROWN: Harold?

CHAIRMAN RAY: Yes.

MR. BROWN: I started telling people about six weeks ago, I will not be here for the September meeting.

CHAIRMAN RAY: I understand.

MR. BROWN: So the Chapter 7 and the back part. And there are open issues. I'm out of the country. And I discussed them with Mike Melton earlier at the break at lunchtime, the two or three open issues still, the ones we discussed last time.

CHAIRMAN RAY: Well, we'll have to make some arrangement for you all to gain access to the information you need as having respective areas of expertise. But I believe we should stick with this schedule, unless we can find a substitute as we continue on here. So it would affect --

MR. BROWN: Chapter 7?

CHAIRMAN RAY: I tell you what, let's let Ravi go ahead with what he has presented.

MR. BROWN: That's fine, I just wanted to put it on the table, that's all.

CHAIRMAN RAY: What I'm going to ask everybody to do is give us individual feedback subsequently based upon which we may request staff to juggle some dates. Okay?

MR. JOSHI: This is based on our current progress right now.

CHAIRMAN RAY: All right.

MR. JOSHI: This could change.

CHAIRMAN RAY: Without consideration of availability of members, I understand.

MR. JOSHI: We can adjust based on your availability also.

CHAIRMAN RAY: Okay what we will do then is we will determine availability. I know for example and I was just about to ask, is six and 15 where we do GSI-191?

MR. JOSHI: That is correct.

CHAIRMAN RAY: All right, because we had already indicated that's the purpose there. I'm going to try and bend Sanjoy's arm and have him chair that. Since I'm not sure what value I can add to the discussion, but I will be here anyway.

MR. JOSHI: One of the reasons that we only put Chapter 6 and 15 in October was because you are a one-day only, and --

CHAIRMAN RAY: I understand.

MR. JOSHI: So certainly what we could do also is that some of the chapters that we are talking about in September we can certainly move, as Chapter 7. We can certainly adjust the final --

CHAIRMAN RAY: All right, well, just bear in mind, I don't think we should take the time here to try - because it is more than Charley, it's Mike and Dennis.

MR. JOSHI: The only point I want to make is that as a part of the September meeting we are also trying to get some response to the issues, specifically Section 2.4, which has not been discussed today, so we want to bring that in September timeframe. And also emergency plan, which is a plant specific issue for this summer. So those are two items we want to bring, that's the whole plan right now.

CHAIRMAN RAY: Okay, but as we said last time we had this discussion, and I want to reiterate now, we have to follow priority. The priorities are the way they're listed here: DCD, Vogtle, and then Summer.

MR. JOSHI: Yes.

CHAIRMAN RAY: Okay?

MR. JOSHI: Yes.

CHAIRMAN RAY: And so we don't have any other choice in the matter. I believe everybody is on the same page there. And so Summer will get addressed within reasonable - all right, it'll be addressed as we're able to do so given the two priorities.

MR. JOSHI: The last slide only talks about the long term remaining, November and December meetings. The November meeting is the remaining chapters that we are not able to complete in September/October. So this is what really catch all the remaining chapters for. DCD is for the Vogtle. And now the December is only we're talking about is not a subcommittee, it's a full committee meeting. So if we are able to complete everything by November timeframe certainly we are talking about full committee on December 2nd and 3rd, to go over all the chapters for DCD and all the chapters for Vogtle.

And as I've talked about previously someone is going to be coming just behind that. So right now we are proposing to have some discussion also in the November - December timeframe also.

CHAIRMAN RAY: All right, well, you are basing this on your projections of the completion of your work and the presentation to us. I just want to say at this time that I can't see as far as December, and there are many things from the standpoint of you completing your you can see better than I can sitting here now.

So what I believe is that we can look beyond November, that is, we can look to December, not sooner than October.

MR. JOSHI: Okay.

CHAIRMAN RAY: In the October meeting we can say, all right, this is what we perceive. But I can't say that sitting here now. Okay?

MR. JOSHI: Any comments or questions.

MR. BROWN: September 21st, is that the one --

CHAIRMAN RAY: Excuse me?

MR. BROWN: September 21st and 22nd, is that still --

CHAIRMAN RAY: 20th and 21st.

MR. JOSHI: It's the Monday and Tuesday.

CHAIRMAN RAY: They pushed us up because of other things going on that week, Charley.

MR. BROWN: Okay, well, I've got to check something. I might be able to fall back in.

CHAIRMAN RAY: Now just you but I would

ask everybody here please identify and I know Mike and Dennis both have already mentioned to me just now, I can't be here at certain times, well, that becomes critical if there is scheduled material as there was today when Said isn't here and I had to ask Sanjoy to step in on this measurement, I'd like to minimize the extent to which that happens if we can avoid it by working with Ravi to schedule when things happen. So please let us know, let Weidong know, when you are not going to be here and if there is something planning for those times so that we can try to make an adjustment if we possibly can.

DR. ARMIJO: Mr. Chairman?

CHAIRMAN RAY: Yes.

DR. ARMIJO: I've lost track of the DCD chapters, we've reviewed so many. Are these in their final versions that we will be seeing in September or October, or will we still be getting them with a bunch of open items?

MR. JOSHI: To answer that question, the answer is yes. The chapter that you have seen in the past in the July meeting, those are what we call advanced final safety SER with no open items. The chapters you will see in September, October and November are exactly the same things. That means we are presenting the chapter with no open items. It's a final SER.

DR. ARMIJO: With no open items?

MR. JOSHI: With no open items.

CHAIRMAN RAY: Boy oh boy, if you are talking about seismic, there's a ways to go on 3.7 and 3.8, I'm telling you.

MR. JOSHI: When you look at the November meeting with Chapter 3, the Chapter 3 consists of everything from 3.1 including 3.7 and 3.8 also. So that is the final SER, what we call advanced final SER with no open items.

CHAIRMAN RAY: And in looking at that, just to give you some candid feedback here, you'd say well, if AP-1000 Chapter 3 and other chapters must have priority in the November meeting, the likelihood that we are going to be doing a lot of heavy lifting on summaries isn't great. To the extent that we can deal with a specific issues such as is listed here, that is a different matter. Very much like we just did with Amy on low level waste, well, okay we can put that in. But a broad scope review is going to be late in the day I tell you in November.

You said you were done. Anything else?

MR. CUMMINS: Ed Cummins, may I ask,

Chapter 6, we only have a one-time review?

MS. McKENNA: I was going to say, to answer Dr. Armijo's question, we had not brought to you as an SER with open items. We were bringing it more as a final SER in this case, because --

DR. ARMIJO: But that's got the shield building.

MS. McKENNA: Chapter 6 is more the PSI 191 material and some other things.

DR. ARMIJO: Chapter 6 is a big chapter.

MS. McKENNA: So it is a big chapter.

CHAIRMAN RAY: I mean if you just sat down and listed all the things that are currently under review by the staff, which may warrant some substantial review by the ACRS, it's a substantial list.

MS. McKENNA: Yes, it is. We are concerned that we might not have enough days currently scheduled to do this.

CHAIRMAN RAY: All right, that's understood. And you understand I'm saying, look we're going to have to get to October before we can see the end of the year. That's I think all we need to do right now.

Everybody else satisfied? Okay, thank

you.

Okay, now we're ready I believe for summer. It's 20 minutes to 3:00. I think I'd get better cooperation from my colleagues if I allowed a break, and so I'm going to do that. And I'll ask you, we'll make it 11 minutes long if we can do that. Otherwise I will wait until you can return, but I will ask you to come back at 10 minutes to 3:00.

(Whereupon at 2:38 p.m. the above-entitled matter went off the record and resumed at 2:51 p.m.)

CHAIRMAN RAY: Okay, we're back on they record. Steve Summer's son is here. Steve Summer is here.

MR. SUMMER: There are actually some people who ask me that a good bit. One of his sons does work for SE&G, so. If I'm related you have to go back to the 1700s. So nothing close enough to count.

CHAIRMAN RAY: All right, you are here to present to us COL Section 2.3.

MR. SUMMER: Right, and hopefully this will

SUMMER COL SECTION 2.3 - APPLICANT

MR. SUMMER: As you see on the display I'm supervisor with Skena Services. Skena Services is a - well its services kind of supports the other companies in Skena, which is a holding company which owns SC&G. So I used to be an SC&G employee. They put us in Skena, but nothing really changed.

CHAIRMAN RAY: We won't talk about that.

MR. SUMMER: Major items of interest, the first thing the DCD is incorporated by reference and we discussed - there was a good bit of discussion on this yesterday. The departure of 2.0-2 deals with the maximum safety wet bulb temperature noncoincident of 87.30, which is a value 1.2 degrees Fahrenheit above the AP-1000 DCD value of 86.1 degrees.

Other major items of interest, COL information items, regional climatology, local meteorology, onsite meteorological measurement program, short-term diffusion estimates, and long-term diffusion estimates.

Continuing with major items, with the exception of the previously discussed departure the AP-1000 required siting characteristics are fully accepted.

Got an aerial photo here to give you a little bit of overview of how we're laid out. If you look at the top of this slide you can see where the Unit #1 meteorological tower is located, in this area. This is right adjacent to Monticello Reservoir. You might remember, Monticello Reservoir is the upper pool, and Parr Reservoir down here is the lower pool for the pump storage unit that is located right here.

So Unit #1, being a once-through cooled plant, sits very close to Monticello Reservoir, and the elevation has changed probably in the neighborhood of 10 feet or so or 20 feet maybe. It's not a large difference between the elevation between Monticello Reservoir and Unit #1.

The new units will be in this area down here. We chose the location for a new met tower in this area. When we started the process of looking at licensing new plants we usually need a new meteorological tower. We looked at locations, and this site was picked because of its topography and elevation and being away from large structures and buildings that would not interfere with the readings.

One thing that happens to Unit #1 met tower is because of the differential heating and cooling of land and water there with the lake, during calm conditions you can get onshore and offshore winds, so there are some effects from the lake.

When we were first getting ready to file the application we were just erecting the new tower. We didn't know that we'd have enough time to get the two years of data from the Unit #2 and #3 tower, so we went ahead and used data from the Unit #1 location originally, and then after we got the units #2 and #3 tower operating for two years we substituted that analysis with the new met data.

DR. HINZE: So you have overlap in the data sets?

MR. SUMMER: No, we didn't.

DR. HINZE: Wouldn't that be helpful, though?

MR. SUMMER: Well, we did a comparison of the two.

DR. HINZE: But that means you must have had some overlap.

CHAIRMAN RAY: Well, I think, Bill, what they are saying here, and I would certainly concur, is that the proximity to the lake significantly affected the Unit #1 data and made it really not something you'd want to see used for #2 and #3.

MR. SUMMER: Right, we looked at the - compared the two groups of data, and there were - the lake effects were higher than we originally expected, so we went with the Unit #2 and #3 data. Although even with using that #2 and #3 data the overall conclusions were effectively unchanged. So the outcome is the same even though there are individual hours and maybe some differences between the two locations. And we will use the Unit #1 tower as backup tower for the Units #2 and #3, and Units #2 and #3 as backup for Unit #1.

And that's all I have.

CHAIRMAN RAY: Okay, well, we did still wonder about something, but I'm not going to ask you about it, because I don't think it's something you should have to answer. But we are still pondering why this is an exception rather than just a change in the envelope to the certified design, but we'll leave that go.

Questions?

MR. SUMMER: Maybe there are some advantages to going late on the second day. (Laughter) And we discussed a lot of this yesterday.

CHAIRMAN RAY: I agree. Don't need to go into it now. Thank you.

MR. SUMMER: Thank you.

CHAIRMAN RAY: Mr. Quinlan.

SUMMER COL SECTION 2.3 - STAFF

MR. WENTZEL: I am Mike Wentzel. I am the chapter project manager for Chapter 2 of the Summer application review. And now we're going to discuss the staff's review of Section 2.3.

Here you see our staff review team. Basically Kevin Quinlan who is our reviewer of the meteorological portion of Chapter 2, and with that I'll turn it over to Kevin who will discuss it.

MR. QUINLAN: Good afternoon.

CHAIRMAN RAY: Good afternoon.

MR. QUINLAN: As Mike said my name is Kevin Quinlan. I'm a meteorologist in the siting accident consequences branch of the Division of Site Environmental Review. And I was the lead reviewer for Section 2.3.

As you know Section 2.3 of the FSAR incorporates by reference of Section 2.3 of AP-1000 DCD. I also wanted to note that Section 2.3 was completed with no open items.

There are five subsections to Section 2.3. First one is regional climatology, second one is local meteorology, then onsite meteorological measurement program, short-term atmospheric dispersion estimates for accident releases, and the fifth is the long-term atmospheric dispersant estimates for routine releases. So SER Section2.3-1 involves a review of the regional climatological information. It addresses one AP-1000 COL information item. One supplemental information item. And has the one departure.

AP-1000 COL information item, VCS COL 2.3-1, states that the applicant should provide the site specific information related to the regional climatology. The applicant presented this information in the FSAR Section 2.3-1. They also provided the supplemental information relating to all five of the subsections of Section 2.3.

Supplemental information discussed climatological and local meteorological conditions, the onsite meteorological measurements program, as well as the short term and long term diffusion estimates.

In Section 2.3.1 the applicant found that the site specific zero percent exceedance noncoincident wetwell temperature to be 87.3 degrees Fahrenheit. This temperature did exceed the AP-1000 DCD site parameter temperature of 86.1.

Staff considers the zero percent exceedance value to represent the greater of the historical maximum or the 100-year return period value as discussed in the standard review plan.

The noncoincident wetwell temperature for the summer site presented in the FSAR is the 100-year return period value.

And as a result of this the applicant submitted a departure VCS 2.0-2, and the staff has found the site characteristic noncoincident wetwell temperature of 87.3 degrees Fahrenheit to be correct and acceptable for the site.

Moving on to Section 2.3-2, it involves the review of local meteorological information and addresses just one AP-1000 COL information item which I had them provide information on local meteorology.

Staff determined the applicant provided this information and all of it was correct and adequate.

Section 2.3.3 involves the review of the onsite meteorological measurements program, and addresses one of AP-1000 COL information items. It states that they should be providing the site specific onsite meteorological measurements program information.

The staff determined that the applicant provided all this information in 2.3.3 and it's correct. As discussed by the applicant, a new meteorological tower was built for Units #2 and # and began recording data in December of 2006. The staff verified the location of the new tower that is representative of the site, and meets the guidance provided in Regulatory Guide 1.2-3, Revision 1.

The Unit #1 meteorological tower is discussed, we'll service back up source for units #2 and #3, routine server maintenance and during accidental atmospheric releases.

Section 2.3.4 involves a review of the short-term atmosphere dispersion estimates that are used to evaluate design basis accidental releases to the explosionary boundary, outer boundary, below population zone and the control room.

SER Section 2.3.4 addresses one AP-1000 COL information item.

This COL information states that the applicant shall provide the site specific short term atmospheric dispersion estimates.

Using NRC-approved computer models, the applicant has provided all the information in the COL information item, and the staff has confirmed the results through independent analysis and accepts them as correct and adequate.

CHAIRMAN RAY: Now you may have heard the discussion yesterday?

MR. QUINLAN: Yes, I wasn't here but I

was informed of what was going on.

CHAIRMAN RAY: All right, one question at least. It's been suggested by someone that the unique discharge of containment activity leaking from the containment in an accident scenario, the unique discharge of that radioactivity out the top of the shield building represents a difference that would result in some nonconservatism. We have - in the analysis -- we've heard I think that that's not the case, that the ground level point source release is assumed, that it is conservative relative to an other discharge point such as the top of the containment that would be the reality. Is that accurate from your standpoint?

MR. QUINLAN: That's accurate for part of Section 2.3.4. I believe you discussed the PAVAN results yesterday.

CHAIRMAN RAY: You believe we discussed what?

MR. QUINLAN: The PAVAN results yesterday, PAVAN computer model. So that's true, we did assume a ground level release for that, and we used building weight assumptions.

CHAIRMAN RAY: So you don't foresee even for the exclusion area boundary that there could be any increase of enhancement of the release effects as a result of it being -someone having it elevated, it's not like a stack but of course the top of the containment? I can't, but I just want to make sure that you are in agreement that that's not something that would increase the exclusionary boundary dose or affect the chi over q in an adverse way.

MR. QUINLAN: No, I believe an elevated release like you're talking about would actually lead to more dispersion which would create greater diffusion, so a less of a source.

CHAIRMAN RAY: Well ,that's what I would think too, but you're the expert, so I just wanted to make sure I checked with you. Okay, thanks.

DR. BONACA: I had a question on page four, regional climatology.

MR. QUINLAN: Yes.

DR. BONACA: Well, essentially, a wetwell temperature, 87.3, is exceeding the AP-1000 DCD. And these were accepted? What happens to the envelope?

MR. QUINLAN: Sir?

DR. BONACA: What happens to the envelope for this parameter, the DCD?

MR. QUINLAN: Just for my review was just to confirm their value of - well whatever value they presented. And for my section I determined that their value was a conservative calculation with conservative assumptions.

CHAIRMAN RAY: Mario, you were asking what happens to the envelope? Did I hear you correctly?

DR. BONACA: Yes.

CHAIRMAN RAY: Well, I think that any exception to this, or any other one simply means that for this COL the envelope is bigger, but only for this COL. So we have to think of all the implications that that has for the certified design. That is my take on it anyway.

MR. SEBROSKY: This is Joe Sebrosky. I'm the lead for the safety review, lead project manager. That's correct, Mr. Ray. It's a site specific exemption request. It is being processed unique for Summer. There is also another exemption request that was proffered on Turkey Point for a similar value.

CHAIRMAN RAY: So we have to look at all of the systems that are affected by this temperature to make sure that they aren't - and that they can still meet their required function?

MR. SEBROSKY: That's correct, and meet

the licensing basis would be unique for Sumner. The safety evaluation report would be unique for Sumner.

CHAIRMAN RAY: Okay. Thank you.

MR. QUINLAN: Okay, and the last section is Section 2.3.5. And this involves a review of the long term atmosphere dispersion estimates that are used to evaluate releases of radiological effluence to the atmosphere during normal plant operation. And this section one AP-1000 information item.

This information item states that the applicant should provide site specific long term atmospheric dispersion estimates. Using the approved NRC computer models the applicant provided all this information to us. The staff confirmed the results through our independent analysis, and has accepted them as correct and adequate.

CHAIRMAN RAY: Questions? Any other questions? Thank you.

All right, now we will take up our last section in two parts. The first part is the applicant's presentation of Section 2.5.

I'd like all the members to note how magically we are back on time.

(Laughter)

I know we're not done, but we're back on time, so far so good.

(Comments off the record)

SUMMER COL SECTION 2.5 - APPLICANT

MR. WHORTON: My name is Bob Whorton. I'm a consulting engineer with SCE&G for the Virgin C. Summer Nuclear Station. I've been employed with SCE&G for 39 years now. I was involved in the original licensing construction, engineering and operation of Unit #1, and since 2005 I've been part of the original team in siting layout design and construction for the new units #2 and #3.

Before I go any further, I would like to make sure I have all the subject matter experts. We have on the far table John Davie and Dave Fenster from Bechtel. And on the phone I'm going to do a quick roll call. I hope we were connected here.

Is Scott Lindvall on?

MR. LINDVALL: Yes, Bob.

MR. WHORTON: Thank you.

Robin McGuire.

MR. McGUIRE: Yes, Bob, I'm here.

MR. WHORTON: Great.

Joe Leitheister?

MR. LEITHEISTER: I'm here, Bob.

MR. WHORTON: Okay, and the last one,

Farhang Ostadon, if they contacted him. Okay, he may not be on yet. But we'll go ahead and get started.

Okay, I'm going to review a few slides just to refresh your memory quickly and look at a little bit of the construction activities which do tie in to Chapter 2.5. Again Summer site is located in the central portion of South Carolina, approximately26 miles northwest of Columbia, and we did reference the Vogtle and Lee sites just for reference as the other projects in the area.

Units #2 and #3 are located at approximately one mile southwest of Unit #1, and Monticello Reservoir, and approximately one mile east of Parr Reservoir Broad River draining system.

In the artist's conception we showed you yesterday showing the rendering of the new units #2 and #3 located southwest of existing unit #1.

The next view is an aerial view from 2007, and the purpose here is just to show you preconstruction of the site area. You see where units #2 and #3 are located where I have identified there, and you'll notice that the terrain in this part of South Carolina is gently rolling hills with local relief to streams and to the Broad River Parr Reservoir system to the west.

The view here is January 2010, and you can see the construction of infrastructure and site grading is well underway. That's six months old and it has dramatically changed in the past six months. Most of the roads are complete. We've started the excavation as you'll see here in just a moment.

CHAIRMAN RAY: While we're looking at this picture, and this isn't really a fair question, but I think you probably know the answer, given your experience, but while we're looking at this, I understand there's a physically divided but electrically integrated switchyard to serve all three units planned. Are there other common facilities, emergency operating facilities, other things? I realize there wouldn't be a common control room obviously, but anything else you can identify that is shared with Unit #1?

MR. PAGLIA: This is Al Paglia, and there will be a common tech support center. And there will be a common EOL also for the entire station.

CHAIRMAN RAY: I see, all right. Okay, I'm just trying to process that. Okay, fine.

MR. WHORTON: Just for reference the new substation area is on a hilltop about where the cursor is being shown there. The existing substation for unit #1 is just south of the existing unit #1 plant.

Okay, the next slide shows you some of the excavation for unit #2 power block. After achieving the nominal plant grade for the site, which for us is elevation, mean sea level elevation 400 which relates to the AP-1000 being elevation 100, we have started the excavation of unit #2. And what we're using for the excavation for each individual unit is a temporary soldier pile retaining wall system, and it's being installed with geological mapping occurring as the installation of the retaining wall proceeds.

The excavation is taking place in 5 - 6 foot lifts, prior to it - lagging being placed. And then once the geologic mapping is completed, then the wooden lagging is put on and additional tie backs are installed, as you'll see in this next view. This is a northeast view of the unit #2 excavation showing the second and third lifts underway, and each panel section of each geologic - of each lift is geologically mapped using GPS, survey and photographs.

The recorded results are then digitally stitched together to provide a panoramic view and record of the geologic setting for the immediate area.

CHAIRMAN RAY: Is this being done under an LWA?

MR. WHORTON: No, sir, it's not. This is a preconstruction activity. All the things you'll see in the photograph are identified as preconstruction.

DR. HINZE: This is a saprolite that is being removed?

MR. WHORTON: Yes, and I'll go through the layers of influence a little later on in 2.5.4.

DR. ARMIJO: How deep do you have to go for this?

MR. WHORTON: Once we have gotten the site table top down to elevation 400, we are going down to the 40 foot depth approximately, which is the embedment depth for the AP-1000 nuclear island. And you'll see shortly that rock conveniently exists at about that elevation.

The purpose of our geologic mapping is to capture all of the geologic evidence of the excavation prior to reaching the bottom of the base level for the power block foundation. This is another view of the unit #2 looking to the south. And you'll note that tie backs have now been installed on the retaining wall as the excavation progresses.

And the building you see in the back that was mentioned earlier, it's the erection of a module assembly building, which is also a preconstruction activity. That's where the major modules will be fabricated together in preparation for installation.

And finally one more geological mapping. This is what one panel section looks like between the vertical piles. And this is a fairly recent photo from about two to three weeks ago. The elevation of the panel is approaching final depth of the unit #2 excavation, and you can see just within this one frame the complexities of the geology, and we'll talk a little bit more about that as time goes on.

(Comments off the record)

MR. WHORTON: Just a couple more construction photos and then we'll get into 2.5. We wanted to show you some of the other construction activities that are taking place. And this is just a drawing showing that we have started installing our circulating water pipes for units #2 and #3. Again as preconstruction activities within the jurisdiction of the interim staff guidance allowing such activities.

The next photo is a view of units #2 and #3, of the installation. And you'll notice that each unit uses four circulating water pipes at 10-foot diameter each.

And finally one last photo here. This is a view of the unit #3 circ water pipes being installed. And then they are encased with a flowable concrete fill material. You can't see it very well in the diagram, but that is the intended purpose that it will be encased.

So I'm going to jump now into the SAR Section 2.5 technical development. This section was developed by the --

CHAIRMAN RAY: Excuse me, because I looked at the cooling pipes I couldn't help wondering, you're using what ultimate heat sink? Tower?

MR. WHORTON: The cooling towers, yes.

CHAIRMAN RAY: That use these lines?

MR. WHORTON: Yes. Those are going towards the cooling towers.

CHAIRMAN RAY: Well, you don't have a stand alone separate ultimate heat sink?

MR. WHORTON: No, no we do not.

Okay on the development of --

DR. ARMIJO: Just one quick question.

MR. WHORTON: Sure.

DR. ARMIJO: The railroad tracks, who owns the railroad?

MR. WHORTON: That is a spur line that SCE&G owns. It runs about 2-1/2 miles from the main railroad line that we heard about yesterday, which is paralleling the Broad River-Parr Reservoir system.

DR. ARMIJO: And that is for your use exclusively?

MR. WHORTON: It was a unit #1 spur line from the early `70s, and we have modified it and changed it slightly going through the unit #2 - 3 site area.

DR. ARMIJO: Thank you.

MR. WHORTON: Okay, in the Chapter 2.5 development, it was developed by SCE&G and Bechtel using subcontractors of William Lettis & Associates, Risk Engineering and Macctec, and we also had a senior technical advisory group which on the next slide you'll see is composed of a very high level of expertise personnel.

And I will wrapup the presentation with their summaries and conclusions of their involvement in this process.

Sections 2.5.1 and 2.5.3 cover the basic geologic and siting information and surface faulting. We followed the regulatory guidance in developing geologic maps and in performing geologic investigations. This map shows a 200-mile map of tectonic features that was prepared. The next slide is the 25-mile geologic map, followed by the 5-mile geologic map, and finally the .6 mile Surficial Geologic Map.

And again you can see on this map the location of unit #1 relative to units #2 and #3.

The geologic and geotechnical evaluations including the soil and rock borings on the site define the Summer units #2 and #3 site foundations as sound rock. And we will discuss this a little more shortly.

An important aspect of units #2 and #3 tie back to unit #1 relative to some of the geology that was discovered, geologic features discovered during the construction of unit #1, and also due to the formation of Monticello Reservoir for unit #1 and the Fairfield pump storage facility whereby some earthquakes started occurring which we termed reservoir-induced seismicity. So I do want to cover those aspects, because they tie in to part of our design requirements and design features for the plant.

The view you are looking at is a foundation map for unit #1. And in 1971 we had two units actually on the books to be built. So unit #1 was on the right, and then a proposed unit #2 was on the left. About in 1974 we dropped down to a single unit even though we had excavated the entire hole for the two units, and we did detailed geologic mapping. As part of the geologic mapping we did find sheer fractures in the excavation, and sheer fractures are also termed faults.

The excavation mapping of unit #1 found small bedrock shears. These minor features were demonstrated to have last moved between 300 million and 45 million years ago. It was concluded through the evaluation that the minor bedrock shears likely exist throughout the site and in fact throughout the entire Piedmont Region, and they do not represent a surface rupture hazard.

I will have a little more discussion because this is a key element of why we are doing the geologic mapping and results being critical to the overall design requirements for units #2 and #3.

The way the unit 2-3 COLA has presented the results based on all the geologic evidence we have determined that there are no quaternary faults or capable tectonic sources existing within 25 miles of the actual site. And the maximum potential for vibratory ground motion at the site due to any reservoir induced seismicity is bounded well by the AP-1000 certified seismic design response spectra.

And I also plan to give you a little brief presentation on the reservoir and do seismicity since they played a key role in not only unit #1 but also in determining safety significance for units #2 and #3.

I'm going to move on now to the vibratory ground motion section 2.5.2. Again there was fairly prescriptive processes on how you develop your seismic hazard at your plant site. One of the first steps is to update the seismicity catalogs which were originally developed using the EPRI database that is from the 1980s. So we did our seismic hazard evaluation to incorporate the seismicity catalogs. Our probabilistic seismic hazards analysis replicated the EPRI results for 1989. They evaluated the effect of the updated seismicity.

We also updated the Charleston seismic source. We subsequently then developed seismic hazard, and uniform hazard response spectra for hard rock site.

And finally you go to the development of the vertical to horizontal motion ratios, and the ground motion response spectra, again for our hard rock site.

Three seismic source areas were reexamined to evaluate the effects of the additional seismicity which also included the eastern Tennessee seismic zone, which had more recent issues relative to any recent events that may change the basis of the understanding of that zone, but we did include all of the latest date for that area.

Four geometries were used for the updated Charleston seismic source models, which was consistent with the other applications.

The summary of the models that were used determined that there were no new capable tectonic sources identified within the site region. There were no modifications to the Eastern Tennessee Seismic Zone required.

The updated Charleston model replaced the EPRI sources, as was adopted from the Vogtle application.

The New Madrid, Missouri source was added, which was adopted from the Clinton initial characterization.

So the process - and I am moving quickly, but there is a lot of information to cover - the process basically takes all of the input data, and from these results a set of peak ground acceleration seismic hazard curves were developed. This is only one representation of hazard curves, and this one is at the deep ground acceleration level.

Next in the process you have development of the uniform hazard spectra for the particular site for the rock site at Summer. And then you develop your horizontal and vertical ground motion response spectra which were developed using the accepted approaches described in ASCE 4305 in Regulatory Guide 1.208.

So lastly in comparison the blue dashed line as shown in this figure you saw a similar figure earlier today - let me start over here, the red line is actually the AP-1000 certified seismic design response spectra, which is anchored to a point 3G acceleration.

The darker or black line, solid line, is the hard rock high frequency spectra which was described also today and the dashed blue line is the VC Summer units #2 and #3 ground motion response spectra, which is our design input ground motion. And as you can see we are enveloped by the hard rock high frequency spectra, and the exceedance you see in the approximate 25 Hertz frequency range is being handled generically by Westinghouse as part of resolution in Section 3.7.

CHAIRMAN RAY: The exceedance you are referring to is between the dashed blue line and the black line?

MR. WHORTON: Well, the exceedance is actually above the certified seismic design, which is from about this point here --

CHAIRMAN RAY: Oh, I see, of course I understand that. But I guess I was thinking you were pointing at something else.

MR. WHORTON: Oh, no, we are bounded by the hard rock high frequency spectra.

CHAIRMAN RAY: Right.

MR. WHORTON: And in fact for your information the hard rock high frequency spectra was developed from the existing hard rock sites that were current applications for the AP-1000, which were Bellefonte, Summer and the lease site, Duke Power.

The ground motion response spectra were developed for each of those three sites, and then all of those were enveloped and then bumped slightly to develop the hard rock high frequency spectra.

Moving on to Section 2.5.4 on the site geotechnical characterizations, and here Dr. Hinze will get into the layering of materials at the Summer site. We basically have five layers of materials in the site area. The upper layer which is the reddish clayish material is called the residual soils. Below that is the more yellow silt and sand material which is the saprolite material, saprolitic material, which is a completely weathered rock but it preserves some of the relic rock structures.

You then come into a layer of partially weathered rock which may be 5 - 10 feet, maybe less. Below that is the moderately weathered rock, which again may be just a few feet in thickness. And then you immediately come to the sound hard rock.

Now what we have found is that from the geotech evaluations the residual soil and the saprolite soil are not acceptable for any power block foundation considerations. So for the excavations of the power blocks we are removing all of the residual and saprolitic soils.

For the nuclear island we will be going down to sound rock. For the adjacent structures, and I will show you8 a figure in just a second, we will be building off of a minimum of the moderately weathered rock with an engineered backfill which will be imported from an offsite location.

The next slide is just to illustrate that for units #2 and #3 we well exceed the average sheer weight velocity of a 1,000 feet per second or greater, which also matches what was presented this morning from Westinghouse showing that their hard rock criterion is 8,000 feet or greater.

DR. HINZE: Bob, in the Westinghouse presentation they used 8,000 feet per second as I recall, not 9,200. Where is the difference?

MR. WHORTON: The problem most of the COLA applicants have found as part of the investigations is that the 9,200 feet per second was more of a generic classification of a true sound rock. It was more of a generalized classification. If you look at this chart you will see that we, just below foundation level, immediately jump above the 9,200 feet per second line, which is actually the dotted red vertical line there. It's only in the lower part of the foundation. So Westinghouse's analysis was based on 8,000 feet per second originally. So what we have determined is that achieving 9,200 feet per second is almost impossible anywhere in the country unless you really go down to great depths in the sound rock.

DR. HINZE: You reached 9,200 in the partially weathered, the moderately weathered?

MR. WHORTON: No, we're actually into the sound rock at that point.

DR. HINZE: You're into the sound rock --

MR. WHORTON: Yes.

DR. HINZE: -- with that 9,200.

MR. WHORTON: Yes.

DR. HINZE: And that's where you are taking the nuclear island?

MR. WHORTON: We are taking it, but immediately at the foundation level of the nuclear island. We are not quite at 9,200 feet per second. But we do exceed the threshold that Westinghouse had established of 8,000 feet per second.

DR. HINZE: Thank you.

DR. MUNSON: This is Cliff Munson. If I could add to your question, the 9,200 feet per second is the hard rock value for the attenuation relationships that EPRI used. So by meeting the 9,200 feet per second they do not have to do site response.

DR. HINZE: Okay.

MR. WHORTON: Okay, the next slide is just one cross-section representation of the power block area, just showing that we are founding the nuclear island on a sound rock base, which obviously with the irregularities of the rock surface it will have some concrete fill as part of that base. However as with the other power block structures we will excavate all the saprolite and residual soils down to the moderately weathered rock layer, and then replace that with an engineered back fill.

Also as part of 2.5.4 liquefaction has to be addressed. And our soils liquefaction potential was evaluated with the overall conclusion or the final conclusion that liquefaction cannot impact plant safety. And the basis is that the nuclear island is on sound rock, or on concrete on sound rock, the other power block structures including the seismic Category II annex building and turbine building are on compacted structural fill which will not liquefy under proper compaction methods.

Additionally the groundwater is approximately at the rock surface level, so our existing groundwater table is roughly where the rock surface, the sound rock surface, is located.

DR. HINZE: So you didn't do a paleoliquefaction study piece.

MR. WHORTON: And then of course we are not using any of the saprolite materials for any of the loading conditions.

I want to revert quickly back to the excavation of unit #1 and the sheer fractures, just to give you an overview of what we encountered then and the importance to date.

In late 1973 while unit #1 was being

excavated, Dames & Moore - and I did meet Mr. Moore many years ago - the Dames & Moore resident geologist identified sheer fractures on the rock surface. Once we had cleaned the rock he identified them as sheer fractures. In early 1974 the NRC then issued a stop work order on our site. We then mobilized a team of regional experts for further evaluation. The experts were generally university professors who were very knowledgeable in the Piedmont region and the characteristics of the region. I won't read the list, but they were noted at - during that timeframe in the early `70s.

The overall project was coordinated by Dames & Moore. And because we were under stop work order conditions to determine the significance of these fractures in the rock, Dames & Moore and the team established that we would do detailed geologic mapping. We excavated additional trenches. We drilled an inclined boring intercepting the sheer fractures, one of the main sheer fractures. We did radiometric age dating, X-ray defraction analysis, literature searches, aerial photos, gravity and magnetic data analyses, in-place stress measurements. We reviewed local microseismic data, and we did additional offsite geologic reconnaissance.

This next picture is a view from 1974 of the unit #1 excavation looking northwest across the reactor site, and where this guy is standing is approximately the center of the unit #1 containment. But what we are looking at is this fracture of rock system coming right through where the unit #1 containment would be. It's one of the shear zones, and in fact there were a series in that unit #1-2 excavation, there were a series of three shear fracture zones identified. They were spaced approximately every several hundred feet. But all of that work was put together to determine the age of movement of these events.

A second view is looking basically the opposite direction. This is a south view, and again you can see this shear fracture running through the rock system. You can also see the quality of the rock which is what we are expecting at our unit 2-3 site area, because it's a very sound granitic based type material.

The conclusions that were reached from unit #1 are that the rock structure characteristics were considered typical of anything in the Piedmont. And you most likely would find such fractures anywhere in the surrounding region. Through the research, there was no documentation of recent tectonic displacement within 100 miles of the site. And the shear orientation was consistent with the regional joint patterns and not integral with any other known fault systems.

There was a hydrothermal event had occurred in one of the shear zones, and we actually collected some crystals that had grown, some Laumontite crystals, Zeolite Laumontite crystals, and this was what was age date, and based on the age dating of these crystals which had not been deformed it was determined that movement along that shear fracture could not have occurred any later than 45 million years before the present, and probably had been inactive for 150 - 300 million years before the present.

The final conclusion was that the rock stresses, in situ rock stresses, were relatively low.

So the results of this have been applied to the unit 2-3 COLA application consistent with results of unit #1. We expect foundation excavations for the two units may well have similar fractures, and that's why we are doing such a detailed geologic mapping at this stage in order to be able to capture any evidence that would help us in the dating of any features that may be observed once we get to the base elevation or the rock elevation.

The current geological investigations have not identified any new data to change our current interpretations. The unit #2-3 excavations are being geologically mapped, and are being prepared for review by the NRC, and hopefully we may be able to arrange a visit in the near future with the NRC staff geologist.

The SAR Section 2.5 concludes that the shear fractures are not capable of tectonic sources and do not represent ground motion or surface rupture hazards to our site.

To give you the background on the reservoir induced seismicity, because this was unique to the Summer site and still has some importance relative to our evaluation, Monticello Reservoir was filled in late 1977 through early 1978. However due to the concern that there could potentially be some reservoir induced seismicity primarily in the Piedmont region of the southeastern U.S. we did install, and the NRC had actually recommended prior to that time, that we install a micro-seismic monitoring network prior to the filling of Monticello, and we did that, and I'll briefly describe it.

We also had a nearby seismometer as part of the University of South Carolina's seismic network at that time, which was in operation in 1974, so we collected data from '74 to '76 and determined that there was generally one small microseismic event about every six days in the immediate vicinity. As I mentioned the reservoir was filled December, '77 to March of '78, and probably within three weeks of the initial filling microseismic activity dramatically increased.

The next slide just basically shows the orientation of the four-station network that we put in. We put a central station on the east shore of Monticello Reservoir, and the three satellite stations were about 10 miles distant.

The next slide is the histogram of the activity. So prior to '77 almost no activity other than one event every six days. We ended up with I think over 1,200 events per month in January, February, March timeframe.

However, as you will notice in this histogram the activity did dramatically or exponentially decay off, although we had spurts of activity over a long period of time.

The record ends in 2004, mainly because the network had aged, and lightning strikes and many other factors determined that it was really no longer producing really good data. So we had concurrence with the NRC that it looked like there was no further risk of not having a well established network. So we did abandon the network even though pieces and parts were continued to Professor Talwani at the University of South Carolina. And I will note that that seismometer that we had used in 1974 is still up and running as part of the South Carolina seismic network. So we do have a seismometer in the near vicinity of Monticello Reservoir and these two Summer sites #2 and #3 which give us data, and we have a good rapport with the University of South Carolina. Even though Dr. Talwani has now retired, we have other contacts. So we have the ability to understand what happened in the immediate area.

And the real significance of the reservoir induced seismicity is that as the earthquakes started happening the USGS became very interested in putting a strong motion accelerometer in the vicinity to see if they could record any of the events. And we graciously allowed them to do so. However this instrument was located near the Fairfield Dams, and in August of 1978, and then again in October of 1979, the instrument recorded two events. Both were magnitude 2.8. These events were very small. They were recognized in the area of 2.8, can generally be recognized and felt. You will notice that the '78 event had a peak ground acceleration measurement of .25 G whereas the '79 event had a .36 G.

The next slide shows you that the VC Summer unit station, you can see where it's located here. The strong motion accelerometer was located on a dam between two of the Fairfield hydro dams or Monticello dams, and then the October 16th, 1979 event was located in a valley off to the west.

But this event was recorded, and unfortunately for us it occurred just prior to going into detailed licensing for the unit #1 site.

The next is what you would see. But if you'll notice this is a one-second time history record you are looking at, and it shows a peak acceleration of .36 g, which is at this level, for a very short duration of less than .06 seconds. However, the concern was what was the impact of short duration high frequency motion on plant structure, systems and components. So for unit #1 as part of our licensing commitments, we did a very detailed engineering analysis to show that the impact of small reservoir induced events would not affect the existing unit #1 site, and in fact part of the evaluation was that we had to postulate the largest event that potentially could occur from the reservoir induced seismicity. And I believe it was determined at that time that no one would expect a magnitude of event greater than about a 4.5, so we evaluated a magnitude 4.5 earthquake nearby from the reservoir as a result of this occurrence.

We successfully showed that, however, even a 4.5 event would not cause any problems to systems, structures or components.

The unit #2 and #3 conclusions extracted part of this data. And we now know that the microseismic activity has diminished back to approximately the preimpoundment background levels. There are occasional spurts of activity. I have had had many discussions with Professor Talwani over the years to see that there is no correlation with rainfall or any fluctuations in the reservoir which is relatively small. It's only 4-1/2 feet in the upper reservoir at Monticello. And therefore our conclusion is that the reservoir-induced seismicity doesn't increase any ground motion hazards for the site area.

DR. HINZE: The range of epicenter

depths?

MR. WHORTON: They were generally very shallow, typically less than 3 kilometer.

DR. HINZE: Did the distribution of the earthquakes with that give any clue as to what major faults in the area?

MR. WHORTON: It did not. There was no correlation to any major faulting in the area.

DR. HINZE: So there wasn't any focusing of these earthquake epicenters and any dip that might indicate major faults?

MR. WHORTON: That's correct. The conclusion was that these small earthquakes were occurring along these small fractures as we had observed in unit #1. And if you look at years of time, the earthquake activity just migrated all over the reservoir, and it almost filled in the entire reservoir every time, and so the conclusion was that they were attributed to the small rupture or fractures in the rock structure due to pore pressure and stress of the weight of the lake.

And finally I'd mentioned earlier the seismic technical advisory group, which was an important aspect of our overall COLA development. Again we used a fairly recognized and diverse group of experts, who most of you probably recognize these people.

The TAG participated in a participatory peer review function, four different sessions for our COLA development. As we got to certain stages of our COLA development we would submit the portion of the COLAs that had been developed or any data to them and then we would bring them together for a two to three day meeting to review all of the results and to make sure that we were headed in the right direction and that we had a handle of what was going on.

During that timeframe there was a lot of COLA development underway, and we determined that - we worked very closely with Southern, Duke, Progress - we determined that it would be most effective if we could join the TAG meetings to cover a number of sites because of the commonalties that existed at many of the sites relative to the evaluation process. So we actually called them the supertags at that point in time. And the four utilities that were involved back then were, on the Bellefonte site, the Lee site, the Summer site, and Grand Gulf was actually interested in it too. Vogtle also participated in the site, and as you'll notice Don Moore from Southern was actually part of our tag review team.

The conclusions that the TAG reached were that the preparation of our COLA Units #2 and #3 properly implemented the state of practice methods and procedures in compliance with NRC's updated regulatory guidance and the interim staff guidance. Coordination with concurrent preparation of COLAs for the Bellefonte, William State's Lee and Grand Gulf along with the other industry-NRC generic seismic issue resolution was particularly effective and productive.

The TAG concurred with the results and conclusions presented in the safety analysis report for Units #2 and #3 and considered them to be appropriately and adequately supported by the data and analyses, and then the TAG developed I will call it an endorsement letter - that's maybe not the right word - but a letter stating their conclusions, which we actually submitted as part of our COLA application.

So with that, we covered a lot of material very quickly.

CHAIRMAN RAY: You did extremely well, and got me back in the good graces of everyone. Maybe this is a question I should ask Al, and I'm going to ask the staff too. I'm surprised at the amount of work you can do in pre-construction, particularly the building of the circulating water lines that include the ultimate heat sink connection. That seems odd to me. I just find myself asking, what the heck more could you do than you are if you had an LWA.

MR. WHORTON: Interim staff guidance 4 I believe is the guidance document. And it clearly identifies components such as circulating water lines, as long as they have no association with safety functions, and you can show that --

CHAIRMAN RAY: That's why I asked you about the ultimate heat sink.

MR. WHORTON: Well, and you can show that they would not result in a reactor trip. So there is justification that has to be developed and prepared to support that.

CHAIRMAN RAY: Okay, there are always surprising things in life.

MR. SEBROSKY: There was a recent rule change within the last two years, and the definition of construction was changed in 10 CFR 50.10. There used to be two LWAs, LWA-1 and LWA-2. There is now just LWA.

CHAIRMAN RAY: Yes, like I say it was just the fact that these lines that serve as the ultimate heat sink would be included as preconstruction surprised me. But like I say you get surprised by things lots of times.

Okay, fine, thanks a lot.

MR. CUMMINS: So if I might.

CHAIRMAN RAY: Yes, sir.

MR. CUMMINS: So the word, heat sink, has maybe different definitions for different people, but for us it's the safety related, which is air.

CHAIRMAN RAY: You're right, Ed. I should have - there was some question earlier today I think it was, somebody asked the question, do you have a cooling gallery. It didn't occur to me that you don't use the circulating water lines for the safety ultimate heat sinks.

MR. CUMMINS: That's right, but we do have a service water cooling tower which defends in depth. But the safety layer was there.

CHAIRMAN RAY: Okay, fine, thank you. Bill, you had a question.

DR. HINZE: Well, I'm curious, how will you meld together the soon to be released the central and eastern United States seismic source characterization project by CAPRI and NRC and DOE and the next generation attributes of the ground motion, how are you going to meld that together?

MR. WHORTON: That is a tough question. We are aware of what is going on with the updated seismic hazards studies, and I understand that it could be coming out as - the results could be coming out as early as the end of this year. We obviously are taking the current considerations as far as our applications, and I don't think we've taken it that next step as to what the implications will be. We obviously will look at the data to make sure there is nothing dramatic that would influence what we have already done.

Robin McGuire, do you have any feel for potentially any significant data, or any of the other consultants that are on the line?

We have to reopen the line.

(Comments off the record)

CHAIRMAN RAY: We can hear you now. Go ahead.

MR. McGUIRE: Okay, this is Robin McGuire. The seismic source that dominates the hazard at Summer is the Charleston source, and that source in the new seismic source model for the central and eastern U.S. has not changed in any fundamental way from the one that was used in the PSHA, the seismic hazards that were just presented by Bob Whorton. So I think fundamentally there won't be very much change. There will be some change in the background sources which contribute a little bit, but fundamentally the large earthquakes that occur in Charleston and potentially may occur in the future will not be changed. So that part of the hazard would not be changed. So I don't expect a very large change if any at all.

CHAIRMAN RAY: Okay. Thank you. Anything else? Thank you.

All right, we will finish up the day with the staff's review of the same material

As occurred earlier, we will ask the staff, since we have just had this presentation to try and focus us on the things that you think we should pay attention to rather than a survey of everything that's already been said.

(Comments off the record)

SUMMER COL SECTION 2.5 - STAFF

MR. WENTZEL: Okay, I'm Mike Wentzel again. And as yesterday I will be filling in for Tony as well.

We will be discussing the staff's review of Section 2.5 of the Summer application. The presenters for the review sitting to my right here for

Section 2.5.1 and 2.5.3, we have Dr. Gerry Stirewalt for Section 2.5.2, =we have Saray Tabatabai in Sections 2.5.4 and 2.5.5, we have Dr. Weijun Wang. And I'd just point that they were supported by other staff members, NRC staff members and consultants.

An overview of Section 2.5 of the Summer advanced final safety evaluation report included - it was issued with two confirmatory items and one license condition. All COL information items, of which there were 11 in Section 2.5.4 and two in Section 2.5.5, have been resolved based on FSAR Revision 2. All confirmatory items were also resolved based on FSAR revision 2, except for 2.5.2-1 which relates to fractile hazard curves, and 2.5.4-1 which relates to concrete fill design, thermal cracking and we will be discussing those later on in the presentation.

License condition 2.5.1-1 for Section 2.5.1 is related to the geological mapping of excavations for safety related structures. And again we'll be discussing that shortly. And with that we'll be turning it over to Dr. Stirewalt for his presentation.

DR. STIREWALT: Thank you, Mike.

We realized the subcommittee is likely getting a little worn down. We will try to be concise and as brief as possible.

I am Gary Stirewalt, as Mike said. I'd like to step directly into 2.5.1, related to basic geologic and seismic information. The technical topic of interest in this situation is assessment of the capability of tectonic structures that have been mapped within the site region, the site vicinity, and the site area.

The issue of interest if you wish to call it that is really to ensure that there are no potentially capable tectonic faults that have been mapped within those localities. And by capable what we mean is effectively a structure, a fault, a tectonic fault of quarternary age, you can see what that timeframe is, 2.6 million years to present.

Now the issue actually arose because the applicant identified 14 potential quarternary tectonic features within the site region. And again as a reminded if they are quarternary in age they are potentially capable structures, and consequently with some possible associated seismic hazards. So we thought that this was an important point to track on.

CHAIRMAN RAY: Gary, these were not on the USGS maps, existed otherwise?

DR. STIREWALT: I'm sorry, these are well shown in what's provided in the FSAR. In fact I'll show you an illustration of that in just a moment. I know that you are aware that the Charleston area seismic source within the site region. The key here is that there are no map structures. And I'm sorry, these are well shown in what's provided in the FSAR. In fact I'll show you an illustration of that in just a moment. I know that you are aware that the Charleston area seismic source within the site region. The key here is that there are no map structures. And certainly even for Charleston as large as that earthquake was in 1886 and also there is information from Paleoliquefaction data that there were earlier earthquakes. But the point is there is not a map feature there, and the Charleston zone, as Bob Whorton so eloquently laid out is certainly - and as Sarah will also address for 2.5.2, it's actually characterized as a seismic source zone, so in fact you don't really need to worry at this stage about where there is a specific fault. But it certainly indicates quarternary deformation.

Let me just sort of show you quickly in the next slide where those 14 potential features are. What I'd like to do, obviously you can see where they lie. But again just to point out the concept of the paleoliquefaction features that are shown by the red triangles that are associated with 1886 and pre-1886 earthquakes in Charleston, certainly again distinguishing the point that there is some sort of quarternary feature there. There is not a map feature in that zone again, and it is handled very properly by treating it as a seismic zone or for the hazardous estimates. Thank you.

The resolution that was effected in this case, the staff's review of the detailed responses that the applicant provided, most were RAIs, in excess of 50 or so, and also including some modifications that they provided already in Rev. 2 for 2.5.1 of the FSAR, certainly resolved the concerns that were related to the occurrence of potentially capable structures actually mapped in the site vicinity.

The basis for that clarification and that basically sort of resolution if you wish, we found that the information that the applicant provided in fact documented that there really are no quarternary tectonic faults mapped in the site region, the site area. So consequently no viable seismic features have been mapped. And that is a pretty important issue.

Let me just address briefly the idea of what types of constraining field data that they provided. One very good way to constrain something geologically, if you have a fault plain, I'll pretend this is a fault plain, and you have some rock body that cross-cuts that, and it's not disrupted, if you get an age date on that rock body, then you can in fact provide a constraining age on that fault. And that is one method that the field data if you wish and combined with radiometric age dates that certainly helped qualify the fact that no mapped quarternary tectonic features.

Another issue of interest that's related to the potential for tectonic structures in excavations for safety related features, and Bob addressed this very very well, the issue really arises as Bob clearly pointed out because in Unit #1 they found minor shear zones. And just because of the nature of the regional deformation style in this geologic area, we really expect similar structures might well be found for Units #2 and #3.

Those particular minor shears are, once again, as Bob qualified them, a minimum age of 45 million years. We had good age date control. They were well mapped. But the point is that the staff will in fact need to examine the geological features that are observed and mapped. Indeed excavations for the safety related structures essentially ensure that there aren't any capable features that are in that excavation.

The resolution that we've affected here is licensing condition 2.5.1-1 that might mention which does require the applicant to perform geologic mapping of that excavation. Again as Bob laid out, that is ongoing right this second even as we speak. They are evaluating the geologic features, and in fact we are already in discussion, they will promptly notify us when those excavations are open for examination. And currently a possible timeframe for that site visit where the geologist will actually go down and look at those features are not depending on whether they are there will actually be the August-September timeframe is how it looks right now.

Are there any questions on 2.5.1?

CHAIRMAN RAY: You've given a concise and clear explanation.

DR. HINZE: If I might.

CHAIRMAN RAY: Yes.

DR. HINZE: Let me ask the same question that I asked of Bob. How is the NRC going to envelope in the results of the study that is supposed to come to us right after the first of the year that you are so intimately involved in?

DR. STIREWALT: Yes, Bill, I think the answer that Dr. McGuire gave is really a very very good response for how it might well affect Summer.

DR. HINZE: But what is the process that the NRC will go through? Will you review this again from the context of the results of that study?

DR. STIREWALT: I'm going to roll that question to Dr. Munson who is spearheading the review.

DR. MUNSON: The NRC will first perform a two-month acceptance review of the new model later this year. And at that time we will determine the scope of the new model and how long it will take us to do a full review which we will perform in 2011, so we will probably do I would say at least a six month review starting in the beginning of 2011 on this new model, and endorse it with a new ISG and eventually a reg guide update.

But we will look at the new model and its implications with respect to the various sites, just to see if there is a significant change in the hazard.

DR. HINZE: So it will be against the COL of this site, right?

DR. MUNSON: Yes, each of the sites we'll take a look at.

DR. HINZE: Okay.

DR. MUNSON: I don't envision us reopening site reviews that we have already completed. These applicants each are required as part of developing their PSHAs to look at new information similar to the new information that was used to develop this new model. So it's - there are significant updates to the Charleston area, other source sums that were updated. So I don't think there will be major surprises.

DR. HINZE: Let me ask one more question: how are the results - how do the results of this study compare to the recent USGS seismic hazard analysis for the Eastern U.S.?

DR. STIREWALT: I'm going to let Cliff handle that one as well.

DR. MUNSON: Well, the applicant has a - we don't require the applicants to specifically look at the USGS hazard map for comparison to their sites. They look at some of the parameters that the USGS uses versus what the original EPRI versus what the updated EPRI models use. But we don't not require - the NRC does not endorse the USGS hazard as a source model. So we don't require applicants to do that.

DR. HINZE: But it is a point of

comparison?

CHAIRMAN RAY: Yes, I mean can you answer the question: how does it compare?

DR. MUNSON: I'd have to go back and take a look at that specific to hazard curves for the Summer site. I could that as a point --

CHAIRMAN RAY: Yes, would you. We will just note that down.

DR. STIREWALT: Any other questions on 2.5.1?

If not I will roll it to Sarah for 2.5.2, vibratory ground motion.

CHAIRMAN RAY: Thank you, Gary.

MS. TABATABAI: I'm going to talk about several issues of interest for Section 2.5.2. The first is related to reservoir induced seismicity. The staff was concerned about the largest potential seismic event associated with Monticello Reservoir due to reservoir induced seismicity. And we were also concerned with any water level changes in the reservoir being correlated with seismicity.

To resolve this the applicant documented that the two largest reservoir-induced earthquakes were only of magnitude 2.8 in 1978 and 1979, that the AP-1000 ACRS bounds the postulated magnitude 4.5 event for unit #1; and that no correlation has been shown between seismicity and water level changes since the initial impoundment of the reservoir.

So that staff concluded that the applicant had adequately characterized reservoir seismicity. Next slide please.

The next issue of interest is related to the Charleston Seismic Source Zone. The applicant updated the 1986 EPRI Charleston Seismic source model with the UCSS model. This model was originally presented in the SSAR for the Vogtle ESP site. However the staff asked the applicant to address a newly reported Charleston area paleoliquefaction feature, which was identified by Talwani and others in 2008. And we asked this question in regard to the UCSS model.

To resolve this Talwani and others in 2008, they had estimated a magnitude of about 6.9 for this causative earthquake, and this magnitude falls within the range that was estimated by the UCSS model, which was about 6.7 to 7.5 range, so it falls well within this range. And then the feature - new reported feature also lies within one of the source geometries for the UCSS model. And this is shown on the next slide.

The feature falls within the red area, which is the highest probability of Charleston type earthquake occurring.

DR. BANERJEE: What's the blue area there?

MS. TABATABAI: The blue area is one of the source zone geometries. It's the southern section of the east coast fault system. It has a low probability of producing a Charleston earthquake, point one.

The final topic of interest that I wanted to mention was the Eastern Tennessee seismic zone. The applicant did not include any of the newer Eastern Tennessee source model that postdate the EPRI 1986 study in their PSHA for the site. This figure shows maximum magnitude distributions for the eastern Tennessee seismic zone. In red is the distribution for the EPRI study, and then in blue and green are the distributions for two more recent studies, the NRC trial and the implementation project study, as well as the Dames & Moore - sorry the Tennessee Valley Authority dam safety site. And you can see that these two more recent studies have maximum magnitude distributions that are slightly higher than what the EPRI model had.

So to resolve this the applicant referred to a recent sensitivity study that was conducted in 2008 by NEI for the Eastern Tennessee seismic zone. And the study showed that for a hypothetical site located in the Eastern Tennessee Seismic Zone that updating the EPRI model maximum magnitude values did not affect, significantly affect, the hazard calculation.

We also performed out own independent sensitivity analysis for the actual Summer site, and we also - we found that increasing the maximum magnitude distribution does not significantly affect the GMRS at the site.

The GMRS values only increased slightly at one Hertz from .094 g to .104 g, and then at 10 Hertz from .428 g to .468 g.

Are there any questions?

CHAIRMAN RAY: Questions? Thank you.

MS. TABATABAI: Now back to Gary.

DR. STIREWALT: I guess I'm next again.

Okay let's talk again about another technical topic of interest that relates to geology, in this case surface faulting in the site vicinity and site area. And there is a distinction between seismicity and surface faulting. Both are hazards.

Surface faulting implies that you might have to have a surface rupture, which in itself is a hazard with or without seismic shaking.

Okay, so the issue in this case then, issue of interest I guess I should say, is to ensure that no capable surface or even near surface tectonic faults exist in the site vicinity and site area.

Again the issue arises because the applicant documented that tectonic surface structures have actually been mapped in the site vicinity. And in just a moment I want to show you one of those structures just so you get a feeling for what those old features look like. Anyhow the issue of concern is surface fault displacement.

Okay, the resolution again, very similar to what was done for the issue related to 2.5.1. We reviewed the responses to again multiple RAIs, reviewed the mods that were provided in the FSAR Section 2.5.3 Rev 2. And concluded that the concerns related to the occurrence of capable surface or near surface faulting in the site vicinity and site area was taken care of.

Again a similar situation, using constraining field relationships, radiometric age dates, the applicant documented that conclusion, their conclusion that that was the case very very well. No surface displacements existed.

There is also another point that I should mention in relation to nontectonic surface deformation or near surface deformation, and certainly because of the risk type. This happens to be a sample of the foundation provided to me happily by the applicant, and legally by the applicant. (Laughter) I mean this is one good solid piece of rock. It is simply not subject to things like dissolution and the other issues that you might be concerned with relative to a nontectonic type of surface deformation. So it's kind of put to rest basically because the physical properties of the crystalline basal rock that occurs in the entire region as well as right at the site itself.

Now what I'd like to do is take a quick look at a map, again similar to one that Bob showed. And let's look within the 25-mile radius just for a moment, and I'd like to call your attention specifically to this fault zone, the Wateree Creek Fault Zone that you will note - or maybe you can't see, but from the color legend, the indication is that this fault is of Mesozoic age. That means that somewhere in the range of 250 million to 65 million years old, so it's not young.

What I'd like to do now, for a couple of reasons, take you on sort of a little mini-field trip with the next slide. A couple of reasons again. Geologists are prone to want to show you a rock. I mean it's sort of our nature; we kind of have to do this. And there are some other points I'd like to make from this. And I have taken the liberty of labeling the legend to distinguish from what Mr. Whorton showed as a real engineer. I felt obligated since we are both disguised in the same color of vest, I felt it important to qualify that.

The other things that are important that are labeled on this - by the way this fault as you saw from the map is located a couple or three kilometers - a couple of miles - south of the site. And there is no surface scar. And there is also no fabric within the rock, something a geologist can see and appraise that indicate that there is really any very very late stage brittle deformation which might indicate youth.

This particular fault, and actually let me - I've labeled weathered sedimentary stuff. I've labeled weathered igneous, and I'd invite you to find fault with me in this case. If you intersect two planes, this is just a road cut, that is one plane; if you intersect this with another plane, that's a structure, you'll get a line. So hopefully you can see that there is some sort of demarcation line right there, very very different rock types, and this is in fact the surface expression in this road cut of that particular structure that is in excess of 206 million years old. This is what they look like in the field.

The other thing I'd like to bring out on this particular slide is the concept of these materials, this is this soft kind of stuff that Bob Whorton mentioned as being saprolitic. This is not the sound rock that Weijun is going to be looking for when he comes up next to talk about. But just by way of showing you what it looks like, this is chemically weathered in place, just as Bob said. It preserved the texture, the structures. There is even a little quartz vein in this intrusive rock that is still in there. So since it's chemical weathering nothing moves, you preserve the texture so you can actually identify things, even better, when you can have the textures preserved.

Okay, I know it's geology, but I will slow down. Are there any questions on 2.5.3?

DR. HINZE: Can I ask a couple of quick ones?

CHAIRMAN RAY: Yes.

DR. HINZE: The - do you have any fault solutions on the reservoir induced seismicity?

DR. STIREWALT: Yes - may I address that Sarah? Yes, there are some focal plane studies that have been done.

DR. HINZE: Lateral slip?

DR. STIREWALT: Yes, and the sheer planes interestingly enough are not northeast; they are basically northwest. So they are planes of we suspect likely finite length. But yes, Talwani and one of his coworkers have done some focal plane solution studies, northwest trending planes, local faults.

DR. HINZE: Has there been any systematic study or investigation of possible surface ruptures associated with a reservoir induced seismicity? Is there any indication of a surface fault?

DR. STIREWALT: There certainly is no indication to my knowledge. I could certainly roll that question to the applicant as well, but basically because of the nature of the kinds of happenings that occur relative to seismicity, very very small events, less than three miles depth, and again certainly no surface expression.

DR. HINZE: No surface expression?

DR. STIREWALT: At all, no surface expression.

DR. HINZE: Thank you.

CHAIRMAN RAY: Anything else?

DR. STIREWALT: Okay, then I guess I will pass it on to Weijun who will begin to discuss 2.5.4 and 2.5.5. Thank you.

CHAIRMAN RAY: Thank you.

DR. WALLIS: Again, I'm Weijun Wang. I'm going to talk about the staff review of Section 2.5.4 and 2.5.5. And I will focus on the two technical issues of interest.

The first one is regarding the excavation because we just saws the photo that Gary was standing somewhere there, Gary put up the photo on purpose to try to compete with Bob. (Laughter) Anyway because according to the excavation plan all the material behind will be removed. And the excavation bottom will reach some rock. That raises the question, how we can determine in the field while you do excavation how can we be sure we reach the sound rock?

And also how can we maintain the integrity of the sound rock? So to resolve this usually applicant gave us a response and indicated that they will use the very heavy equipment like the large ripper or the track hoe and to dig out all the material above the sound rock until it reach so-called nonrippable. And then they will send somebody like Gary will go there and take a look and use the hammer - I wondered why you didn't hold it up (laughter).

DR. STIREWALT: Let me inject, if it's a ringer when you hit it with a hammer it's hard rock. If it thuds, or the hammer gets buried in it a few inches, Bill as you know, then guess what, it's not hard rock.

DR. WALLIS: So you use such a way to ensure that the excavation reaches the solid rock. And because the method used is not explosive, so therefore the integrity of the sound rock will be kept. So that is the resolution. Next slide.

And the following issue will be, because we saw the - a slide presented by Bob for the units #1, the solid rock is not flat surface. Some places are at higher elevation, and some at lower. So you have to create a concrete field there. And in some areas we would be like 16 feet thick. So for that thick concrete field the question here is if the - how do you make the concrete field have similar property as the solid rock? So that is what will keep the uniformity there. And for the very thick concrete field the potential thermal cracking will be a problem. So with that issue the applicant provided a solution, which is, they will use the concrete fill of similar property as the sound rock. And also they will follow the inner fill standard for the concrete fill design, and the thermal temperature control and the thermal cracking monitoring.

So then that provided a solution to resolve this technical issue, and this one became confirmatory item, because we need to see the revised FSAR to present all the proposed changes.

And before I go on to the 2.5.5, this new item related to waterproofing membrane. You already knew that. So that is for the 2.5.4 And next slide.

DR. ARMIJO: Before you leave that, is this concrete fill approach, is that fairly standard? Or this really a unique -- get a level surface out of a rocky undulating surface?

DR. WALLIS: That's the standard in union practice now, because if you are required to level up, just try to get rid of like some solid rock, that is one practical approach that people usually can do that. And very normally people will use a concrete fill. And the only difference is what type of concrete they will use. Like for the Summer they propose they will use the 5,000 psi concrete there. And we saw for the other site they may use it or like the 2,500 psi, concrete. It's dependent on the site.

Okay, for 2.5.5 regarding the slope possibility, there is no issue there. The applicant analyzed all the slopes, and found that there is no concern about the slope regulating.

Okay, that ends my presentation. Any questions?

CHAIRMAN RAY: I don't see any, so thank you very much.

DR. WALLIS: Thank you.

CHAIRMAN RAY: Appreciate it. Okay, this concludes the set agenda. Sanjoy, when I go around the table I will start with you because I know you've got a train to catch. I don't know if anybody else is leaving tonight. But before I do get everybody's input, I first want to ask Weidong if he could simply tick off for us the new action items as a result of today's meeting. Do you have a list of them available?

DR. WANG: Not really organized.

CHAIRMAN RAY: Okay, I just wanted for people to avoid having to re-construct things that they had already identified, if you picked them up. But if you are not prepared to do that, that's okay.

DR. WANG: The main one is follow up on the flow, and we want a statistical method.

CHAIRMAN RAY: Statistical method, yes, an explanation. That is something that we will get some feedback from Sanjoy after he has had a chance to look at the reference document to see whether we want to actually create a feedback to staff.

DR. BANERJEE: Let's put this as an action that Weidong will owe it to me the reference that you get from the staff.

CHAIRMAN RAY: Okay, that's fair enough.

DR. BANERJEE: Don't just send me the reference, send me the paper that I can read. I don't have time to actually find the reference.

CHAIRMAN RAY: There is also a question that is associated with that that Sam asked which is, well, how does staff look at this issue. Whether we want to pose that, I think we'll wait and see what you do, but we want to keep track of it.

DR. ARMIJO: Just note at some point since a tech spec depends on - reading a tech spec depends on its methodology, somewhere along the line the staff has to say, okay.

CHAIRMAN RAY: Yes, and I think it's not totally clear to me but the potential that this is a precedent in that it would be the accepted practice going forward. As far as I can tell it's an enhancement over maybe what has been done in the past. But whether or not it's got some area in it that we are not clear on, I think we need to keep track of that.

So there is that item with two parts. One that you will take a look at, action item, we will get you the information so you can do that. I would say also we have a need to interface with Said and say, we've had this presentation and Weidong will make sure he gets the material that we received today.

I want to again acknowledge that Westinghouse did respond to the question as it stood coming into this meeting and I thought in a very comprehensive way.

Okay anything else you want to mention to us, Weidong?

DR. WANG: Nothing particular.

COMMITTEE DISCUSSION

CHAIRMAN RAY: Okay, then I will go around the table as we usually do, starting with

Mario.

DR. BONACA: Okay, I don't have any issues beyond the ones that were addressed by Sanjoy, and I thought that the presentations were informative, and I think the issues have been addressed.

CHAIRMAN RAY: Okay, all right, Charley we know that we need to see if we can't accommodate your schedule by making sure that we make presentations in September I guess it is when you are available.

MR. BROWN: Yes.

CHAIRMAN RAY: Anything else?

MR. BROWN: I will get back to you and Weidong within the next day or so.

CHAIRMAN RAY: Anything else on that?

MR. BROWN: No, I have nothing else.

CHAIRMAN RAY: Mike?

DR. RYAN: I sent Weidong a kind of summary of the waste issues that I have. The EPRI document, I will review that, just offer him closure help on that issue for next time.

CHAIRMAN RAY: Okay, anything else, Sanjoy?

DR. BANERJEE: No, I think everything - you are not recapping what happened yesterday obviously.

CHAIRMAN RAY: Well, we had a recap yesterday, or we had this kind of a discussion yesterday.

DR. BANERJEE: Right, and today you know everything that we discussed in the morning I guess we also sort of recapped, didn't we?

CHAIRMAN RAY: Well, you are referring to seismic?

DR. BANERJEE: Yes.

CHAIRMAN RAY: We observed a large amount of work in progress.

DR. BANERJEE: And we are going to see this at some point.

CHAIRMAN RAY: That's right, we understand that.

Dennis?

DR. BLEY: The only thing that cropped up that I want to pursue a little bit, maybe the whole committee will, is this coherency function. We never at least as far as I can find out we have never reviewed ISG-01 and - nor the EPRI reports on that issue. And I think we've got to get comfortable with that, unless many of you already are. I haven't seen it before today.

CHAIRMAN RAY: I mentioned that in the context that Sanjoy just asked which was, we did recap then as something we needed to do. But I didn't identify it as something we needed to do on this forced march that we are on on AP-1000. I just said we need to look and see if we can do that. Do you feel that that --

DR. BLEY: The one thing the Brookhaven guy said that makes me comfortable with that is that they looked with and without the coherency and found that the structures met the criteria in both cases, so I think we are probably okay here, but this is going to come up somewhere else.

MR. BROWN: I thought there was one other comment, and I don't know which gentleman it was, that there was a fairly large attenuation. Somebody asked how much additional attenuation - I call it attenuation -

(Simultaneous speaking.)

MR. BROWN: -- very large.

DR. BLEY: Fifty to 60 percent. But they said they did look at it both ways.

MR. BROWN: And it didn't make any difference.

CHAIRMAN RAY: It might in another case.

Well, we will not make it something that we've got to shoehorn in to this mix.

DR. BANERJEE: We don't have the time.

CHAIRMAN RAY: But we do need to do something about it, so we will make sure it's tracked.

Sam.

DR. ARMIJO: First of all I'd like to compliment the presenters. Yesterday and today we got a lot of good information; cleared up a lot of things in my mind. As far as today the issue were really those flow measurements and understanding how they work and how the analysis is done. But I don't think that is going to turn out to be a big big problem.

CHAIRMAN RAY: Okay, and you are referring to the additional inquiry that comes out of the presentation rather than the presentations themselves I trust.

DR. ARMIJO: And that's really all I have.

CHAIRMAN RAY: Okay, Bill.

DR. BANERJEE: Sorry, before we go, I was sort of surprised by this design change to the containment. We really need to share a little bit more about that at some point.

CHAIRMAN RAY: We are looking forward

with bated breath to that.

DR. ARMIJO: That's be November, is that what we are talking about now, or October?

CHAIRMAN RAY: I haven't asked about that. That's a good question. It's of course not the shield building, but it is the containment design change. I think we are anxious to hear about it as soon as we can recognizing that it is I think even from the applicant's point of view a work that is in progress or in the process of being submitted.

So I think that has been noted previously. It's not an action item so to speak, but it is --

DR. BANERJEE: It's of great interest.

CHAIRMAN RAY: It will be of interest. I doubt anybody isn't aware of that.

Okay, Bill.

DR. HINZE: Well, in my report I will speak to the earth science issues and the DCD and then the Vogtle and Summer materials that we've reviewed. I must say that I am really very impressed with the COLs from both Vogtle and the Summer, and the NRC's review of them. That doesn't mean that I won't have some comments and concerns, and I will be putting those in the report. I think that will be very valuable to look at the USGS seismic hazard analysis, and we will be receiving that.

CHAIRMAN RAY: Yes, I feel regardless of whether it's endorsed or not it's a piece of information that one can't not look at in this context and we will definitely - and Weidong make sure we don't drop that; is that right?

Okay, Graham.

DR. WALLIS: Yes, I think there is an interest in this flow measurement. I can contribute it if the committee wants to follow it up and Sanjoy is doing that. Maybe he could share stuff with me.

DR. BANERJEE: Absolutely.

CHAIRMAN RAY: Anything else?

DR. WALLIS: That's it.

CHAIRMAN RAY: Okay. All right.

DR. KRESS: What most interested me was the flow measurement.

DR. BANERJEE: I'll send it to you.

DR. KRESS: And I'd like to get that too. I'd like to know what the assumptions were.

DR. BANERJEE: I think Weidong may as well send it to the whole committee. And then whoever likes can look at it.

CHAIRMAN RAY: All I can say is, Ed, you did a good job of answering the question, but it prompted more questions.

DR. BANERJEE: It's getting there.

MR. CUMMINS: We understand.

(Simultaneous speaking.)

MR. CUMMINS: Maybe on the containment just a little bit of schedule. Tomorrow we have a meeting with staff so we are showing them our design, and we have various deadlines with them at the end of the month, and so we are finalizing this, and so we will be communicating quickly.

CHAIRMAN RAY: I have no doubt.

Anything else? We stand adjourned.

(Whereupon at 4:36 p.m. the above-entitled matter was adjourned.)

AP1000 Design Control Document Amended Design

Section 3.7
Seismic Design

Westinghouse

Section 3.7 Overview

- 3.7.1 Seismic Input
  - Design Response Spectra
  - Supporting media
- 3.7.2 Seismic System Analysis (Structures)
  - Seismic analysis methods
  - Soil-Structure interaction
  - Floor response spectra
  - Combination of modal responses
  - Seismic interactions

Section 3.7 Overview

- 3.7.3 Seismic Subsystem Analysis (Mechanical Systems and Components)
  - Seismic Analysis Methods
  - Combination of modal responses
  - Analytical Procedure for piping
- 3.7.4 Seismic Instrumentation – No Changes
- Combined License Information
  - Timing clarification

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Section 3.7 Changes

- Extension of hard-rock sites to soil sites
- Utilization of 3-D finite element shell models
- Effect of High Frequency Ground Motion
- Use of the Coherency Function
- Classification of adjacent buildings

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Extension of hard-rock sites to soil sites

- AP1000 Design Certification (DCD Rev. 15) is for a fixed base hard rock site.
- Design Certification amendment adds 5 other rock and soils cases.
- AP1000 certified seismic design response spectra (CSDRS) is unchanged.
- Soil-Structure interaction evaluation
- Revised floor response spectra

Soil Cases

- Hard-rock site - Vs of 8000 fps
- Firm-rock site - Vs of 3500 fps
- Soft-rock site - a Vs of 2400 fps increasing linearly to 3200 fps at a depth of 240 feet
- Upper bound soft-to-medium soil site - a Vs of 1414 fps increasing parabolically to 3394 fps at 240 feet

Soil Cases

- Soft-to-medium soil site - a Vs of 1000 fps, increasing parabolically to 2400 fps at 240 feet,.
- Soft-soil site - a Vs of 1000 fps increasing linearly to 1200 fps at 240 feet

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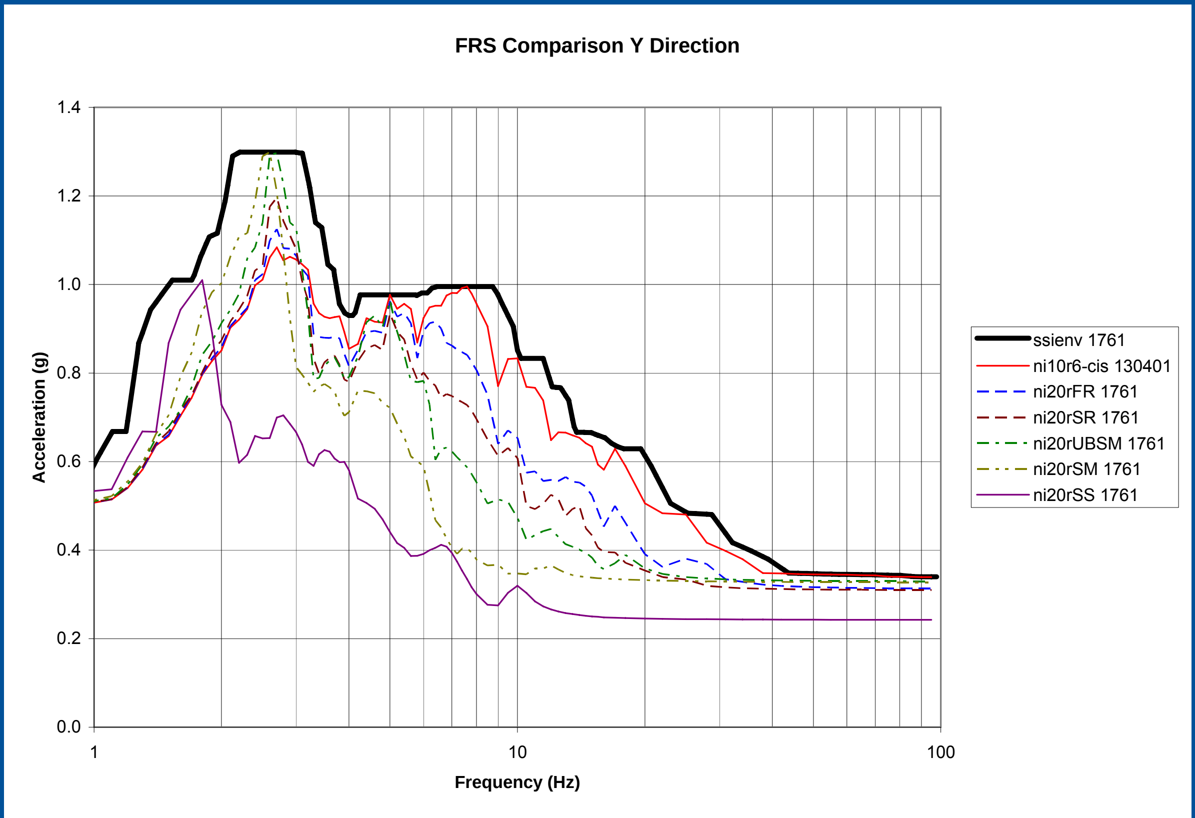
Typical Floor Response Spectra for 6-Soil Case (RPV Support)



Utilization of 3-D finite element shell models

- The design certification used 3-D lumped mass models for time history analysis to represent the auxiliary building, containment internal structures (CIS), shield building (SB), and steel containment.
- Design Certification amendment uses 3-D finite element shell models for auxiliary building, shield building, and CIS

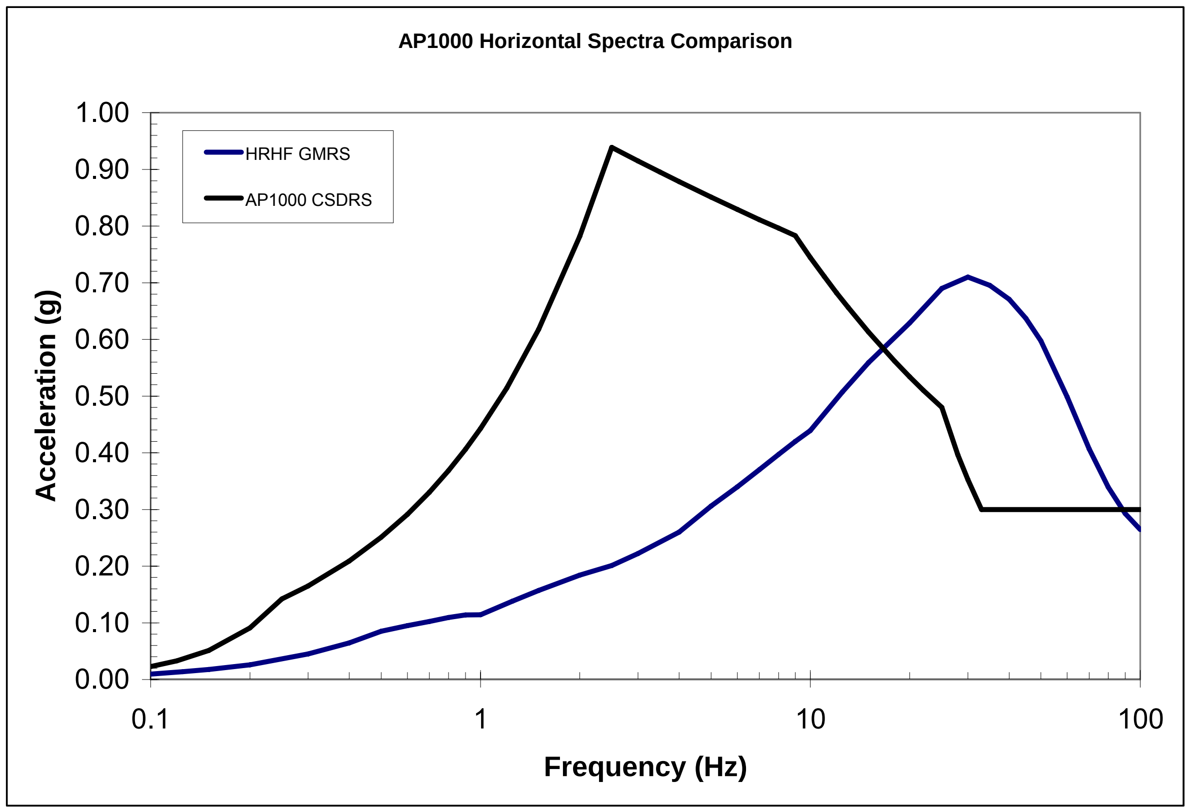
Utilization of 3-D finite element shell models

- Three main models are used for the SSI and seismic analysis
  - ANSYS NI10
  - ANSYS NI20
  - SASSI NI20
- ANSYS NI05 is used for design of the structures using seismic loads

Effect of High Frequency Ground Motion

- Seismic analysis and design of the AP1000 plant is based on the CSDRS,
  - Dominant energy content is in the low frequency range of 2-10 Hz
- Spectra shapes for the Central and Eastern United States (CEUS) show increased amplification in the frequency range above 10 Hz.
- The AP1000 hard-rock high frequency (HRHF) response spectra shape was developed to envelop the site-specific GMRS of several high frequency sites

CSDRS and HRHF Spectra



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Effect of High Frequency Ground Motion

- SSCs were evaluated using both the CSDRS and the HRHF response spectra as seismic inputs and then make comparisons of important analysis parameters
- The evaluation is done on a sampling/screening basis and included building structures, reactor pressure vessel internals, primary component supports, primary loop nozzles, piping, and electro-mechanical equipment.

Use of the Coherency Function

- In DCD Revision 15, a coherent seismic analysis was used for developing the in-structure floor response spectra
- A seismic ground motion coherency function is being used to reduce the amplifications caused by the HRHF ground motion.
- The incoherency of seismic waves has an effect on structures with large dimensions,
- The incoherency of seismic waves generally results in a reduction of structural translational responses

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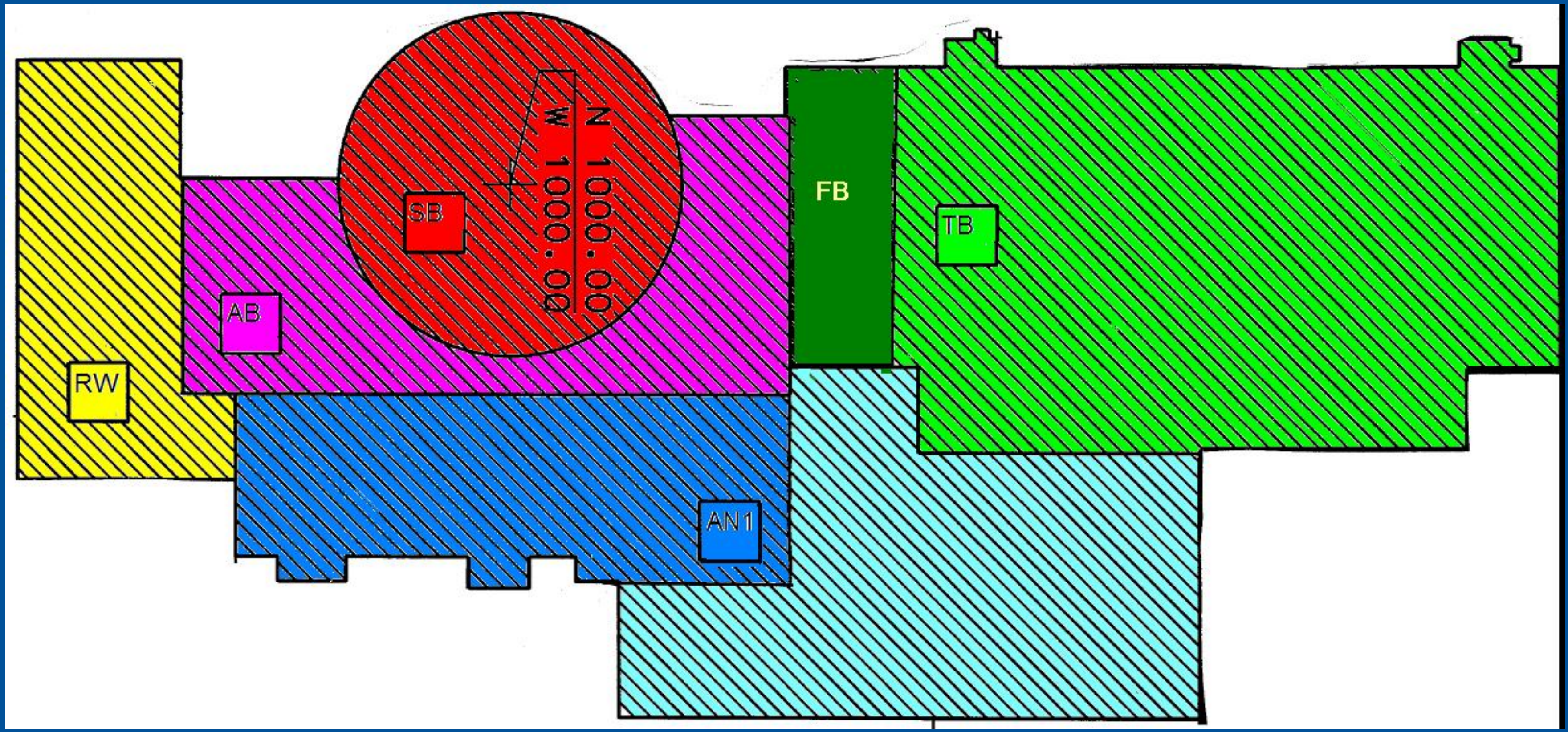
Classification of adjacent buildings

- First Bay of Turbine Building
  - More robust – Reinforced concrete
  - Larger; contains more equipment
  - SC II
  - Remainder of Turbine Building is non-seismic
- Annex Building adjacent to Nuclear Island
  - Reinforced concrete and steel framing - SC II
  - Access control to Nuclear Island
  - Remainder of Annex Building is a low rise non-seismic structure

Classification of adjacent buildings



Open Items

- 15 Open Items in 3.7 SER
  - These open items are a result of NRC staff questions about changes to the DCD
  - Most of the questions are due to the addition of soil cases
- 8 Items Completed Since SER Prep.
- 4 Confirmatory Items

Open Items

- OI-SEB1-3.7.1-018 - Free field in-column response spectra
  - In-column response spectra at the basemat elevation was plotted for each of the generic sites PGA are all above 0.1g
- OI-SRP3.7.1-SEB1-19 - Concrete cracking and damping value
- OI-TR03-001 - Describe analysis assumptions used for the revised SB design dynamic models

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Open Items

- OI-TR03-005 - Justify 0.8 stiffness reduction factor for concrete cracking used for the SB analysis
- OI-TR03-032 - Description of the proposed method using more detailed NI05 model to evaluate flexible regions.
- OI-SRP3.7.1-SEB1-03 - Demonstrate the implementation of the approach for HRHF analysis
  – Resolved at Audit

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Open Items

- OI-SRP3.7.1-SEB1-04 - Containment shell models
  - Figures in RAI response have been updated to reflect the corrected seismic model.
- OI-SRP3.7.1-SEB1-06 - NI20 model for flexible regions up to 50 Hz
- OI-SRP3.7.1-SEB1-08 - Model inconsistency
  - differences in Figure 5.1-7 and 5.1-8 in Technical Report 115 are due to the differences in geometry between the NI10 and NI20 models at the Southeast and Northeast Corners

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Open Items

- OI-SRP3.7.1-SEB1-09 - Model inconsistency, review SASSI results, and how are exceedances of CSDRS-based ISRS by HRHF-based ISRS addressed
  - Reviewed during audit
  - Exceedances of CSDRS-based ISRS by HRHF-based ISRS are addressed as part of the sampling evaluation

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Open Items

- OI-SRP3.7.1-SEB1-10 - Review SASSI results and update figures provided as part of previous revisions
  - Reviewed during audit
  - Figures have been updated
- OI-SRP3.7.1-SEB1-11 - Review SASSI results and update figures
  - Reviewed during audit
  - Figures have been updated

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Open Items

- OI-SRP3.7.1-SEB1-17 - Treatment of missing mass in mode superposition
- OI-SRP3.7.1-SEB1-15 - Structure-soil-structure interaction analyses of buildings adjacent to the NI
- OI-TR03-007 - Modeling approach (sloshing) for the PCS water storage tank
  - dimensions of the PCS tank were not changed and the sloshing analysis is not changed

Questions

Presentation to the ACRS Subcommittee

SER with Open Items
Section 3.7 – Seismic Design

Westinghouse AP1000 Design Certification Amendment Application Review

July 21-22, 2010

Staff Review Team

- Technical Staff
  - Brian Thomas, Chief, SEB1
  - Bret Tegeler, Sr. Structural Engineer
  - Pravin Patel, Structural Engineer
- Project Management
  - Terri Spicher
- Contractor Support
  - Brookhaven National Laboratory (C. Costantino, R. Morante)

OVERVIEW

- Changes in analysis/design due to:
  - Extension of AP1000 design from hard rock site to a range of soil/rock sites
  - Seismic re-analyses of Nuclear Island (NI) structures for updated seismic loading utilizing 3-D FEM (Finite Element Shell Models)
  - Evaluation of the effects of High Frequency Ground Motion (HRHF)
  - Use of the Seismic Wave Coherency Functions per Interim staff guidance ISG-COL-001

Phase 2 Status of 3.7 (Rev.17)

SRP Section/Application Section		AP1000 Changes
3.7.1	Seismic Design Parameters	a) Extend the AP1000 certified seismic hard-rock design basis, to include a broad range of soil and rock sites.
3.7.2	Seismic System Analysis	a) Use 3-D shell models of building structures, instead of 3-D stick models. b) Conduct SSI analyses using SASSI, for 5 site conditions. c) Evaluate a representative hard rock high frequency (HRHF) motion for potential effects on the design of the AP1000 SSCs, using the EPRI ground motion coherency function.
3.7.3	Seismic Subsystem Analysis	No changes

Phase 2 Status of 3.7 (Rev. 17)

SRP Section/Application Section		AP1000 Status
3.7.1	Seismic Design Parameters	2 Open Items 1 Confirmatory Item
3.7.2	Seismic System Analysis	11 Open Items 3 Confirmatory Items
3.7.3	Seismic Subsystem Analysis	1 Open Item

Section 3.7.1 – Seismic Design Parameters

- Open Items:
  - OI-SRP3.7.1-SEB1-18
    - Submit the free-field, in-column response spectra and associated PGA at bottom of foundation, for each of the generic site columns (firm rock and soil sites), demonstrating that the criteria in 10 CFR Part 50, Appendix S are satisfied.
  - OI-SRP3.7.1-SEB1-19
    - Justify the concrete stiffness and damping value(s) used in the building seismic analyses.

Section 3.7.2 – Seismic System Analysis

- Open Items:
  - OI-TR03-001
    - Include in TR-03 the dynamic modeling details for the enhanced shield building design.
  - OI-TR03-005
    - Demonstrate that only minor concrete cracking occurs, justifying the use of 0.8 factor for concrete stiffness reduction.
  - OI-TR03-032; OI-SRP3.7.1-SEB1-06
    - Demonstrate that additional local amplification in flexible regions (walls, floors, roof) is adequately considered in developing ISRS for the CSDRS and for the HRHF ground motion .

Section 3.7.2 – Seismic System Analysis

- Open Items:
  - OI-SRP3.7.1-SEB1-03
    - Correct the errors in the HRHF analysis model, re-run the ACS SASSI analysis, submit the revised results to the staff. [TR-115, Rev. 2, submitted by applicant]
  - OI-SRP3.7.1-SEB1-04
    - Demonstrate that high frequency modes in the SCV upper closure dome are not excited by HRHF ground motion.
  - OI-SRP3.7.1-SEB1-08
    - Explain inconsistent ANSYS NI20 results, compared to ANSYS NI10 and SASSI NI20 results, at 2 locations on the Aux Bldg roof.

Section 3.7.2 – Seismic System Analysis

- Open Items:
  - OI-SRP3.7.1-SEB1-09, OI-SRP3.7.1-SEB1-10, OI-SRP3.7.1-SEB1-11:
    - Clarify and justify both the low frequency in-structure response reductions and the high frequency in-structure response reductions obtained by applying ground motion incoherency in the HRHF analysis. Address after performing re-analysis with the corrected model.
  - OI-SRP3.7.1-SEB1-17
    - Provide details on how residual rigid response in modal superposition time history analysis is addressed. Explain differences and/or similarities between applicant's method and RG 1.92, Revision 2 approach, and justify any differences.

Section 3.7.2 – Seismic System Analysis

- Open Items:
  - OI-SRP3.7.1-SEB1-15
    - Submit detailed results for structure-soil-structure interaction between the NI and adjacent Seismic Category II building structures.

Section 3.7.3 – Seismic Subsystem Analysis

- Open Items:
  - OI-TR03-007
    - Re-evaluate sloshing phenomenon in the PCCS tank on top of the shield building, factoring in subsequent shield building design changes that may affect earlier conclusions.

Phase 2 Status of 3.7 (Rev. 17) As of July 21, 2010

SRP Section/Application Section		**AP1000 Status**
3.7.1	Seismic Design Parameters	1 Open Item 2 Confirmatory Items
3.7.2	Seismic System Analysis	6 Open Items 8 Confirmatory Items
3.7.3	Seismic Subsystem Analysis	1 Confirmatory Item

AP1000 Design Control Document Amended Design

Section 3.8

Design of Category I Structures

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Section 3.8 Overview

- Steel Containment
- Concrete and Steel Internal Structures
- Other Category I Structures
- Foundations

Section 3.8 Changes from DCD Rev. 15

- Redesign of the Shield Building
  - Discussed in a later meeting
- Extended the AP1000 structure design to sites ranging from soft soils to hard rock.
- Critical Section Design Updated
  - Soil Cases
  - Design finalization
- Settlement evaluation during construction
  - Include construction sequence limits

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Construction Sequence Limits

- Prior to completion of both the shield building and auxiliary building at elevation 82′ -6″:
  - Concrete may not be placed above elevation 84′ -0″ for the shield building or containment internal structure.
  - Concrete may not be placed above elevation 117′ -6″ in the auxiliary building, except in the CA20 structural module, where it may be placed to elevation 135′-3″.

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Material specification changes
Since DCD Rev. 15

- Containment - change the process for creating high quality, vacuum-degassed steel
- Modules - change in material of structural modules from Nitronic 33 to Duplex 2101
- Industry standard change from NQA-2 to NQA-1 for packaging, shipping, receiving, storage and handling
- Concrete material – changed the compressive strength of concrete in the shield building from 4,000 psi to 6,000 psi

Elimination of COL information items

- Design of containment vessel adjacent to large penetrations.
- PCS water storage tank inspections that were redundant to ITAACs.
- In-service inspection of containment vessel that is required by other NRC regulations including 10 CFR 50.55a

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Section 3.8 Open Items

- 20 Open Items have been identified in SER for DCD Chapter 3.8
- 1 Additional RAI
- 5 confirmatory items identified in SER
- 10 Items have been submitted since SER was prepared
- 2 Placeholder items.

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Section 3.8.2 – Steel Containment Open Items

- OI-SRP3.8.2-SEB1-03 – Address questions about load combinations for the steel containment design including wind tornado and hydrogen generated pressure loads
  - The AP1000 containment is not subject to direct wind loads
  - Hydrogen pressure and burn loads clarified

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Section 3.8.2 – Steel Containment Open Items

- OI-SRP3.8.2-SEB1-02 – Details with compliance to Regulatory Guides 1.7, 1.57, 1.160, and 1.199.
  - Addressed conformance with Reg. Guides including hydrogen pressure loads, load combinations, maintenance rule information, and anchors

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Section 3.8.2 – Steel Containment Open Items

- OI-RAI-TR09-05 – Open Item against TR09 awaiting closure of OI-SRP3.8.2-SEB1-03.
  - – Placeholder for NRC action
- OI-RAI-TR09-08 – Details regarding temperature and external pressure loads of containment.
  - – This answer pending containment design change.

Section 3.8.2 – Steel Containment Open Items

- OI-SRP3.8.2-CIB1-01 – include bounding calculation using -40°F, and wind speed of 48 mph in calculation of lowest service metal temperature
  - Westinghouse will revise APP-MV50-Z0C-039 Rev. 0 to incorporate the bounding case
- RAI-SRP3.8.2-SPCV-01 – Explain assumptions used in evaluation to determine containment external pressure.
  - This answer pending containment design change.

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Section 3.8.3 - Concrete and Steel Internal Structures - Open Items

- OI-SRP3.8.3-SEB1-01 – Use of AISC/ANSI N690 Supplement 2 and AWS Standards.
- OI-SRP3.8.3-SEB1-03 – Further justification needed regarding the proper stiffness utilization for the modules of the CIS and for other reinforced concrete structures.

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Section 3.8.3 - Concrete and Steel Internal Structures - Open Items

- OI-SRP3.8.3-SEB1-04 – Description of how the loads from the module could be properly transferred from the module to the embedded bars in the base concrete.
- OI-SRP3.8.3-SEB1-05 – Include information on plate thicknesses as Tier 2* information in the DCD.
  - DCD is revised to include plate thickness

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Section 3.8.4 - Other Category I Structures - Open Items

- OI-SRP3.8.4-SEB1-03 – Request for more detail in the DCD related to enhanced shield building design and reason for removal of certain Tier 2* information.
- OI-TR85-SEB1-29 – Computer code used to proportion the cross-sectional strength of members involving concrete materials.
  - NRC MACRO Inspection on May 11 - 13, 2010 resolved this issue.

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Section 3.8.4 - Other Category I Structures - Open Items

- OI-TR85-SEB1-27 – Implementation of 100-40-40 method for combination of the three direction seismic loading

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Section 3.8.5 - Basemat - Open Items

- OI-TR85-SEB1-10 – Request to make TR-09, TR-57, and TR-85 Tier 2* or provide acceptable alternative.
- OI-TR85-SEB1-35 – Further clarification in the DCD on the waterproofing materials.
  – Additional information is included in the DCD on waterproofing used under the foundation of the AP1000.

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Section 3.8.5 - Basemat - Open Items

- OI-TR85-SEB1-32 – Assumption of Uniform Soil Spring Beneath the Basemat.
- OI-TR85-SEB1-37 – Additional information on the evaluation of stability and the soil friction angle
  - DCD information on stability evaluation and the Minimum Soil Angle of Internal Friction is added and clarified.

Section 3.8.4 - Other Category I Structures - Open Items

- OI-TR85-SEB1-36 – Include Nuclear Island Settlement Criteria in Tier 1 of the DCD
  - Additional settlement criteria are added to Tier 1 Table 5.0-1
- OI-TR85-SEB1-17 – Further evaluation of construction sequence limitations needed for stiffer foundation materials.
  - DCD is changed to make limitations applicable to all soils except hard rock

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Section 3.8.6 – Combined License Information - Open Items

- OI-SRP3.8.6-SEB1-01 – Evaluate change to COL information item related to Containment Vessel Design Adjacent to Large Penetrations against TR09 changes
  - NRC Placeholder
- OI-SRP3.8.6-SEB1-02 – Consistency between ITAAC to inspect PCS water storage tank for cracking and guidance in DCD Section 3.8.4.7.
  - ITAAC is revised to clarify inspection

Westinghouse

Questions

Presentation to the ACRS Subcommittee

SER with Open Items
Section 3.8 – Design of Category I Structures

Westinghouse AP1000 Design Certification Amendment Application Review

July 21-22, 2010

Staff Review Team

- Technical Staff
  - Brian Thomas, Chief, Structural Engineering Branch
  - John Ma, Sr. Structural Engineer
- Project Management
  - Terri Spicher, AP1000
- Contractor Support
  - Brookhaven National Laboratory (J. Braverman)

OVERVIEW

- Changes in analysis/design due to:
  - Extension of AP1000 design from hard rock site to a range of soil/rock sites
  - Seismic re-analyses of Nuclear Island (NI) structures for updated seismic loading
  - Shield Bldg. redesign (not addressed in this meeting)
  - Use of additional analysis methods for design (i.e., response spectra & time history analyses)
  - Change in structural steel materials and concrete strength
  - Revised stiffness assumption for containment internal structures
  - Revision required for seismic stability evaluation
  - Elimination of Combined License Information Items

Phase 2 Status of 3.8 (Rev.17)

SRP Section/Application Section		AP1000 Changes
3.8.2	Steel Containment	a) Calculation update due to extension from hard rock site to a range of soil/rock sites b) Addressed Rev. 15 COL Action Item for design of containment vessel next to large penetrations (Technical Report TR-09) c) Deleted requirement for in-service inspection of containment vessel, in accordance with ASME Code Section XI, Subsection IWE; transferred responsibility to COL
3.8.3	Concrete and Steel Internal Structures of Steel or Concrete Containments	a) Removed Section 3.8.3.4.1.2 "Stiffness Assumptions for Global Seismic Analyses" b) Revised Section 3.8.3.5.7 – "Design Summary Report"

Phase 2 Status of 3.8 (Rev.17)

SRP Section/Application Section		AP1000 Changes
3.8.3	Concrete and Steel Internal Structures of Steel or Concrete Containments	c) Revised Appendix 3H – Auxiliary and Shield Building Critical Sections d) Revised Section 3.8.3.6 – "Materials, Quality Control, and Special Construction Techniques." e) Revised Section 3.8.6.3 – "Concrete Placement" f) Reduced height of 2100 ft^3 pressurizer
3.8.4	Other Seismic Category I Structures	a) Revised 3.8.4.2 – "Applicable Codes, Standards, and Specifications." b) Redesign of shield building. **(not addressed in this meeting)** c) Revised design analysis procedures under Section 3.8.4.4.1 – "Seismic Category I Structures" d) Revised Section 3.8.4.5.3 – "Design Summary Report."

Phase 2 Status of 3.8 (Rev.17)

SRP Section/Application Section		AP1000 Changes
3.8.4	Other Seismic Category I Structures	e) Revised Section 3.8.4.6.1.1 – “Concrete.” Specimen age for strength test increased to 56 days for certain concrete, compressive strength increased to 6,000 psi in shield bldg., and additional revisions to chemical composition and proportioning of concrete mix.
3.8.5	Foundations	a) Revised 3.8.5.4.1 – “Analyses for Loads during Operation.” Revised 3.8.4.2 – “Applicable Codes, Standards, and Specifications.” b) Revised design analysis procedures under Section 3.8.4.4.1 – “Seismic Category I Structures” c) Revised Section 3.8.4.5.3 – “Design Summary Report.”

Phase 2 Status of 3.8 (Rev.17)

SRP Section/Application Section		AP1000 Changes
3.8.6	Combined License Information	a) Revised 3.8.6.1 by eliminating COL information item, because it had been addressed in APP-GW-GLR-005 (TR-09) and incorporated into DCD b) Revised 3.8.6.2 through 3.8.6.4 with regard to remaining COL information items

Phase 2 Status of 3.8 (Rev. 17)

SRP Section/Application Section		AP1000 Status
3.8.1	Concrete Containment	Not applicable
3.8.2	Steel Containment	4 Open Items 1 Confirmatory Item
3.8.3	Concrete and Steel Internal Structures of Steel or Concrete Containments	4 Open Item 2 Confirmatory Items
3.8.4	Other Seismic Category I Structures	1 Open Items
3.8.5	Foundations	8 Open Items 2 Confirmatory Items
3.8.6	Combined License Information	2 Open Items

Section 3.8.2 – Steel Containment

- Open Items:
  - OI-SRP3.8.2-SEB1-02
    - Explain whether design, construction, and inspection are in accordance with RGs 1.7, 1.57, 1.160 and 1.199
  - OI-SRP3.8.2-SEB1-03
    - Explain why DCD does not include load combinations that combine wind load with design pressure load and tornado wind load with external pressure load; clarify hydrogen generated pressure loads
  - OI-RAI-TR09-05
    - Describe the loads considered, how they were combined, and whether the containment post –LOCA flooding load was included; placeholder for OI-SRP3.8.2-SEB1-03
  - OI-RAI-TR09-08
    - Describe pressure and temperature condition used in Service Level A combination, and technical basis for deciding it is the worst case

Section 3.8.3 – Concrete and Steel Internal Structures of Steel or Concrete Containments

- Open Items:
  - OI-SRP3.8.3-SEB1-01
    - Identify whether the AP1000 plant meets industry standard AISC-N690-1994, Supplement 2 (2005) and the more recent versions of the applicable AWS standards
  - OI-SRP3.8.3-SEB1-03
    - Justify the use of the stiffness reduction factor of 0.8 for containment internal structures (CIS) and reinforced concrete structures
  - OI-SRP3.8.3-SEB1-04
    - Describe how the loads from the CIS could be properly transferred to the base concrete, and explain how the design is performed
  - OI-SRP3.8.3-SEB1-05
    - Include required plate thicknesses for the CIS, and correct the designation of the Tier 2* information in DCD Section 3.8.3.5.8.1

Section 3.8.4 – Other Seismic Category I Structures

- Open Items:
  - OI-SRP3.8.4-SEB1-03
    - Address Staff concerns about incomplete information regarding the identification of required reinforcement for concrete sections, reduction in number of critical sections evaluated, reasoning behind certain loads not appearing in the load combinations, inconsistency in allowable stress values, and removal of some Tier 2* information

Section 3.8.5 – Foundations

- **Open Item:**
  - **OI-TR85-SEB1-10**
    - **Identify TR-09, TR-57, and TR-85 as Tier 2* information, or provide an acceptable justification as to why they are not**
  - **OI-TR85-SEB1-35**
    - **Provide more details about the type and industry standard used for the waterproofing membrane, and information that demonstrates adequacy of waterproofing material**
  - **OI-TR85-SEB1-32**
    - **Demonstrate that assumption of uniform soil pressure acting at the bottom of basemat is conservative/adequate**
  - **OI-TR85-SEB1-27**
    - **Confirm combination method of loads from the 3 directional components of earthquake motion used for basemat design**

Section 3.8.5 – Foundations

- Open Item:
  - OI-TR85-SEB1-29
    - Explain apparent error found in computer macro code used to design concrete members. Independent simplified confirmatory analysis being performed.
  - OI-TR85-SEB1-37
    - Clarify site-specific evaluation requirements for sliding and overturning stability for use by COL applicants
  - OI-TR85-SEB1-36
    - Present settlement criteria in DCD Tier 1, Table 5.0-1 – Site Parameters
  - OI-TR85-SEB1-17
    - Justify why construction sequence limitations are unnecessary for “soft rock,” “firm rock,” or “hard rock” sites

Section 3.8.6 – Combined License Information

- Open Item:
  - OI-SRP3.8.6-SEB1-01
    - Placeholder for resolution of remaining TR-09 RAIs; needed to accept removal of COL Information Item for containment design around penetrations
  - OI-SRP3.8.6-SEB1-02
    - Include commitment to inspect the PCS tank for significant cracking in accordance with ACI 349.3R-96 in ITAAC Table 3.3-6, and explain whether inspection will be performed for all three structural regions (PCS tank boundary, shield building roof, and tension ring). Inconsistencies exist between which regions will be inspected according to the ITAAC and Section 3.8.4.7

As of July 21, 2010

SRP Section/Application Section		AP1000 Status
3.8.1	Concrete Containment	Not applicable
3.8.2	Steel Containment	4 Open Items 1 Confirmatory Item
3.8.3	Concrete and Steel Internal Structures of Steel or Concrete Containments	3 Open Items 2 Confirmatory Items
3.8.4	Other Seismic Category I Structures	1 Open Item
3.8.5	Foundations	5 Open Items 5 Confirmatory Items
3.8.6	Combined License Information	1 Open Item 1 Confirmatory Item

ACRS Meeting

AP1000 RCS Flow Uncertainties

July 2010

Proprietary Class 2

Westinghouse

Purpose

- Purpose – Address ACRS Questions
- ACRS Questions
  - What are the accuracy needs for RCS flow measurements?
  - What are the uncertainties in measuring RCS flow?
  - How will the differences in the various measures of RCS flow be reconciled?
  - How will a final RCS flow value be established?

RCS Flow Success Criteria

- Minimum Measured Flow ≥ Thermal Design Flow + Measurement Inaccuracy
  - TDF used in nuclear safety analyses
  - Measurement inaccuracy uses a statistical combination of several RCS flow measurement methods
- Measurement Inaccuracy ≤ 1.9% of MMF (which is equivalent to 1.8% of BEF) to assure RCS flow is greater than Thermal Design Flow

DCD Table 5.1-3 RCS Flows

Mechanical Design Flow	163,800 gpm / loop	(104.0%)
Best Estimate Flow	157,500	(100%)
Minimum Measured Flow	150,835*	(95.8%)
Thermal Design Flow	148,000*	(94.0%)

*Used in safety analysis / includes 10% SG tubes plugged

- Too little flow requires revision of thermal design / safety analysis / component thermal stresses
- Too much flow requires re-evaluation of mechanical design

RCS Flow Measurement Strategy

- Make a Baseline Flow Measurement as part of initial plant start up tests, using a combination of methods

- Use that Baseline Flow Measurement as calibration for the RCS flow elements
  - Two hot leg elbows (four 1E channels per elbow, for loss of flow reactor trip)
  - Four cold leg bends (one non-1E channel per bend for surveillance)

- Subsequent RCS flow measurements would be a weighted average from the calibrated RCS flow element differential pressures

Baseline Flow Measurement

- An Engineering Report will establish the Baseline Flow Measurement using all available measurements of RCS flow at time of plant startup
- These measurements and tests include:
  - ΔT - Calorimetric during power escalation
  - RCP d/p and motor power (compared to factory tests)*
  - Hot leg elbow and cold leg bend d/p*
  - Reactor vessel d/p measurements*

  *Used for pre-criticality test flow confirmation
- Ultrasonic flow meter measurements would be considered as an additional method to improve accuracy IF the statistical combination of these methods will NOT be adequate to meet the required accuracy
- The Engineering Report will reconcile all measurements and report the determined RCS flow (X ± Y gpm) at specified conditions

Uncertainty in RCS Flow Measurements

- The uncertainty in various RCS flow measurement methods are still being evaluated
- Our target (potentially achievable) and reasonably expected uncertainties are as follows:

	Percent of Measured Flow	
	Target	Minimum Expectation
• ΔT- Calorimetric	1.8%	3%
• RCP plant vs. factory	3%	5%
• Elbow and bend d/p	2.5%	3%
• Reactor vessel d/p	5%	7%
• **Composite**	**1.3%**	**1.9%**

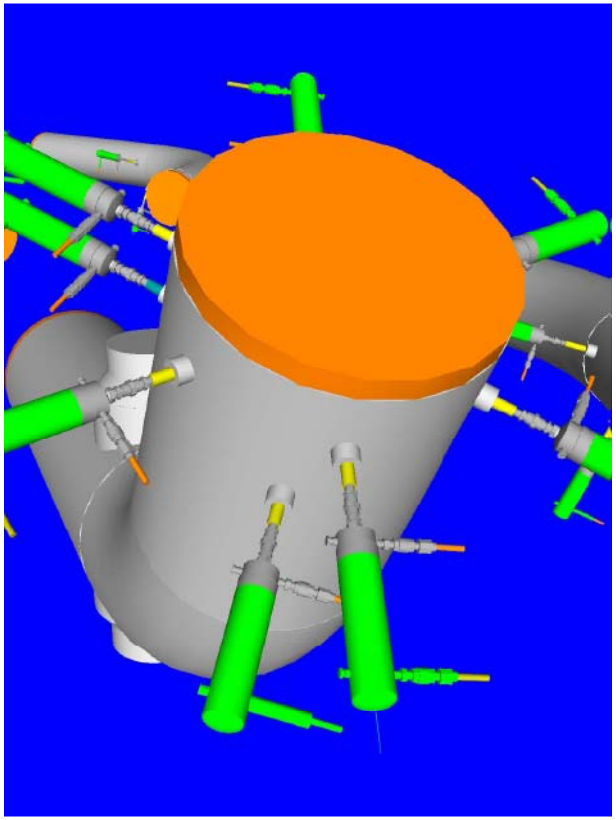
Proprietary Class 2

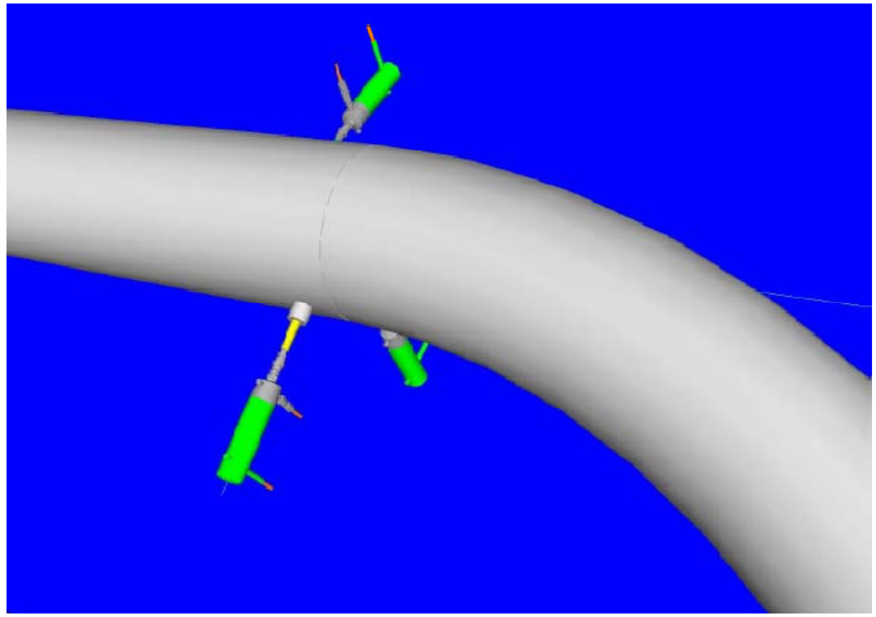
Westinghouse

ΔT – Calorimetric Method

- Traditional method for W-PWRs in last 40 years
  - ~2.5% uncertainty for 2- and 3-loop plants
  - ~1.8% to 2% uncertainty for 4-loop plants
- More uncertainty with modern trend due to low-leakage loading patterns and the resultant increase in magnitude of hot leg temperature streaming
- AP1000 will have seven RTD locations per hot leg (vs three on operating W PWRs)

AP1000 RCS Hot Leg / Cold Leg RTDs





Proprietary Class 2

Summary: ΔT – Calorimetric Method

- We can measure temperature of platinum wire in RTD very accurately (within tenths of a degree)
  - RTDs are laboratory calibrated to 0.2^{o}F
  - Analog-to-Digital conversion is within 0.1^{o}C
  - In-situ cross calibration adjusts T_{hot} and T_{cold} signals to within ~0.2^{o}F at zero power

- Uncertainties in T_{hot} streaming are limiting

- Each hot leg has six dual-element RTDs
  - Located every 60 degrees around pipe circumference
    - Inserted to depth of 4 inches
  - A total of 24 elements (28 counting wide-range RTDs)

RCS Flow - Comparison with RCP Factory Measurements

- AP1000 will be first W PWR with factory performance tests on each RCP
- Principle is to compare factory measurements (head, flow, power, motor frequency, and/or rotor speed) with plant measurements
- Advantages are good factory measurements

RCS Flow – Comparison with Design d/p's

- Principle is to compare design and measured d/p across reactor vessel as a measure of flow
- Calculated d/p is traditionally assumed to be good only to within 10%
- Vessel d/p is large (~65 psid)

RCS Flow – Measurement with d/p's from Hot Leg Elbows and Cold Leg Bends

- Principle is centrifugal force
- Individual un-calibrated elbow taps can calculate flow with 4% error if reasonable geometry and accurate dimensions (ASME Fluid Meters, Sixth Edition)
- Westinghouse uses 6% uncertainty for hot leg elbows due to adverse geometry, or 5% for average of two
- Westinghouse uses 4% for each cold leg bend, or 3% for average of all four
- Westinghouse uses 3% uncertainty to combination of all bends and elbows

RCS Flow – Historical Un-calibrated Elbow Tap d/p Flow Measurement Data

Un-calibrated Error		Cycle
Plant 1	**5.2%**	1
Plant 2	**2.0%**	1
Plant 3	**2.5%**	12
Plant 4	**1.7%**	11
Plant 5	**0.4%**	8
Plant 6	**3.1%**	2
Plant 7	**3.1%**	1

Average	**2.6%**

- Error represents difference between baseline calorimetric flows and flow calculated from raw d/p's using elbow meter equations
- Represents average error of all elbow taps in all loops per unit

RCS Flow – Historical Calibrated Elbow Tap d/p Flow Measurement Data

Calibrated Errors	
Max	**1.1%**
Average	**0.4%**
Median	**0.2%**

- Elbow tap d/p's are normalized after the baseline precision calorimetric measurement
- "Calibrated accuracies" reflect difference between calculated best-estimate flow and elbow d/p measurements

Determination of RCS Flow

- Assuming that reconciliation does not change the previous uncertainty estimates for the various methods, then the composite average, weighted by the inverse square of the uncertainty, is
  - RCP power - 5%
  - Reactor vessel d/p – 7%
  - Calorimetric - Delta-T – 3%
  - Bend and elbow d/p's – 3%
  - Composite – 1.9% of MMF (meets requirement)

Determination of RCS Flow

- Once RCS baseline flow is determined (as the weighted average of the methods found to be valid in the reconciliation), then that value is used as the calibration point for the hot leg elbows and cold leg bends

- All subsequent RCS flow measurements are taken from elbow and bend d/p's

Summary

- We have a robust strategy for RCS flow measurement to meet the following requirements:
  - ≥ Minimum Measured Flow
  - Uncertainty ≤ 1.9% of Minimum Measured Flow

- The accuracy (and value) of measured RCS flow will be established in the Reactor Coolant Flow Measurement Report following plant startup

Questions?

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

Presentation to the ACRS Subcommittee

Vogtle Units 3 and 4 COL Application Review
Upcoming ACRS Interactions
Eileen McKenna, Branch Chief (AP1000 Projects)
Jeffrey Cruz, Branch Chief (AP1000 Projects)

July 21 -July 22, 2010

Upcoming ACRS Meetings

- Near term interactions (tentative)
  - September 2010
    - DCD Chapters 5,7,8,13, and 18
    - Vogtle Chapters 5,7,8,13,14 and 18
    - Summer-Plant Specific issues-Section 2.4, and Emergency Plan
  - October 2010
    - DCD Chapters 6, and 15
    - Vogtle Chapters 6,and 15

ACRS Interactions

Date	Topics(s)
September 20-21, 2010 Advanced FSER Presentations	Day 1 AP1000 DCD Chapters 5, 7, 8, 13, 18 Day 2 Vogtle COL Chapters 5, 7, 8, 13, 14, 18 Summer Plant Specific Issues-Section 2.4 and Emergency Planning
October 5, 2010 Advanced FSER Presentations	Day 1 AP1000 DCD Chapters 6, 15 Vogtle Chapters 6, 15
November 18-19, 2010 Advanced FSER Presentations	Day 1 AP1000 DCD All Chapters and 1, 3,9, 19, 23 Day 2 Vogtle All Chapters and 1, 3,9, 19 Summer COL Chapters (Plant Specific Portion) and plant specific issues-Wet Bulb Temperature
December 2-3, 2010 ACRS Full Committee Meeting	Days 1 AP1000 DCD All Chapters Day 2 Vogtle COL All Chapters Summer COL All Chapters

VC Summer Units 2 and 3
SAR Section 2.3 Meteorology

Steve Summer

SCANA Services – Supervisor Environmental Services

Major Items of Interest

- DCD Incorporated by Reference
  - VCS DEP 2.0-2 deals with a maximum safety wet bulb temperature (noncoincident) of 87.3ºF, a value of 1.2ºF above the AP1000 DCD value of 86.1ºF

Major Items of Interest

- 5 COL Information Items Addressed
  - COL 2.3-1 Regional Climatology
  - COL 2.3-2 Local Meteorology
  - COL 2.3-3 Onsite Meteorological Measurement Program
  - COL 2.3-4 Short Term (Accident) Diffusion Estimates
  - COL 2.3-5 Long Term (Routine Release) Diffusion Estimates

Major Items of Interest

- With the exception of the previously discussed departure, all AP1000 required siting characteristics are fully acceptable.

Unit 1 Met Tower

Units 2 &3 General Location

New Met Tow

(built 12-2006)

V.C. SUMMER NEW NUCLEAR PROJECT

COL Information Item 2.3-3

- Three years of data from the VCSNS Unit 1 meteorological monitoring location was collected, analyzed and submitted (while the Units 2 and 3 tower was being constructed and data was being collected).
- After comparing Units 2 and 3 tower data to the Unit 1 data, lake effects were found to have a greater impact than originally expected.

COL Information Item 2.3-3

In light of the data comparison,

- Two years of data from the Units 2 and 3 tower were subsequently utilized to update the application with more representative information.
- The overall conclusions were effectively unchanged based on the new data.

Comments

U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

Presentation to the ACRS Subcommittee

V.C. Summer Units 2 and 3 COL Application Review

AFSER Section 2.3
Meteorology

July 21-22, 2010

Staff Review Team

- Technical Staff
  - **Kevin Quinlan,** Physical Scientist (Meteorologist)

- Project Management
  - **Mike Wentzel**

Content of Section 2.3

- FSAR Chapter 2.3 incorporates by reference Revision 17 of the AP1000 DCD.

- COL items, Supplemental Information, and a Departure
  - VCS COL 2.3-1 – Regional Climatology
  - VCS COL 2.3-2 – Local Climatology
  - VCS COL 2.3-3 – Onsite Meteorological Measurements Program
  - VCS COL 2.3-4 – Short-Term Diffusion Estimates
  - VSS COL 2.3-5 – Long-Term Diffusion Estimates
  - VCS SUP 2.0-2 – Comparison Table of Site Parameters and Site Characteristics
  - VCS SUP 2.3-1 – Regional and Local Climatology
  - VCS DEP 2.0-2 – Noncoincident Wet-Bulb

Technical Topics of Interest

- 2.3.1 Regional Climatology
  - Comparison of climatic site parameters and site characteristics
    - 50-year/100-year Wind Speed (3-second gust)
    - Maximum Tornado Wind Speed
    - Maximum Roof Load (Winter Precipitation)
    - 0% Exceedance and 100-year Return Period Temperatures
      - **VCS DEP 2.0-2** stated that the 100-year return period noncoincident wet-bulb temperature of 87.3 F exceeded the AP1000 DCD site parameter value of 86.1 F
- 2.3.2 Local Meteorology
  - Addressed the Cooling Tower-Induced Effects on Temperature, Moisture, and Salt Deposition
  - Provided detailed information showing that the VCS meteorological data is representative of the site area

Technical Topics of Interest

- 2.3.3 Onsite Meteorological Measurement Program
  - COL applicant described the onsite meteorological measurements program and provided a copy of the resulting meteorological data.
  - Applicant met RG 1.23, Revision 1 criteria for siting of the tower in relation to Units 2 & 3
    - New meteorological tower began recording data in December 2006.
    - Staff verified that the location of the new tower is representative of the site area.
    - Unit 1 meteorological tower will serve as a backup data source for Units 2 and 3 during routine service, maintenance, and accidental atmospheric radiological releases.

Technical Topics of Interest

- 2.3.4 Short-Term (Accident) Diffusion Estimates
  - Comparison of atmospheric dispersion site parameters and site characteristics
  - COL FSAR presented EAB & LPZ χ/Q values
  - COL FSAR presented Control Room χ/Q values

- 2.3.5 Long-Term (Routine) Diffusion Estimates
  - Comparison of atmospheric dispersion site parameters and site characteristics
  - COL FSAR 2.3-5 verified release points and receptor locations

VC Summer Unit 2/3
Site Overview & SAR Section 2.5

Bob Whorton

SCE&G - Consulting Engineer


MAPQUEST
LEE
SUMMER
VOGTLE
North Carolina
South Carolina
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Gastonia
Concord
Huntersville
Stanley
Albemarle
Troy
Hendersonville
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Shelby
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Brevard
Cullowhee
Etowah
Tuckasegee
Glenville
Cashiers
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Landrum
Cleveland
Gaffney
Clover
Matthews
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Clinton
Union
Chester
Lancaster
Cheraw
Hartsville
Darlington
Florence
Winnsboro
Newberry
Prosperity
Blythewood
Chapin
St. Andrews
Columbia
Lexington
Batesburg-Leesville
Camden
Lugoff
Bishopville
Sumter
Manning
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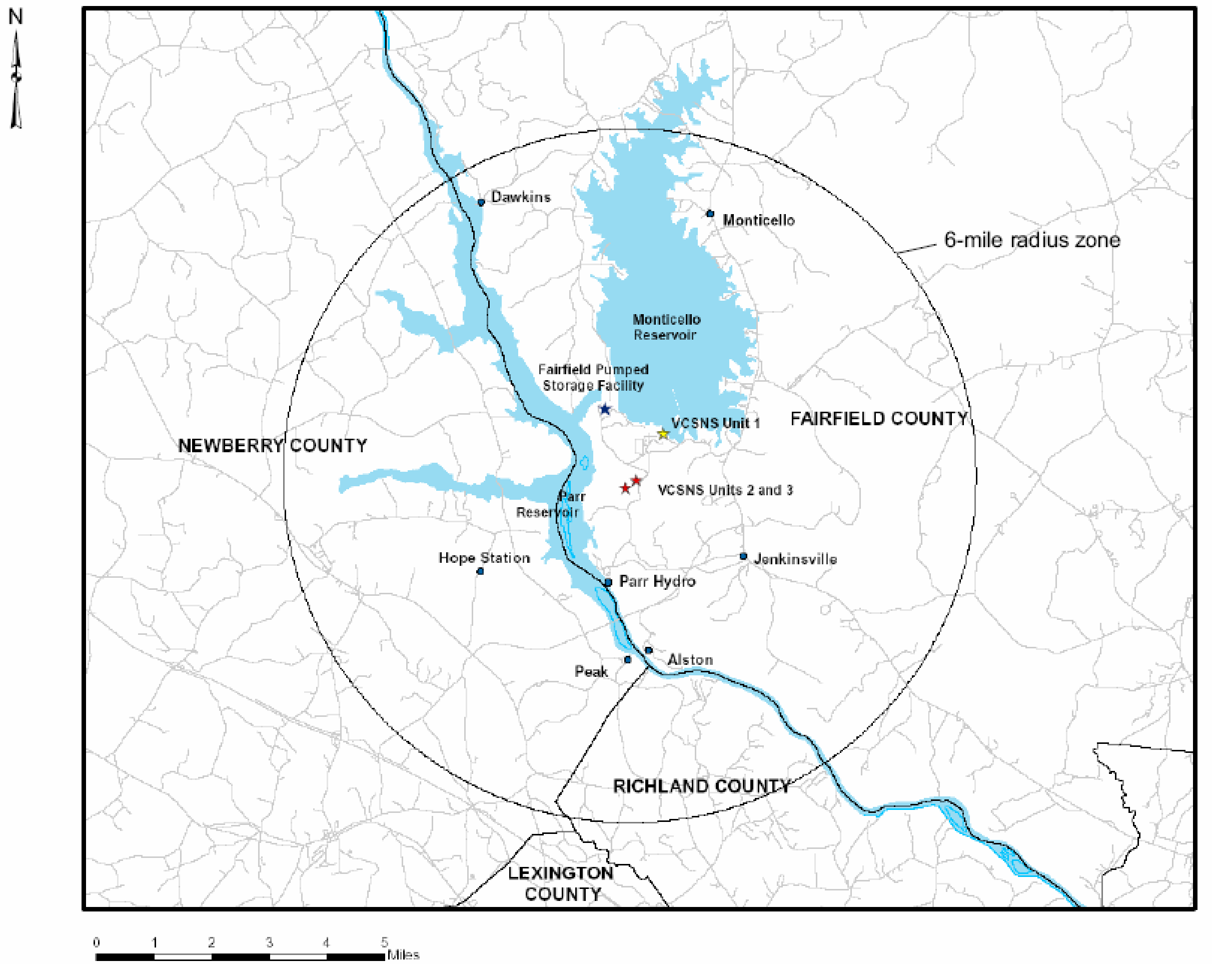
VC Summer Unit 2/3




Lake Monticello
V.C. Summer Station Unit 1
Proposed Units 2 & 3
(Artist rendering)
Low profile cooling towers
for proposed Units 2 & 3
(Artist rendering)

Unit 1 – 2007 Aerial Photo


VC Summer Site - Jan 2010
VCS Units 2&3
Equipment Laydown Area
Warehouse Area
Construction Offices

U2 Power Block Excavation & Geologic Mapping

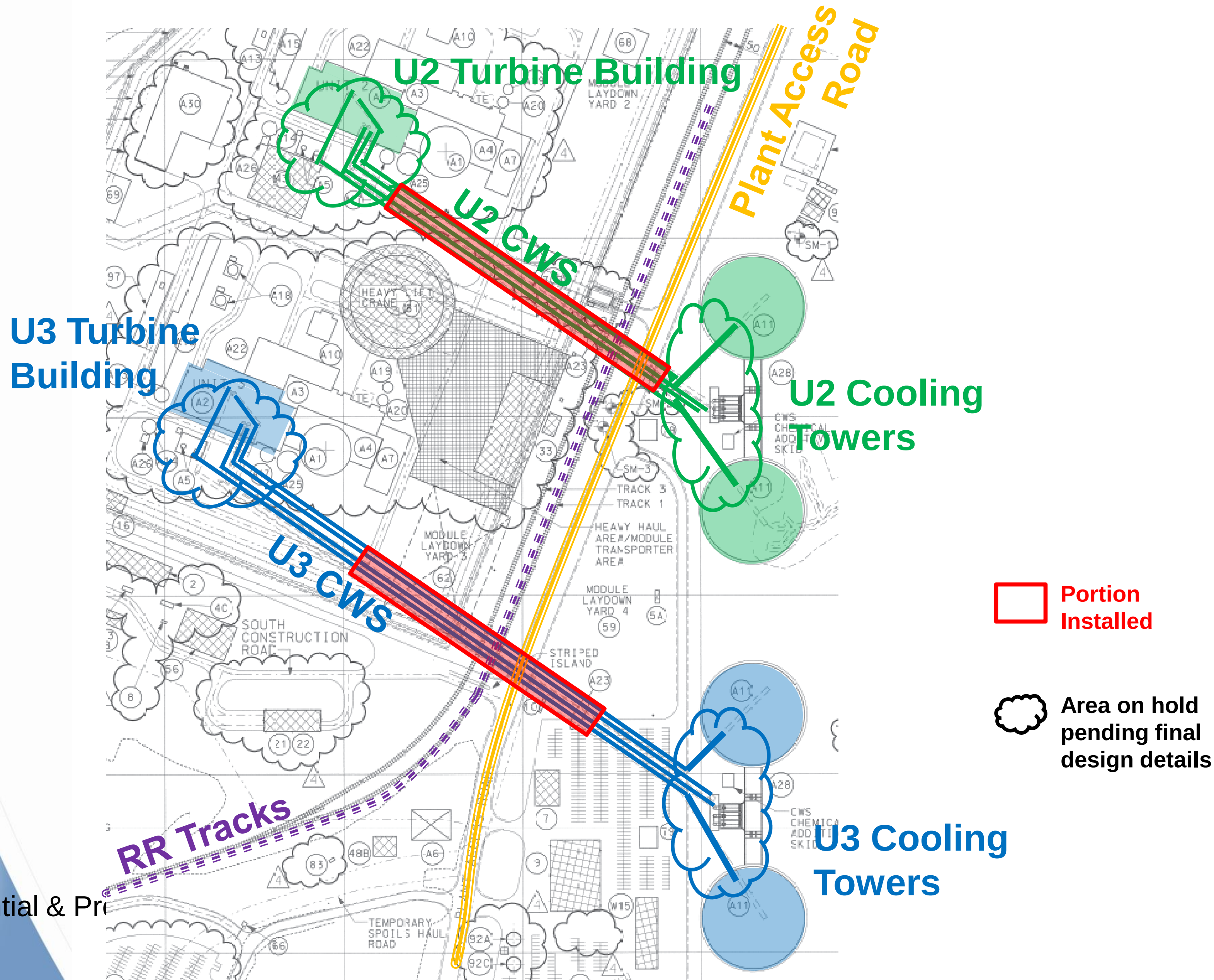
VCS
V.C. SUMMER
NEW NUCLEAR PROJECT

Unit 2 Power Block Excavation

Unit 2 Excavation

Unit 2 Panel Section Geologic Mapping

CWS Pipe Installation



CWS Pipe Installation

VCS
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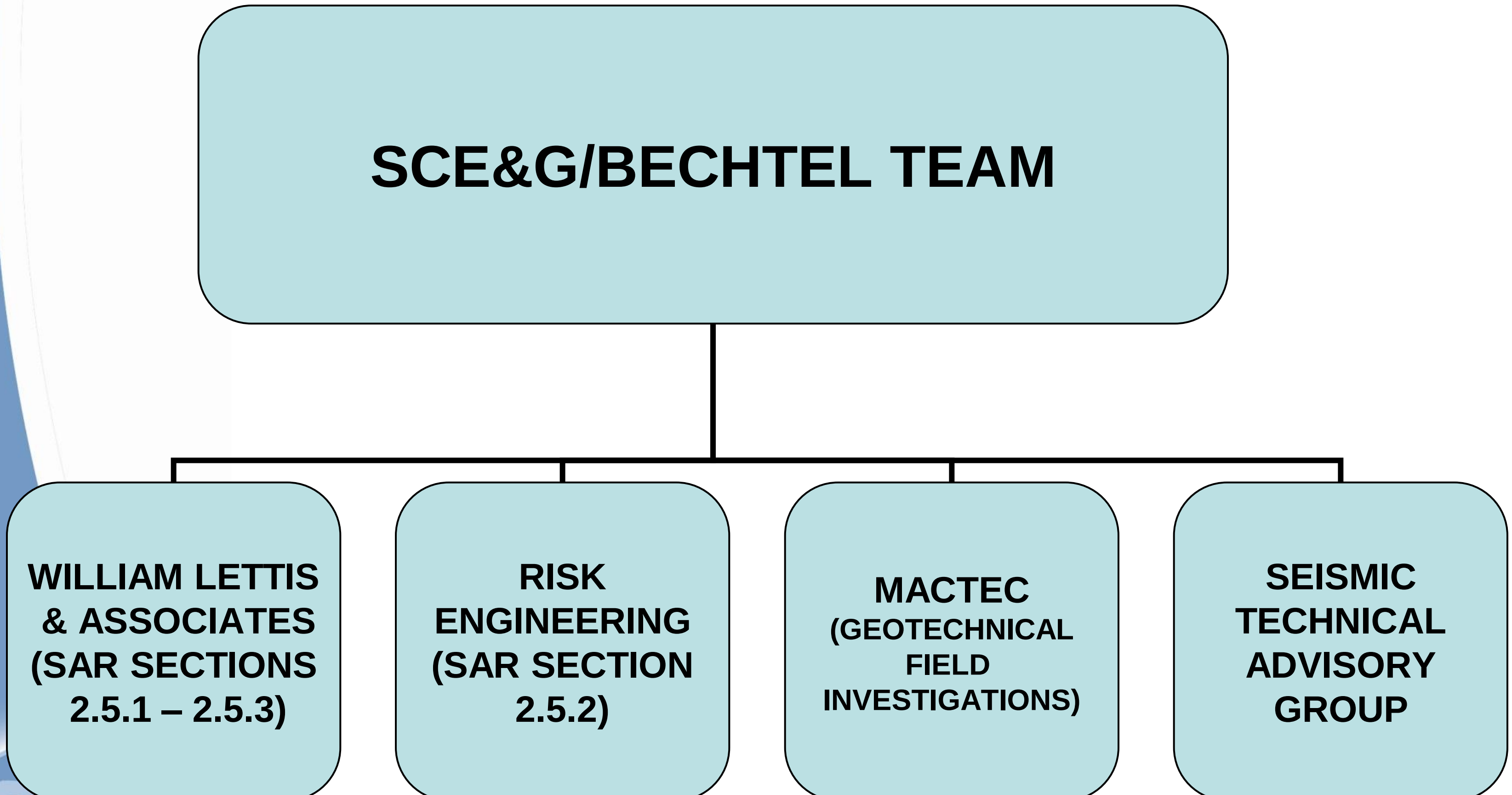
NEW NUCLEAR PROJECT

Unit 3 – CW Line Installation

SAR SECTION 2.5
TECHNICAL DEVELOPMENT



SUMMER - SEISMIC TECHNICAL ADVISORY GROUP (TAG)

- Dr. Martin Chapman – Virginia Tech
- Dr. Allin Cornell – Stanford
- Dr. Robert Kennedy – Consultant
- Mr. Don Moore – Southern Company
- Dr. Carl Stepp – Consultant

SCE&G VC Summer COL

SCE&G • Santee Cooper
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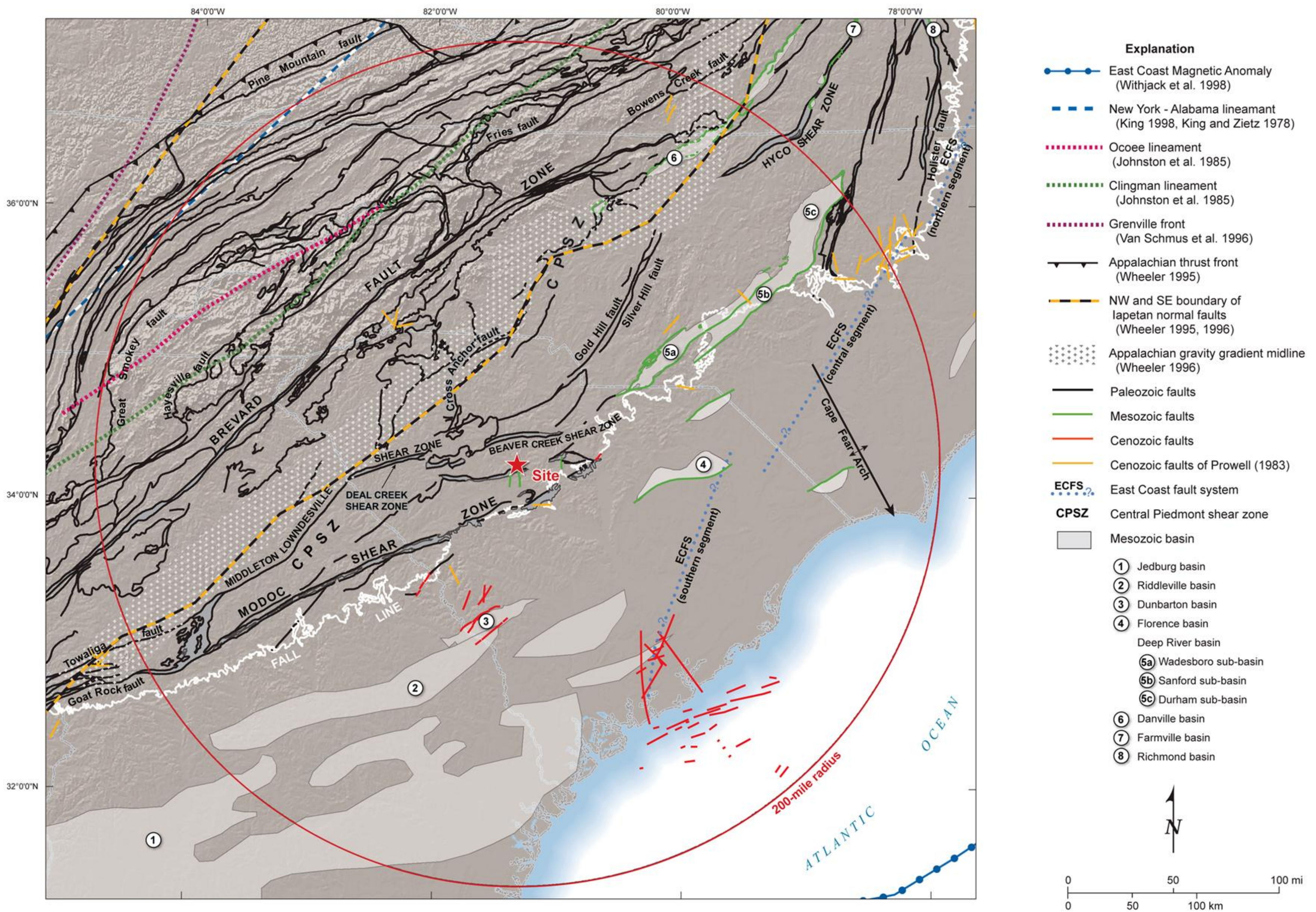
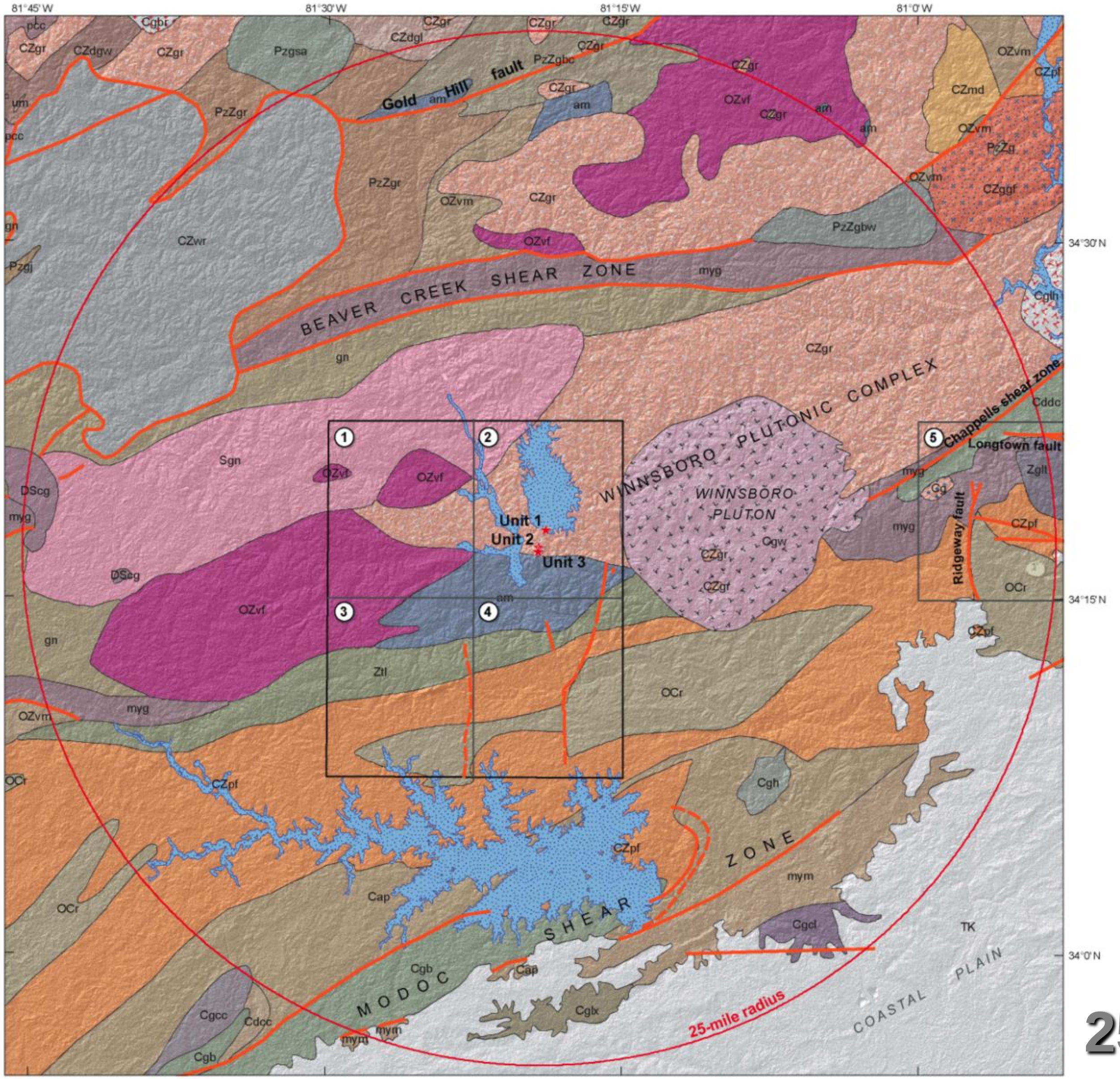
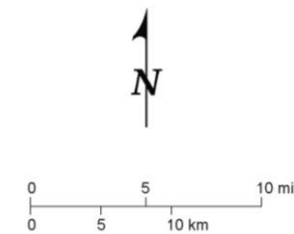
SAR Sections
2.5.1 and 2.5.3

Basic Geologic and Seismic Information & Surface Faulting

200-mi Map of Tectonic Features



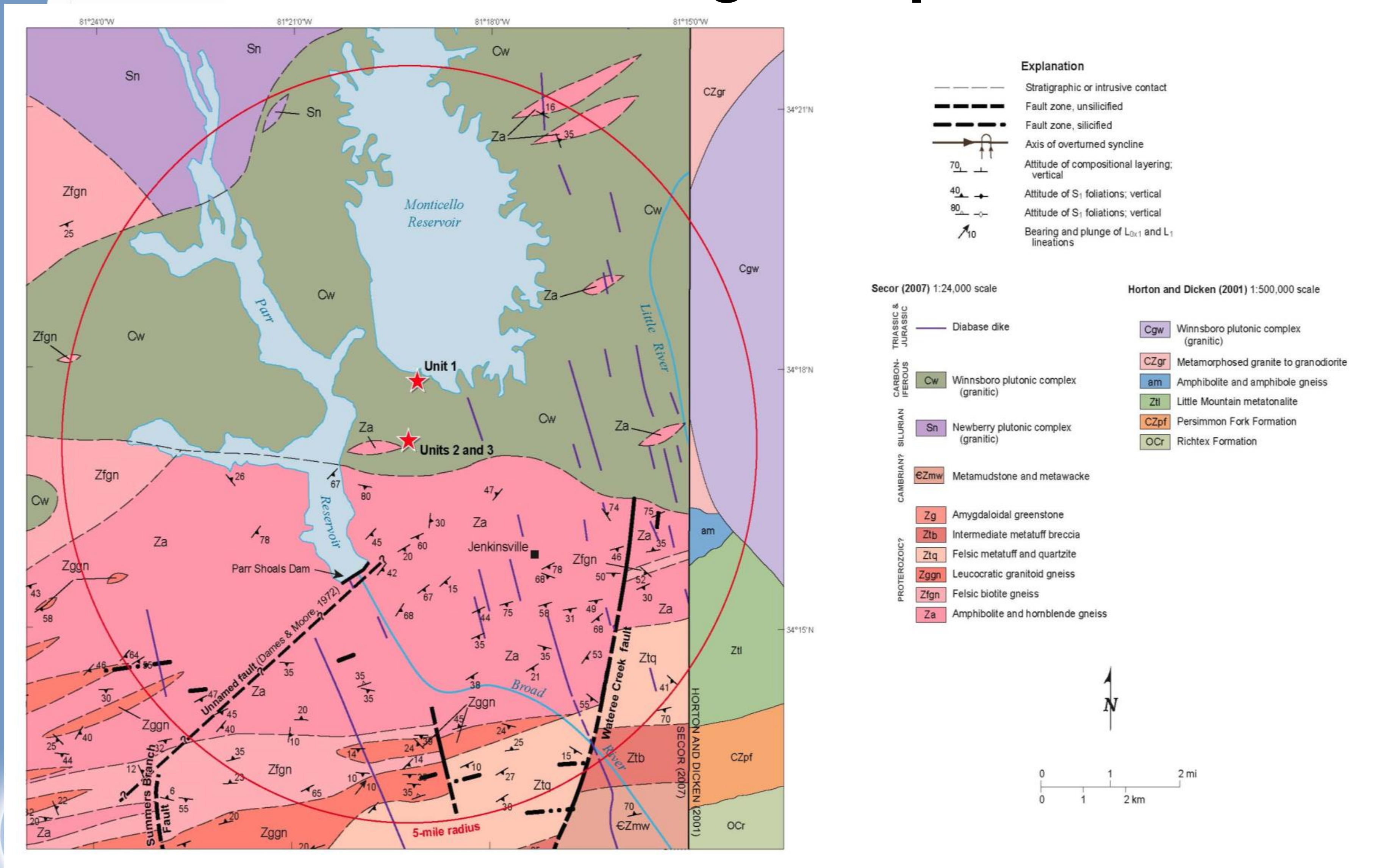




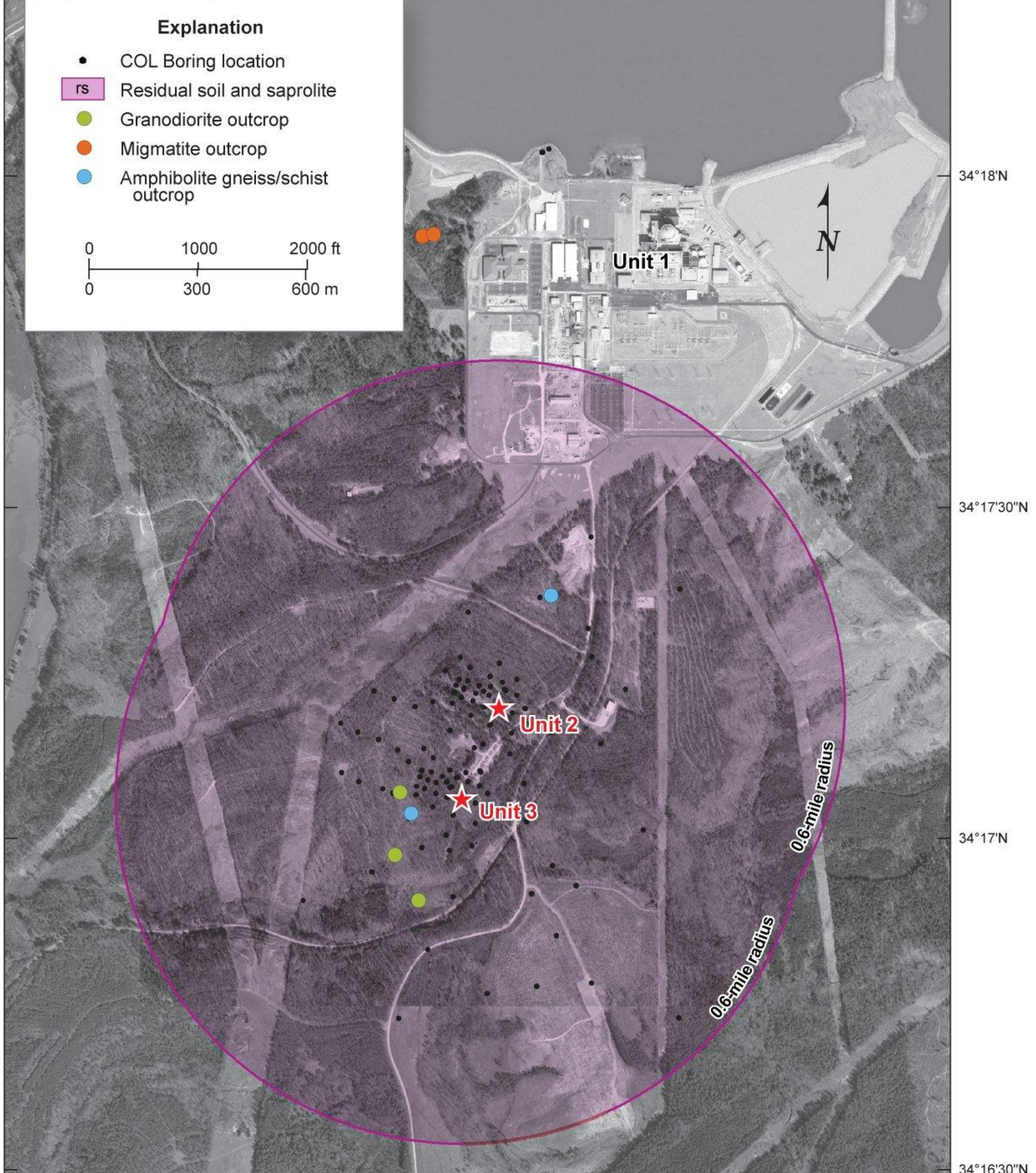
25-mi Geologic Map

Modified from Horton and Dicken (2001), Hibbard et al (2006), and Secor (2007)

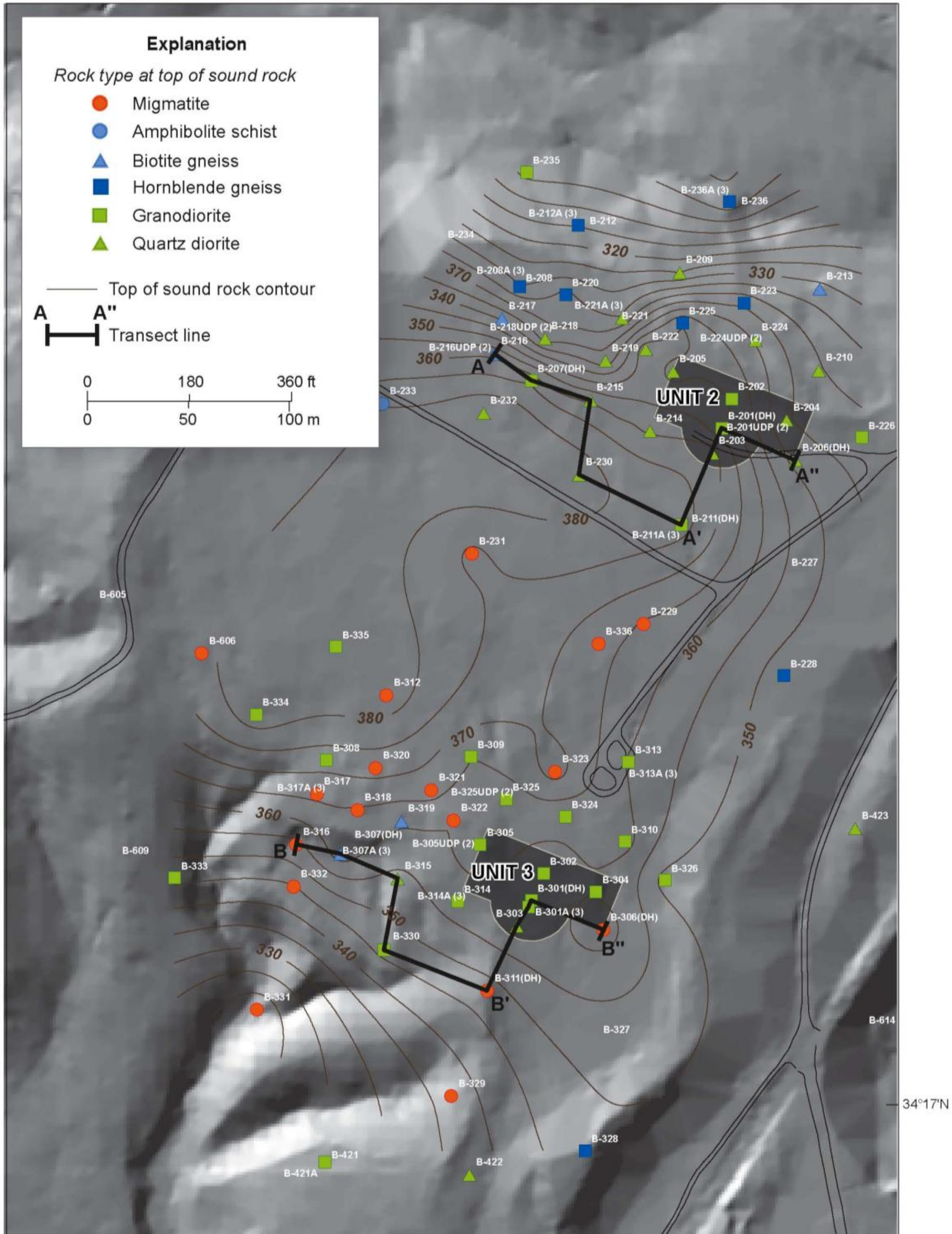
5-mi Geologic Map



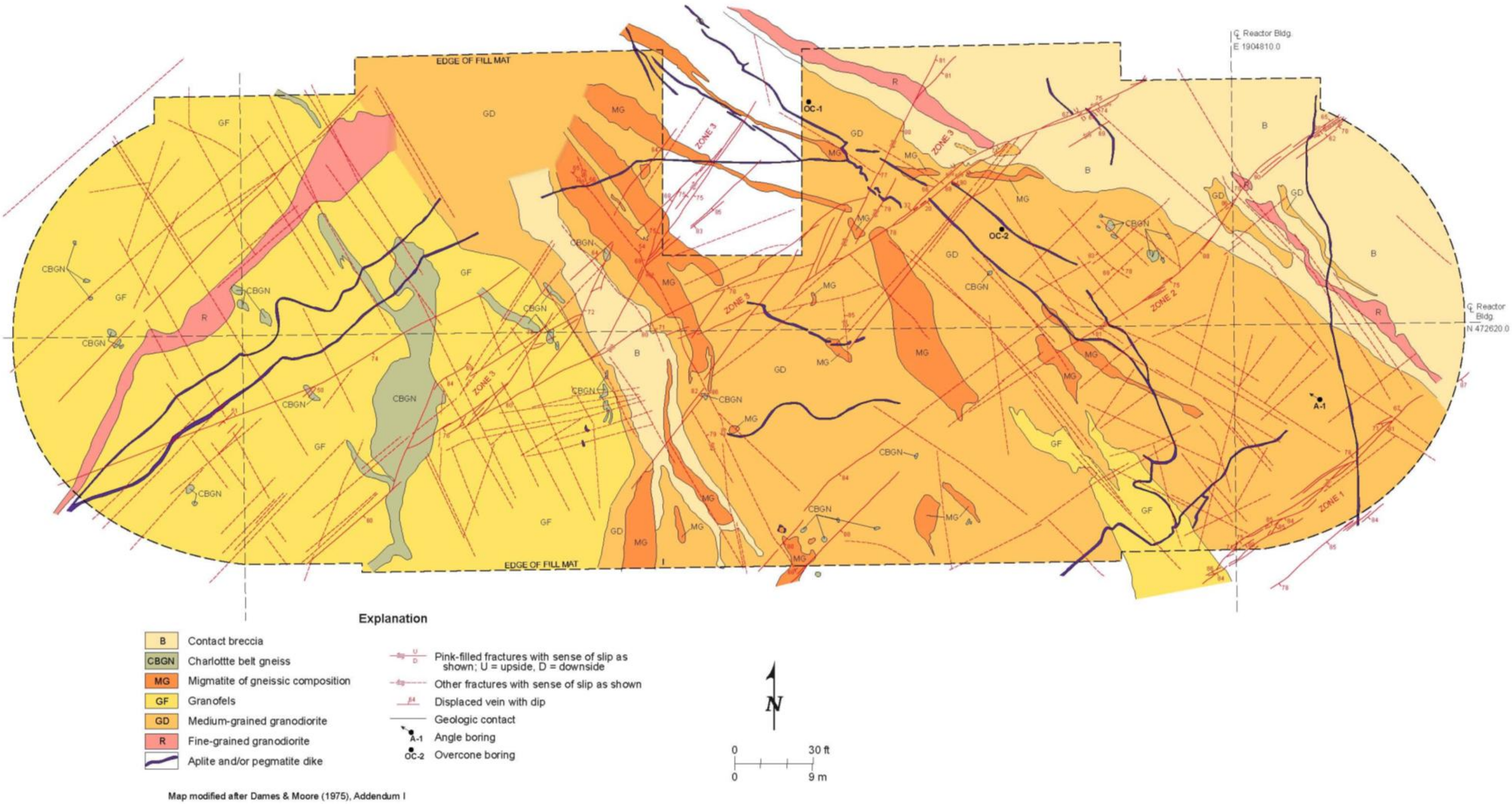
0.6-mi Surficial Geologic Map



Top of Sound Rock Beneath Units 2 and 3



Unit 1 Foundation Map (Right)



Unit 1 Surface Faulting Summary

- Excavation mapping of Unit 1 found small, bedrock shears. These minor features were demonstrated to have last moved between 300 and 45 Ma.
- It was concluded that minor bedrock shears likely exist throughout site, but these <u>do not</u> represent a surface rupture hazard

Unit 2/3 COLA RESULTS

- No Quaternary Fault or Capable Tectonic Sources exist within 25 Miles of the Site
- Maximum Potential for Vibratory Ground Motion at the Site due to Reservoir Induced Seismicity is Bounded by the AP1000 Certified Seismic Design Response Spectra

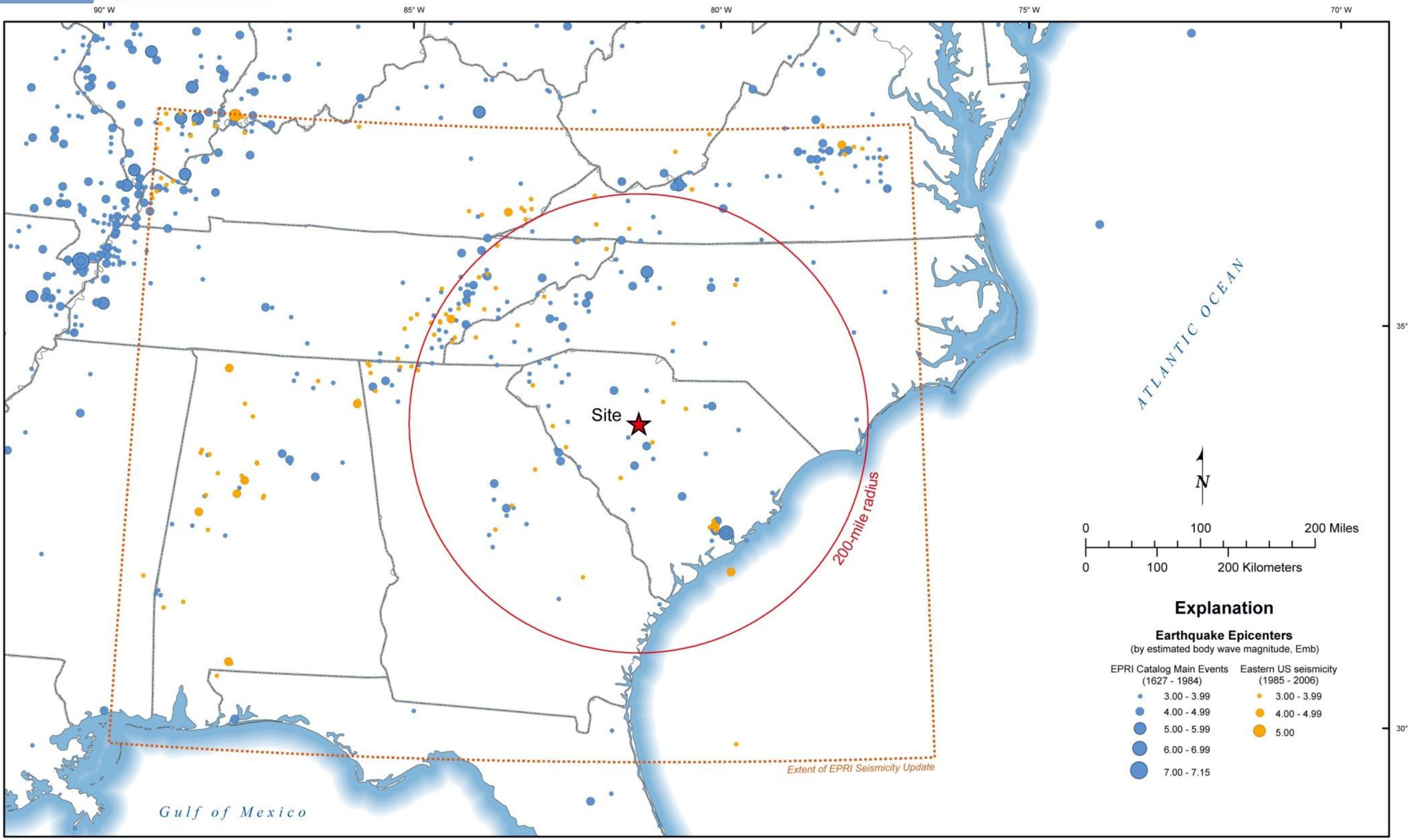
SCE&G VC Summer COL

SCE&G • Santee Cooper
Shaw • Westinghouse Electric Company

FSAR Sections
2.5.2

Vibratory Ground Motion

Updated Seismicity Catalogs

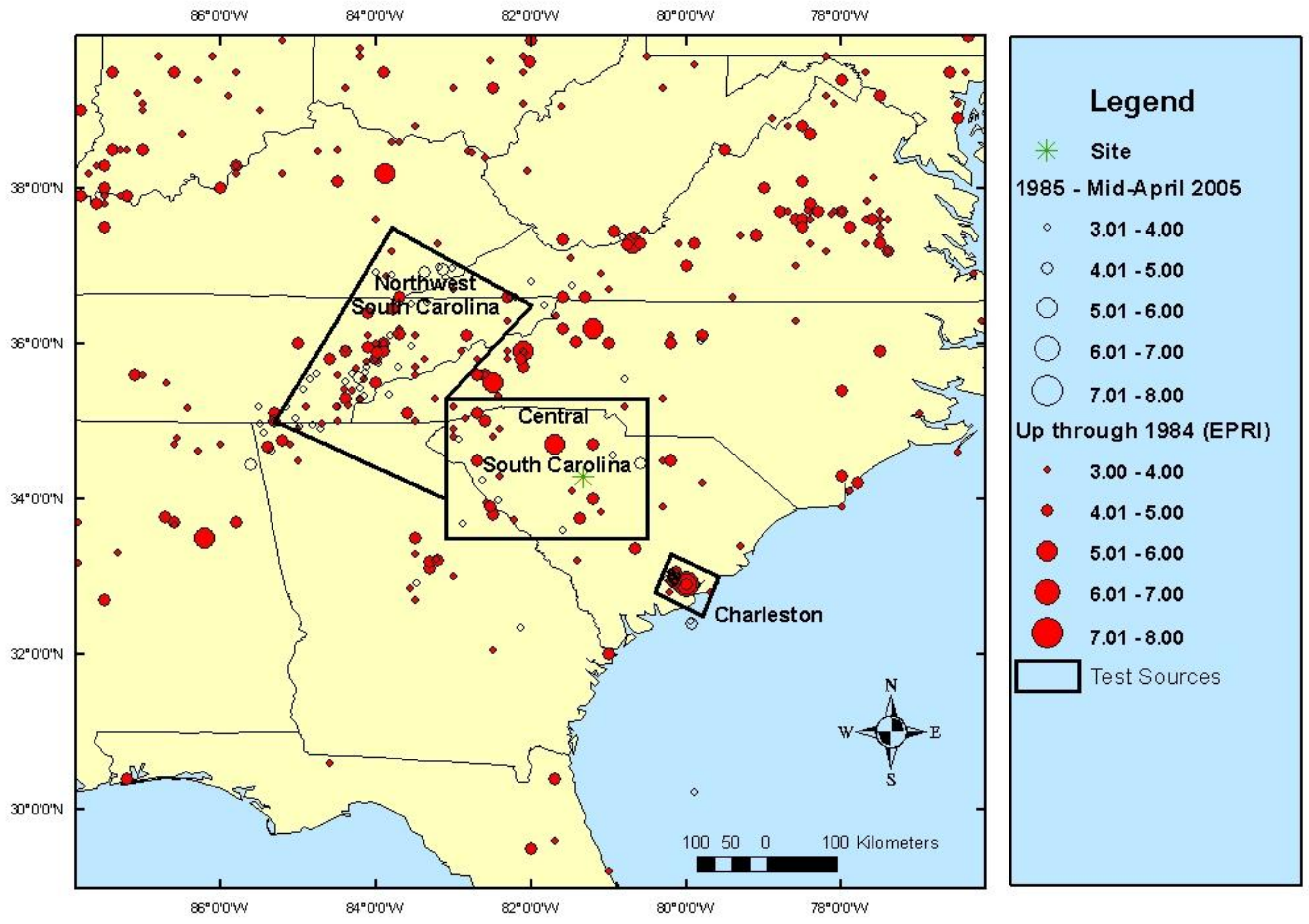


V.C. SUMMER
NEW NUCLEAR PROJECT

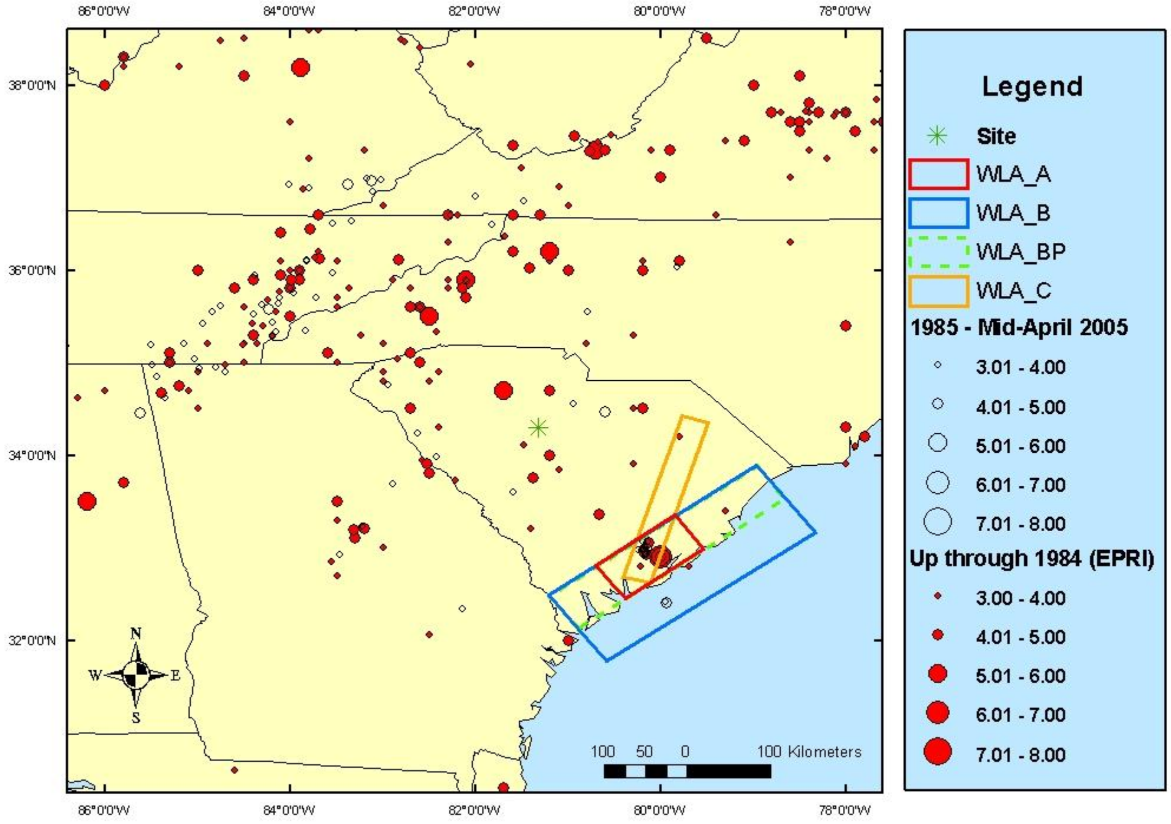
Probabilistic Seismic Hazard Analysis

- Replicated 1989 EPRI hazard results
- Evaluated effect of updated seismicity
- Updated the Charleston seismic sources
- Developed Seismic Hazard and UHRS (hard rock)
- Developed V/H ratios and GMRS (hard rock)

Historical seismicity in vicinity of Summer site and three areas used to test the effects of additional seismicity



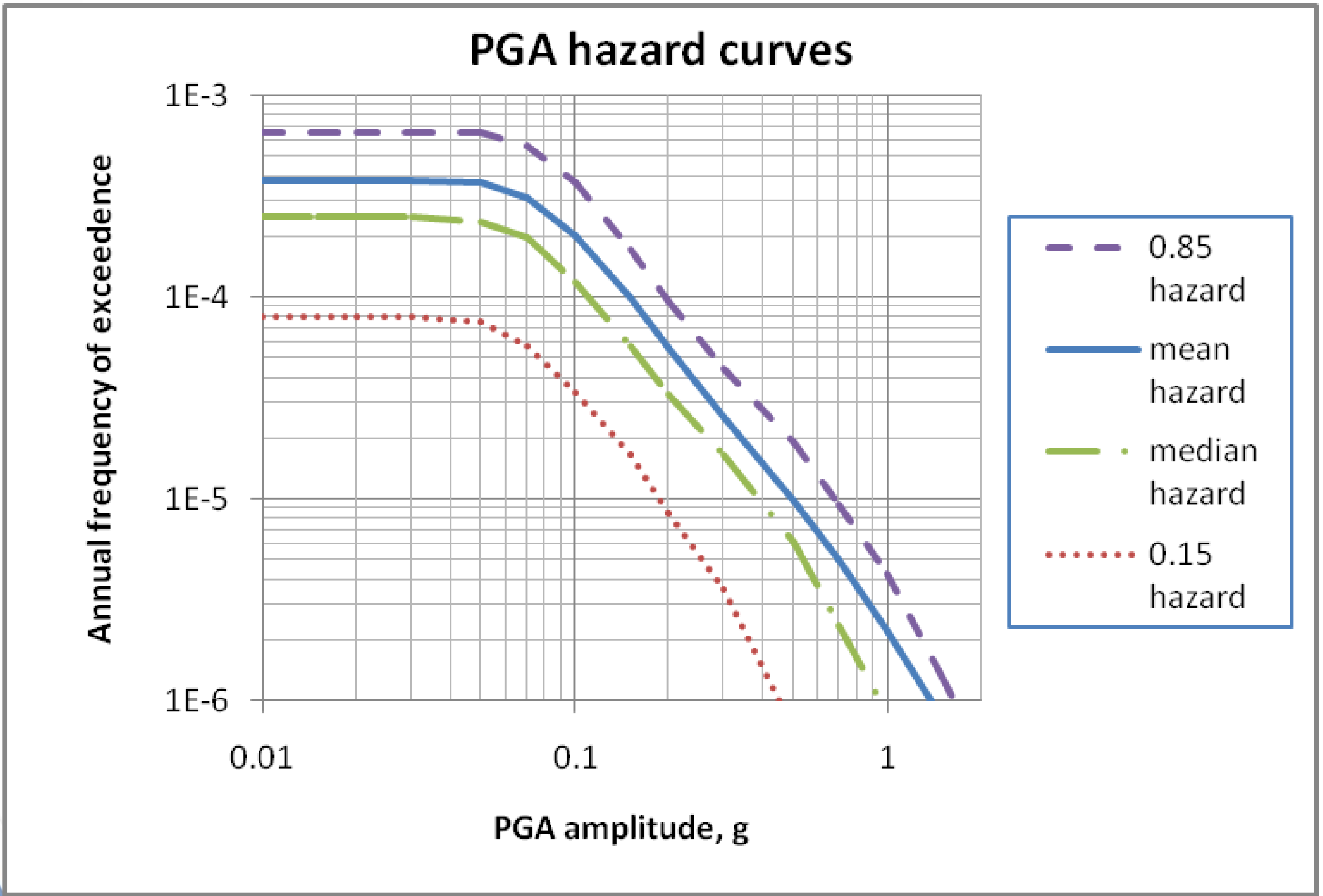
Geometry of Four Sources Used in Updated Charleston Seismic Source (UCSS) Model



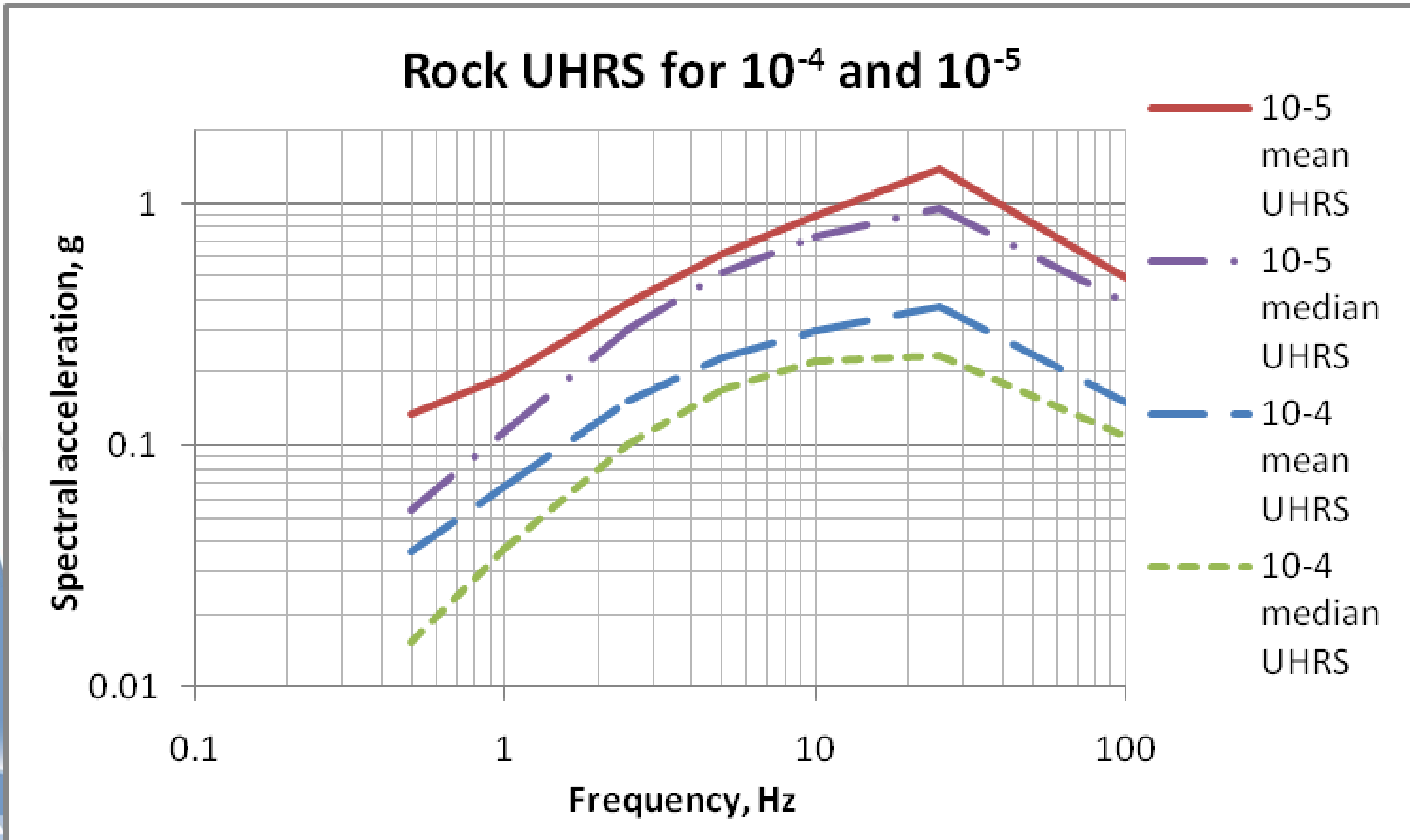
Summary of VC Summer Seismic Source Model

- No new Capable Tectonic Sources were identified within the site region
- No modifications to the Eastern Tennessee Seismic Zone were required
- Updated Charleston model replaced the EPRI sources (as adopted from Vogtle)
- New Madrid Source was added (which adopted the Clinton characterization)

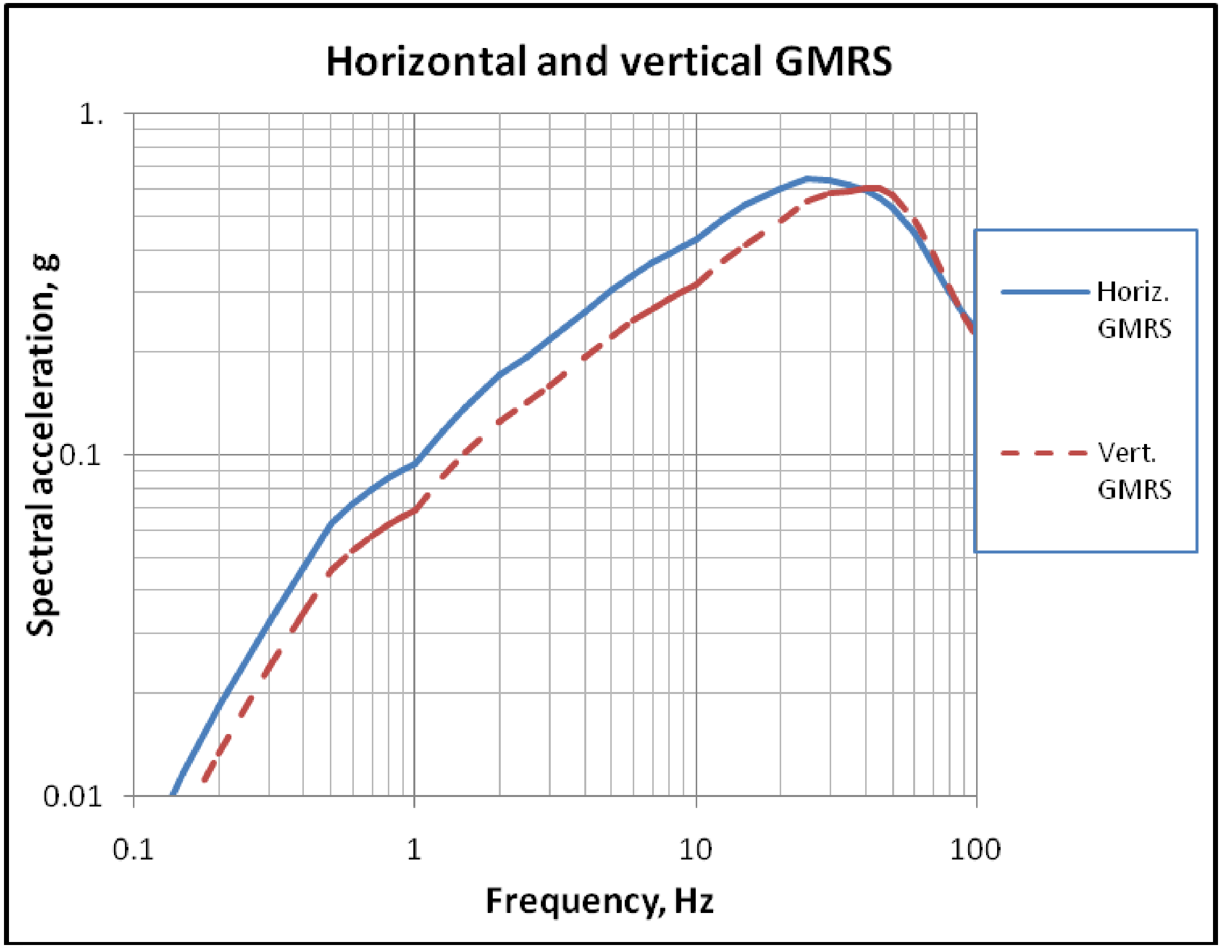
Mean and Fractile PGA Seismic Hazard Curves



Mean and Median Uniform Hazard Response Spectra



Horizontal and Vertical GMRS



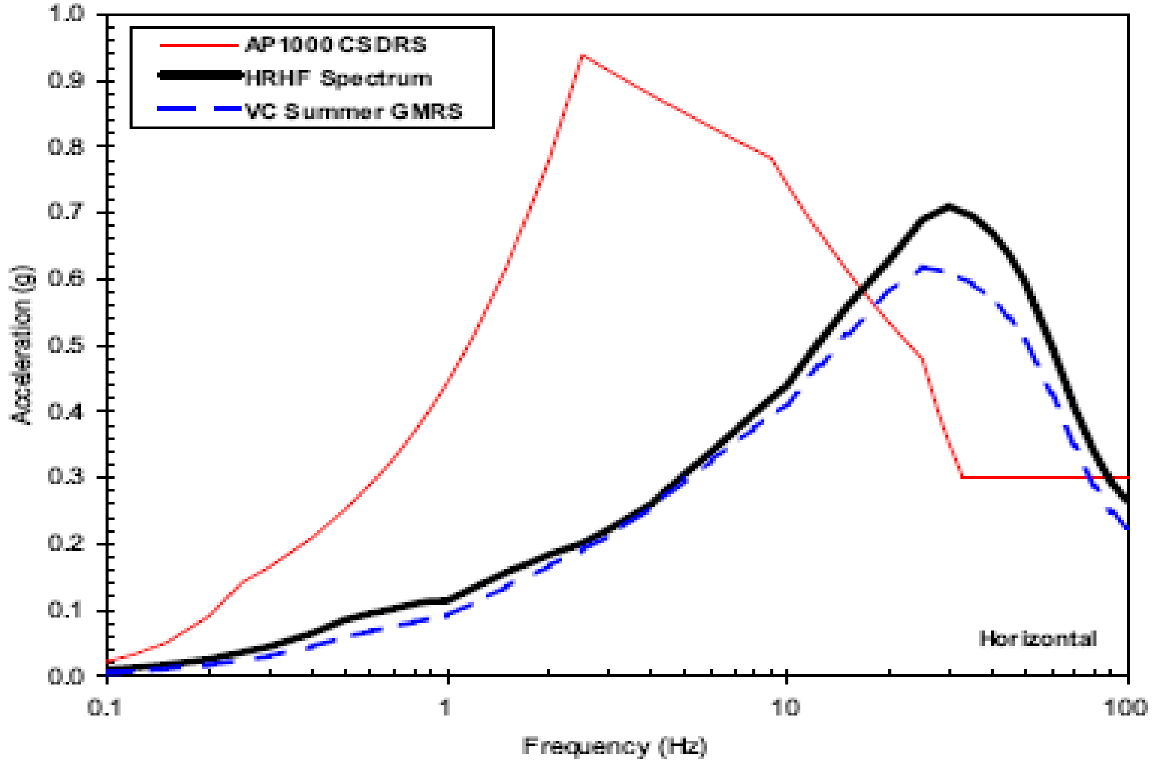


Figure 2.0-201. Comparison Plot of V. C. Summer GMRS and HRHF Spectra for the Horizontal Component of Motion

SCE&G VC Summer COL

SCE&G • Santee Cooper
Shaw • Westinghouse Electric Company

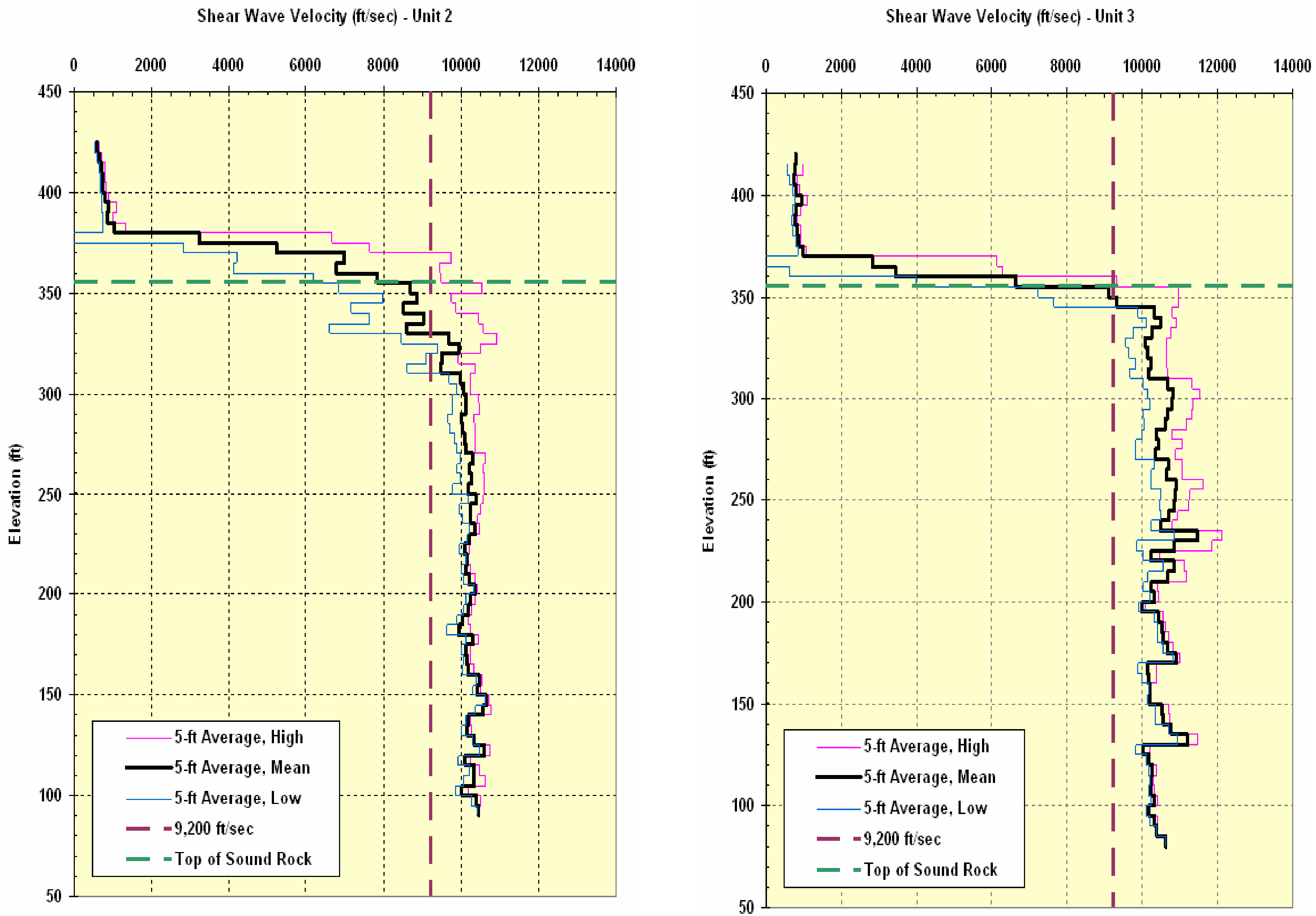
FSAR Sections
2.5.4

Site Geotechnical Characterization/ Foundations

Description of Subsurface Materials

- **Residual Soil** – reddish silty sands and sandy silts with variable clay content
- **Saprolite** – completely weathered rock but w/preserved relict rock structure, mainly silty sands
- **Partially Weathered Rock (PWR)** – decomposed rock matrix mixed w/semi-hard rock fragments
- **Moderately Weathered Rock (MWR)** -- >50% by volume of sound rock interspersed w/decomposed zones
- **Sound Rock** – Hard fresh to slightly discolored rock (granodiorite, quartz diorite, gneiss, schist, migmatite)

2.5.4.7.2 Vs Averaging at 5 Ft Intervals



Excavation Cross-Section

V. C. Summer Nuclear Station, Units 2 and 3
COL Application
Part 2, FSAR

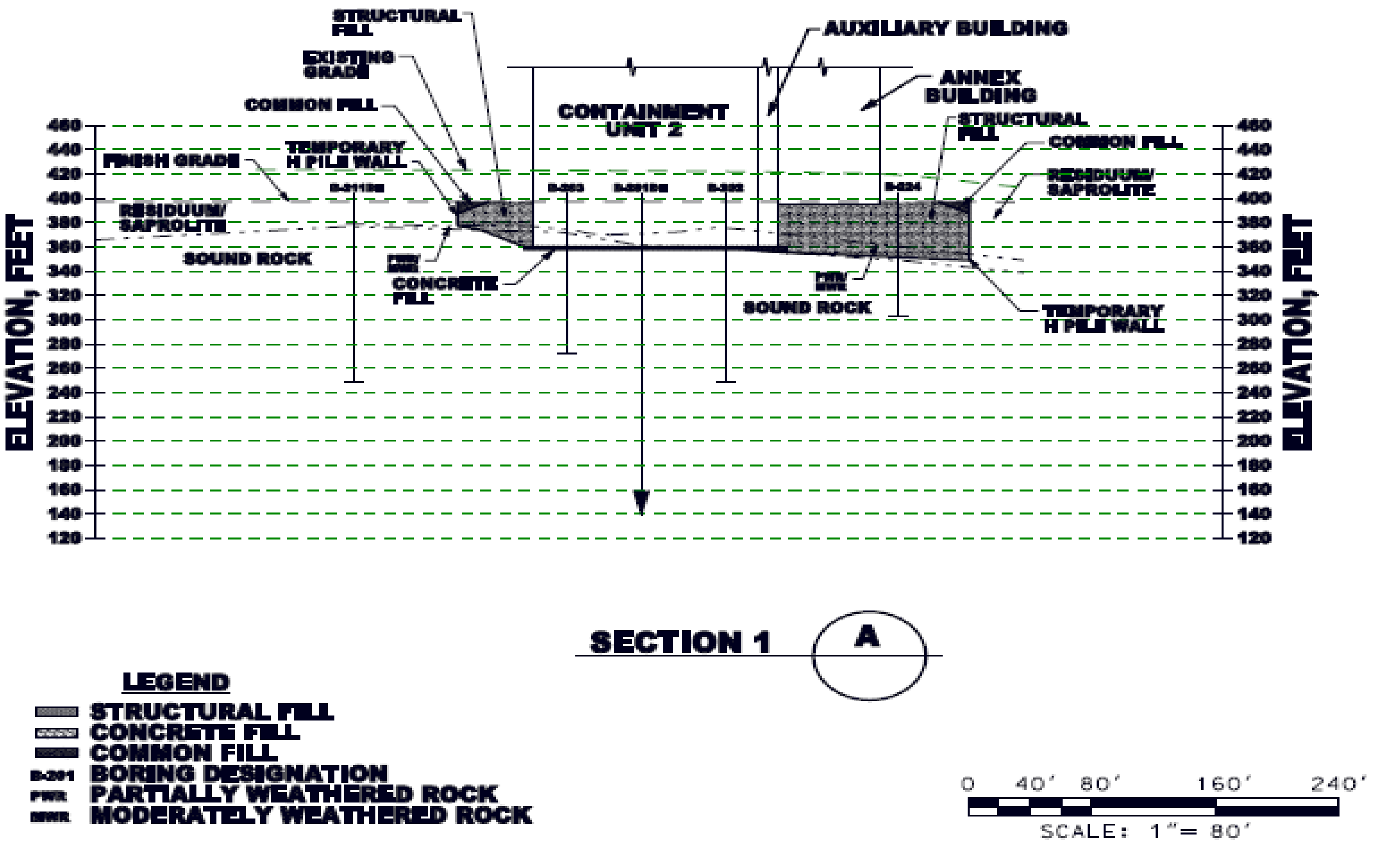


Figure 2.5.4-220. Cross-Section of Structure Foundation A-A

Section 2.5.4.8 Liquefaction Potential

- Nuclear Island is on sound rock or on concrete on sound rock.

- Power Block structures, including Seismic Category II Annex Building and Turbine Building (1st Bay) are on compacted structural fill. Which will not liquefy

- No saprolite is within the zone of influence of the foundation loading of Seismic Category I / II structures

<u>CONCLUSION: Liquefaction can not impact plant safety</u>

VCS V.C. SUMMER NEW NUCLEAR PROJECT

VCSNS UNIT 1 EXCAVATION SHEAR FRACTURES

- **Late 1973 - Unit 1 Excavations Removed Overburden Material to Competent Rock**
- **Dames & Moore Resident Geologist Identified Shear Fractures at Rock Surface**
- **Early 1974 - NRC Issued Stop-Work-Order**
- **SCE&G Mobilized Team of Regional Experts for Further Evaluations**

EXPERT REVIEW TEAM

- **Dr. Robert Butler – UNC**
- **Dr. Gil Bollinger – Virginia Tech**
- **Dr. Robert Carpenter – Georgia**
- **Dr. Villard Griffin – Clemson**
- **Dr. Jasper Stuckey – NC State**

Geological Investigation – Dames & Moore

GEOLOGICAL INVESTIGATION

- Detailed Geologic Mapping & Sampling
- Excavation of Trenches
- Drilling an Inclined Boring
- Radiometric Age Dating
- X-Ray Defraction Analysis

GEOLOGICAL INVESTIGATION

- Literature Searches
- Aerial Photo & ERTS-1 Imagery
- Gravity & Magnetic Data Analysis
- In-Place Stress Measurement
- Review of Local Microseismic Data
- Off-Site Geological Reconnaissance

VCS V.C. SUMMER NEW NUCLEAR PROJECT

Unit 1 Excavation (Northeast View)

Unit 1 Excavation (South View)

UNIT 1 CONCLUSIONS

- **Rock Structure Characteristics Considered Typical of Piedmont Conditions – With Similar Fractures Likely to be Found Anywhere in the Surrounding Region**
- **Documentation of Recent Tectonic Displacement (within 100 Miles of the Site) Does Not Exist**
- **Shear Orientation is Consistent with Regional Joint Pattern and Not Integral with Any Known Fault System**

UNIT 1 CONCLUSIONS

- **A Hydrothermal Event Occurred Subsequent to Termination of All Shear Movement with Emplacement of Zeolite Laumontite (which has not deformed)**
- **Age Dating Indicates that Movement Along the Shears could not have Occurred Later than 45 MYBP and Probably Inactive for 150-300 MYBP**
- **In-Situ Rock Stresses are Relatively Low**

UNITS 2 & 3 CONCLUSIONS

- **Consistent with the results of the Unit 1 investigation, we expect foundation excavations for Units 2 & 3 will have similar shear fractures. Current mapping indicates that such features are integral with the geologic setting.**
- **Current Geological Investigations have not Identified any New Data to Change our Current Interpretations.**
- **Units 2 & 3 Excavations are being geologically mapped and results documented for review by NRC.**
- **SAR Section 2.5.1 Concludes that the Shear Fractures are not Capable Tectonic Sources and do not Represent Ground Motion or Surface Rupture Hazards to the Site.**

UNIT 1
RESERVOIR INDUCED SEISMICITY

- 1974-76 – Prior to Construction of Monticello Reservoir, Background Microseismic Activity ~ 1 Event Every 6 Days [Jenkinsville (JSC)]
- Mid-1977 – SCE&G Installed 4-Station Microseismic Network (Recommended by Dr. Gil Bollinger)
- December 1977 - March 1978 Monticello Reservoir Filled
- Late December 1977 – Microseismic Activity Dramatically Increased (Peaking at 800 Events During February 1978)

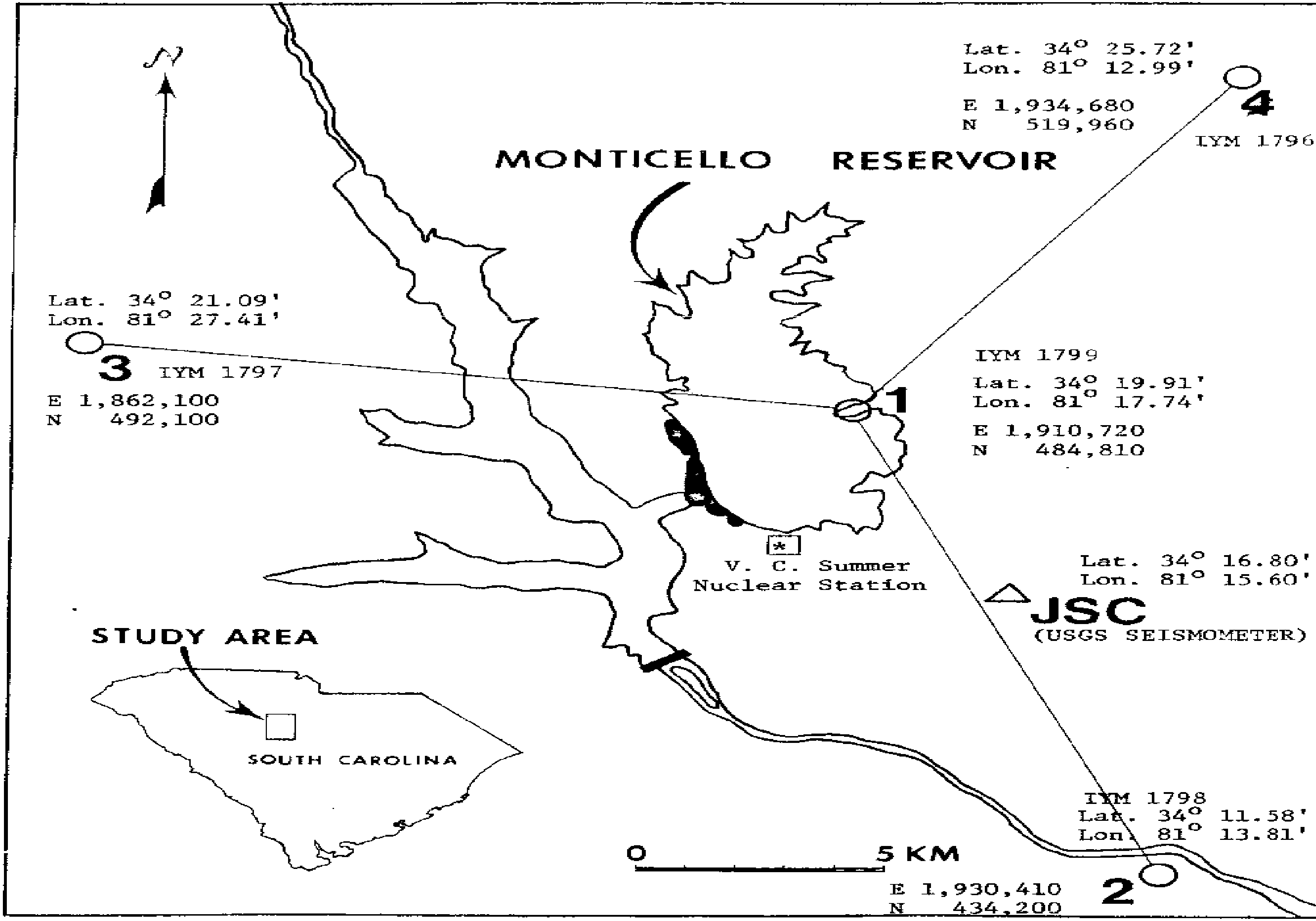
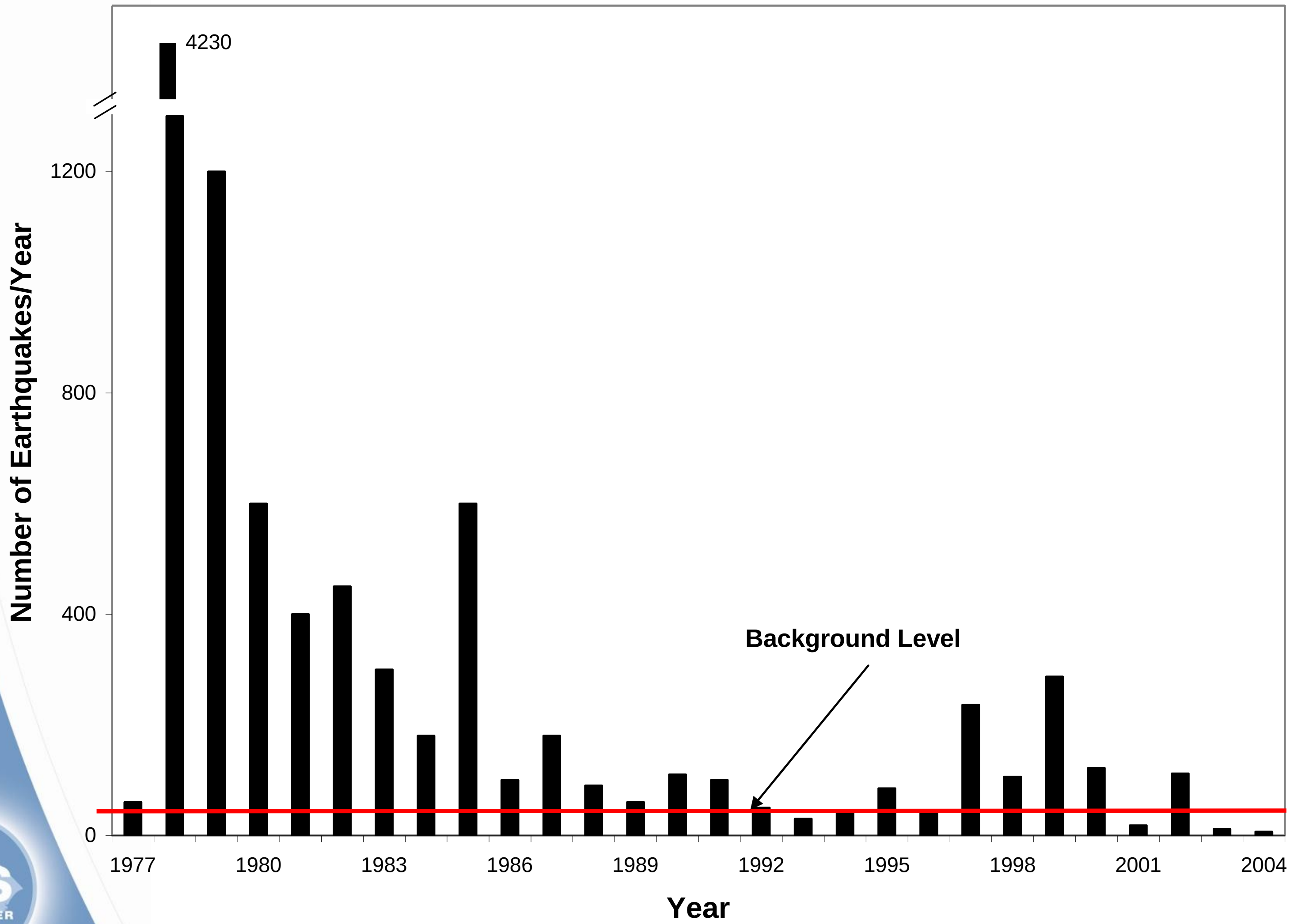


Figure 3
ORIGINAL LOCATIONS OF SCE&G 4-STATION MICROSEISMIC NETWORK

RIS Histogram (1977 – 2004)

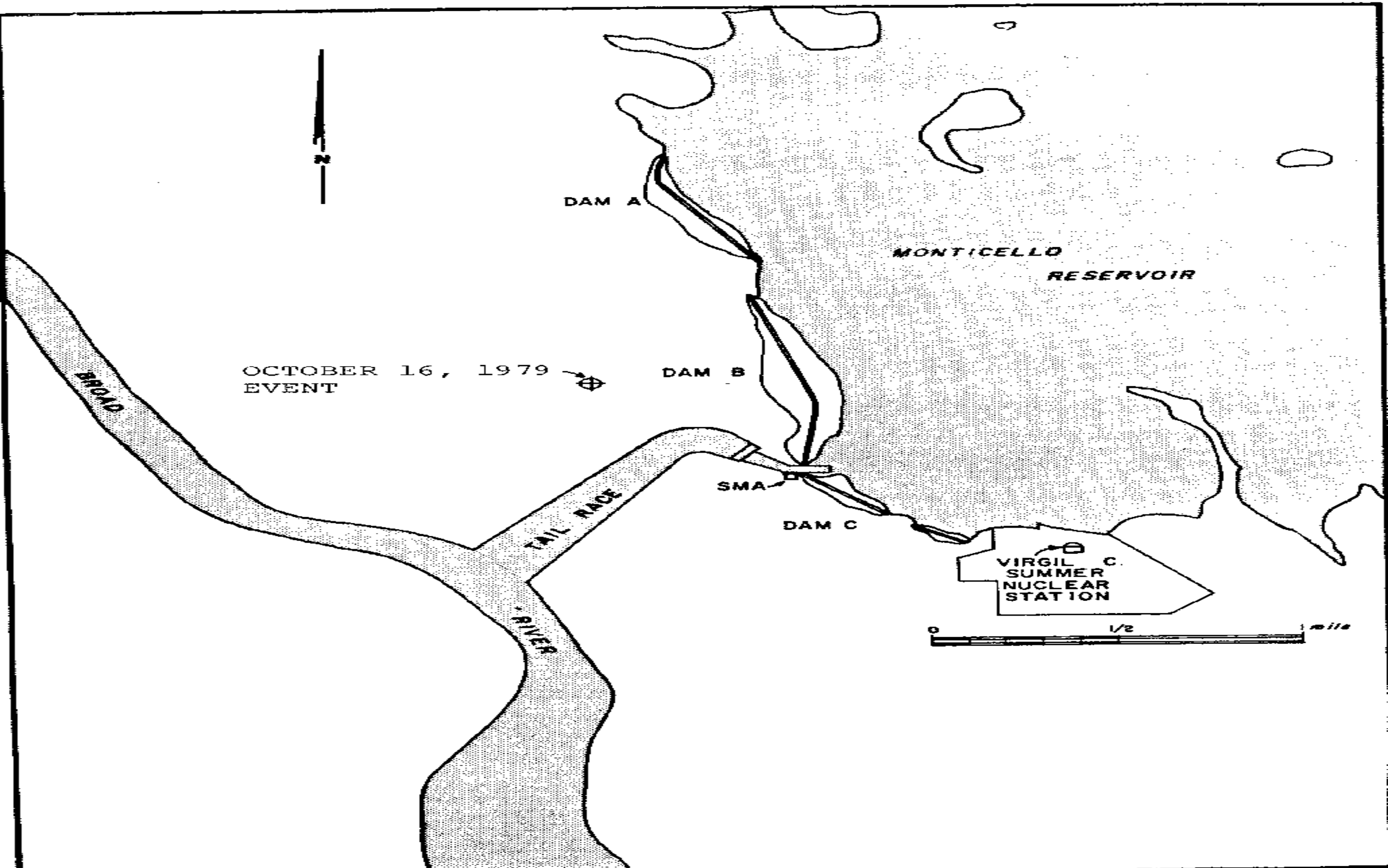


SEISMIC MONITORING PROGRAM

- 1974 – SC Network Seismometer at Jenkinsville (JSC) Installed Nearby (approximately 2.5 miles SE of Unit 1)
- 1977 - SCE&G Microseismic Monitoring Network (4-Station) Installed, with Data Evaluated by Dr. Pradeep Talwani (USC)
- 1995 – NRC Approved the SCE&G Request for Discontinuation of the Seismic Monitoring Network
- 1996 – SCE&G Donates Network Instrumentation to USC (along with providing supplemental funding)
- 2004 – USC Terminates Network Operation due to Equipment Age and Failures
- 2010 – Jenkinsville Seismometer (JSC) Continues operation as part of the SC Seismic Network

RESERVOIR INDUCED SEISMICITY

- **Early-1978 - USGS Installed a Strong Motion Accelerometer at a Free-Field Dam Abutment of Monticello Reservoir which recorded two events:**
  - **August 27, 1978 – M_L 2.8 – PGA: 0.25g**
  - **October 16, 1979 – M_L 2.8 – PGA: 0.36g**



LEGEND:

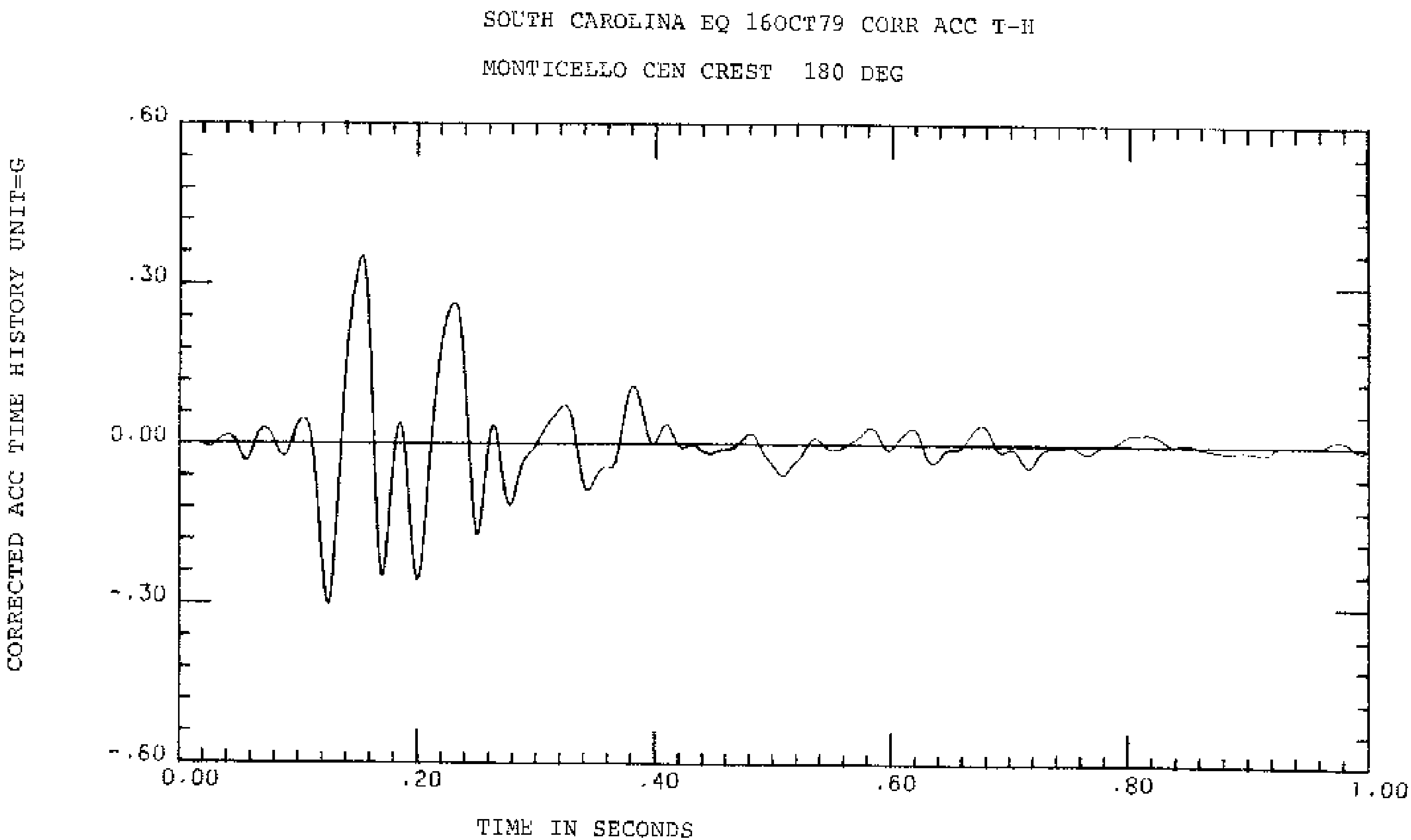
⊕ COMPUTED LOCATION OF EPICENTER OF 0.36g EVENT OF OCTOBER 16, 1979

SMA□ LOCATION OF STRONG MOTION ACCELEROGRAPH

South Carolina Electric & Gas Co.
Virgil C. Summer Nuclear Station

OCTOBER 16, 1979
EARTHQUAKE

Figure 9



TIME HISTORY OF CORRECTED 180° RECORD WITHOUT CLIPPING

Figure 10

UNITS 2 & 3 CONCLUSIONS

- SAR Section 2.5.2 Documents RIS Associated with Monticello Reservoir
- Microseismic Activity has diminished to the Pre-Impoundment Background Rate with Occasional Spurts of Activity
- RIS does not Increase Ground Motion Hazards for the Site

SEISMIC TECHNICAL ADVISORY GROUP REVIEW

VIRGIL C. SUMMER NUCLEAR STATION UNITS 2 & 3 COLA

(AS PRESENTATION TO THE
NUCLEAR REGULATORY COMMISSION
October 3, 2007)

Seismic Technical Advisory Group (TAG)

Prof. Martin C. Chapman – Virginia Tech

Prof. C. Allin Cornell – Stanford University

Dr. Robert P. Kennedy – Consultant

Mr. Donald P. Moore – Southern Nuclear

Dr. J. Carl Stepp – Consultant

Participatory Peer Review

- **TAG review meetings:**
  - Four meetings at selected COLA completion stages
  - Review draft technical results
  - Joint TAG meetings with parallel COLA preparation activities

TAG Coordination

- **AP1000 Seismic Review Committee (APSRC) - SCE&G, Duke, Entergy, TVA**
  - **New Plant Seismic Issues Resolution Program - EPRI, NEI**
    - **Updating seismic regulatory guidance**
  - **AP1000 foundation interface issues - NuStart**
  - **COLA preparation joint TAG meetings**
    - **Bellefonte Nuclear Station (BNS)**
    - **William States Lee Nuclear Station (WSLNS)**
    - **Virgil C. Summer Nuclear Station (VCSNS)**
    - **Grand Gulf Nuclear Station (GGNS)**

TAG Summer Unit 2/3 Conclusions

- Preparation of the VCSNS Units 2 & 3 COLA properly implemented state of practice methods and procedures in compliance with NRC's updated seismic regulatory guidance and interim staff guidance.

- Coordination with concurrent preparation of COLA for BNS, WSLNS, and GGNS and with Industry-NRC generic seismic issue resolution was particularly effective and productive.

- The TAG concurs with the results and conclusions presented in the Safety Analysis Report supporting the VCSNS Units 2 & 3 COLA and consider them to be appropriately and adequately supported by the data and analysis.

- These endorsements were included in the TAG letter which accompanied the Summer COLA submittal.

Comments

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

Presentation to the ACRS Subcommittee

V.C. Summer Nuclear Station Units 2 and 3
COL Application Review

AFSER Section 2.5
Geology, Seismology, and Geotechnical Engineering

July 22, 2010

Staff Review Team

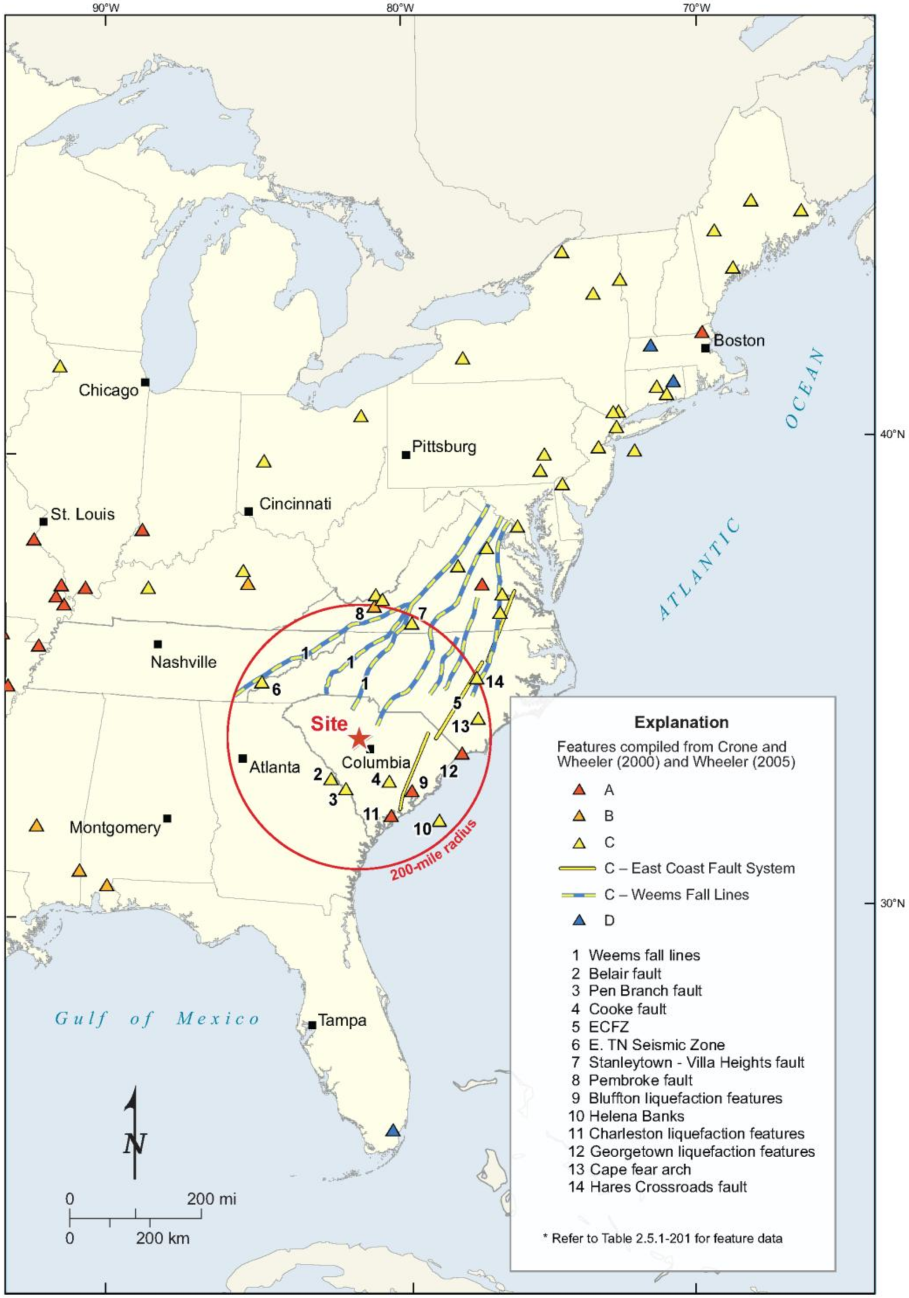
- Sections 2.5.1 and 2.5.3
  - Dr. Gerry L. Stirewalt, Senior Geologist (presenter)
  - Meralis Perez-Toledo, Geologist
  - Drs. Anthony J. Crone and Richard W. Briggs, U.S. Geological Survey Geologists
- Section 2.5.2
  - Sarah Tabatabai, Geophysicist (presenter)
  - Drs. David M. Boore, Stephen H. Hartzell, and Yuehua Zeng, U.S. Geological Survey Geologists
- Sections 2.5.4 and 2.5.5
  - Dr. Weijun Wang, Senior Geotechnical Engineer (presenter)
  - Frankie Vega, Geotechnical Engineer
  - Dr. Carl J. Constantino and Thomas W. Houston, Information Systems Laboratories Geotechnical Engineering Consultants
- Project Management
  - Mike Wentzel

Overview

- Section 2.5 of the VCSNS AFSER issued with two Confirmatory Items and one License Condition
  - All COL Information Items (11 for AFSER Section 2.5.4 and two for AFSER Section 2.5.5) resolved based on FSAR Revision 2.
  - All Confirmatory Items resolved based on FSAR Revision 2, except 2.5.2-1 related to fractile hazard curves and 2.5.4-1 related to concrete fill design, thermal cracking, and monitoring.
  - License condition 2.5.1-1 for AFSER Section 2.5.1 related to geologic mapping of excavations for safety-related structures.

Section 2.5.1–Basic Geologic and Seismic Information

- **Capability of tectonic structures mapped in the site region, site vicinity, and site area**
  - Issue: Ensure that no potentially-capable tectonic faults (i.e., faults of Quaternary age, 2.6 million years ago [Ma] to present) have been mapped in the site region, site vicinity, or site area.
    - Applicant identified 14 potential Quaternary tectonic features in the site region (i.e., potentially capable tectonic structures with possible associated seismic hazard).
    - No mapped tectonic structure to which the 1886 Charleston area earthquake can be associated has been identified. Charleston area is characterized as a seismic source zone for assessment of seismic hazard (AFSER Section 2.5.2).



2.5.1 – Basic Geologic and Seismic Information

Potential Quaternary Features in the VCSNS Site Region (AFSER Figure 2.5.1-2 after FSAR Figure 2.5.1-215)

Section 2.5.1–Basic Geologic and Seismic Information

- **Capability of tectonic structures mapped in the site region, site vicinity, and site area**
  - Resolution: Staff's review of detailed responses to RAIs resolved concerns related to occurrence of potentially capable tectonic structures mapped in the site region, site vicinity, and site area.
    - Staff found that information (i.e., constraining field relationships and radiometric age dates) provided by the applicant documented that no Quaternary tectonic faults have been mapped in the site region, site vicinity, and site area.

Section 2.5.1–Basic Geologic and Seismic Information

- **Potential for tectonic structures in excavations for safety-related structures**
  - Issue: Ensure that no capable tectonic faults exist in the excavations for safety-related structures.
    - Staff must examine geologic features observed and mapped in excavations for safety-related structures to ensure that no capable tectonic faults exist.
    - Minor shear zones proven by the applicant to be at least 45 Ma in age were mapped in the Unit 1 excavation, and similar structures may occur in the excavations for Units 2 and 3.
  - Resolution: License Condition 2.5.1-1 requires applicant to perform geologic mapping of excavations for safety-related structures; evaluate geologic features discovered; and notify NRC when excavations are open for examination.

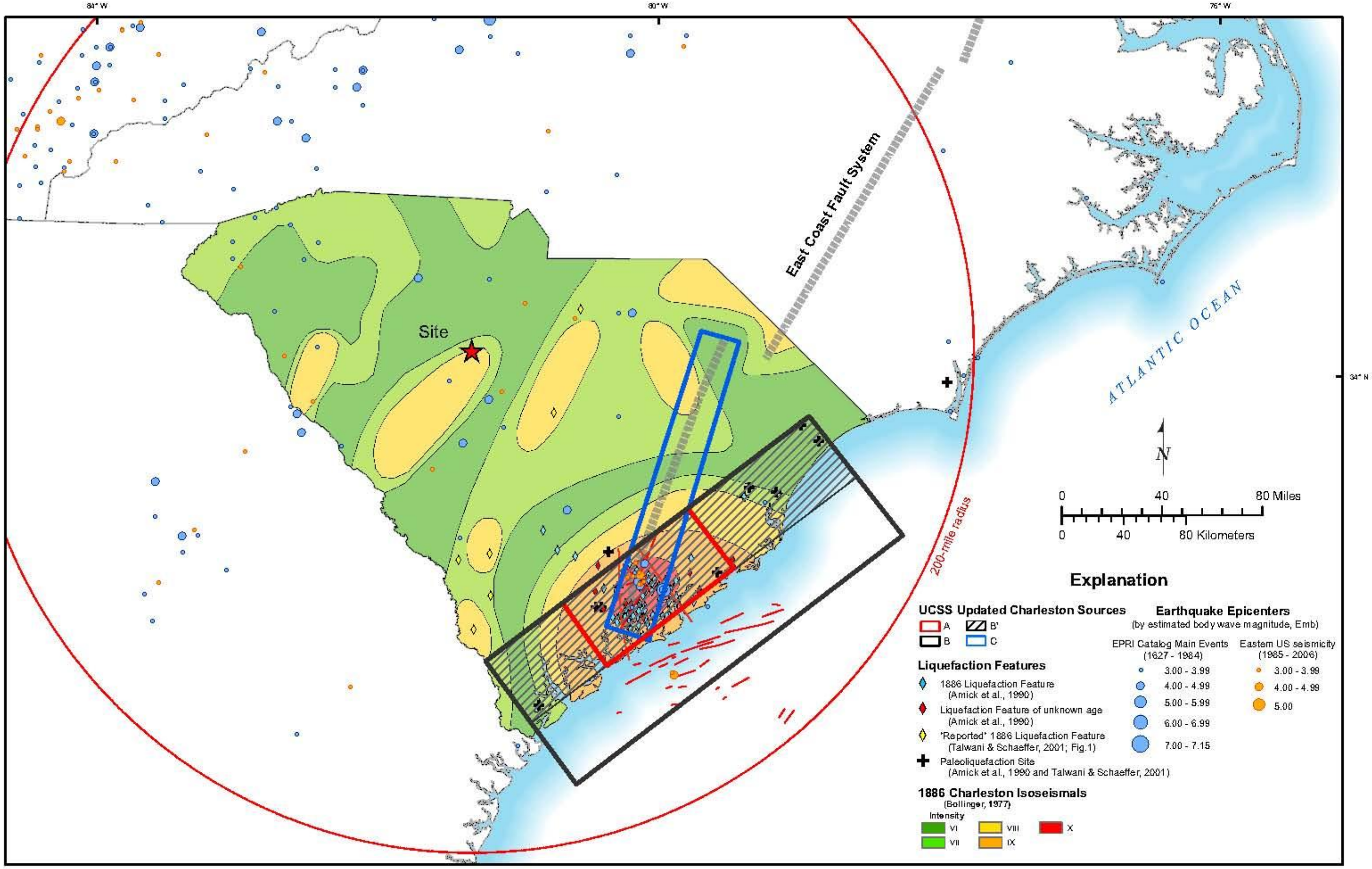
Section 2.5.2–Vibratory Ground Motion

- **Reservoir-Induced Seismicity (RIS)**
  - Issue: Staff was concerned about the largest potential seismic event associated with the Monticello reservoir due to RIS, and whether water level changes in the reservoir have been correlated with seismicity.
  - Resolution: Applicant documented that the two largest reservoir-induced earthquakes were of magnitude 2.8 (1978 and 1979); that the AP1000 CSDRS bounds the postulated magnitude 4.5 event for Unit 1; and that no correlation has been shown between seismicity and water level changes since initial filling of the reservoir.

Section 2.5.2–Vibratory Ground Motion

- **Charleston Seismic Zone**
  - Issue: Applicant updated the original 1986 EPRI Charleston seismic source models with the UCSS model originally presented in the SSAR for the Vogtle ESP site (SNC, 2008).
    - Staff asked applicant to address a newly-reported Charleston area paleoliquefaction feature (Talwani and others, 2008) in regard to the UCSS model.
  - Resolution: Talwani and others (2008) estimated a magnitude of about 6.9 for the causative earthquake, which falls within the M_{max} range captured in the UCSS model, and the newly-reported paleoliquefaction feature lies within one of the source area geometries defined for the UCSS model.

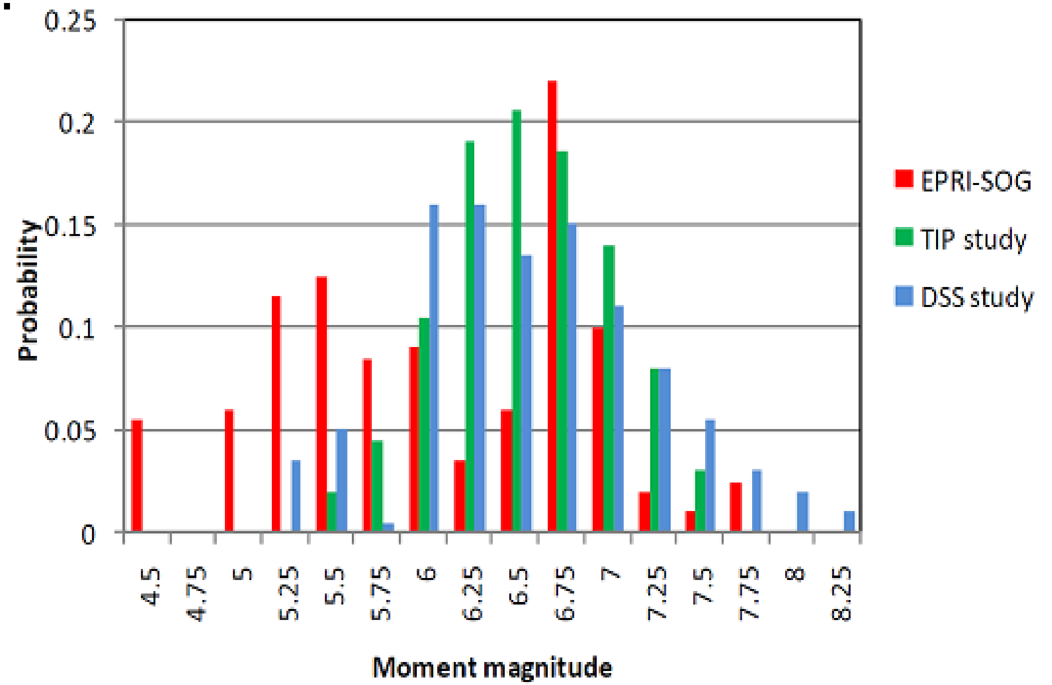
Section 2.5.2–Vibratory Ground Motion



Updated Charleston Seismic Source (UCSS) Model
(FSAR Figure 2.5.2-213)

Section 2.5.2–Vibratory Ground Motion

- **Eastern Tennessee Seismic Zone (ETSZ)**
  - Issue: Applicant did not include newer ETSZ source models that post-date the 1986 EPRI study in the VCSNS PSHA.



Comparison of ETSZ M_{max} distributions from EPRI-SOG, TIP, and TVA Dam Safety Studies (AFSER Figure 2.5.2-13)

Section 2.5.2–Vibratory Ground Motion

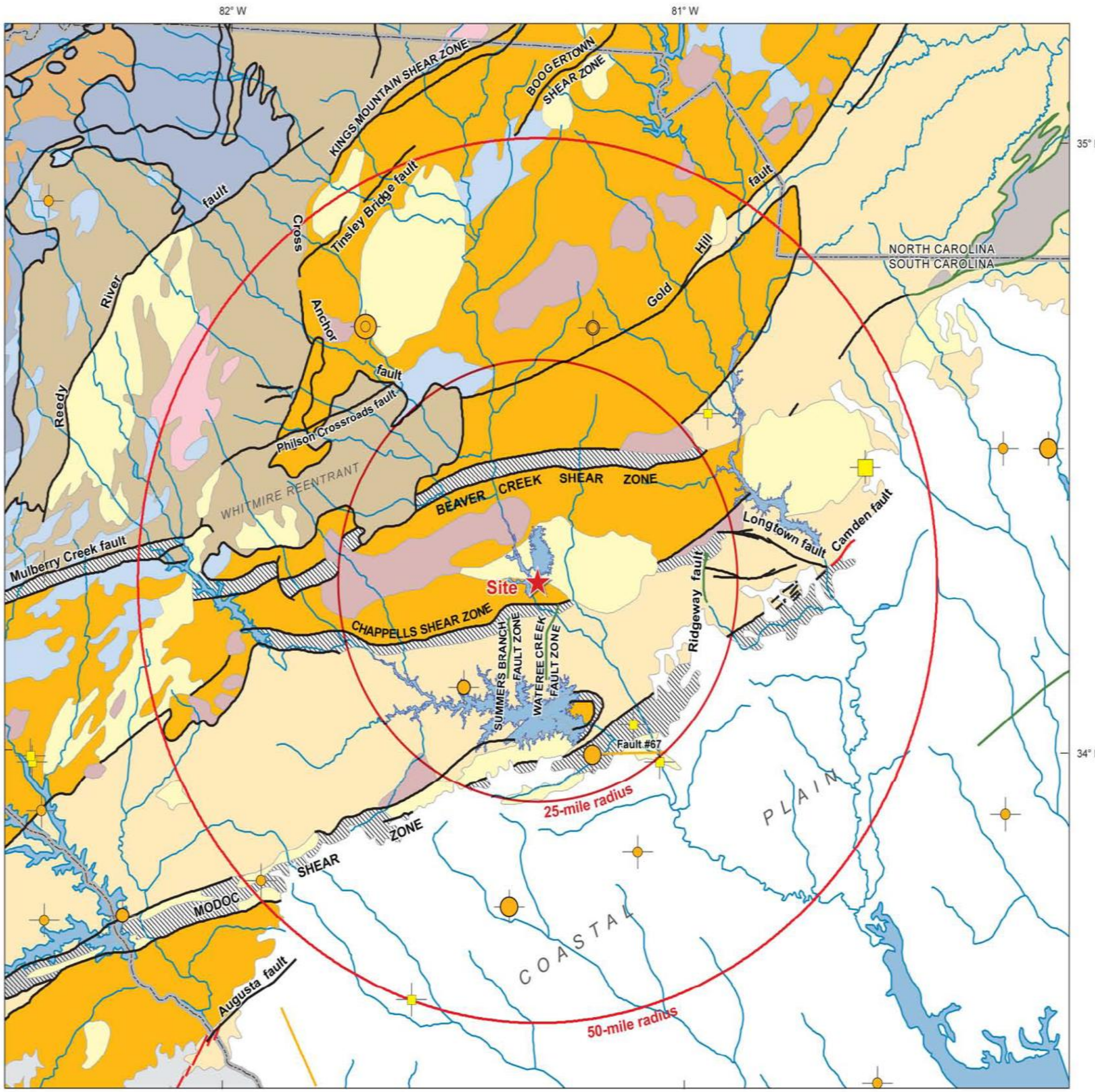
- **Eastern Tennessee Seismic Zone**
  - Resolution: Applicant referred to a sensitivity study conducted by NEI for the ETSZ (2008) and concluded, based on results of that generic study for a hypothetical site in the middle of the ETSZ, that changes resulting from updating the 1986 EPRI study were not significant.
    - Staff performed an independent sensitivity analysis to assess whether the updated M_{max} distribution used in the NEI sensitivity study significantly changed the final GMRS for the VCSNS site.
    - Results of staff's sensitivity calculation showed that increasing original EPRI-SOG M_{max} distributions for the ETSZ did not significantly impact seismic hazard for the VCSNS site. GMRS values increased only slightly at 1 Hz (0.094 g to 0.104 g) and 10 Hz (0.428 g to 0.468 g).

Section 2.5.3–Surface Faulting

- **Surface Faulting in the Site Vicinity & Site Area**
  - Issue: Ensure that no capable surface or near-surface tectonic faulting exists in the site vicinity and site area.
    - Applicant documented that tectonic surface structures have been mapped in the site vicinity.
  - Resolution: Staff's review of detailed responses to RAIs resolved concerns related to occurrence of capable surface or near-surface faulting in the site vicinity and site area.
    - Staff found that information (i.e., constraining field relationships and radiometric age dates) provided by the applicant documented that no surface or near-surface Quaternary tectonic faults occur in the site vicinity or site area.
    - Non-tectonic surface or near-surface deformation is not expected because of the physical properties of crystalline bedrock in the site vicinity and site area and at the site.

2.5.3 Surface Faulting

V. C. Summer Site Vicinity Tectonic Features Map (AFSER Figure 2.5.3-1 after FSAR Figure 2.5.1-212)



Explanation

- Paleozoic faults
- Mesozoic faults
- Cenozoic faults
- Cenozoic faults of Prowell (1983)
- Mesozoic basin

Earthquake Epicenters (by Magnitude, m_b)

EPRI catalog (1627 - 1984)	Eastern US seismicity (1985 - 2006)
3.00 - 3.50	3.00 - 3.50 *
3.51 - 4.00	3.51 - 3.90
4.01 - 4.50	
4.51 - 5.04	

* includes three events less than m_b 3 assigned intensity of 4 or greater

Tectonic features compiled and modified from Hibbard et al. (2006), Secor (2007), Secor et al. (1998), and Prowell (1983)

See Figure 2.5.1-204 for explanation of lithotectonic units

N

0 10 20 mi
0 10 20 km

2.5.3 Surface Faulting

Exposure of the Wateree Creek fault (206-144 Ma in age), located 3 km (2 mi) south of the VCSNS site

Section 2.5.4–Stability of Subsurface Material and Foundations

- **Excavation Plan**
  - Issue: Identification of “sound rock” in the field during excavation, and how to maintain integrity of “sound rock” underlying Category 1 foundations.
  - Resolution: Applicant stated that all overlying soils would be removed with a large ripper or trackhoe until non-rippable (i.e., “sound rock”) was reached. “Sound rock” will be confirmed in the field by a geologist using a rock hammer and visual inspection. This non-explosive method of excavation will not affect integrity of rock underlying the Category 1 foundations.

Section 2.5.4–Stability of Subsurface Material and Foundations

- **Concrete Fill Underlying Foundations**
  - Issue: How to ensure that concrete fill underlying Category 1 foundations has similar properties as "sound rock", and how to resolve a potential thermal cracking issue for some areas with up to 17 ft of concrete fill.
  - Resolution: Applicant indicated that concrete fill will have a similar strength and shear wave velocity as "sound rock"; appropriate industry standards will be followed for concrete fill design and thermal cracking control; and a thermal control monitoring plan will be provided.
    - Confirmatory Item 2.5.4-1: Staff will ensure that a detailed concrete fill design, thermal cracking control, and monitoring plan are included in a revised FSAR.

Section 2.5.5–Stability of Slopes

- **No technical issues of interest for AFSER Section 2.5.5**
  - Applicant addressed 2 COL Information Items (VCS COL 2.5-14 and VCS COL 2.5-15) related to stability of all earth and rock slopes and the need for additional dams or embankments to be constructed at the site.
    - Staff found that slopes at the site are at an adequate distance from the power block and cooling tower area, and there is no need for additional dams or embankments to be constructed at the site.