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6 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
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11 Commission Advisory Committee on Reactor Safeguards,
12 as reported herein, is a record of the discussions
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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
(ACRS)

AP1000 SUBCOMMITTEE

+ + + + +

THURSDAY

JULY 22, 2010

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

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

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1 ACRS CONSULTANTS:

2 WILLIAM HINZE

3 THOMAS S. KRESS

4 GRAHAM B. WALLIS

5

6 NRC STAFF PRESENT:

7 WEIDONG WANG, Designated Federal Official

8 HOSUNG AHN

9 GOUTAM BAGCHI, NRO/DSER

10 PERRY BUCKBERG

11 QUINTANA LUISSE CANDELARIO, NRO/DSER/RGS2

12 JILL CAVERLY

13 TRAVIS CHAPMAN, NRO/DCIP/CTSB

14 PEI-YING CHEN, NRO/DE/EMB

15 CHRISTOPHER COOK

16 STEPHANIE DEVLIN, NRO/DSER/RGS2

17 THOMAS GALLETTA, NRO/DNRL

18 BILLY GLEAVES, NRO/DNRL

19 SUJATA GOETZ

20 DON HABIB, NRO/DNRL

21 BRAD HARVEY, NRO/DSER/RSAC

22 ANN HODGDON, OGC

23 RAVI JOSHI, NRO/DNRL

24 REBECCA KARAS, NRO/DSER/RGS1

25 KERRI KAVANAGH

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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

PRAVIN PATEL, NRO/DE

MALCOLM PATTERSON

MERALIS PLAZA-TOLEDO, NRO/DSER/RGS1

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JOE SEBROSKY

KENNETH SEE

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DAVID SISK, NRO/DSER/RSAC

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1 THEODORE TJADER, NRO/DCIP/CTSB

2

3 NRC STAFF PRESENT

4 MILTON VAUNTIN, NRO/DE/SEB1

5 FRANKIE G. VEGA, NRO/DSER/RGS1

6 WEIJUN WANG

7 MIKE WENTZEL, NRO/DNRL

8 ZUHAN XI, NRO/DSER/RGS1

9

10 ALSO PRESENT:

11 AMY AUGHTMAN, Southern Nuclear

12 JOSEPH BRAVERMAN, BNL

13 CHUCK BROCKHOFF, Westinghouse

14 TOBY BURNETT Westinghouse

15 ED CUMMINS, Westinghouse

16 JOHN DAMM, Bechtel

17 JOHN DAVIE, Bechtel

18 MATT EVANS, Westinghouse

19 DAVID FENSTER, Bechtel

20 JOHN GIDDENS, Southern Nuclear

21 JULIE GILES, SCE&G

22 EDDIE GRANT, NuStart

23 BOB HIRMANPOW, NuStart

24 ANTHONY JAMES, ORS

25 WILLIAM LaPAY, Westinghouse

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1 MIKE LEWIS, Bechtel
2 DON LINDGREN, Westinghouse

3

4 ALSO PRESENT

5 PAUL LOZA, Westinghouse
6 MIKE MELTON, Westinghouse
7 GARY MOFFETT, SCE&G
8 AMY MONROE, SCE&G
9 DON MOORE, Southern Nuclear
10 RICHARD ORR, Westinghouse
11 AL PAGLIA, SCE&G
12 DAN PATTON, Bechtel
13 JEFF PETERSON, Westinghouse
14 KEVIN PIGG, Southern Nuclear
15 TONY PILO, Progress Energy
16 JOHN PREBULA, Bechtel
17 BOB PRUNTY, Bechtel
18 THOM RAY, Westinghouse
19 JASON REDD, Southern Nuclear
20 APRIL RICE, SCE&G
21 MARY RICHMOND, Bechtel
22 TIM SCHMIDT, SCE&G
23 ROB SISK, Westinghouse
24 WES SPARKMAN, Southern Nuclear
25 STEPHEN SUMMER, SCE&G

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JOHN TODD, SCE&G
BOB WHORTON, SCE&G
ROLF ZIESING, Westinghouse

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

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(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

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1 past we've had six of these subcommittee meetings.

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

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

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

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

25 We will hear presentations from the DCD

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

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

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

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

25 But for the portion of the meeting which

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1 is to be closed, attendance will be limited to the
2 applicant, Southern Nuclear Operating Company,
3 NuStart, Westinghouse, South Carolina Electric & Gas,
4 NRC staff and our consultants, and those individuals
5 and organizations who have entered into an appropriate
6 confidentiality agreement with them.

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

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

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

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1 they may be readily heard.

2 We will now proceed with the meeting.

3 And Westinghouse, Don, is that yours to start?

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

5 DCD SECTION 3.7 - APPLICANT

6 MR. LINDGREN: My name is Don Lindgren.

7 I'm a licensing engineer for AP-1000 licensing,

8 Westinghouse Electric. Assisting me this morning is

9 Richard Orr and Dr. William LaPay.

10 We are speaking this morning in two

11 sessions on Section 3.7, which is seismic design, and

12 3.8, which is structures. These two sections have not

13 previously been before the ACRS. So this is the first

14 time we are discussing many of these items. The SDR

15 you received was an SDR with open items, though we are

16 in many cases well past that stage, and in fact we are

17 working to resolve all the open items by the end of

18 this month.

19 Some of the topics in Section 3.7, 3.7.1

20 there is seismic input.

21 CHAIRMAN RAY: Don, may I interrupt you

22 for a second, when we are talking about this subject,

23 we are, am I correct in assuming talking just about

24 seismic relative to the things that are affected by

25 the amendment?

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

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

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

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

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

13 CHAIRMAN RAY: Okay.

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

17 3.7.2, which is seismic system analysis,
18 and in 3.7, that means structures, there is
19 information about the seismic analysis method with
20 soil structure interaction, the floor response
21 spectra, combination of modal responses and seismic
22 interactions. And all of these areas have been
23 impacted by our various changes in some manner or
24 another.

25 3.7.3 is seismic subsystem analysis, which

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1 in 3.7 means mechanical systems and components. And
2 there we also talk about seismic analysis methods,
3 combination of modal responses and analytical
4 procedure for piping.

5 3.7.4 talks about seismic instrumentation.

6 And we have made no changes in the amendment in that
7 area. And the combined license information is the
8 final section of interest. We have made a timing
9 clarification on one of them. It was something that
10 cannot be done by the applicant; it needs to be done
11 by the COL holder; and that was clarified.

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

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

25 The design certification amendment adds

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

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

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

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

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

21 A sort rock site is 2,400 feet per second
22 for the sheer wave velocity increasing linearly to
23 3,200 feet per second at 240 feet.

24 We have an upper bound soft to medium soil
25 site with a sheer wave velocity of 14 feet per second

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1 increasing to 3,394 feet per second.

2 We have two more cases. We have a soft to
3 medium soil site, which is a sheer wave velocity
4 starting off at 1,000 feet per second, increasing to
5 2,400 feet per second. And then finally our soft
6 soil site is 1,000 feet per second increasing to 1,200
7 feet per second.

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

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

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

21 MR. ORR: Yes.

22 DR. HINZE: Thank you.

23 MR. LINDGREN: Okay, the soft soil site
24 is the softest (laughter), and so you will see
25 reference to 1,000 feet per second in many cases. If

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1 you were here yesterday for Vogtle you saw that there
2 was reference to 1,000 feet per second in much of
3 their presentation on soil conditions. So the 1,000
4 feet per second becomes an important number.

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

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

22 CHAIRMAN RAY: What's the peak site
23 acceleration?

24 MR. LINDGREN: It's three tenths.

25 CHAIRMAN RAY: Three tenths.

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

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

12 CHAIRMAN RAY: Steel containment.

13 MR. LINDGREN: Steel containment, the
14 pressure valve.

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

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

24 We also have an ANSYS NI05 model, which is
25 used for the design of the structures using seismic

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1 loads. This permits us a little bit more refinement
2 in some of the more flexible areas, and is really
3 used the design of the structures.

4 Effect of high frequency ground motion.
5 The seismic analysis and design of the AP-1000 is
6 based on this CSDRS. The dominant energy content in
7 this area is in the low frequency range of 2 - 10
8 Hertz. We have learned over the years that spectra
9 shapes for central and Eastern U.S. sites show
10 increased amplification in the frequency range above
11 10 Hertz.

12 So - no, not don't yet.

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

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

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

25 This evaluation was done - was consistent

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

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

11 In addition to doing selected analysis for
12 potentially sensitive equipment which is primarily
13 electronic, sensitive to high frequency motions, that
14 is subject to a screening test. What we do is we
15 evaluate the equipment and make a judgment as to
16 whether or not it could be sensitive to high frequency
17 motion. Obviously large mechanical equipment and the
18 like are not typically, are not considered sensitive.

19 But particularly electronic components. The classic
20 components, the class example is relays. You can get
21 relay chatter from high frequency motions. That
22 equipment will be run through a high frequency
23 screening test as part of their qualification for
24 seismic analysis.

25 And anything that fails the screening test

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1 will be redone, and if we get a different component we
2 will redesign the supports. But we will not in the
3 end have anything that is susceptible to high
4 frequency motion.

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

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

23 Classification of adjacent buildings --

24 MR. BROWN: Can I ask one question?

25 MR. LINDGREN: Yes.

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

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

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

11 MR. BROWN: Has it been used before?

12 MR. LINDGREN: Yes.

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

15 MR. LINDGREN: Yes.

16 MR. BROWN: That's all I wanted.

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

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

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

12 So that is what went into the ISG-1.

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

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

22 DR. BLEY: I didn't say my question
23 right, then. I understand the phenomena you are
24 describing, but this coherency or noncoherency
25 function is a simple adjustment based on these

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1 elaborate analyses. Is that true? Or is it actually
2 doing the detailed analysis?

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

7 DR. BLEY: Okay.

8 MR. LINDGREN: Thanks.

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

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1 same methods and criteria for Seismic Category II as
2 we do for Seismic Category I.

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

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

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

19 Okay, this is a --

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

23 MR. LINDGREN: Yes.

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

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1 MR. LINDGREN: Okay.

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

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

6 DR. BLEY: Okay, fair enough.

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

9 DR. BLEY: Okay.

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

12 So the red building is the shield
13 building. The big building is the auxiliary building.

14 The yellow is the rad waste building. The darker
15 blue is the Seismic Category II portion of the annex
16 building. As I said this is a multistory reinforced
17 concrete and steel frame structure.

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

22 The first bay of the turbine, and FB in
23 this case stands for first bay, not fuel building, is
24 a reinforced concrete structure that is Seismic
25 Category II. The lighter green which is the remainder

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1 of the turbine building is a steel frame structure
2 built to building code requirements.

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

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

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

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

23 We had two audits during the month of June
24 to discuss seismic and structural issues and to move
25 forward on the open items. Our goal is that we

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1 resolve all these open items by the end of July.
2 That's why you do not see a larger representation of
3 experts here, because they are back in Cranberry
4 working on getting these things resolved.

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

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

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

25 DR. WALLIS: You are going to discuss

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1 that later, are you?

2 MR. LINDGREN: We can discuss anything
3 you want.

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

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

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

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

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

3 DR. LaPAY: Yes, it is.

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

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

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

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

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

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

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1 DR. WALLIS: That's still going on?

2 DR. LaPAY: Yes.

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

9
10 DR. WALLIS: So this is still to be
11 responded to?

12 MR. LINDGREN: Yes.

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

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

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

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

25 MR. LINDGREN: But this question is only

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1 about the structural modules, right?

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

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

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

16 OI-TR03-005 is one that asks us to justify
17 the .8 stiffness reduction factor for concrete
18 cracking used in the shield building analysis. As I
19 said, this is the third of four of them. The fourth
20 question is actually in 3.8. But there are four very
21 closely related questions that will be basically
22 answered. And as I said we are working on a
23 resolution. We discussed these responses quite a bit
24 at the audits in June, so we believe we have a good
25 understanding on what it's going to take.

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

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

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

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

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

17 (Simultaneous speaking.)

18 MR. LINDGREN: I have no problem
19 answering a few questions, or actually having these
20 gentlemen answer a few questions. DR.

21 WALLIS: So you are just telling us what you are
22 going to do, is that what it is?

23 MR. LINDGREN: In some cases. In some
24 cases we are just saying that the question is still
25 open. Where I've answered is one that we think it's

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1 resolved. But you notice I don't make any statement
2 about this other than the fact that it is out there.

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

6 MR. LINDGREN: Okay, moving on, OI-TR03-
7 032 is a description of the proposed method for using
8 more detailed NIO05 model to evaluate flexible
9 regions. During this - during our - during the
10 staff's review of our seismic analysis and basically
11 comparison of the three models, the ANSYS NI-10, the
12 ANSYS NI-20, and the SASSI NI-20 they observed some
13 differences in responses that they didn't understand,
14 and we could not initially explain adequately. And
15 some of these relate to the flexibility of the model
16 and the flexibility of the structure, and in certain
17 locations we have evaluated it using a more refined
18 model to evaluate the flexible regions. And this
19 question relates to that.

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

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

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

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

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

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

20 DR. LaPAY: That's a different issue
21 than the flexibility. That's actually the refinement.

22 That's why we brought in the NI05 model that has a
23 lot of that refinement in there where we have that
24 boundary condition where you may have the extra loads.

25 DR. ARMIJO: We will hear all about this

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1 in October, I guess?

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

4 DR. ARMIJO: Sometime this year?

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

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

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

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

25 OI-SRP3.7.1-SEB1-08 was a question about

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1 model inconsistency, once again how the three models
2 we used initially line up. Differences in the - there
3 were differences in a couple of figures in the
4 technical report that are due to differences in the
5 geometry between the NI10 and the NI20 model at the
6 southeast corner. That's how we resolved this
7 question. That's the explanation.

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

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

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

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

23 MR. LINDGREN: What you will find is that
24 at the high frequencies if you use the hard rock high
25 frequency you will find at the high frequencies

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1 amplitudes greater than the in floor response spectra,
2 but the thing about high frequency is that there is
3 not a lot of energy there, so it's something that is
4 bouncing back and forth at 20 Hertz, it can't move
5 very far, and that is how we have resolved that
6 question.

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

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

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

21 DR. BANERJEE: And what does that mean?

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

24 DR. LaPAY: When you do like response
25 vector analysis, you have a mode cutoff. And you

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1 don't get the effect of mass for those modes that go
2 beyond that frequency?

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

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

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

12 DR. LaPAY: There are techniques you can
13 use; there's more than one that you can choose from.

14 And I'm not going to go into those here. But it's
15 from Reg. Guide 192 is one that you would follow.

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

18 DR. LaPAY: Yes.

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

20 DR. LaPAY: We did that. We had to
21 demonstrate that we have addressed those especially
22 for the response spectra that we had, where you don't
23 have this. You can actually develop the loads with
24 the effective mass, but do those higher modes affect
25 the response spectra? And we had gone through that,

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1 and in that OI, demonstrating, and during the audit we
2 did the same, we provided results that the spectra
3 does not change in the area where the response of our
4 equipment is, that we have the proper response spectra
5 that is conservative.

6 So they have no effect.

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

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

16 DR. BANERJEE: How much mass is missing?

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

19 DR. BANERJEE: And how much is that?

20 DR. LaPAY: Maybe 10 percent.

21 DR. BANERJEE: Okay.

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

25 DR. BANERJEE: This must be fairly

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1 standard stuff. People have to do this, right?

2 DR. LaPAY: It's standard procedure, yes.

3 However what you have to go through is a process to
4 demonstrate that you have not missed any missing mass.

5 That you have accounted for it, or it's not
6 significant to your response spectra.

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

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

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

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

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

25 DR. BANERJEE: That was a rather strange

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

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

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

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

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

17 DR. LaPAY: It does something.

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

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

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

25 MR. LINDGREN: And there's a large hole

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1 in the middle.

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

4 DR. WALLIS: That's for sloshing?

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

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

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

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

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

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

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

23 DR. WALLIS: At a low frequency?

24 MR. ORR: Yes, the sloshing frequency is
25 .13 Hertz. The building frequency is between 2 - 3

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1 Hertz.

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

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

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

9 MR. LINDGREN: It's standard design.

10

11 DR. WALLIS: Very mysterious.

12 MR. LINDGREN: Sloshing is well known.

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

16 DR. LaPAY: We have done that, yes.

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

20 DR. LaPAY: And the two match.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

16 Now if there are any more questions?

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

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

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1 CHAIRMAN RAY: It is.

2 DCD SECTION 3.7 - STAFF

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

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

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

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

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

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

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

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

12 CHAIRMAN RAY: Hopefully we will, yes.

13 MS. SPICHER: Bret.

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

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

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

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

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

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

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

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

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

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

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

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

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

18 CHAIRMAN RAY: Okay.

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

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1 model.

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

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

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

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

21 MR. CONSTANTINO: If I could make a
22 comment?

23 CHAIRMAN RAY: Sure.

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

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1 approximation.

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

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

13 CHAIRMAN RAY: Yes, as you say.

14 DR. BANERJEE: That's useful.

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

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

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

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

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

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

15 CHAIRMAN RAY: But the plants are still
16 in service.

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

19 CHAIRMAN RAY: Okay, thank you. Go
20 ahead.

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

25 So with that I'll lead into a brief

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

4 In 3.7.2 we mentioned they are now using
5 3-D shell models for the seismic dynamic analysis
6 instead of the sticks. They are conducting soil
7 structure interaction analysis, and again, using -
8 evaluating the effects of high frequency ground motion
9 on in structure response and in structures.

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

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

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

21 Really, we take out the wave passage from
22 all of that data, and then look at the response at one
23 point and an adjacent point, and the little
24 differences at the high frequency are what's being
25 captured by the coherency function. As someone said,

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1 it's really a noncoherency function. But it's really
2 taking all of the data and then enveloping that, so in
3 fact the coherency function that is being used in all
4 of these calcs is based on incorporating the effects
5 at hard rock sites.

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

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

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

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

25 MR. CONSTANTINO: Yes, the spectral

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1 density.

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

5 MR. CONSTANTINO: Where is it coming
6 from?

7 DR. BANERJEE: Yes, why is it --

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

25 DR. BANERJEE: So the coherency function

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1 sort of drops off?

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

4
5 DR. KRESS: Is it a multiplier on the
6 acceleration?

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

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

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

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

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

23 DR. WALLIS: It's an empirical
24 measurement.

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

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1 based on empirical data.

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

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

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

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

13 DR. HINZE: Are these from the East
14 Coast?

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

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

24 MR. CONSTANTINO: We apply all of that to
25 wherever you are going to be, right? So we took all

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1 of the data including the hot rock data, enveloped
2 that so we have a conservative coherency function or
3 however you want to call it.

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

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

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

16 CHAIRMAN RAY: Yes, obviously.

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

24 Okay, this table, I'm not going to spend a
25 lot of time on this. This is essentially where we

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1 were at the development of the SE. And we have done
2 this. We have made progress in a number of areas,
3 so I won't spend time on that.

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

12 Well, with the extension of soil sites,
13 the CSDRS is applied at grade elevation or the pre-
14 surface. So we wanted to make sure that as you - at
15 slightly deeper at the foundation elevation that you
16 will still have or meet this point one G requirement.

17 So that's what this question was. And Westinghouse
18 has responded.

19 Number 19 we spent a little bit of time
20 on. This is dealing with the assumptions relating to
21 concrete cracking and assumptions relating to material
22 damping, and the dynamic analysis models. This
23 question started out through the shield building
24 review, and the - we are not going to spend a lot of
25 time on shield building here, but this question arose

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1 because of the staff's concern that Westinghouse was
2 using an 80 percent or 20 percent reduction in
3 concrete stiffness. And the staff was asking for a
4 justification based on the shield building analysis,
5 why that is a reasonable assumption. So that is what
6 led to this question.

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

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

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

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

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

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

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

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

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

21 MR. TEGELER: Yes.

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

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

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

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

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

17 CHAIRMAN RAY: Speak up, Rich.

18 MR. MORANTE: Part of our question here
19 on number one, and I think somebody alluded to this or
20 mentioned it this morning during Westinghouse's
21 presentation, we did ask them to incorporate into TR-
22 03 the details of how they modeled the concrete module
23 section. We also asked them to correlate that, tie it
24 back to test results. So they've done a lot of
25 testing. And I don't think that came out clearly this

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1 morning. But we did ask them as part of that to tie
2 it back to their test results.

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

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

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

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

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

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1 just try it?

2 MR. CONSTANTINO: I think there are rules
3 available.

4 MR. TEGELER: Well, the SRP talks about a
5 10 percent, if you refine your mesh such that - you
6 keep refining your mesh until your solutions get
7 within 10 percent of one another.

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

12 MR. CONSTANTINO: Yes, right. Very
13 straightforward.

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

16 MR. MORANTE: In this case the NI-20
17 model in some cases they would be wall or floor
18 sections which are represented by a single element.
19 Obviously they were not going to pick up any
20 amplification in the middle. So it was primarily to
21 address those types of areas where it was obvious they
22 were not getting the amplification that they analyze
23 the NI-05 model using the time history input at the
24 base of the NI-05 to see what type of amplification
25 existed in these areas, because these areas were

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1 modeled more finely. So basically this, the results
2 of this analysis augment the floor response vector
3 that they developed from their less refined models.
4 So that was our intent was to get them to take it a
5 step further and make sure they didn't miss any
6 amplifications that might be important for future
7 design of piping systems or equipment that might be
8 mounted in that part of the building.

9 CHAIRMAN RAY: Okay, that's clear.

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

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

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1 CHAIRMAN RAY: Okay.

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

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

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

18 So there were two distinct --

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

22 MR. MORANTE: I'm sorry?

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

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

6 DR. BANERJEE: Errors in the model?

7 MR. CONSTANTINO: In the model.

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

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

14 DR. BANERJEE: What were the errors?

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

24 So then there were some other issues that
25 in some parts of the basement it looked like there

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1 were areas that were missing. That was more a minor
2 correction. But the connection of six degrees of
3 freedom to four degrees of freedom is a serious issue,
4 has big impact on SASSI response, and that was the
5 biggest thing that came out of that confirmatory calc.

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

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

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

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1 So that was a relatively significant finding from
2 our perspective.

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

6 DR. BANERJEE: Yes.

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

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

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

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

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

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

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

9 MR. TEGELER: That's right.

10 DR. BANERJEE: Okay, all right.

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

18 MR. MORANTE: No, mid-20s.

19 MR. TEGELER: Mid-20s?

20 MR. MORANTE: Yes.

21 MR. TEGELER: And so we asked the
22 question, could this high frequency ground motion
23 input rich in energy in that frequency band excite
24 that closure dome? And so Westinghouse has
25 essentially showed that the design of that, of the

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1 closure dome, is controlled by the CSDRS and not the
2 HRHF. So that's - so the end story on that is we were
3 concerned that if the effects of incoherency were used
4 in correctly or implemented incorrectly then you could
5 have a bump out at the base of the steel, in the
6 response structure at the base of the steel
7 containment vessel such that the HRHF would then
8 govern or control that closure dome design. But it
9 turns out their response has indicated that this issue
10 is resolved.

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

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

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

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

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1 intentional or not. j

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

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

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

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

25 MR. TEGELER: Do you recall?

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

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

24 So using that as our basis for assessing
25 the reasonableness if you will of the new calculation,

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1 or the new Westinghouse calc, where in responses to
2 nine, 10 and 11, for low frequency reduction they are
3 showing very small reductions below 10 Hertz, and then
4 above that they are getting about a comparable level
5 of reduction, 50 percent. So based on that
6 observation, and to check that they are using the
7 correct 2007 Norm Abrahamson coherency function, we
8 believe that they are correctly implementing
9 coherency.

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

19 CHAIRMAN RAY: Okay.

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

23 MR. THOMAS: Right, okay.

24 DR. BANERJEE: But how key is it to the
25 sort of revised spectrum if you like, the

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1 acceptability of everything, that this production at
2 the high frequency - is it an extremely important
3 factor? It is?

4 MR. TEGELER: It is important, I think,
5 and you can get reductions on the order of as I said,
6 between comparing coherence, the traditional method
7 Carl was raised on essentially, and now using this,
8 you get a 50 percent difference. So now you can -
9 it's not so much - this is in the higher frequency
10 range, so it's mostly equipment and qualification you
11 are talking about, not so much on the structural side.

12 So it is important, it's an important issue, and I
13 think generically a number of applicants are going to
14 be using this, AP-1000 is the first to come before you
15 using this. But I think you are going to see more of
16 this, so we wanted to make sure that it was done
17 correctly; that it was again, the purpose of the
18 confirmatory work.

19 DR. BANERJEE: Thank you.

20 MR. BAGCHI: A little bit of history
21 might help here. The standard spectra, point three G
22 Reg Guide 1.60 type of spectrum, was in place prior to
23 the changes in regulation, 100.2, three and so on. So
24 when the probabilistic size, the hazard analysis, was
25 adopted by the staff and performance based response

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1 tests were developed it turned out that seismologists
2 went all the way up to 100 Hertz as opposed to the
3 previous case where the peak ground acceleration
4 became asymptotic at point - at about 33 Hertz or so.

5 Now it goes up to 100 Hertz, and it turns out that
6 very near source earthquakes caused very high
7 frequencies at rock sites, and you may recall from the
8 ESG of North Anna, the 100 Hertz value of the peak
9 ground acceleration from the PSHA which is also the
10 GRMS part of that site, is about point five g. The
11 design basis for that existing unit was about point
12 one g. So that - at that time a lot of discussion
13 started and NEI really initiated this seismic working
14 group. And we all now realize that at 100 Hertz even
15 the ground acceleration may be very high, it will
16 produce a low relative displacement, on the order of
17 maybe a hundredth of a mil, that cannot cause
18 structural damage. It might cause some stuff which is
19 addressed in high frequency effects.

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

24 DR. BLEY: Goutam, before you leave, and
25 we'll come back to it in a different venue I think

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1 rather than this specific one. But it seemed to me
2 that the people doing seismic PRA fragility analysis
3 of equipment, when they look at correlation between
4 the equipment, you are already accounting for
5 something like this in coherence effect by saying that
6 equipment that is separated either quite a bit
7 horizontally or some vertically in a structure are
8 effectively that they independently rather than
9 correlated because of something akin to this kind of
10 incoherence, are we running the risk of kind of double
11 counting this effect in the fragility analysis and in
12 the ground motion?

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

15 MR. BAGCHI: I need to think about that.

16 MR. TEGELER: Thank you, Goutam.

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

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

25 CHAIRMAN RAY: Okay, proceed.

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

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

7 MR. TEGELER: Oh, sorry.

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

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

19 MR. MORANTE: If I could expand on that,
20 the Reg Guide which came out in 2006 is very
21 definitive how to treat missing mass when you are
22 doing response spectrum analysis, or mode
23 superposition time history analysis. Prior to that
24 the typical approach especially for mode superposition
25 time history analysis is, you would include a

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1 significant number of additional modes beyond the so
2 called cutoff frequency. And in theory if I included
3 as many modes as there were degrees of freedom I would
4 have 100 percent of the mass participating in the
5 solution. Typically nobody is going to run thousands
6 and thousands of modes. They'll cut it off at some
7 point either at the cutoff frequency which would be
8 where the input goes down to a ZPA ,or they would
9 include additional modes to pick up additional mass
10 effects, effects of mass that participate in modes
11 above that frequency and incorporate them into the
12 solution.

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

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

21 Now historically for building type
22 analyses which is what we have here, the effect that
23 we found looking at distributed systems most likely
24 doesn't exist. So Westinghouse's approach was to
25 include a significant number of modes beyond the

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1 frequency at which the input spectrum went down to the
2 ZPA. And in the latest audit they showed us
3 comparisons at different solutions, some to different
4 numbers of frequencies, one at the official cutoff
5 which is where it goes down to the ZPA, and another
6 solution where they added many twice as many modes.
7 And the comparison showed no difference.

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

14 CHAIRMAN RAY: Understood.

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

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

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

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

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

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

22 MR. TEGELER: Rich did a little bit.

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

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

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

19 DR. WALLIS: Just to clarify, as I think
20 about this problem, you shake this thing and there is
21 a pressure grid pushing the water, and it pushes it,
22 and it also pushes it up and down, to keep a constant
23 pressure on the surface. So this 60 percent must be
24 some effective mass. You can't say that some of the
25 water is moving and some of it isn't. It's an

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1 effective mass when you integrate over the whole, when
2 you solve the whole 3-dimensional problem.

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

5
6 DR. WALLIS: Well, I don't know, when you
7 actually solve the problem you can figure it out, if
8 you do the continuous 3-dimensional analysis of what's
9 really happening.

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

14 DR. WALLIS: That some of it escapes
15 sideways?

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

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

22 MR. MORANTE: It's that portion of the
23 mass that tells you how much of that mass should you
24 incorporate into the overall seismic model, how much
25 of that should you incorporate. Westinghouse made an

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1 assumption that 60 percent could be removed. Our way
2 of dealing with it was to do the simple calculation,
3 when we looked at it with them, without the 60
4 percent to see what the overall effect is. That 60
5 percent mass compared to the total mass of the shield
6 building and aux building is a very small percentage.

7 So in the overall response, seismic response, we are
8 accepting the assumption.

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

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

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

22 CHAIRMAN RAY: That's accurate. I think
23 though, at least in my case, the focus on the shield
24 building has gotten broader since we've had this
25 briefing from you and Westinghouse. I guess I lean,

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1 and Weidong, I should say as we look to the future,
2 this discussion has gone on and yet has deferred a
3 lot of things that might take time, and the last time
4 around, depending on how closure occurs. Hence we
5 ought to keep that in mind when we are trying to
6 schedule things.

7 And the ISG that was mentioned, I don't
8 know if it's possible for us to see that apart from
9 this application before we try and reach closure, but
10 it might be a good idea to look and see if that is
11 possible to do. We have a very very full agenda going
12 forward, so I don't know what is going to be possible.

13 But this is an area of very great interest,
14 substantial change having been made, ongoing staff
15 review. I just want to alert everybody that in order
16 to get closure we are going to need something more
17 than just 15 minutes for somebody to say all the open
18 items have been closed.

19 Okay, any other questions? Thank you.

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

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

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

7 (Whereupon at 10:24 a.m. the above-
8 entitled matter went off the record and resumed at
9 10:40 a.m.)

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

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

24 And that will allow us to have discussion
25 that may be of interest to folks who would otherwise

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1 be able to depart.

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

4 DCD SECTION 3.8 - APPLICANT

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

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

16 The sections of interest --

17 CHAIRMAN RAY: At the end of?

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

20 Section 3.8, sections of interest are
21 steel containment, concrete and steel internals,
22 structures, this is internal to the containment.
23 Other Category I structures which in our case is the
24 auxiliary building and the shield building. And
25 foundations, which includes the base mat. Obviously

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1 we don't worry about concrete containment in our
2 design.

3 The Section 3 changes in the DCD from Rev.
4 15 include the redesign of the shield building. We
5 are not talking about the redesign of the shield
6 building at this meeting; that will be discussed at a
7 later meeting. However we will discuss when the
8 shield building impacts the design of the other
9 structures. The shield building, the stiffness and
10 the mass of the shield building changed somewhat, and
11 that had an impact on the response spectra, the
12 building response spectra for the auxiliary building
13 and the containment.

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

18 Within 3.8 there is information referred
19 to as critical sections. These were a total of 15
20 different locations within the shield building,
21 auxiliary building, and base mat that were identified
22 as part of the design certification as critical
23 sections, and they provide information about the
24 design specifically and the design generally. These
25 were updated because of the change in response vector

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1 soil cases, in some cases the loads went up because
2 of that, and also our design finalization effort made
3 some changes in those sections.

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

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

14 CHAIRMAN RAY: DCP?

15 MR. LINDGREN: Design change package.

16 CHAIRMAN RAY: Okay.

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

22 She section sequence limits. Construction
23 sequence limits are put into place basically so that
24 you do not overstress the base mat and the
25 reinforcement within the base mat during construction

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1 by if you have a soft soil and you build on one side
2 of the base mat faster than the other, you have the
3 potential to put some unacceptable stresses and
4 strains on the base mat, so we have a limit, which is
5 prior to completion on both the shield building and the
6 aux building to 82 feet 6 inches. Remember that this
7 is below ground level. Our ground level is 100.
8 Concrete may not be placed above the elevation of
9 84'0" for the shield building or containment internal
10 structures, and concrete may not be placed above the
11 elevation of 16'6" - 17'6" for the auxiliary building
12 except the structure - one particular structural
13 module can go up to 185.

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

22 Okay?

23 CHAIRMAN RAY: Yep.

24 MR. LINDGREN: Material specifications,
25 we include some material specification changes in the

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1 design. We updated the material of the containment
2 shell to reflect how steel is actually made these
3 days. We had an older specification that basically
4 isn't used anymore.

5 The modules, these are particularly the
6 internal containment modules, the material that
7 structural modules, where it needs to be corrosion
8 resistant, was changed from Nitronic 33 to Duplex
9 2101. This had to do with the availability of the
10 material and the sizes we needed primarily.

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

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

20 DR. ARMIJO: But the mechanical
21 properties --

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

25 DR. ARMIJO: In the two materials,

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1 Nitronic versus Duplex 2101, are these fundamentally
2 the same?

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

8
9 DR. WALLIS: What is the gas you want to
10 get out when you vacuum degas?

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

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

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

21 The concrete material we did increase the
22 specification for the impressive strength of the
23 concrete and the shield building from 4,000 psi TO
24 6,000 psi. We eliminated some COL information items,
25 mostly because they looked to be redundant to us, or

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1 not necessary anymore. We completed the design of
2 they containment vessel adjacent to lodge penetration,
3 so we don't need a COL information item on that one
4 anymore.

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

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

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

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

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1 anything in for them to take care of those action
2 items.

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

5 MR. TUNINSANJA: This is Lee Tuninsanja of
6 Westinghouse.

7 CHAIRMAN RAY: Thank you.

8 MR. LINDGREN: Thank you, Lee.

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

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

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

24 Details, the NRC asked us to revise our
25 discussion of compliance with regulatory guides 171,

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1 571, 60 and 199. There was not much to do for 171,
2 and 157, those were handled easily. 1.160 and 1.199
3 were addressed. These dealt with hydrogen pressure
4 loads, load combinations, maintenance rule and
5 anchors, and as a result of this interaction we added
6 a COL information item on maintenance, so we believe
7 this one is now resolved and are awaiting NRC
8 confirmation.

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

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

19 OI SRP --

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

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

24
25 DR. WALLIS: So it's a weather-induced --

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

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

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

9 The OI-SRP382-CIV-101 is one that is
10 related to the containment and the external pressure.

11 We - because of our field building and baffle chimney
12 what happens in a high wind as we get more air coming
13 through the baffles, and if you are in Duluth and it's
14 minus 40 out, you have to worry about it cooling off
15 the containment. So we have incorporated the
16 requested information from the staff. We believe this
17 one is actually now resolved and awaiting
18 confirmation. This was actually a question that talks
19 about service metal temperature.

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

22 DR. BANERJEE: But not the temperature.

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

25 MR. LINDGREN: You've got cold air coming

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1 through there.

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

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

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

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

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

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

19 DR. WALLIS: In the worst place.

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

23 We have an RAI-SRP-382-SP-CV01 which came
24 about as a result of an audit of our calculations for
25 addressing external pressure and the metal

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1 temperatures, and they asked us about analysis
2 assumptions.

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

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

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

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

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

20 DR. BANERJEE: A what?

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

24
25 DR. WALLIS: This external pressure of .9

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

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

9
10 DR. WALLIS: I'm just saying that just
11 the barometric pressure itself can change by that
12 much.

13 MR. LINDGREN: Well, I think it's about
14 .2 or .4 is actually what the barometric pressure
15 would do. And normally there is some air exchange.
16 You have to have some kind of equipment malfunction
17 that isolates everything and turns on the fans or
18 you lose AC power and that kind of thing to actually
19 get these external pressures. But anyway, so we are
20 going to be talking about for ACRS that you will see
21 the containment changes in Chapter 23, at some future
22 date.

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

25 MR. LINDGREN: Yes. Okay, moving to

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

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

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

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

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

25 OI-SRP-383-SEB1-05 is one that we believe

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1 is resolved, and we are awaiting NRC confirmation. It
2 requested that we include information on plate
3 thicknesses, that's Tier 2 star information in the
4 DCD. We have included markups of the DCD to show how
5 we will revise these plate thicknesses.

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

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

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

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

21 Now moving on to 384, which is other
22 Category I structures including the shield building
23 and the auxiliary building, OI-SRP-384-SEB-1-03 was a
24 request that we include more detail with the DCD
25 related to enhanced shield building design and the

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1 reason for the removal of certain Tier 2 star
2 information. We're basically putting that Tier 2 star
3 information back in, and providing the information
4 they requested. But this is still an open question.

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

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

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

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

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

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

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

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

5 CHAIRMAN RAY: Okay.

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

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

15 MR. LINDGREN: Yes.

16 DR. WALLIS: It actually lifts up?

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

21 DR. WALLIS: Because of intention?

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

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

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

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

3

4 DR. WALLIS: That's better.

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

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

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

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

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

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

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

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

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

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1 And I think we are done.

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

7 Thank you.

8 MS. SPICHER:

9 CHAIRMAN RAY: Okay, Terry.

10 DCD SECTION 3.8 - STAFF

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

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

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

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

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

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

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

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

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

23 The next slide, I'm going to tell you in
24 SRP Sections what the changes are. 3.8.2 steel
25 containment, the first changes, they made the

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1 calculation update due to extension from hot rock site
2 to range of soil rock site, and this already been
3 discussed in 3.7.

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

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

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

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

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

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

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

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

6 CHAIRMAN RAY: It sounds bizarre to me.

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

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

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

20 DR. BLEY: But the ITAAC stays.

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

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

25 CHAIRMAN RAY: They can hire anybody they

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1 want as long as they are qualified to do it. Okay,
2 never mind, we're wasting time. I just couldn't
3 understand what you're talking about.

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

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

9 MR. MA: Maybe Westinghouse can answer
10 that question.

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

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

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

24 The next item, revised Section 3.8.6.3,
25 concrete placement. Originally they were talking

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1 about single placement; now they allow the multiple
2 placement.

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

5 3.8.4, revised 3.8.4.2, applicable code,
6 standards and specifications. This is to extend the
7 welding to two additional areas.

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

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

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

22 3.8.5, revised 3.8.5.4.1, analyses for
23 loads during operation. This is the increase, 20
24 percent margin for the reinforcement to account for
25 the soil variability in the basement.

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

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

8 MR. MA: We will be later on.

9 CHAIRMAN RAY: Okay, all right.

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

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

16 MR. MA: These are design changes.

17 CHAIRMAN RAY: Well, okay.

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

25 CHAIRMAN RAY: To me it sounds like it's

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

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

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

13 CHAIRMAN RAY: Okay, so physically it
14 changes.

15 MR. MA: Physically it changes.

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

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

20 CHAIRMAN RAY: Got it.

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

25 CHAIRMAN RAY: Thank you, I understand

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1 now.

2 MR. MA: Item C is revised Section
3 3.8.5.7, design summary report. This is the same
4 thing; they removed the word, by COLA.

5 3.8.6, combined license information,
6 revised 3.8.6.1 by eliminating COL information item,
7 because it had been addressed in TR-09.

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

10 Let's go to next one.

11 MR. BRAVERMAN: Back it up one.

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

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

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

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

25 MR. MA: Okay, the first open item is

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

5 DR. BLEY: And have they responded?

6 MR. MA: They did respond.

7 MR. BRAVERMAN: Yes, they have; they're
8 reviewing that now. Actually we had a structural
9 audit as mentioned before, the week of June 28th, and
10 we went actually over all these open items, and some
11 of them were determined to be technically acceptable.

12 Others, we developed a path forward, and subsequent
13 to that we also had a conference call that they had
14 been submitting draft RAI responses. We've gotten
15 back to them, and in four cases the open items have
16 been converted to confirmatory items, and in one case
17 it was resolved.

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

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

24 DR. BLEY: Good.

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

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1 there is a summary slide.

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

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

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

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

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

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

25 CHAIRMAN RAY: The problem is though that

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

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

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

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

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

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

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

24 MR. BRAVERMAN: Well, 3.8.2.0.2 is
25 relatively minor. Because during the last audit they

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1 acknowledged they will revise the DCD to indicate that
2 they are in accordance with these regulatory guides.

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

6 MR. MA: Yes.

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

11 MR. BRAVERMAN: Okay.

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

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

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

22 MR. MA: Okay, if that is the case - I
23 think the next one, 3.8.3, the second item, 03, we
24 want them to justify the use of the stiffness
25 reduction factor of .8 for containment internal

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1 structure and reinforced concrete structure.
2 Originally they used one, which is assuming concrete,
3 no crack. And now they reduced it to 80 percent of -
4 20 percent of cracks, so now they reduce it to 80
5 percent of the original 100 percent uncracked. So we
6 want them to justify the reason for doing that.

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

23 As far as the input to that model --

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

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1 "it."

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

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

7 MR. BRAVERMAN: Right.

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

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

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

20 MR. MA: The next one is the 04, is how
21 do they transfer the load from containment internal
22 structure down into the foundation. So this kind of
23 new type of construction they use, like they put
24 concrete inside two steel face plates. How those
25 forces will be transferred down into the basement,

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1 that's - we asked them how to do that, because this is
2 an unusual kind of connection.

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

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

11 DR. ARMIJO: Shield building.

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

14 Also I'd like to add that Westinghouse
15 previously had several options of how to transfer the
16 loads from the modules inside containment to the base
17 concrete. A couple of the methods relied on what we
18 call a direct path of load. So the load from steel
19 face plates would have at the bottom a steel plate
20 welded to it with a mechanical connector, then bars
21 which would be embedded into concrete. That is
22 considered a direct load path. The other design
23 option which we believe they are going to finally
24 eliminate because it has difficulty in demonstrating
25 adequacy relies on the load going from the steel face

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1 plate to the studs that are welded to the plate -
2 that's what ties the plates into the concrete, is a
3 series of studs spaced a certain dimension vertically
4 and horizontally. So the load would have to go from
5 the face plate to the studs, then they have bars that
6 pass from the base concrete up into the module inside
7 the stud region. And that's not a direct load path.
8 The load has to go from the plate to the studs to the
9 concrete, and then from the concrete to the bar, and
10 then the bar would pass it down.

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

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

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

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

23 (Simultaneous speaking.)

24 MR. THOMAS: The shield building also has
25 the module connection to the base mat. So both

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1 configurations apply to the shield building. But then
2 it's the modules and the terminal to containment, that
3 detail is still evolving.

4 CHAIRMAN RAY: Okay.

5 MR. MA: Okay, the next one.

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

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

13 CHAIRMAN RAY: I see.

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

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

18 MR. THOMAS: Yes.

19 CHAIRMAN RAY: All right.

20 (Comments off the record)

21 MR. MA: The next one, more important
22 one, is the 385-SEB1-32. Currently they assume all
23 the soil is uniform underneath the base mat, and from
24 soil structure mechanics we now - at the edge normally
25 you have much higher reaction than in the middle. So

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1 if you assume everything is uniform, you may not be
2 conservative for some areas of the design. So that is
3 why we are asking them to justify their analysis is
4 conservative or adequate. We are still working with
5 them on this issue right now.

6 And the next important one is --

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

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

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1 accommodate that effect.

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

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

7 CHAIRMAN RAY: Seismic?

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

14 CHAIRMAN RAY: It's the edge effect.

15 MR. MA: It's the edge effect.

16 CHAIRMAN RAY: Okay, I got it.

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

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

23 MR. MA: No.

24 CHAIRMAN RAY: Okay.

25 MR. MA: The next issue we feel is

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

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

14 CHAIRMAN RAY: All right. Good.

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

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

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1 MR. MA: There is a path forward.

2 CHAIRMAN RAY: All right.

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

11 CHAIRMAN RAY: Okay.

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

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

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

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

23 CHAIRMAN RAY: Excuse me, on slide 14.

24 MR. MA: Okay.

25 CHAIRMAN RAY: Inspect the PCS tank for

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

5 MR. BRAVERMAN: That's correct.

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

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

11 CHAIRMAN RAY: I see.

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

17 CHAIRMAN RAY: Go it, thank you.

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

22 MR. BRAVERMAN: That's a good point.
23 This is just one inspection right after construction.
24 There is the maintenance rule, 10 CFR 50.65, and Reg
25 Guide 1.16 which requires examination and inspection

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1 of seismic Cat I structures throughout the life. And
2 if you saw the earlier open item on reg guides, I
3 think you may have seen Reg Guide 1.60, so they have
4 committed to that in Reg Guide 1.60, it tells you how
5 to implement 10 CFR 50.65. So they will be monitoring
6 it throughout the life.

7 MR. BROWN: Okay, thank you.

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

10 MR. BRAVERMAN: Which slide was that?

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

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

25 DR. ARMIJO: So you don't want it to be a

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1 lubricant of some sort?

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

3 DR. ARMIJO: But as far as the rest of
4 the property, the membrane is there for water proofing
5 --

6 MR. MA: That is not our --

7 DR. ARMIJO: Your worry, this open item?

8 MR. MA: Yes.

9 MR. BRAVERMAN: But we still look at
10 good engineering practices, and the life expectancy is
11 60 years. So any steps they take to prolong the life
12 of concrete is also a concern.

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

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

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

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

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

16 DR. ARMIJO: So that is a Vogtle --

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

18 DR. ARMIJO: -- a Vogtle COLA issue.

19 MR. MA: Yes.

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

22 MR. BRAVERMAN: No, typically for design
23 certification applications they put in the
24 requirement, the criteria, and then the COLA has to
25 provide information to show that the particular type

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1 of water proofing system or membrane they pick can
2 achieve that criterion.

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

12 DR. ARMIJO: Thank you.

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

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

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

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

22 We will be adjourning for lunch. And as I
23 said, when we come back, just as a matter of
24 convenience for everybody involved we will at that
25 time start with a closed session so we don't have to

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1 have people come in and then leave. And at that time
2 we will address one of the action items that
3 information has been prepared for us for. So I
4 appreciate everybody who is interested in that and
5 should be attending to attend the start of that
6 session which will be at 1:00 o'clock.

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

11 With that we will adjourn for lunch.

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

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

21 Sanjoy, to the extent that you want to
22 pursue that item yourself there is no need for you to
23 do anything more. To the extent that you want to get
24 it captured and maybe pursued by others, if you could
25 write down what you said at the end in a way that we

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1 can capture it, I'd be grateful.

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

4 DR. ARMIJO: Harold?

5 CHAIRMAN RAY: Yes.

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

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

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

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

24 CHAIRMAN RAY: Okay, thank you.

25 Okay, what are we doing now? We are

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1 going to talk about other action items are we?

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

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

9 MS. McKENNA: Okay.

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

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

17 CHAIRMAN RAY: Okay.

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

22 CHAIRMAN RAY: The answer to that
23 question is, no I don't. We will take up Amy's issue,
24 when Mike is back and he's back now - is Amy here?
25 All right, we are going to provide the response to

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1 another question having to do with low level rad
2 waste, then we'll go to item 11 which is the upcoming
3 interactions. Then we'll take up and then I assume a
4 lot of people will scatter out of here, and we'll take
5 up summer.

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

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

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

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

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1 11.4.2.4.3 that provided options available for
2 disposition of Class B and C waste. Should a disposal
3 facility not be available by the desired time.

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

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

13 And the third option --

14 DR. RYAN: Where would that storage
15 occur?

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

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

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

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

24 MS. AUGHTMAN: Right.

25 DR. RYAN: I'm not positive.

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

4 DR. RYAN: Okay.

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

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

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

20 (Microphone interference)

21 CHAIRMAN RAY: Go ahead.

22 MS. AUGHTMAN: So to I guess show what we
23 would provide if we were to construct a facility
24 onsite, we in the application gave some general design
25 criteria, and programmatic criteria that we would

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1 follow or commit to and employ should we have an
2 onsite storage path. And those criteria were based
3 largely on the EPRI guidelines, the technical report
4 number is 1018644. And the title is Guidelines for
5 Operating an Interim Onsite Low Level Rad Waste
6 Storage Facility.

7 And the final version I think is Rev. 1 of
8 2009. And I'll talk about later that gets referenced
9 in an NRC regulatory issue summary.

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

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

23 So I don't know if that --

24 DR. RYAN: That is an excellent answer,
25 and I appreciate the reference to the other documents

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1 that you have cited from your other material. I'd
2 like to mine the transcript and get all those for sure
3 and take a look, but that is pretty helpful. It's
4 nice to know you have a plan, and I realize this is
5 not a problem of your making to solve. So it's a good
6 reaction. Thank you for the details. It's very
7 helpful.

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

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

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

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

8 UPCOMING ACRS INTERACTIONS

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

16 CHAIRMAN RAY: That's right.

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

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

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

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

4 MR. JOSHI: We can.

5 MR. BROWN: Harold?

6 CHAIRMAN RAY: Yes.

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

10 CHAIRMAN RAY: I understand.

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

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

22 MR. BROWN: Chapter 7?

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

25 MR. BROWN: That's fine, I just wanted to

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1 put it on the table, that's all.

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

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

8 CHAIRMAN RAY: All right.

9 MR. JOSHI: This could change.

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

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

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

18 MR. JOSHI: That is correct.

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

24 MR. JOSHI: One of the reasons that we
25 only put Chapter 6 and 15 in October was because you

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1 are a one-day only, and --

2 CHAIRMAN RAY: I understand.

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

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

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

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

25 MR. JOSHI: Yes.

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1 CHAIRMAN RAY: Okay?

2 MR. JOSHI: Yes.

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

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

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

24 CHAIRMAN RAY: All right, well, you are
25 basing this on your projections of the completion of

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1 your work and the presentation to us. I just want to
2 say at this time that I can't see as far as December,
3 and there are many things from the standpoint of you
4 completing your you can see better than I can sitting
5 here now.

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

9 MR. JOSHI: Okay.

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

13 MR. JOSHI: Any comments or questions.

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

16 CHAIRMAN RAY: Excuse me?

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

19 CHAIRMAN RAY: 20th and 21st.

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

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

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

25 CHAIRMAN RAY: Now just you but I would

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

13 DR. ARMIJO: Mr. Chairman?

14 CHAIRMAN RAY: Yes.

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

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

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1 are presenting the chapter with no open items. It's a
2 final SER. DR. ARMIJO: With no open
3 items?

4 MR. JOSHI: With no open items.

5 CHAIRMAN RAY: Boy oh boy, if you are
6 talking about seismic, there's a ways to go on 3.7 and
7 3.8, I'm telling you.

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

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

24 You said you were done. Anything else?

25 MR. CUMMINS: Ed Cummins, may I ask,

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

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

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

8 MS. MCKENNA: Chapter 6 is more the PSI
9 191 material and some other things.

10 DR. ARMIJO: Chapter 6 is a big chapter.

11 MS. MCKENNA: So it is a big chapter.

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

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

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

25 Everybody else satisfied? Okay, thank

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1 you.

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

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

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

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

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

20 MR. SUMMER: Right, and hopefully this
21 will

22 SUMMER COL SECTION 2.3 - APPLICANT

23 MR. SUMMER: As you see on the display
24 I'm supervisor with Skena Services. Skena Services is
25 a - well its services kind of supports the other

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1 companies in Skena, which is a holding company which
2 owns SC&G. So I used to be an SC&G employee. They
3 put us in Skena, but nothing really changed.

4 CHAIRMAN RAY: We won't talk about that.

5 MR. SUMMER: Major items of interest, the
6 first thing the DCD is incorporated by reference and
7 we discussed - there was a good bit of discussion on
8 this yesterday. The departure of 2.0-2 deals with the
9 maximum safety wet bulb temperature noncoincident of
10 87.30, which is a value 1.2 degrees Fahrenheit above
11 the AP-1000 DCD value of 86.1 degrees.

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

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

21 Got an aerial photo here to give you a
22 little bit of overview of how we're laid out. If you
23 look at the top of this slide you can see where the
24 Unit #1 meteorological tower is located, in this area.

25 This is right adjacent to Monticello Reservoir. You

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1 might remember, Monticello Reservoir is the upper
2 pool, and Parr Reservoir down here is the lower pool
3 for the pump storage unit that is located right here.

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

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

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

23 When we were first getting ready to file
24 the application we were just erecting the new tower.
25 We didn't know that we'd have enough time to get the

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1 two years of data from the Unit #2 and #3 tower, so we
2 went ahead and used data from the Unit #1 location
3 originally, and then after we got the units #2 and #3
4 tower operating for two years we substituted that
5 analysis with the new met data.

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

8 MR. SUMMER: No, we didn't.

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

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

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

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

20 MR. SUMMER: Right, we looked at the -
21 compared the two groups of data, and there were - the
22 lake effects were higher than we originally expected,
23 so we went with the Unit #2 and #3 data. Although
24 even with using that #2 and #3 data the overall
25 conclusions were effectively unchanged. So the

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1 outcome is the same even though there are individual
2 hours and maybe some differences between the two
3 locations. And we will use the Unit #1 tower as
4 backup tower for the Units #2 and #3, and Units #2 and
5 #3 as backup for Unit #1.

6 And that's all I have.

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

14 Questions?

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

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

20 MR. SUMMER: Thank you.

21 CHAIRMAN RAY: Mr. Quinlan.

22 SUMMER COL SECTION 2.3 - STAFF

23 MR. WENTZEL: I am Mike Wentzel. I am
24 the chapter project manager for Chapter 2 of the
25 Summer application review. And now we're going to

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1 discuss the staff's review of Section 2.3.

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

6
7 MR. QUINLAN: Good afternoon.

8 CHAIRMAN RAY: Good afternoon.

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

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

18 There are five subsections to Section 2.3.
19 First one is regional climatology, second one is
20 local meteorology, then onsite meteorological
21 measurement program, short-term atmospheric dispersion
22 estimates for accident releases, and the fifth is the
23 long-term atmospheric dispersant estimates for routine
24 releases. So SER Section 2.3-1 involves a
25 review of the regional climatological information. It

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1 addresses one AP-1000 COL information item. One
2 supplemental information item. And has the one
3 departure.

4 AP-1000 COL information item, VCS COL 2.3-
5 1, states that the applicant should provide the site
6 specific information related to the regional
7 climatology. The applicant presented this information
8 in the FSAR Section 2.3-1. They also provided the
9 supplemental information relating to all five of the
10 subsections of Section 2.3.

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

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

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

25 The noncoincident wetwell temperature for

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1 the summer site presented in the FSAR is the 100-year
2 return period value.

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

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

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

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

21 The staff determined that the applicant
22 provided all this information in 2.3.3 and it's
23 correct. As discussed by the applicant, a new
24 meteorological tower was built for Units #2 and # and
25 began recording data in December of 2006. The staff

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1 verified the location of the new tower that is
2 representative of the site, and meets the guidance
3 provided in Regulatory Guide 1.2-3, Revision 1.

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

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

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

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

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

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

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

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1 was informed of what was going on.

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

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

18 CHAIRMAN RAY: You believe we discussed
19 what?

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

24 CHAIRMAN RAY: So you don't foresee even
25 for the exclusion area boundary that there could be

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1 any increase of enhancement of the release effects as
2 a result of it being -someone having it elevated, it's
3 not like a stack but of course the top of the
4 containment? I can't, but I just want to make sure
5 that you are in agreement that that's not something
6 that would increase the exclusionary boundary dose or
7 affect the chi over q in an adverse way.

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

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

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

17 MR. QUINLAN: Yes.

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

21
22 MR. QUINLAN: Sir?

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

25 MR. QUINLAN: Just for my review was just

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1 to confirm their value of - well whatever value they
2 presented. And for my section I determined that their
3 value was a conservative calculation with conservative
4 assumptions.

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

8 DR. BONACA: Yes.

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

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

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

25 MR. SEBROSKY: That's correct, and meet

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

3 CHAIRMAN RAY: Okay. Thank you.

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

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

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

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

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

24 (Laughter)

25 I know we're not done, but we're back on

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1 time, so far so good.

2 (Comments off the record)

3 SUMMER COL SECTION 2.5 - APPLICANT

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

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

17 Is Scott Lindvall on?

18 MR. LINDVALL: Yes, Bob.

19 MR. WHORTON: Thank you.

20 Robin McGuire.

21 MR. MCGUIRE: Yes, Bob, I'm here.

22 MR. WHORTON: Great.

23 Joe Leitheister?

24 MR. LEITHEISTER: I'm here, Bob.

25 MR. WHORTON: Okay, and the last one,

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

3 Okay, I'm going to review a few slides
4 just to refresh your memory quickly and look at a
5 little bit of the construction activities which do tie
6 in to Chapter 2.5. Again Summer site is located in
7 the central portion of South Carolina, approximately 26
8 miles northwest of Columbia, and we did reference the
9 Vogtle and Lee sites just for reference as the other
10 projects in the area.

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

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

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

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

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

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

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

23 MR. WHORTON: Just for reference the new
24 substation area is on a hilltop about where the cursor
25 is being shown there. The existing substation for

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1 unit #1 is just south of the existing unit #1 plant.

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

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

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

24 CHAIRMAN RAY: Is this being done under
25 an LWA?

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

4 DR. HINZE: This is a saprolite that is
5 being removed?

6 MR. WHORTON: Yes, and I'll go through
7 the layers of influence a little later on in 2.5.4.

8 DR. ARMIJO: How deep do you have to go
9 for this?

10 MR. WHORTON: Once we have gotten the
11 site table top down to elevation 400, we are going
12 down to the 40 foot depth approximately, which is the
13 embedment depth for the AP-1000 nuclear island. And
14 you'll see shortly that rock conveniently exists at
15 about that elevation.

16 The purpose of our geologic mapping is to
17 capture all of the geologic evidence of the excavation
18 prior to reaching the bottom of the base level for the
19 power block foundation. This is another view of the
20 unit #2 looking to the south. And you'll note that
21 tie backs have now been installed on the retaining
22 wall as the excavation progresses.

23 And the building you see in the back that
24 was mentioned earlier, it's the erection of a module
25 assembly building, which is also a preconstruction

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1 activity. That's where the major modules will be
2 fabricated together in preparation for installation.

3 And finally one more geological mapping.
4 This is what one panel section looks like between the
5 vertical piles. And this is a fairly recent photo
6 from about two to three weeks ago. The elevation of
7 the panel is approaching final depth of the unit #2
8 excavation, and you can see just within this one
9 frame the complexities of the geology, and we'll talk
10 a little bit more about that as time goes on.

11 (Comments off the record)

12 MR. WHORTON: Just a couple more
13 construction photos and then we'll get into 2.5. We
14 wanted to show you some of the other construction
15 activities that are taking place. And this is just a
16 drawing showing that we have started installing our
17 circulating water pipes for units #2 and #3. Again as
18 preconstruction activities within the jurisdiction of
19 the interim staff guidance allowing such activities.

20 The next photo is a view of units #2 and
21 #3, of the installation. And you'll notice that each
22 unit uses four circulating water pipes at 10-foot
23 diameter each.

24 And finally one last photo here. This is
25 a view of the unit #3 circ water pipes being

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1 installed. And then they are encased with a flowable
2 concrete fill material. You can't see it very well in
3 the diagram, but that is the intended purpose that it
4 will be encased.

5 So I'm going to jump now into the SAR
6 Section 2.5 technical development. This section was
7 developed by the --

8 CHAIRMAN RAY: Excuse me, because I
9 looked at the cooling pipes I couldn't help
10 wondering, you're using what ultimate heat sink?
11 Tower?

12 MR. WHORTON: The cooling towers, yes.

13 CHAIRMAN RAY: That use these lines?

14 MR. WHORTON: Yes. Those are going
15 towards the cooling towers.

16 CHAIRMAN RAY: Well, you don't have a
17 stand alone separate ultimate heat sink?

18 MR. WHORTON: No, no we do not.

19 Okay on the development of --

20 DR. ARMIJO: Just one quick question.

21 MR. WHORTON: Sure.

22 DR. ARMIJO: The railroad tracks, who
23 owns the railroad?

24 MR. WHORTON: That is a spur line that
25 SCE&G owns. It runs about 2-1/2 miles from the main

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1 railroad line that we heard about yesterday, which is
2 paralleling the Broad River-Parr Reservoir system.

3 DR. ARMIJO: And that is for your use
4 exclusively?

5 MR. WHORTON: It was a unit #1 spur line
6 from the early '70s, and we have modified it and
7 changed it slightly going through the unit #2 - 3 site
8 area.

9 DR. ARMIJO: Thank you.

10 MR. WHORTON: Okay, in the Chapter 2.5
11 development, it was developed by SCE&G and Bechtel
12 using subcontractors of William Lettis & Associates,
13 Risk Engineering and Macctec, and we also had a senior
14 technical advisory group which on the next slide
15 you'll see is composed of a very high level of
16 expertise personnel.

17 And I will wrapup the presentation with
18 their summaries and conclusions of their involvement
19 in this process.

20 Sections 2.5.1 and 2.5.3 cover the basic
21 geologic and siting information and surface faulting.

22 We followed the regulatory guidance in developing
23 geologic maps and in performing geologic
24 investigations. This map shows a 200-mile map of
25 tectonic features that was prepared. The next slide

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1 is the 25-mile geologic map, followed by the 5-mile
2 geologic map, and finally the .6 mile Surficial
3 Geologic Map.

4 And again you can see on this map the
5 location of unit #1 relative to units #2 and #3.

6 The geologic and geotechnical evaluations
7 including the soil and rock borings on the site define
8 the Summer units #2 and #3 site foundations as sound
9 rock. And we will discuss this a little more shortly.

10 An important aspect of units #2 and #3 tie
11 back to unit #1 relative to some of the geology that
12 was discovered, geologic features discovered during
13 the construction of unit #1, and also due to the
14 formation of Monticello Reservoir for unit #1 and the
15 Fairfield pump storage facility whereby some
16 earthquakes started occurring which we termed
17 reservoir-induced seismicity. So I do want to cover
18 those aspects, because they tie in to part of our
19 design requirements and design features for the plant.

20 The view you are looking at is a
21 foundation map for unit #1. And in 1971 we had two
22 units actually on the books to be built. So unit #1
23 was on the right, and then a proposed unit #2 was on
24 the left. About in 1974 we dropped down to a single
25 unit even though we had excavated the entire hole for

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1 the two units, and we did detailed geologic mapping.
2 As part of the geologic mapping we did find sheer
3 fractures in the excavation, and sheer fractures are
4 also termed faults.

5 The excavation mapping of unit #1 found
6 small bedrock shears. These minor features were
7 demonstrated to have last moved between 300 million
8 and 45 million years ago. It was concluded through
9 the evaluation that the minor bedrock shears likely
10 exist throughout the site and in fact throughout the
11 entire Piedmont Region, and they do not represent a
12 surface rupture hazard.

13 I will have a little more discussion
14 because this is a key element of why we are doing the
15 geologic mapping and results being critical to the
16 overall design requirements for units #2 and #3.

17 The way the unit 2-3 COLA has presented
18 the results based on all the geologic evidence we have
19 determined that there are no quaternary faults or
20 capable tectonic sources existing within 25 miles of
21 the actual site. And the maximum potential for
22 vibratory ground motion at the site due to any
23 reservoir induced seismicity is bounded well by the
24 AP-1000 certified seismic design response spectra.

25 And I also plan to give you a little brief

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1 presentation on the reservoir and do seismicity since
2 they played a key role in not only unit #1 but also in
3 determining safety significance for units #2 and #3.

4 I'm going to move on now to the vibratory
5 ground motion section 2.5.2. Again there was fairly
6 prescriptive processes on how you develop your
7 seismic hazard at your plant site. One of the first
8 steps is to update the seismicity catalogs which were
9 originally developed using the EPRI database that is
10 from the 1980s. So we did our seismic hazard
11 evaluation to incorporate the seismicity catalogs.
12 Our probabilistic seismic hazards analysis replicated
13 the EPRI results for 1989. They evaluated the effect
14 of the updated seismicity.

15 We also updated the Charleston seismic
16 source. We subsequently then developed seismic
17 hazard, and uniform hazard response spectra for hard
18 rock site.

19 And finally you go to the development of
20 the vertical to horizontal motion ratios, and the
21 ground motion response spectra, again for our hard
22 rock site.

23 Three seismic source areas were reexamined
24 to evaluate the effects of the additional seismicity
25 which also included the eastern Tennessee seismic

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1 zone, which had more recent issues relative to any
2 recent events that may change the basis of the
3 understanding of that zone, but we did include all of
4 the latest date for that area.

5 Four geometries were used for the updated
6 Charleston seismic source models, which was consistent
7 with the other applications.

8 The summary of the models that were used
9 determined that there were no new capable tectonic
10 sources identified within the site region. There were
11 no modifications to the Eastern Tennessee Seismic Zone
12 required.

13 The updated Charleston model replaced the
14 EPRI sources, as was adopted from the Vogtle
15 application.

16 The New Madrid, Missouri source was added,
17 which was adopted from the Clinton initial
18 characterization.

19 So the process - and I am moving quickly,
20 but there is a lot of information to cover - the
21 process basically takes all of the input data, and
22 from these results a set of peak ground acceleration
23 seismic hazard curves were developed. This is only
24 one representation of hazard curves, and this one is
25 at the deep ground acceleration level.

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1 Next in the process you have development
2 of the uniform hazard spectra for the particular site
3 for the rock site at Summer. And then you develop
4 your horizontal and vertical ground motion response
5 spectra which were developed using the accepted
6 approaches described in ASCE 4305 in Regulatory Guide
7 1.208.

8 So lastly in comparison the blue dashed
9 line as shown in this figure you saw a similar figure
10 earlier today - let me start over here, the red line
11 is actually the AP-1000 certified seismic design
12 response spectra, which is anchored to a point 3G
13 acceleration.

14 The darker or black line, solid line, is
15 the hard rock high frequency spectra which was
16 described also today and the dashed blue line is the
17 VC Summer units #2 and #3 ground motion response
18 spectra, which is our design input ground motion. And
19 as you can see we are enveloped by the hard rock high
20 frequency spectra, and the exceedance you see in the
21 approximate 25 Hertz frequency range is being handled
22 generically by Westinghouse as part of resolution in
23 Section 3.7.

24 CHAIRMAN RAY: The exceedance you are
25 referring to is between the dashed blue line and the

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1 black line?

2 MR. WHORTON: Well, the exceedance is
3 actually above the certified seismic design, which is
4 from about this point here --

5 CHAIRMAN RAY: Oh, I see, of course I
6 understand that. But I guess I was thinking you were
7 pointing at something else.

8 MR. WHORTON: Oh, no, we are bounded by
9 the hard rock high frequency spectra.

10 CHAIRMAN RAY: Right.

11 MR. WHORTON: And in fact for your
12 information the hard rock high frequency spectra was
13 developed from the existing hard rock sites that were
14 current applications for the AP-1000, which were
15 Bellefonte, Summer and the lease site, Duke Power.

16 The ground motion response spectra were
17 developed for each of those three sites, and then all
18 of those were enveloped and then bumped slightly to
19 develop the hard rock high frequency spectra.

20 Moving on to Section 2.5.4 on the site
21 geotechnical characterizations, and here Dr. Hinze
22 will get into the layering of materials at the Summer
23 site. We basically have five layers of materials in
24 the site area. The upper layer which is the reddish
25 clayish material is called the residual soils. Below

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1 that is the more yellow silt and sand material which
2 is the saprolite material, saprolitic material, which
3 is a completely weathered rock but it preserves some
4 of the relic rock structures.

5 You then come into a layer of partially
6 weathered rock which may be 5 - 10 feet, maybe less.
7 Below that is the moderately weathered rock, which
8 again may be just a few feet in thickness. And then
9 you immediately come to the sound hard rock.

10 Now what we have found is that from the
11 geotech evaluations the residual soil and the
12 saprolite soil are not acceptable for any power block
13 foundation considerations. So for the excavations of
14 the power blocks we are removing all of the residual
15 and saprolitic soils.

16 For the nuclear island we will be going
17 down to sound rock. For the adjacent structures, and
18 I will show you a figure in just a second, we will be
19 building off of a minimum of the moderately weathered
20 rock with an engineered backfill which will be
21 imported from an offsite location.

22 The next slide is just to illustrate that
23 for units #2 and #3 we will exceed the average shear
24 weight velocity of a 1,000 feet per second or greater,
25 which also matches what was presented this morning

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1 from Westinghouse showing that their hard rock
2 criterion is 8,000 feet or greater.

3 DR. HINZE: Bob, in the Westinghouse
4 presentation they used 8,000 feet per second as I
5 recall, not 9,200. Where is the difference?

6 MR. WHORTON: The problem most of the
7 COLA applicants have found as part of the
8 investigations is that the 9,200 feet per second was
9 more of a generic classification of a true sound rock.

10 It was more of a generalized classification. If you
11 look at this chart you will see that we, just below
12 foundation level, immediately jump above the 9,200
13 feet per second line, which is actually the dotted red
14 vertical line there. It's only in the lower part of
15 the foundation. So Westinghouse's analysis was based
16 on 8,000 feet per second originally. So what we have
17 determined is that achieving 9,200 feet per second is
18 almost impossible anywhere in the country unless you
19 really go down to great depths in the sound rock.

20 DR. HINZE: You reached 9,200 in the
21 partially weathered, the moderately weathered?

22 MR. WHORTON: No, we're actually into the
23 sound rock at that point.

24 DR. HINZE: You're into the sound rock --

25 MR. WHORTON: Yes.

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1 DR. HINZE: -- with that 9,200.

2 MR. WHORTON: Yes.

3 DR. HINZE: And that's where you are
4 taking the nuclear island?

5 MR. WHORTON: We are taking it, but
6 immediately at the foundation level of the nuclear
7 island. We are not quite at 9,200 feet per second.
8 But we do exceed the threshold that Westinghouse had
9 established of 8,000 feet per second.

10 DR. HINZE: Thank you.

11 DR. MUNSON: This is Cliff Munson. If I
12 could add to your question, the 9,200 feet per second
13 is the hard rock value for the attenuation
14 relationships that EPRI used. So by meeting the 9,200
15 feet per second they do not have to do site response.

16 DR. HINZE: Okay.

17 MR. WHORTON: Okay, the next slide is
18 just one cross-section representation of the power
19 block area, just showing that we are founding the
20 nuclear island on a sound rock base, which obviously
21 with the irregularities of the rock surface it will
22 have some concrete fill as part of that base. However
23 as with the other power block structures we will
24 excavate all the saprolite and residual soils down to
25 the moderately weathered rock layer, and then replace

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1 that with an engineered back fill.

2 Also as part of 2.5.4 liquefaction has to
3 be addressed. And our soils liquefaction potential
4 was evaluated with the overall conclusion or the final
5 conclusion that liquefaction cannot impact plant
6 safety. And the basis is that the nuclear island is
7 on sound rock, or on concrete on sound rock, the other
8 power block structures including the seismic Category
9 II annex building and turbine building are on
10 compacted structural fill which will not liquefy under
11 proper compaction methods.

12 Additionally the groundwater is
13 approximately at the rock surface level, so our
14 existing groundwater table is roughly where the rock
15 surface, the sound rock surface, is located.

16 DR. HINZE: So you didn't do a
17 paleoliquefaction study piece.

18 MR. WHORTON: And then of course we are
19 not using any of the saprolite materials for any of
20 the loading conditions.

21 I want to revert quickly back to the
22 excavation of unit #1 and the sheer fractures, just to
23 give you an overview of what we encountered then and
24 the importance to date.

25 In late 1973 while unit #1 was being

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1 excavated, Dames & Moore - and I did meet Mr. Moore
2 many years ago - the Dames & Moore resident geologist
3 identified sheer fractures on the rock surface. Once
4 we had cleaned the rock he identified them as sheer
5 fractures. In early 1974 the NRC then issued a stop
6 work order on our site. We then mobilized a team of
7 regional experts for further evaluation. The experts
8 were generally university professors who were very
9 knowledgeable in the Piedmont region and the
10 characteristics of the region. I won't read the list,
11 but they were noted at - during that timeframe in the
12 early '70s.

13 The overall project was coordinated by
14 Dames & Moore. And because we were under stop work
15 order conditions to determine the significance of
16 these fractures in the rock, Dames & Moore and the
17 team established that we would do detailed geologic
18 mapping. We excavated additional trenches. We
19 drilled an inclined boring intercepting the sheer
20 fractures, one of the main sheer fractures. We did
21 radiometric age dating, X-ray defraction analysis,
22 literature searches, aerial photos, gravity and
23 magnetic data analyses, in-place stress measurements.
24 We reviewed local microseismic data, and we did
25 additional offsite geologic reconnaissance.

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1 This next picture is a view from 1974 of
2 the unit #1 excavation looking northwest across the
3 reactor site, and where this guy is standing is
4 approximately the center of the unit #1 containment.
5 But what we are looking at is this fracture of rock
6 system coming right through where the unit #1
7 containment would be. It's one of the shear zones,
8 and in fact there were a series in that unit #1-2
9 excavation, there were a series of three shear
10 fracture zones identified. They were spaced
11 approximately every several hundred feet. But all of
12 that work was put together to determine the age of
13 movement of these events.

14 A second view is looking basically the
15 opposite direction. This is a south view, and again
16 you can see this shear fracture running through the
17 rock system. You can also see the quality of the rock
18 which is what we are expecting at our unit 2-3 site
19 area, because it's a very sound granitic based type
20 material.

21 The conclusions that were reached from
22 unit #1 are that the rock structure characteristics
23 were considered typical of anything in the Piedmont.
24 And you most likely would find such fractures anywhere
25 in the surrounding region. Through the research,

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1 there was no documentation of recent tectonic
2 displacement within 100 miles of the site. And the
3 shear orientation was consistent with the regional
4 joint patterns and not integral with any other known
5 fault systems.

6 There was a hydrothermal event had
7 occurred in one of the shear zones, and we actually
8 collected some crystals that had grown, some
9 Laumontite crystals, Zeolite Laumontite crystals, and
10 this was what was age date, and based on the age
11 dating of these crystals which had not been deformed
12 it was determined that movement along that shear
13 fracture could not have occurred any later than 45
14 million years before the present, and probably had
15 been inactive for 150 - 300 million years before the
16 present.

17 The final conclusion was that the rock
18 stresses, in situ rock stresses, were relatively low.

19 So the results of this have been applied
20 to the unit 2-3 COLA application consistent with
21 results of unit #1. We expect foundation excavations
22 for the two units may well have similar fractures, and
23 that's why we are doing such a detailed geologic
24 mapping at this stage in order to be able to capture
25 any evidence that would help us in the dating of any

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1 features that may be observed once we get to the base
2 elevation or the rock elevation.

3 The current geological investigations have
4 not identified any new data to change our current
5 interpretations. The unit #2-3 excavations are being
6 geologically mapped, and are being prepared for review
7 by the NRC, and hopefully we may be able to arrange a
8 visit in the near future with the NRC staff geologist.

9 The SAR Section 2.5 concludes that the
10 shear fractures are not capable of tectonic sources
11 and do not represent ground motion or surface rupture
12 hazards to our site.

13 To give you the background on the
14 reservoir induced seismicity, because this was unique
15 to the Summer site and still has some importance
16 relative to our evaluation, Monticello Reservoir was
17 filled in late 1977 through early 1978. However due
18 to the concern that there could potentially be some
19 reservoir induced seismicity primarily in the Piedmont
20 region of the southeastern U.S. we did install, and
21 the NRC had actually recommended prior to that time,
22 that we install a micro-seismic monitoring network
23 prior to the filling of Monticello, and we did that,
24 and I'll briefly describe it.

25 We also had a nearby seismometer as part

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1 of the University of South Carolina's seismic network
2 at that time, which was in operation in 1974, so we
3 collected data from '74 to '76 and determined that
4 there was generally one small microseismic event about
5 every six days in the immediate vicinity. As I
6 mentioned the reservoir was filled December, '77 to
7 March of '78, and probably within three weeks of the
8 initial filling microseismic activity dramatically
9 increased.

10 The next slide just basically shows the
11 orientation of the four-station network that we put
12 in. We put a central station on the east shore of
13 Monticello Reservoir, and the three satellite stations
14 were about 10 miles distant.

15 The next slide is the histogram of the
16 activity. So prior to '77 almost no activity other
17 than one event every six days. We ended up with I
18 think over 1,200 events per month in January,
19 February, March timeframe.

20 However, as you will notice in this
21 histogram the activity did dramatically or
22 exponentially decay off, although we had spurts of
23 activity over a long period of time.

24 The record ends in 2004, mainly because
25 the network had aged, and lightning strikes and many

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1 other factors determined that it was really no longer
2 producing really good data. So we had concurrence
3 with the NRC that it looked like there was no further
4 risk of not having a well established network. So we
5 did abandon the network even though pieces and parts
6 were continued to Professor Talwani at the University
7 of South Carolina. And I will note that that
8 seismometer that we had used in 1974 is still up and
9 running as part of the South Carolina seismic network.

10 So we do have a seismometer in the near vicinity of
11 Monticello Reservoir and these two Summer sites #2 and
12 #3 which give us data, and we have a good rapport with
13 the University of South Carolina. Even though Dr.
14 Talwani has now retired, we have other contacts. So
15 we have the ability to understand what happened in the
16 immediate area.

17 And the real significance of the reservoir
18 induced seismicity is that as the earthquakes started
19 happening the USGS became very interested in putting a
20 strong motion accelerometer in the vicinity to see if
21 they could record any of the events. And we
22 graciously allowed them to do so. However this
23 instrument was located near the Fairfield Dams, and
24 in August of 1978, and then again in October of 1979,
25 the instrument recorded two events. Both were

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1 magnitude 2.8. These events were very small. They
2 were recognized in the area of 2.8, can generally be
3 recognized and felt. You will notice that the '78
4 event had a peak ground acceleration measurement of
5 .25 G whereas the '79 event had a .36 G.

6 The next slide shows you that the VC
7 Summer unit station, you can see where it's located
8 here. The strong motion accelerometer was located on
9 a dam between two of the Fairfield hydro dams or
10 Monticello dams, and then the October 16th, 1979 event
11 was located in a valley off to the west.

12
13 But this event was recorded, and
14 unfortunately for us it occurred just prior to going
15 into detailed licensing for the unit #1 site.

16 The next is what you would see. But if
17 you'll notice this is a one-second time history record
18 you are looking at, and it shows a peak acceleration
19 of .36 g, which is at this level, for a very short
20 duration of less than .06 seconds. However, the
21 concern was what was the impact of short duration high
22 frequency motion on plant structure, systems and
23 components. So for unit #1 as part of our licensing
24 commitments, we did a very detailed engineering
25 analysis to show that the impact of small reservoir

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1 induced events would not affect the existing unit #1
2 site, and in fact part of the evaluation was that we
3 had to postulate the largest event that potentially
4 could occur from the reservoir induced seismicity.
5 And I believe it was determined at that time that no
6 one would expect a magnitude of event greater than
7 about a 4.5, so we evaluated a magnitude 4.5
8 earthquake nearby from the reservoir as a result of
9 this occurrence.

10 We successfully showed that, however, even
11 a 4.5 event would not cause any problems to systems,
12 structures or components.

13 The unit #2 and #3 conclusions extracted
14 part of this data. And we now know that the
15 microseismic activity has diminished back to
16 approximately the preimpoundment background levels.
17 There are occasional spurts of activity. I have had
18 had many discussions with Professor Talwani over the
19 years to see that there is no correlation with
20 rainfall or any fluctuations in the reservoir which is
21 relatively small. It's only 4-1/2 feet in the upper
22 reservoir at Monticello. And therefore our conclusion
23 is that the reservoir-induced seismicity doesn't
24 increase any ground motion hazards for the site area.

25 DR. HINZE: The range of epicenter

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1 depths?

2 MR. WHORTON: They were generally very
3 shallow, typically less than 3 kilometer.

4 DR. HINZE: Did the distribution of the
5 earthquakes with that give any clue as to what major
6 faults in the area?

7 MR. WHORTON: It did not. There was no
8 correlation to any major faulting in the area.

9 DR. HINZE: So there wasn't any focusing
10 of these earthquake epicenters and any dip that might
11 indicate major faults?

12 MR. WHORTON: That's correct. The
13 conclusion was that these small earthquakes were
14 occurring along these small fractures as we had
15 observed in unit #1. And if you look at years of
16 time, the earthquake activity just migrated all over
17 the reservoir, and it almost filled in the entire
18 reservoir every time, and so the conclusion was that
19 they were attributed to the small rupture or fractures
20 in the rock structure due to pore pressure and stress
21 of the weight of the lake.

22 And finally I'd mentioned earlier the
23 seismic technical advisory group, which was an
24 important aspect of our overall COLA development.
25 Again we used a fairly recognized and diverse group of

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1 experts, who most of you probably recognize these
2 people.

3 The TAG participated in a participatory
4 peer review function, four different sessions for our
5 COLA development. As we got to certain stages of our
6 COLA development we would submit the portion of the
7 COLAs that had been developed or any data to them and
8 then we would bring them together for a two to three
9 day meeting to review all of the results and to make
10 sure that we were headed in the right direction and
11 that we had a handle of what was going on.

12 During that timeframe there was a lot of
13 COLA development underway, and we determined that - we
14 worked very closely with Southern, Duke, Progress - we
15 determined that it would be most effective if we could
16 join the TAG meetings to cover a number of sites
17 because of the commonalties that existed at many of
18 the sites relative to the evaluation process. So we
19 actually called them the supertags at that point in
20 time. And the four utilities that were involved back
21 then were, on the Bellefonte site, the Lee site, the
22 Summer site, and Grand Gulf was actually interested
23 in it too. Vogtle also participated in the site, and
24 as you'll notice Don Moore from Southern was actually
25 part of our tag review team.

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1 The conclusions that the TAG reached were
2 that the preparation of our COLA Units #2 and #3
3 properly implemented the state of practice methods and
4 procedures in compliance with NRC's updated
5 regulatory guidance and the interim staff guidance.
6 Coordination with concurrent preparation of COLAs for
7 the Bellefonte, William State's Lee and Grand Gulf
8 along with the other industry-NRC generic seismic
9 issue resolution was particularly effective and
10 productive.

11 The TAG concurred with the results and
12 conclusions presented in the safety analysis report
13 for Units #2 and #3 and considered them to be
14 appropriately and adequately supported by the data and
15 analyses, and then the TAG developed I will call it an
16 endorsement letter - that's maybe not the right word -
17 but a letter stating their conclusions, which we
18 actually submitted as part of our COLA application.

19 So with that, we covered a lot of material
20 very quickly.

21 CHAIRMAN RAY: You did extremely well,
22 and got me back in the good graces of everyone. Maybe
23 this is a question I should ask Al, and I'm going to
24 ask the staff too. I'm surprised at the amount of
25 work you can do in pre-construction, particularly the

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1 building of the circulating water lines that include
2 the ultimate heat sink connection. That seems odd to
3 me. I just find myself asking, what the heck more
4 could you do than you are if you had an LWA.

5 MR. WHORTON: Interim staff guidance 4 I
6 believe is the guidance document. And it clearly
7 identifies components such as circulating water lines,
8 as long as they have no association with safety
9 functions, and you can show that --

10 CHAIRMAN RAY: That's why I asked you
11 about the ultimate heat sink.

12 MR. WHORTON: Well, and you can show that
13 they would not result in a reactor trip. So there is
14 justification that has to be developed and prepared to
15 support that.

16 CHAIRMAN RAY: Okay, there are always
17 surprising things in life.

18 MR. SEBROSKY: There was a recent rule
19 change within the last two years, and the definition
20 of construction was changed in 10 CFR 50.10. There
21 used to be two LWAs, LWA-1 and LWA-2. There is now
22 just LWA.

23 CHAIRMAN RAY: Yes, like I say it was
24 just the fact that these lines that serve as the
25 ultimate heat sink would be included as pre-

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1 construction surprised me. But like I say you get
2 surprised by things lots of times.

3 Okay, fine, thanks a lot.

4 MR. CUMMINS: So if I might.

5 CHAIRMAN RAY: Yes, sir.

6 MR. CUMMINS: So the word, heat sink, has
7 maybe different definitions for different people, but
8 for us it's the safety related, which is air.

9 CHAIRMAN RAY: You're right, Ed. I
10 should have - there was some question earlier today I
11 think it was, somebody asked the question, do you have
12 a cooling gallery. It didn't occur to me that you
13 don't use the circulating water lines for the safety
14 ultimate heat sinks.

15 MR. CUMMINS: That's right, but we do
16 have a service water cooling tower which defends in
17 depth. But the safety layer was there.

18 CHAIRMAN RAY: Okay, fine, thank you.
19 Bill, you had a question.

20 DR. HINZE: Well, I'm curious, how will
21 you meld together the soon to be released the central
22 and eastern United States seismic source
23 characterization project by CAPRI and NRC and DOE and
24 the next generation attributes of the ground motion,
25 how are you going to meld that together?

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1 MR. WHORTON: That is a tough question.
2 We are aware of what is going on with the updated
3 seismic hazards studies, and I understand that it
4 could be coming out as - the results could be coming
5 out as early as the end of this year. We obviously
6 are taking the current considerations as far as our
7 applications, and I don't think we've taken it that
8 next step as to what the implications will be. We
9 obviously will look at the data to make sure there is
10 nothing dramatic that would influence what we have
11 already done.

12 Robin McGuire, do you have any feel for
13 potentially any significant data, or any of the other
14 consultants that are on the line?

15 We have to reopen the line.

16 (Comments off the record)

17 CHAIRMAN RAY: We can hear you now. Go
18 ahead.

19 MR. MCGUIRE: Okay, this is Robin
20 McGuire. The seismic source that dominates the hazard
21 at Summer is the Charleston source, and that source in
22 the new seismic source model for the central and
23 eastern U.S. has not changed in any fundamental way
24 from the one that was used in the PSHA, the seismic
25 hazards that were just presented by Bob Whorton. So I

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1 think fundamentally there won't be very much change.
2 There will be some change in the background sources
3 which contribute a little bit, but fundamentally the
4 large earthquakes that occur in Charleston and
5 potentially may occur in the future will not be
6 changed. So that part of the hazard would not be
7 changed. So I don't expect a very large change if
8 any at all.

9 CHAIRMAN RAY: Okay. Thank you.
10 Anything else? Thank you.

11 All right, we will finish up the day with
12 the staff's review of the same material

13 As occurred earlier, we will ask the
14 staff, since we have just had this presentation to try
15 and focus us on the things that you think we should
16 pay attention to rather than a survey of everything
17 that's already been said.

18 (Comments off the record)

19 SUMMER COL SECTION 2.5 - STAFF

20 MR. WENTZEL: Okay, I'm Mike Wentzel
21 again. And as yesterday I will be filling in for
22 Tony as well.

23 We will be discussing the staff's review
24 of Section 2.5 of the Summer application. The
25 presenters for the review sitting to my right here for

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1 Section 2.5.1 and 2.5.3, we have Dr. Gerry Stirewalt
2 for Section 2.5.2, we have Saray Tabatabai in
3 Sections 2.5.4 and 2.5.5, we have Dr. Weijun Wang.
4 And I'd just point that they were supported by other
5 staff members, NRC staff members and consultants.

6 An overview of Section 2.5 of the Summer
7 advanced final safety evaluation report included - it
8 was issued with two confirmatory items and one license
9 condition. All COL information items, of which there
10 were 11 in Section 2.5.4 and two in Section 2.5.5,
11 have been resolved based on FSAR Revision 2. All
12 confirmatory items were also resolved based on FSAR
13 revision 2, except for 2.5.2-1 which relates to
14 fractile hazard curves, and 2.5.4-1 which relates to
15 concrete fill design, thermal cracking and we will be
16 discussing those later on in the presentation.

17 License condition 2.5.1-1 for Section
18 2.5.1 is related to the geological mapping of
19 excavations for safety related structures. And again
20 we'll be discussing that shortly. And with that we'll
21 be turning it over to Dr. Stirewalt for his
22 presentation.

23 DR. STIREWALT: Thank you, Mike.

24 We realized the subcommittee is likely
25 getting a little worn down. We will try to be concise

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1 and as brief as possible.

2 I am Gary Stirewalt, as Mike said. I'd
3 like to step directly into 2.5.1, related to basic
4 geologic and seismic information. The technical topic
5 of interest in this situation is assessment of the
6 capability of tectonic structures that have been
7 mapped within the site region, the site vicinity, and
8 the site area.

9 The issue of interest if you wish to call
10 it that is really to ensure that there are no
11 potentially capable tectonic faults that have been
12 mapped within those localities. And by capable what
13 we mean is effectively a structure, a fault, a
14 tectonic fault of quarternary age, you can see what
15 that timeframe is, 2.6 million years to present.

16 Now the issue actually arose because the
17 applicant identified 14 potential quarternary tectonic
18 features within the site region. And again as a
19 reminded if they are quarternary in age they are
20 potentially capable structures, and consequently with
21 some possible associated seismic hazards. So we
22 thought that this was an important point to track on.

23 CHAIRMAN RAY: Gary, these were not on
24 the USGS maps, existed otherwise?

25 DR. STIREWALT: I'm sorry, these are well

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1 shown in what's provided in the FSAR. In fact I'll
2 show you an illustration of that in just a moment. I
3 know that you are aware that the Charleston area
4 seismic source within the site region. The key here
5 is that there are no map structures. And I'm sorry,
6 these are well shown in what's provided in the FSAR.
7 In fact I'll show you an illustration of that in just
8 a moment. I know that you are aware that the
9 Charleston area seismic source within the site region.

10 The key here is that there are no map structures.
11 And certainly even for Charleston as large as that
12 earthquake was in 1886 and also there is information
13 from Paleoliquefaction data that there were earlier
14 earthquakes. But the point is there is not a map
15 feature there, and the Charleston zone, as Bob Whorton
16 so eloquently laid out is certainly - and as Sarah
17 will also address for 2.5.2, it's actually
18 characterized as a seismic source zone, so in fact you
19 don't really need to worry at this stage about where
20 there is a specific fault. But it certainly indicates
21 quaternary deformation.

22 Let me just sort of show you quickly in
23 the next slide where those 14 potential features are.

24 What I'd like to do, obviously you can see where
25 they lie. But again just to point out the concept of

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1 the paleoliquefaction features that are shown by the
2 red triangles that are associated with 1886 and pre-
3 1886 earthquakes in Charleston, certainly again
4 distinguishing the point that there is some sort of
5 quarternary feature there. There is not a map feature
6 in that zone again, and it is handled very properly by
7 treating it as a seismic zone or for the hazardous
8 estimates. Thank you.

9 The resolution that was effected in this
10 case, the staff's review of the detailed responses
11 that the applicant provided, most were RAIs, in excess
12 of 50 or so, and also including some modifications
13 that they provided already in Rev. 2 for 2.5.1 of the
14 FSAR, certainly resolved the concerns that were
15 related to the occurrence of potentially capable
16 structures actually mapped in the site vicinity.

17 The basis for that clarification and that
18 basically sort of resolution if you wish, we found
19 that the information that the applicant provided in
20 fact documented that there really are no quarternary
21 tectonic faults mapped in the site region, the site
22 area. So consequently no viable seismic features have
23 been mapped. And that is a pretty important issue.

24 Let me just address briefly the idea of
25 what types of constraining field data that they

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1 provided. One very good way to constrain something
2 geologically, if you have a fault plain, I'll pretend
3 this is a fault plain, and you have some rock body
4 that cross-cuts that, and it's not disrupted, if you
5 get an age date on that rock body, then you can in
6 fact provide a constraining age on that fault. And
7 that is one method that the field data if you wish and
8 combined with radiometric age dates that certainly
9 helped qualify the fact that no mapped quarternary
10 tectonic features.

11 Another issue of interest that's related
12 to the potential for tectonic structures in
13 excavations for safety related features, and Bob
14 addressed this very very well, the issue really arises
15 as Bob clearly pointed out because in Unit #1 they
16 found minor shear zones. And just because of the
17 nature of the regional deformation style in this
18 geologic area, we really expect similar structures
19 might well be found for Units #2 and #3.

20 Those particular minor shears are, once
21 again, as Bob qualified them, a minimum age of 45
22 million years. We had good age date control. They
23 were well mapped. But the point is that the staff
24 will in fact need to examine the geological features
25 that are observed and mapped. Indeed excavations for

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1 the safety related structures essentially ensure that
2 there aren't any capable features that are in that
3 excavation.

4 The resolution that we've affected here is
5 licensing condition 2.5.1-1 that might mention which
6 does require the applicant to perform geologic mapping
7 of that excavation. Again as Bob laid out, that is
8 ongoing right this second even as we speak. They are
9 evaluating the geologic features, and in fact we are
10 already in discussion, they will promptly notify us
11 when those excavations are open for examination. And
12 currently a possible timeframe for that site visit
13 where the geologist will actually go down and look at
14 those features are not depending on whether they are
15 there will actually be the August-September timeframe
16 is how it looks right now.

17 Are there any questions on 2.5.1?

18 CHAIRMAN RAY: You've given a concise and
19 clear explanation.

20 DR. HINZE: If I might.

21 CHAIRMAN RAY: Yes.

22 DR. HINZE: Let me ask the same question
23 that I asked of Bob. How is the NRC going to envelope
24 in the results of the study that is supposed to come
25 to us right after the first of the year that you are

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1 so intimately involved in?

2 DR. STIREWALT: Yes, Bill, I think the
3 answer that Dr. McGuire gave is really a very very
4 good response for how it might well affect Summer.

5 DR. HINZE: But what is the process that
6 the NRC will go through? Will you review this again
7 from the context of the results of that study?

8 DR. STIREWALT: I'm going to roll that
9 question to Dr. Munson who is spearheading the review.

10 DR. MUNSON: The NRC will first perform a
11 two-month acceptance review of the new model later
12 this year. And at that time we will determine the
13 scope of the new model and how long it will take us to
14 do a full review which we will perform in 2011, so we
15 will probably do I would say at least a six month
16 review starting in the beginning of 2011 on this new
17 model, and endorse it with a new ISG and eventually a
18 reg guide update.

19 But we will look at the new model and its
20 implications with respect to the various sites, just
21 to see if there is a significant change in the hazard.

22 DR. HINZE: So it will be against the COL
23 of this site, right?

24 DR. MUNSON: Yes, each of the sites we'll
25 take a look at.

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1 DR. HINZE: Okay.

2 DR. MUNSON: I don't envision us
3 reopening site reviews that we have already completed.
4 These applicants each are required as part of
5 developing their PSHAs to look at new information
6 similar to the new information that was used to
7 develop this new model. So it's - there are
8 significant updates to the Charleston area, other
9 source sums that were updated. So I don't think there
10 will be major surprises.

11 DR. HINZE: Let me ask one more question:
12 how are the results - how do the results of this
13 study compare to the recent USGS seismic hazard
14 analysis for the Eastern U.S.?

15 DR. STIREWALT: I'm going to let Cliff
16 handle that one as well.

17 DR. MUNSON: Well, the applicant has a -
18 we don't require the applicants to specifically look
19 at the USGS hazard map for comparison to their sites.
20 They look at some of the parameters that the USGS
21 uses versus what the original EPRI versus what the
22 updated EPRI models use. But we don't not require -
23 the NRC does not endorse the USGS hazard as a source
24 model. So we don't require applicants to do that.

25 DR. HINZE: But it is a point of

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1 comparison?

2 CHAIRMAN RAY: Yes, I mean can you
3 answer the question: how does it compare?

4 DR. MUNSON: I'd have to go back and take
5 a look at that specific to hazard curves for the
6 Summer site. I could that as a point --

7 CHAIRMAN RAY: Yes, would you. We will
8 just note that down.

9 DR. STIREWALT: Any other questions on
10 2.5.1?

11 If not I will roll it to Sarah for 2.5.2,
12 vibratory ground motion.

13 CHAIRMAN RAY: Thank you, Gary.

14 MS. TABATABAI: I'm going to talk about
15 several issues of interest for Section 2.5.2. The
16 first is related to reservoir induced seismicity. The
17 staff was concerned about the largest potential
18 seismic event associated with Monticello Reservoir due
19 to reservoir induced seismicity. And we were also
20 concerned with any water level changes in the
21 reservoir being correlated with seismicity.

22 To resolve this the applicant documented
23 that the two largest reservoir-induced earthquakes
24 were only of magnitude 2.8 in 1978 and 1979, that the
25 AP-1000 ACRS bounds the postulated magnitude 4.5 event

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1 for unit #1; and that no correlation has been shown
2 between seismicity and water level changes since the
3 initial impoundment of the reservoir.

4 So that staff concluded that the applicant
5 had adequately characterized reservoir seismicity.
6 Next slide please.

7 The next issue of interest is related to
8 the Charleston Seismic Source Zone. The applicant
9 updated the 1986 EPRI Charleston Seismic source model
10 with the UCSS model. This model was originally
11 presented in the SSAR for the Vogtle ESP site.
12 However the staff asked the applicant to address a
13 newly reported Charleston area paleoliquefaction
14 feature, which was identified by Talwani and others in
15 2008. And we asked this question in regard to the
16 UCSS model.

17 To resolve this Talwani and others in
18 2008, they had estimated a magnitude of about 6.9 for
19 this causative earthquake, and this magnitude falls
20 within the range that was estimated by the UCSS model,
21 which was about 6.7 to 7.5 range, so it falls well
22 within this range. And then the feature - new
23 reported feature also lies within one of the source
24 geometries for the UCSS model. And this is shown on
25 the next slide.

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1 The feature falls within the red area,
2 which is the highest probability of Charleston type
3 earthquake occurring.

4 DR. BANERJEE: What's the blue area
5 there?

6 MS. TABATABAI: The blue area is one of
7 the source zone geometries. It's the southern section
8 of the east coast fault system. It has a low
9 probability of producing a Charleston earthquake,
10 point one.

11 The final topic of interest that I wanted
12 to mention was the Eastern Tennessee seismic zone.
13 The applicant did not include any of the newer Eastern
14 Tennessee source model that postdate the EPRI 1986
15 study in their PSHA for the site. This figure shows
16 maximum magnitude distributions for the eastern
17 Tennessee seismic zone. In red is the distribution
18 for the EPRI study, and then in blue and green are the
19 distributions for two more recent studies, the NRC
20 trial and the implementation project study, as well
21 as the Dames & Moore - sorry the Tennessee Valley
22 Authority dam safety site. And you can see that these
23 two more recent studies have maximum magnitude
24 distributions that are slightly higher than what the
25 EPRI model had.

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1 So to resolve this the applicant referred
2 to a recent sensitivity study that was conducted in
3 2008 by NEI for the Eastern Tennessee seismic zone.
4 And the study showed that for a hypothetical site
5 located in the Eastern Tennessee Seismic Zone that
6 updating the EPRI model maximum magnitude values did
7 not affect, significantly affect, the hazard
8 calculation.

9 We also performed our own independent
10 sensitivity analysis for the actual Summer site, and
11 we also - we found that increasing the maximum
12 magnitude distribution does not significantly affect
13 the GMRS at the site.

14 The GMRS values only increased slightly at
15 one Hertz from .094 g to .104 g, and then at 10 Hertz
16 from .428 g to .468 g.

17 Are there any questions?

18 CHAIRMAN RAY: Questions? Thank you.

19 MS. TABATABAI: Now back to Gary.

20 DR. STIREWALT: I guess I'm next again.

21 Okay let's talk again about another
22 technical topic of interest that relates to geology,
23 in this case surface faulting in the site vicinity and
24 site area. And there is a distinction between
25 seismicity and surface faulting. Both are hazards.

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1 Surface faulting implies that you might have to have a
2 surface rupture, which in itself is a hazard with or
3 without seismic shaking.

4 Okay, so the issue in this case then,
5 issue of interest I guess I should say, is to ensure
6 that no capable surface or even near surface tectonic
7 faults exist in the site vicinity and site area.

8 Again the issue arises because the
9 applicant documented that tectonic surface structures
10 have actually been mapped in the site vicinity. And
11 in just a moment I want to show you one of those
12 structures just so you get a feeling for what those
13 old features look like. Anyhow the issue of concern
14 is surface fault displacement.

15 Okay, the resolution again, very similar
16 to what was done for the issue related to 2.5.1. We
17 reviewed the responses to again multiple RAIs,
18 reviewed the mods that were provided in the FSAR
19 Section 2.5.3 Rev 2. And concluded that the concerns
20 related to the occurrence of capable surface or near
21 surface faulting in the site vicinity and site area
22 was taken care of.

23 Again a similar situation, using
24 constraining field relationships, radiometric age
25 dates, the applicant documented that conclusion, their

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1 conclusion that that was the case very very well. No
2 surface displacements existed.

3 There is also another point that I should
4 mention in relation to nontectonic surface deformation
5 or near surface deformation, and certainly because of
6 the risk type. This happens to be a sample of the
7 foundation provided to me happily by the applicant,
8 and legally by the applicant. (Laughter) I mean this
9 is one good solid piece of rock. It is simply not
10 subject to things like dissolution and the other
11 issues that you might be concerned with relative to a
12 nontectonic type of surface deformation. So it's kind
13 of put to rest basically because the physical
14 properties of the crystalline basal rock that occurs
15 in the entire region as well as right at the site
16 itself.

17 Now what I'd like to do is take a quick
18 look at a map, again similar to one that Bob showed.

19 And let's look within the 25-mile radius just for a
20 moment, and I'd like to call your attention
21 specifically to this fault zone, the Wateree Creek
22 Fault Zone that you will note - or maybe you can't
23 see, but from the color legend, the indication is that
24 this fault is of Mesozoic age. That means that
25 somewhere in the range of 250 million to 65 million

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1 years old, so it's not young.

2 What I'd like to do now, for a couple of
3 reasons, take you on sort of a little mini-field trip
4 with the next slide. A couple of reasons again.
5 Geologists are prone to want to show you a rock. I
6 mean it's sort of our nature; we kind of have to do
7 this. And there are some other points I'd like to
8 make from this. And I have taken the liberty of
9 labeling the legend to distinguish from what Mr.
10 Whorton showed as a real engineer. I felt obligated
11 since we are both disguised in the same color of vest,
12 I felt it important to qualify that.

13 The other things that are important that
14 are labeled on this - by the way this fault as you saw
15 from the map is located a couple or three kilometers -
16 a couple of miles - south of the site. And there is
17 no surface scar. And there is also no fabric within
18 the rock, something a geologist can see and appraise
19 that indicate that there is really any very very late
20 stage brittle deformation which might indicate youth.

21 This particular fault, and actually let me
22 - I've labeled weathered sedimentary stuff. I've
23 labeled weathered igneous, and I'd invite you to find
24 fault with me in this case. If you intersect two
25 planes, this is just a road cut, that is one plane; if

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1 you intersect this with another plane, that's a
2 structure, you'll get a line. So hopefully you can
3 see that there is some sort of demarcation line right
4 there, very very different rock types, and this is in
5 fact the surface expression in this road cut of that
6 particular structure that is in excess of 206 million
7 years old. This is what they look like in the field.

8 The other thing I'd like to bring out on
9 this particular slide is the concept of these
10 materials, this is this soft kind of stuff that Bob
11 Whorton mentioned as being saprolitic. This is not
12 the sound rock that Weijun is going to be looking for
13 when he comes up next to talk about. But just by way
14 of showing you what it looks like, this is chemically
15 weathered in place, just as Bob said. It preserved
16 the texture, the structures. There is even a little
17 quartz vein in this intrusive rock that is still in
18 there. So since it's chemical weathering nothing
19 moves, you preserve the texture so you can actually
20 identify things, even better, when you can have the
21 textures preserved.

22 Okay, I know it's geology, but I will slow
23 down. Are there any questions on 2.5.3?

24 DR. HINZE: Can I ask a couple of quick
25 ones?

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1 CHAIRMAN RAY: Yes.

2 DR. HINZE: The - do you have any fault
3 solutions on the reservoir induced seismicity?

4 DR. STIREWALT: Yes - may I address that
5 Sarah? Yes, there are some focal plane studies that
6 have been done.

7 DR. HINZE: Lateral slip?

8 DR. STIREWALT: Yes, and the sheer planes
9 interestingly enough are not northeast; they are
10 basically northwest. So they are planes of we
11 suspect likely finite length. But yes, Talwani and
12 one of his coworkers have done some focal plane
13 solution studies, northwest trending planes, local
14 faults.

15 DR. HINZE: Has there been any systematic
16 study or investigation of possible surface ruptures
17 associated with a reservoir induced seismicity? Is
18 there any indication of a surface fault?

19 DR. STIREWALT: There certainly is no
20 indication to my knowledge. I could certainly roll
21 that question to the applicant as well, but basically
22 because of the nature of the kinds of happenings that
23 occur relative to seismicity, very very small events,
24 less than three miles depth, and again certainly no
25 surface expression.

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1 DR. HINZE: No surface expression?

2 DR. STIREWALT: At all, no surface
3 expression.

4 DR. HINZE: Thank you.

5 CHAIRMAN RAY: Anything else?

6 DR. STIREWALT: Okay, then I guess I will
7 pass it on to Weijun who will begin to discuss 2.5.4
8 and 2.5.5. Thank you.

9 CHAIRMAN RAY: Thank you.

10 DR. WALLIS: Again, I'm Weijun Wang. I'm
11 going to talk about the staff review of Section 2.5.4
12 and 2.5.5. And I will focus on the two technical
13 issues of interest.

14 The first one is regarding the excavation
15 because we just saw the photo that Gary was standing
16 somewhere there, Gary put up the photo on purpose to
17 try to compete with Bob. (Laughter) Anyway because
18 according to the excavation plan all the material
19 behind will be removed. And the excavation bottom
20 will reach some rock. That raises the question, how
21 we can determine in the field while you do excavation
22 how can we be sure we reach the sound rock?

23 And also how can we maintain the integrity
24 of the sound rock? So to resolve this usually
25 applicant gave us a response and indicated that they

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1 will use the very heavy equipment like the large
2 ripper or the track hoe and to dig out all the
3 material above the sound rock until it reach so-called
4 nonrippable. And then they will send somebody like
5 Gary will go there and take a look and use the hammer
6 - I wondered why you didn't hold it up (laughter).

7 DR. STIREWALT: Let me inject, if it's a
8 ringer when you hit it with a hammer it's hard rock.
9 If it thuds, or the hammer gets buried in it a few
10 inches, Bill as you know, then guess what, it's not
11 hard rock.

12 DR. WALLIS: So you use such a way to
13 ensure that the excavation reaches the solid rock.
14 And because the method used is not explosive, so
15 therefore the integrity of the sound rock will be
16 kept. So that is the resolution. Next slide.

17 And the following issue will be, because
18 we saw the - a slide presented by Bob for the units
19 #1, the solid rock is not flat surface. Some places
20 are at higher elevation, and some at lower. So you
21 have to create a concrete field there. And in some
22 areas we would be like 16 feet thick. So for that
23 thick concrete field the question here is if the - how
24 do you make the concrete field have similar property
25 as the solid rock? So that is what will keep the

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1 uniformity there. And for the very thick concrete
2 field the potential thermal cracking will be a
3 problem. So with that issue the applicant provided a
4 solution, which is, they will use the concrete fill of
5 similar property as the sound rock. And also they
6 will follow the inner fill standard for the concrete
7 fill design, and the thermal temperature control and
8 the thermal cracking monitoring.

9 So then that provided a solution to
10 resolve this technical issue, and this one became
11 confirmatory item, because we need to see the revised
12 FSAR to present all the proposed changes.

13 And before I go on to the 2.5.5, this new
14 item related to waterproofing membrane. You already
15 knew that. So that is for the 2.5.4 And next slide.

16 DR. ARMIJO: Before you leave that, is
17 this concrete fill approach, is that fairly standard?

18 Or this really a unique -- get a level surface out
19 of a rocky undulating surface?

20 DR. WALLIS: That's the standard in union
21 practice now, because if you are required to level up,
22 just try to get rid of like some solid rock, that is
23 one practical approach that people usually can do
24 that. And very normally people will use a concrete
25 fill. And the only difference is what type of

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1 concrete they will use. Like for the Summer they
2 propose they will use the 5,000 psi concrete there.
3 And we saw for the other site they may use it or like
4 the 2,500 psi, concrete. It's dependent on the site.

5 Okay, for 2.5.5 regarding the slope
6 possibility, there is no issue there. The applicant
7 analyzed all the slopes, and found that there is no
8 concern about the slope regulating.

9 Okay, that ends my presentation. Any
10 questions?

11 CHAIRMAN RAY: I don't see any, so thank
12 you very much.

13 DR. WALLIS: Thank you.

14 CHAIRMAN RAY: Appreciate it. Okay, this
15 concludes the set agenda. Sanjoy, when I go around
16 the table I will start with you because I know you've
17 got a train to catch. I don't know if anybody else is
18 leaving tonight. But before I do get everybody's
19 input, I first want to ask Weidong if he could simply
20 tick off for us the new action items as a result of
21 today's meeting. Do you have a list of them
22 available?

23 DR. WANG: Not really organized.

24 CHAIRMAN RAY: Okay, I just wanted for
25 people to avoid having to re-construct things that

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1 they had already identified, if you picked them up.
2 But if you are not prepared to do that, that's okay.

3
4 DR. WANG: The main one is follow up on
5 the flow, and we want a statistical method.

6 CHAIRMAN RAY: Statistical method, yes,
7 an explanation. That is something that we will get
8 some feedback from Sanjoy after he has had a chance to
9 look at the reference document to see whether we want
10 to actually create a feedback to staff.

11 DR. BANERJEE: Let's put this as an
12 action that Weidong will owe it to me the reference
13 that you get from the staff.

14 CHAIRMAN RAY: Okay, that's fair enough.

15 DR. BANERJEE: Don't just send me the
16 reference, send me the paper that I can read. I don't
17 have time to actually find the reference.

18 CHAIRMAN RAY: There is also a question
19 that is associated with that that Sam asked which is,
20 well, how does staff look at this issue. Whether we
21 want to pose that, I think we'll wait and see what you
22 do, but we want to keep track of it.

23 DR. ARMIJO: Just note at some point
24 since a tech spec depends on - reading a tech spec
25 depends on its methodology, somewhere along the line

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1 the staff has to say, okay.

2 CHAIRMAN RAY: Yes, and I think it's not
3 totally clear to me but the potential that this is a
4 precedent in that it would be the accepted practice
5 going forward. As far as I can tell it's an
6 enhancement over maybe what has been done in the past.

7 But whether or not it's got some area in it that we
8 are not clear on, I think we need to keep track of
9 that.

10 So there is that item with two parts. One
11 that you will take a look at, action item, we will get
12 you the information so you can do that. I would say
13 also we have a need to interface with Said and say,
14 we've had this presentation and Weidong will make sure
15 he gets the material that we received today.

16 I want to again acknowledge that
17 Westinghouse did respond to the question as it stood
18 coming into this meeting and I thought in a very
19 comprehensive way.

20 Okay anything else you want to mention to
21 us, Weidong?

22 DR. WANG: Nothing particular.

23 COMMITTEE DISCUSSION

24 CHAIRMAN RAY: Okay, then I will go
25 around the table as we usually do, starting with

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1 Mario.

2 DR. BONACA: Okay, I don't have any
3 issues beyond the ones that were addressed by Sanjoy,
4 and I thought that the presentations were informative,
5 and I think the issues have been addressed.

6 CHAIRMAN RAY: Okay, all right, Charley
7 we know that we need to see if we can't accommodate
8 your schedule by making sure that we make
9 presentations in September I guess it is when you are
10 available.

11 MR. BROWN: Yes.

12 CHAIRMAN RAY: Anything else?

13 MR. BROWN: I will get back to you and
14 Weidong within the next day or so.

15 CHAIRMAN RAY: Anything else on that?

16 MR. BROWN: No, I have nothing else.

17 CHAIRMAN RAY: Mike?

18 DR. RYAN: I sent Weidong a kind of
19 summary of the waste issues that I have. The EPRI
20 document, I will review that, just offer him closure
21 help on that issue for next time.

22 CHAIRMAN RAY: Okay, anything else,
23 Sanjoy?

24 DR. BANERJEE: No, I think everything -
25 you are not recapping what happened yesterday

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1 obviously.

2 CHAIRMAN RAY: Well, we had a recap
3 yesterday, or we had this kind of a discussion
4 yesterday.

5 DR. BANERJEE: Right, and today you know
6 everything that we discussed in the morning I guess we
7 also sort of recapped, didn't we?

8 CHAIRMAN RAY: Well, you are referring to
9 seismic?

10 DR. BANERJEE: Yes.

11 CHAIRMAN RAY: We observed a large amount
12 of work in progress.

13 DR. BANERJEE: And we are going to see
14 this at some point.

15 CHAIRMAN RAY: That's right, we
16 understand that.

17 Dennis?

18 DR. BLEY: The only thing that cropped up
19 that I want to pursue a little bit, maybe the whole
20 committee will, is this coherency function. We never
21 at least as far as I can find out we have never
22 reviewed ISG-01 and - nor the EPRI reports on that
23 issue. And I think we've got to get comfortable with
24 that, unless many of you already are. I haven't seen
25 it before today.

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1 CHAIRMAN RAY: I mentioned that in the
2 context that Sanjoy just asked which was, we did recap
3 then as something we needed to do. But I didn't
4 identify it as something we needed to do on this
5 forced march that we are on on AP-1000. I just said
6 we need to look and see if we can do that. Do you
7 feel that that --

8 DR. BLEY: The one thing the Brookhaven
9 guy said that makes me comfortable with that is that
10 they looked with and without the coherency and found
11 that the structures met the criteria in both cases, so
12 I think we are probably okay here, but this is going
13 to come up somewhere else.

14 MR. BROWN: I thought there was one other
15 comment, and I don't know which gentleman it was, that
16 there was a fairly large attenuation. Somebody asked
17 how much additional attenuation - I call it
18 attenuation -

19 (Simultaneous speaking.)

20 MR. BROWN: -- very large.

21 DR. BLEY: Fifty to 60 percent. But they
22 said they did look at it both ways.

23 MR. BROWN: And it didn't make any
24 difference.

25 CHAIRMAN RAY: It might in another case.

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1 Well, we will not make it something that we've got to
2 shoehorn in to this mix.

3 DR. BANERJEE: We don't have the time.

4 CHAIRMAN RAY: But we do need to do
5 something about it, so we will make sure it's tracked.

6 Sam.

7 DR. ARMIJO: First of all I'd like to
8 compliment the presenters. Yesterday and today we got
9 a lot of good information; cleared up a lot of things
10 in my mind. As far as today the issue were really
11 those flow measurements and understanding how they
12 work and how the analysis is done. But I don't think
13 that is going to turn out to be a big big problem.

14 CHAIRMAN RAY: Okay, and you are
15 referring to the additional inquiry that comes out of
16 the presentation rather than the presentations
17 themselves I trust.

18 DR. ARMIJO: And that's really all I
19 have.

20 CHAIRMAN RAY: Okay, Bill.

21 DR. BANERJEE: Sorry, before we go, I was
22 sort of surprised by this design change to the
23 containment. We really need to share a little bit
24 more about that at some point.

25 CHAIRMAN RAY: We are looking forward

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1 with bated breath to that.

2 DR. ARMIJO: That's be November, is that
3 what we are talking about now, or October?

4 CHAIRMAN RAY: I haven't asked about
5 that. That's a good question. It's of course not the
6 shield building, but it is the containment design
7 change. I think we are anxious to hear about it as
8 soon as we can recognizing that it is I think even
9 from the applicant's point of view a work that is in
10 progress or in the process of being submitted.

11 So I think that has been noted previously.
12 It's not an action item so to speak, but it is --

13 DR. BANERJEE: It's of great interest.

14 CHAIRMAN RAY: It will be of interest. I
15 doubt anybody isn't aware of that.

16 Okay, Bill.

17 DR. HINZE: Well, in my report I will
18 speak to the earth science issues and the DCD and then
19 the Vogtle and Summer materials that we've reviewed.
20 I must say that I am really very impressed with the
21 COLs from both Vogtle and the Summer, and the NRC's
22 review of them. That doesn't mean that I won't have
23 some comments and concerns, and I will be putting
24 those in the report. I think that will be very
25 valuable to look at the USGS seismic hazard analysis,

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1 and we will be receiving that.

2 CHAIRMAN RAY: Yes, I feel regardless of
3 whether it's endorsed or not it's a piece of
4 information that one can't not look at in this context
5 and we will definitely - and Weidong make sure we
6 don't drop that; is that right?

7 Okay, Graham.

8 DR. WALLIS: Yes, I think there is an
9 interest in this flow measurement. I can contribute
10 it if the committee wants to follow it up and Sanjoy
11 is doing that. Maybe he could share stuff with me.

12 DR. BANERJEE: Absolutely.

13 CHAIRMAN RAY: Anything else?

14 DR. WALLIS: That's it.

15 CHAIRMAN RAY: Okay. All right.

16 DR. KRESS: What most interested me was
17 the flow measurement.

18 DR. BANERJEE: I'll send it to you.

19 DR. KRESS: And I'd like to get that too.
20 I'd like to know what the assumptions were.

21 DR. BANERJEE: I think Weidong may as
22 well send it to the whole committee. And then whoever
23 likes can look at it.

24 CHAIRMAN RAY: All I can say is, Ed, you
25 did a good job of answering the question, but it

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1 prompted more questions.

2 DR. BANERJEE: It's getting there.

3 MR. CUMMINS: We understand.

4 (Simultaneous speaking.)

5 MR. CUMMINS: Maybe on the containment
6 just a little bit of schedule. Tomorrow we have a
7 meeting with staff so we are showing them our design,
8 and we have various deadlines with them at the end of
9 the month, and so we are finalizing this, and so we
10 will be communicating quickly.

11 CHAIRMAN RAY: I have no doubt.

12 Anything else? We stand adjourned.

13 (Whereupon at 4:36 p.m. the above-entitled
14 matter was adjourned.)

15

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AP1000 Design Control Document Amended Design

Section 3.7 Seismic Design

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

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

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

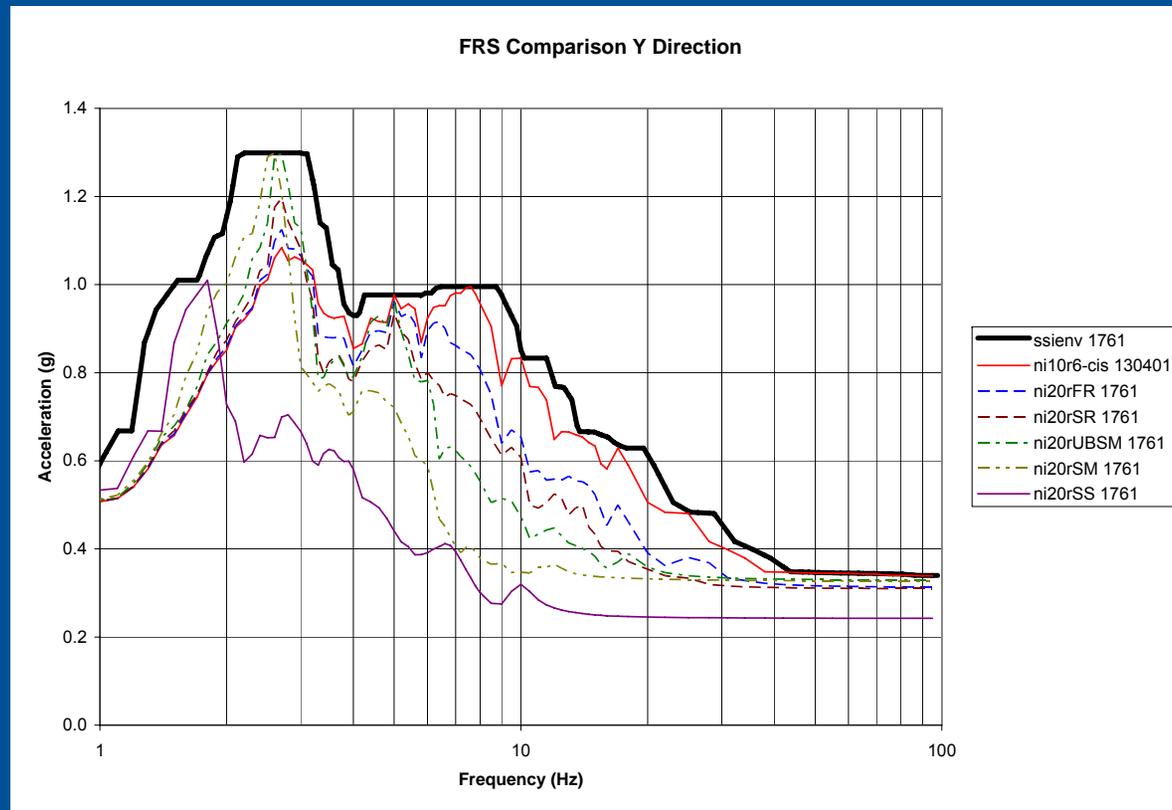
Soil Cases

- Hard-rock site - V_s of 8000 fps
- Firm-rock site - V_s of 3500 fps
- Soft-rock site - a V_s of 2400 fps increasing linearly to 3200 fps at a depth of 240 feet
- Upper bound soft-to-medium soil site - a V_s of 1414 fps increasing parabolically to 3394 fps at 240 feet

Soil Cases

- Soft-to-medium soil site - a V_s of 1000 fps, increasing parabolically to 2400 fps at 240 feet,.
- Soft-soil site - a V_s of 1000 fps increasing linearly to 1200 fps at 240 feet

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

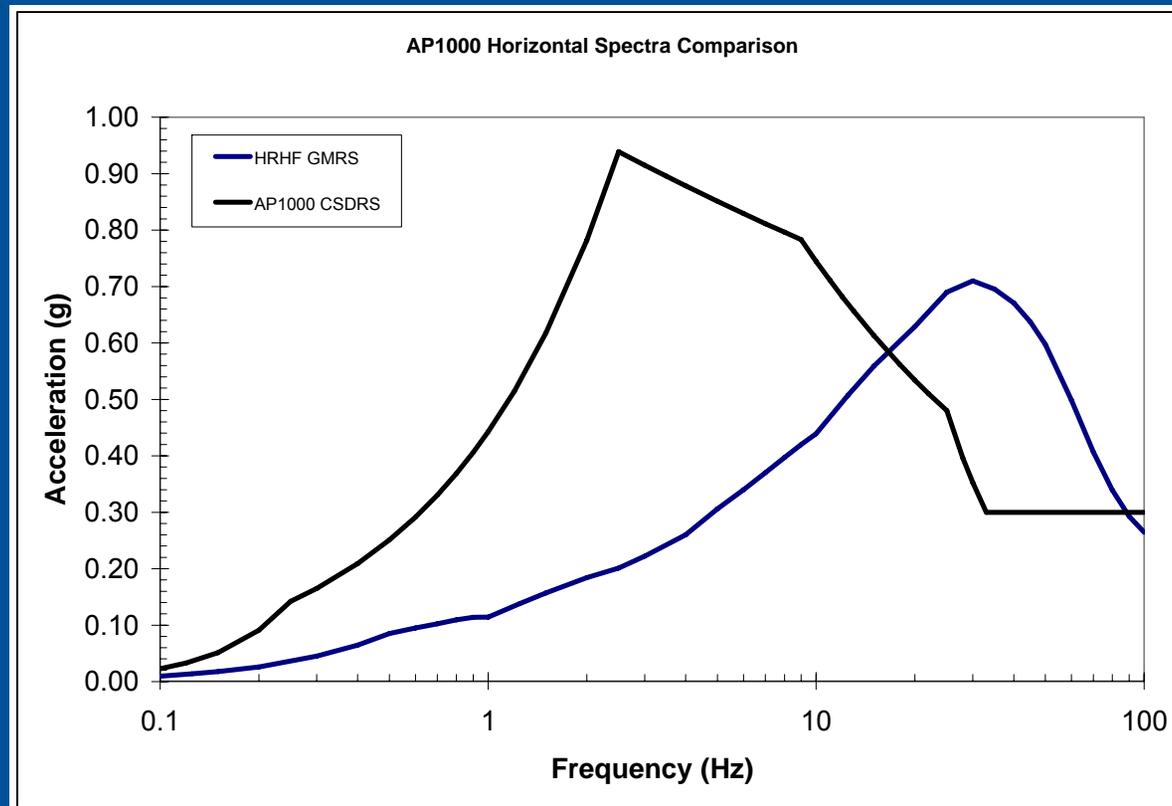
Utilization of 3-D finite element shell models

- 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



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.

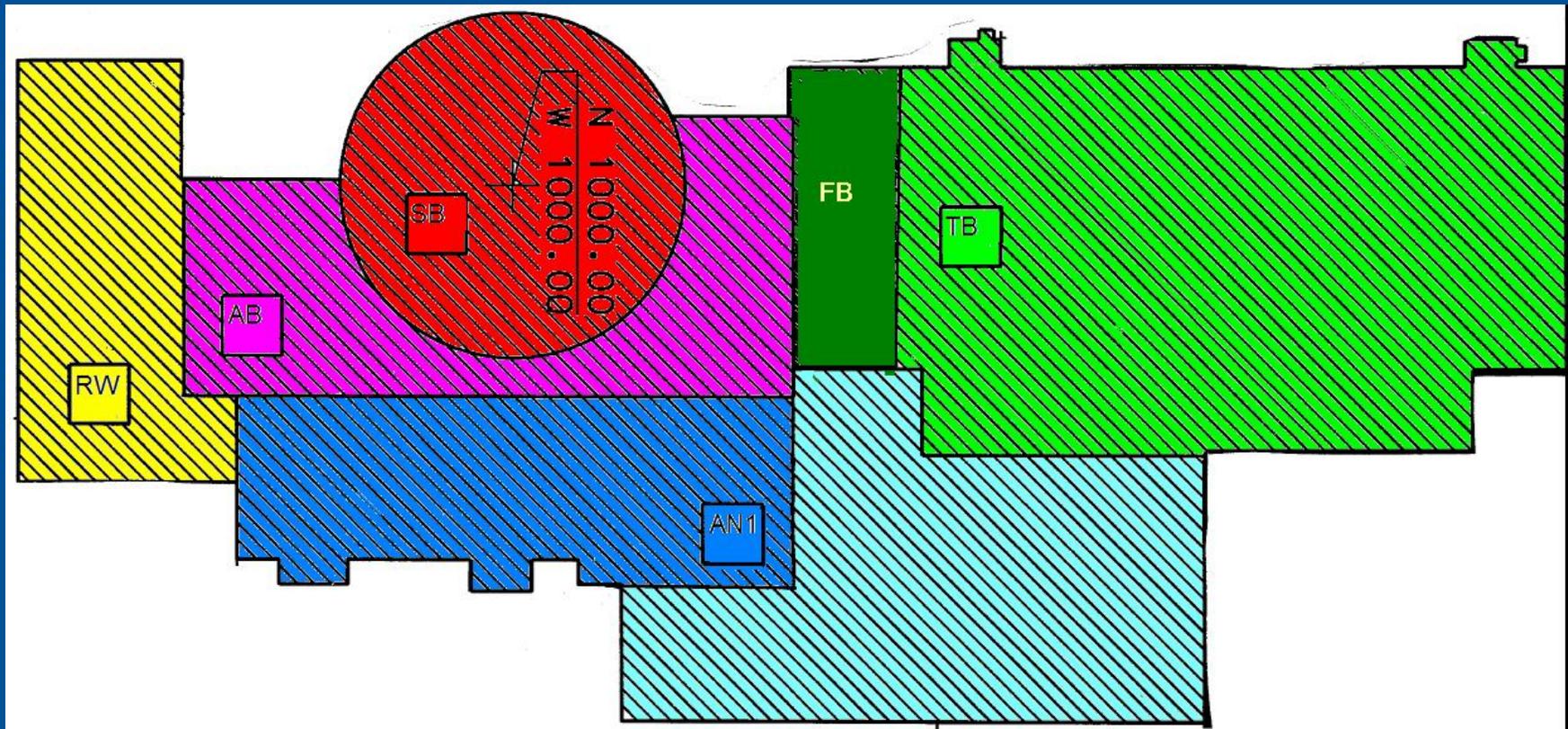
Use of the Coherency Function

- 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

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

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

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

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

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

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



United States Nuclear Regulatory Commission

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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	<ul style="list-style-type: none"> 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

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

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".

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

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.

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

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

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.

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.

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

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.

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

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.

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

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

Questions



United States Nuclear Regulatory Commission

Protecting People and the Environment

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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 ft³ pressurizer
3.8.4	Other Seismic Category I Structures	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none">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 DCDb) 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



United States Nuclear Regulatory Commission

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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



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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 87.3°F, a value of 1.2°F above the AP1000 DCD value of 86.1°F

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 Tower
(built 12-2006)**



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





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



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VC Summer Unit 2/3

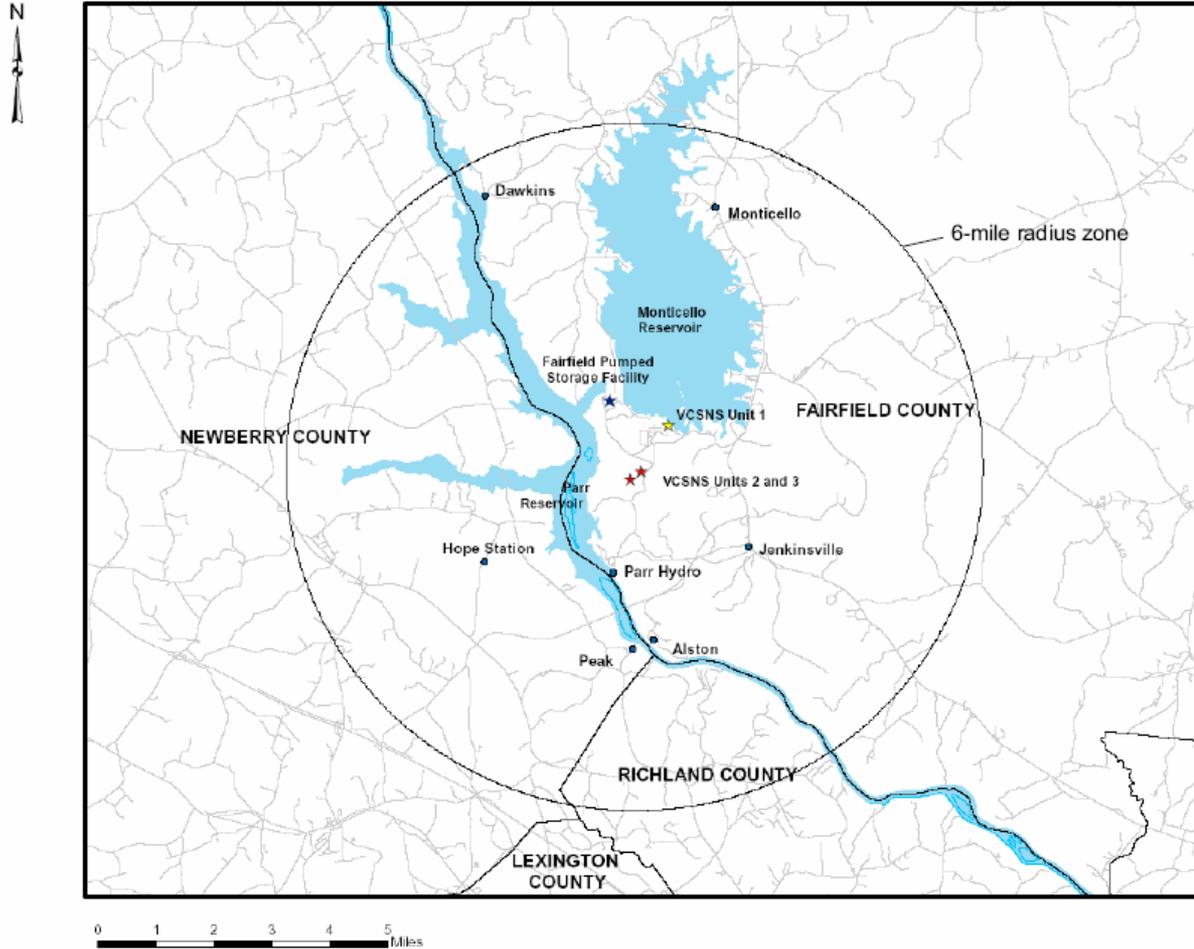
Site Overview & SAR Section 2.5

Bob Whorton

SCE&G - Consulting Engineer



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



Units 2/3

VC Summer Site - Jan 2010

VCS
Units
2&3



Equipment
Laydown
Area



Warehouse
Area



Construction
Offices



U2 Power Block Excavation & Geologic Mapping



04/22/2010

Unit 2 Power Block Excavation



Unit 2 Excavation



Unit 2 Panel Section Geologic Mapping



Engineer —
Not a
Geologist

07/08/2010 13:41

CWS Pipe Installation

**Unit 2 CWS West
End Bulkhead**



**Unit 3 CWS Excavation
and Installation**



Unit 3 – CW Line Installation



SAR SECTION 2.5 TECHNICAL DEVELOPMENT

SCE&G/BECHTEL TEAM

```
graph TD; A[SCE&G/BECHTEL TEAM] --- B[WILLIAM LETTIS & ASSOCIATES (SAR SECTIONS 2.5.1 - 2.5.3)]; A --- C[RISK ENGINEERING (SAR SECTION 2.5.2)]; A --- D[MACTEC (GEOTECHNICAL FIELD INVESTIGATIONS)]; A --- E[SEISMIC TECHNICAL ADVISORY GROUP];
```

**WILLIAM LETTIS
& ASSOCIATES
(SAR SECTIONS
2.5.1 – 2.5.3)**

**RISK
ENGINEERING
(SAR SECTION
2.5.2)**

**MACTEC
(GEOTECHNICAL
FIELD
INVESTIGATIONS)**

**SEISMIC
TECHNICAL
ADVISORY
GROUP**

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**



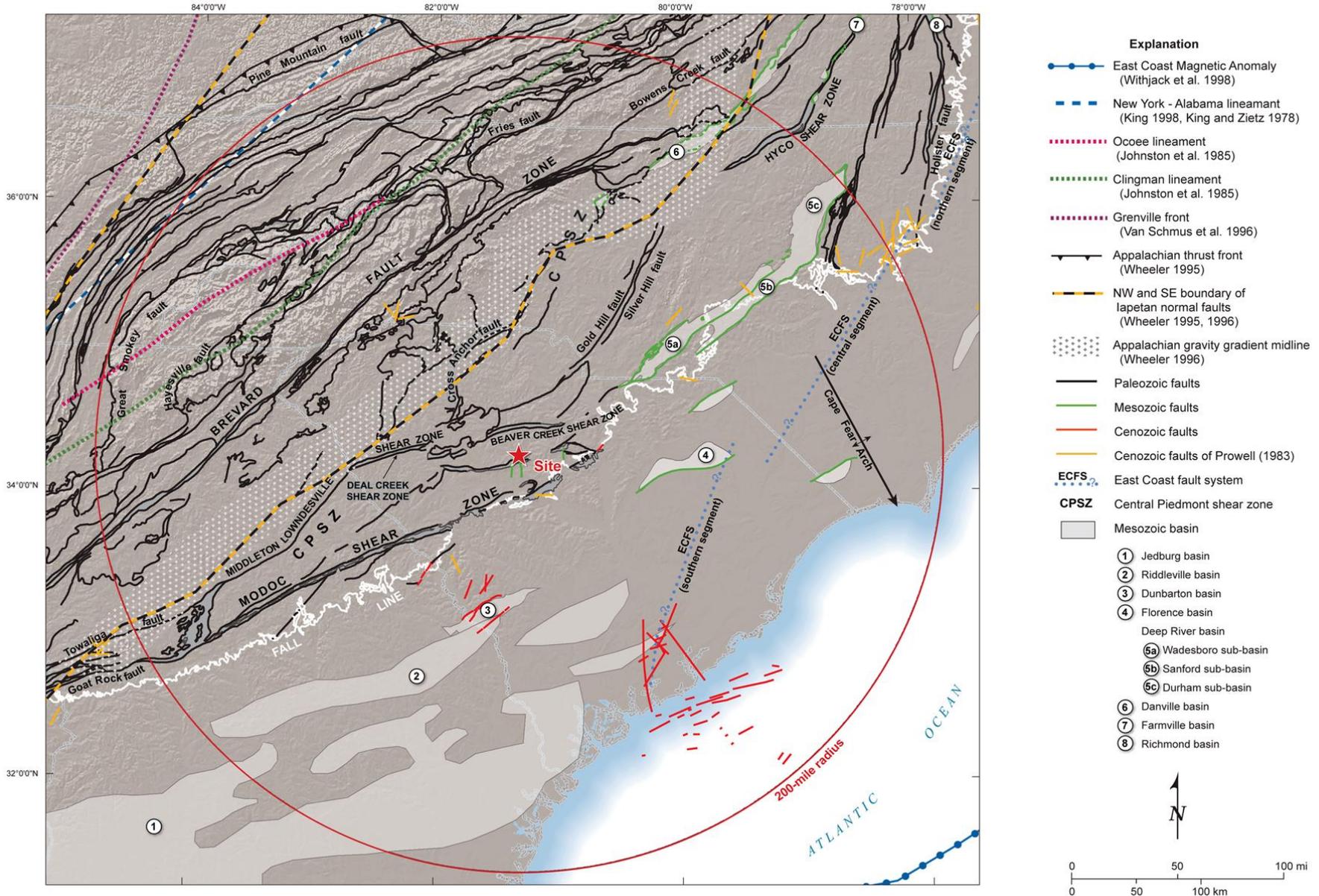
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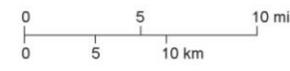
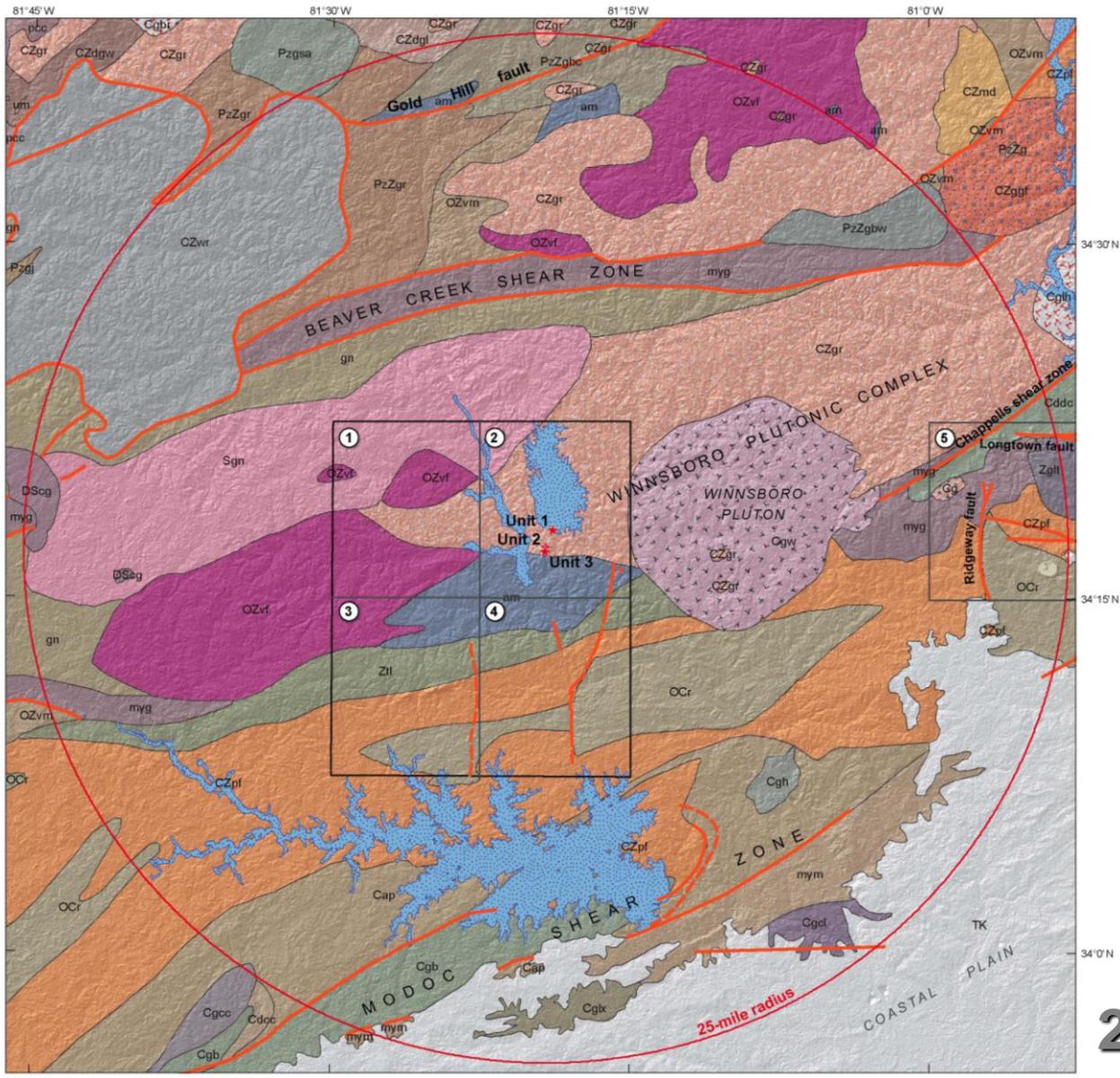
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SAR Sections 2.5.1 and 2.5.3

Basic Geologic and Seismic Information & Surface Faulting

200-mi Map of Tectonic Features



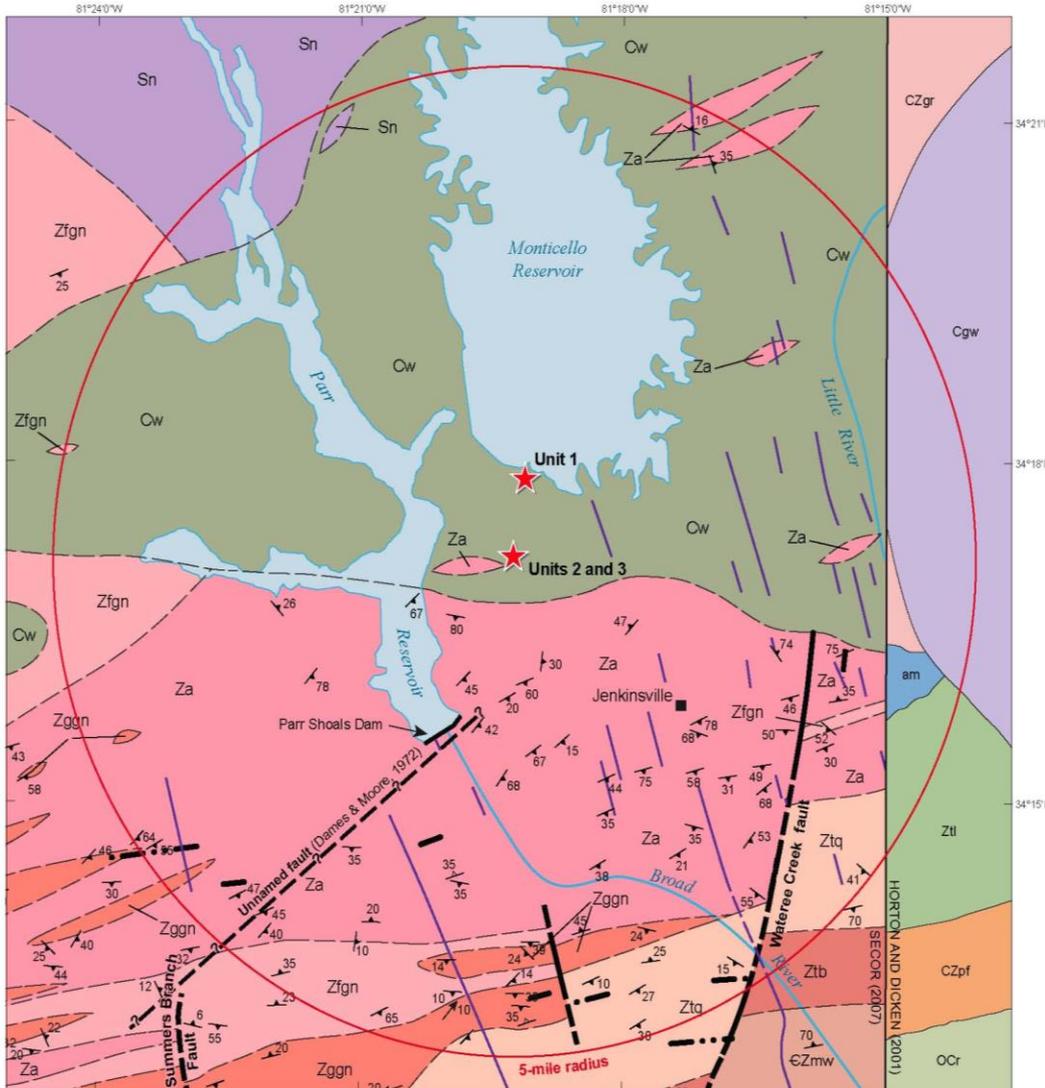


25-mi Geologic Map



Modified from Horton and Dicken (2001), Hibbard et al (2006), and Secor (2007)

5-mi Geologic Map



Explanation

- Stratigraphic or intrusive contact
- Fault zone, unsilicified
- Fault zone, silicified
- Axis of overturned syncline
- 70° Attitude of compositional layering; vertical
- 40° Attitude of S₁ foliations; vertical
- 80° Attitude of S₁ foliations; vertical
- ↗₁₀ Bearing and plunge of L_{0x1} and L₁ lineations

Secor (2007) 1:24,000 scale

- Diabase dike
- Cw Winnsboro plutonic complex (granitic)
- Zl Little Mountain metatonalite
- Sn Newberry plutonic complex (granitic)
- €Zmw Metamudstone and metawacke
- Zg Amygdaloidal greenstone
- Ztb Intermediate metatuff breccia
- Ztq Felsic metatuff and quartzite
- Zggn Leucocratic granitoid gneiss
- Zfgn Felsic biotite gneiss
- Za Amphibolite and hornblende gneiss

Horton and Dicken (2001) 1:500,000 scale

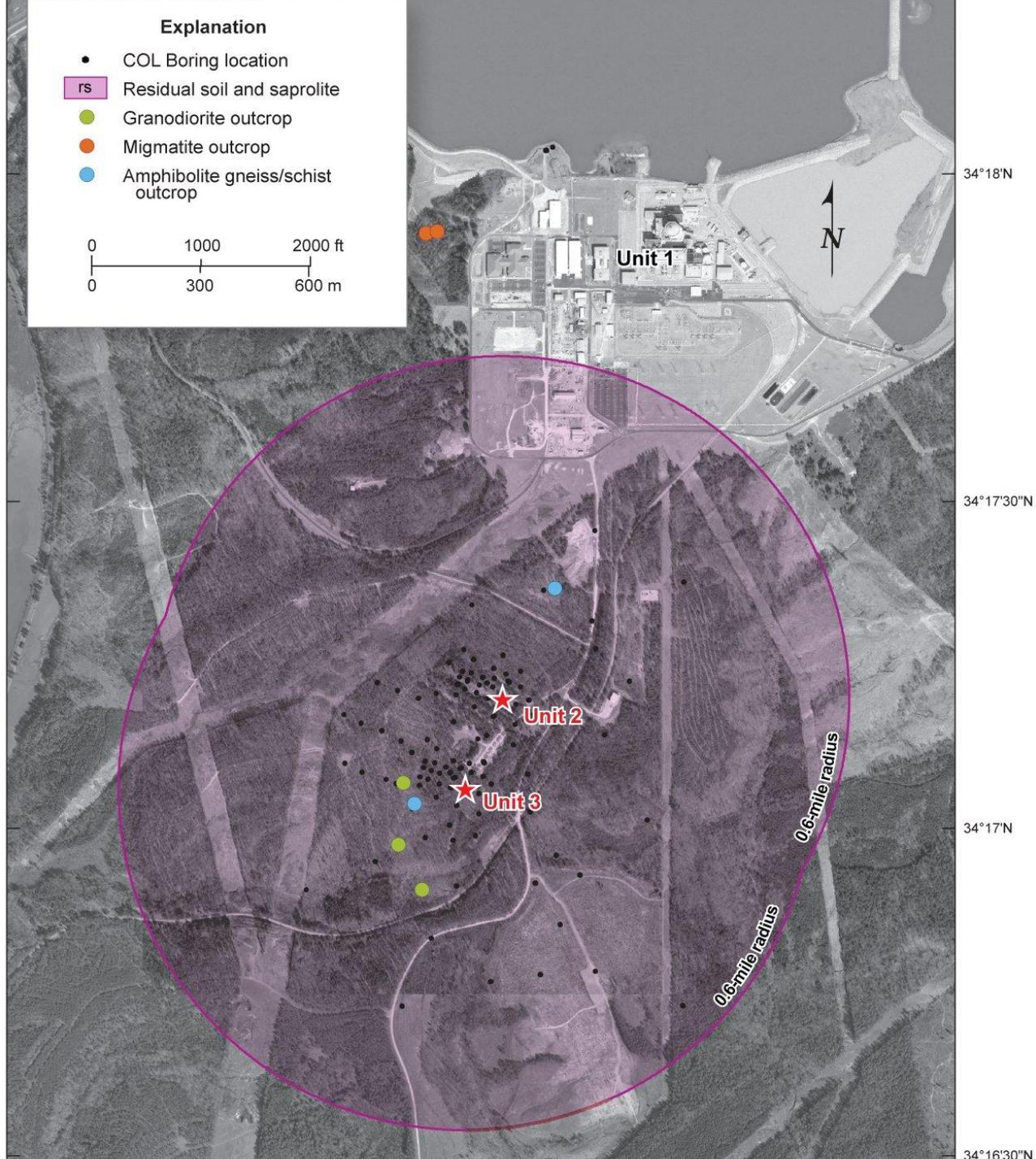
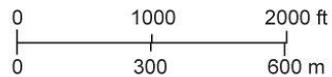
- Cgw Winnsboro plutonic complex (granitic)
- CZgr Metamorphosed granite to granodiorite
- am Amphibolite and amphibole gneiss
- Zl Little Mountain metatonalite
- CZpf Persimmon Fork Formation
- OCr Richtex Formation



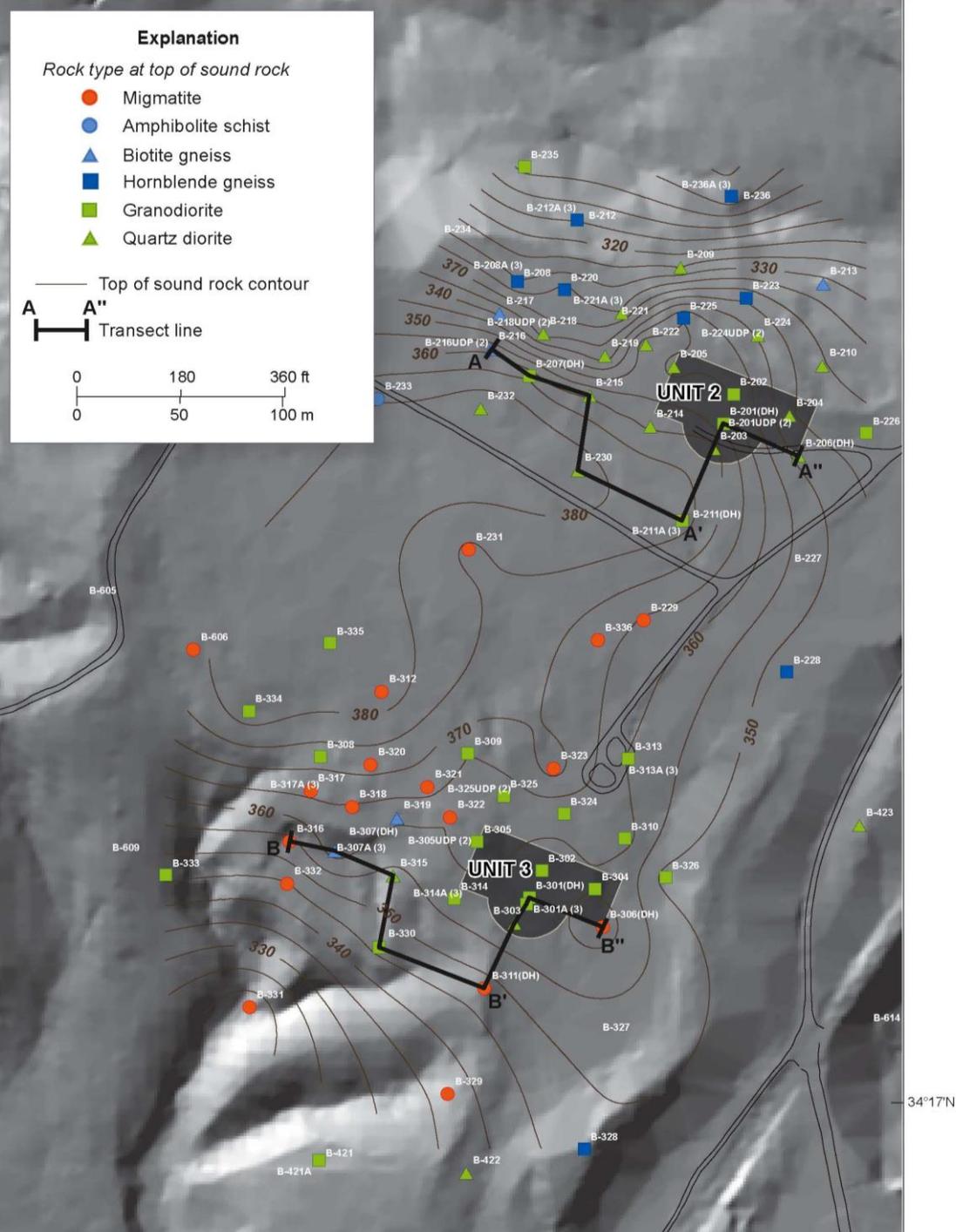
0.6-mi Surficial Geologic Map

Explanation

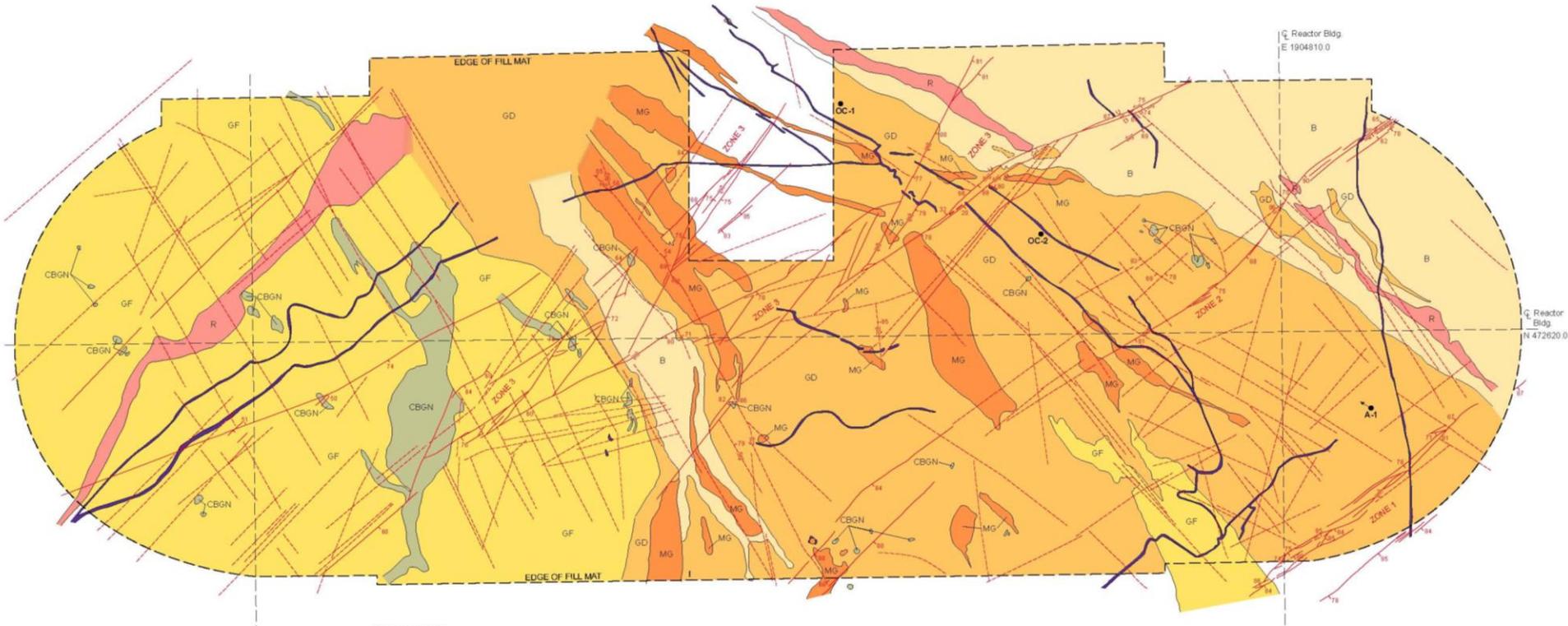
- COL Boring location
- rs Residual soil and saprolite
- Granodiorite outcrop
- Migmatite outcrop
- Amphibolite gneiss/schist outcrop



Top of Sound Rock Beneath Units 2 and 3



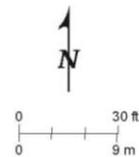
Unit 1 Foundation Map (Right)



Explanation

- | | |
|--|---|
| B Contact breccia | Pink-filled fractures with sense of slip as shown; U = upside, D = downside |
| CBGN Charlotte belt gneiss | Other fractures with sense of slip as shown |
| MG Migmatite of gneissic composition | Displaced vein with dip |
| GF Granofels | Geologic contact |
| GD Medium-grained granodiorite | Angle boring |
| R Fine-grained granodiorite | Overcone boring |
| Aplite and/or pegmatite dike | |

Map modified after Dames & Moore (1975), Addendum I



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 do not 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



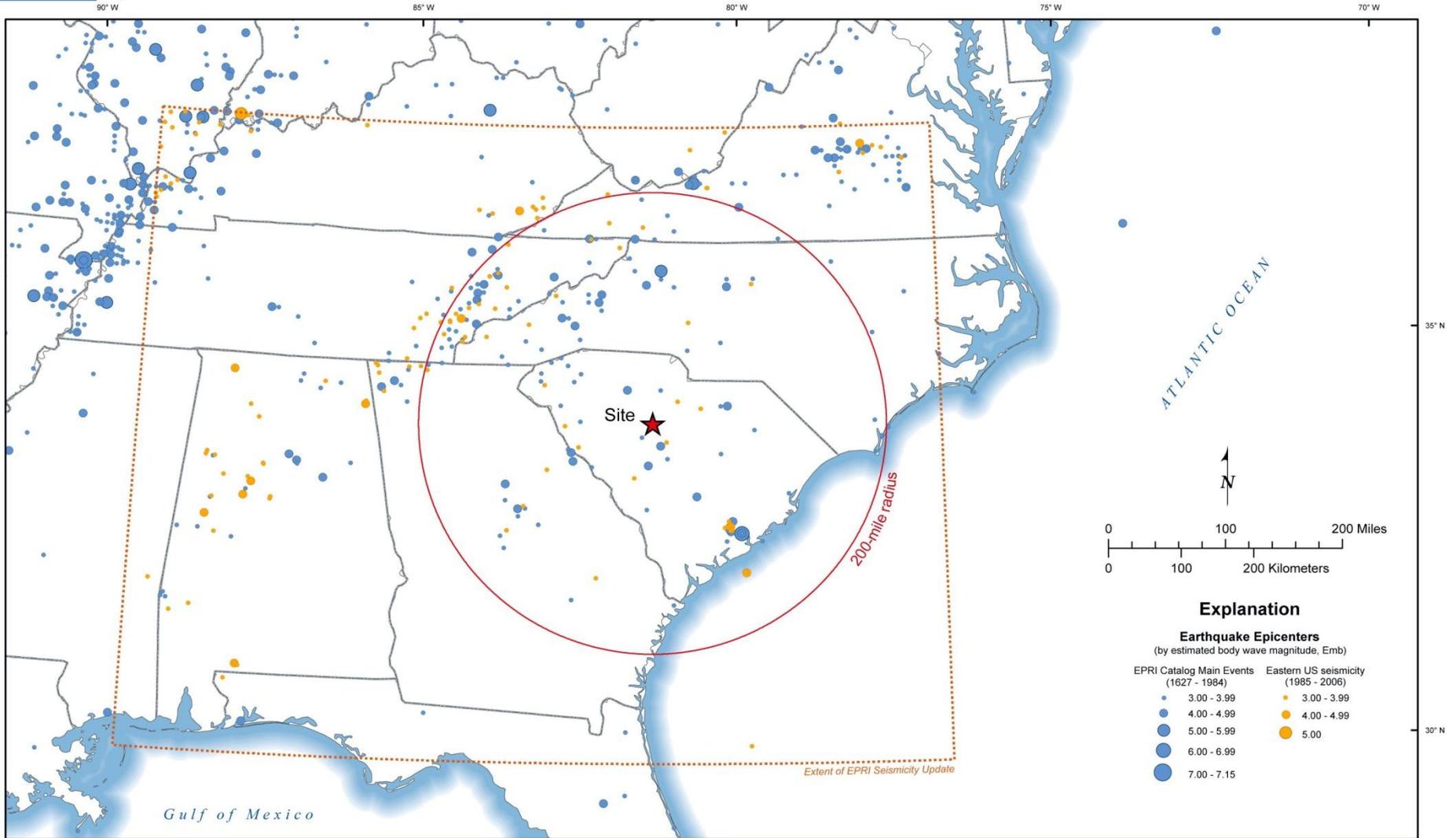
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FSAR Sections 2.5.2

Vibratory Ground Motion

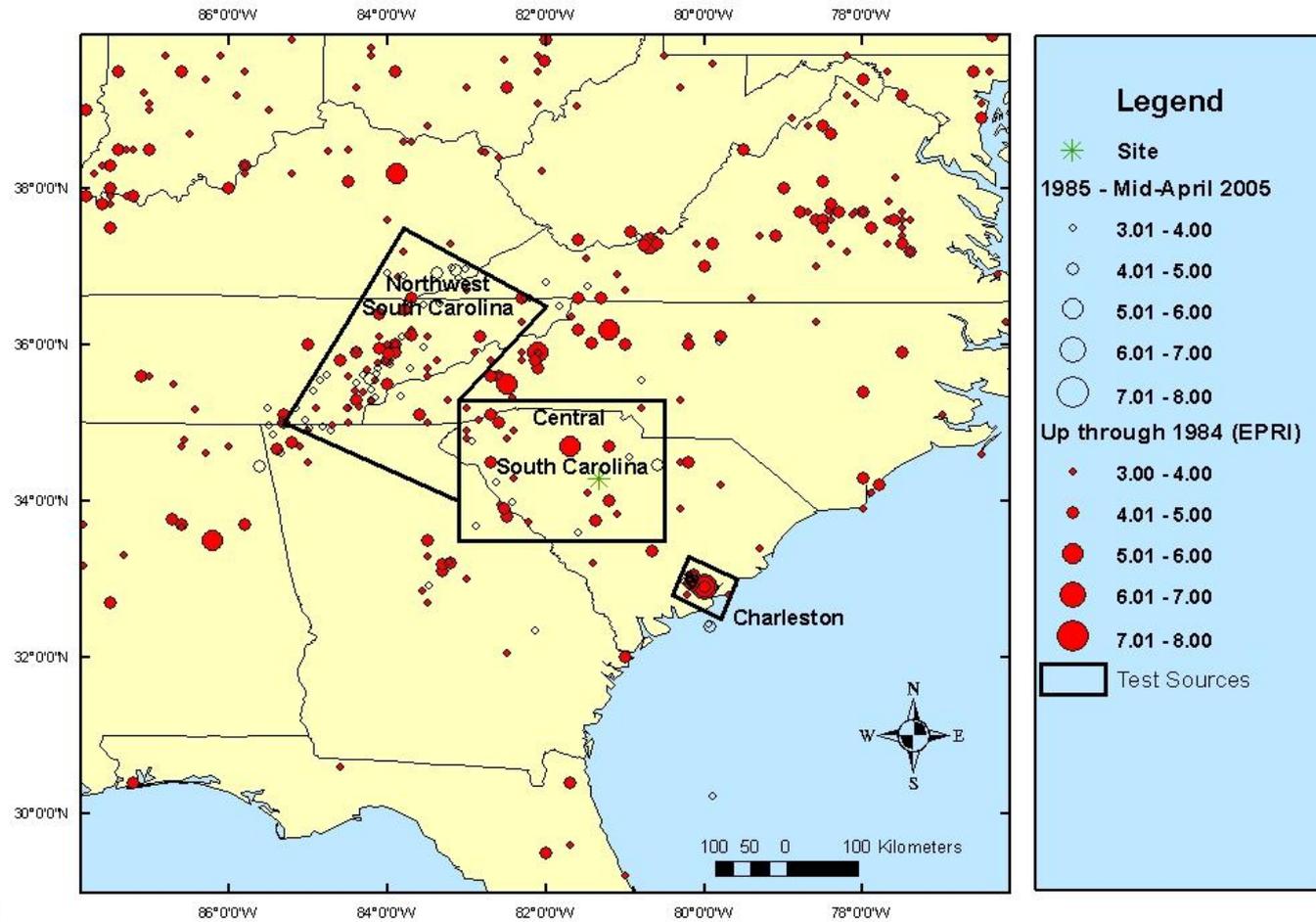
Updated Seismicity Catalogs



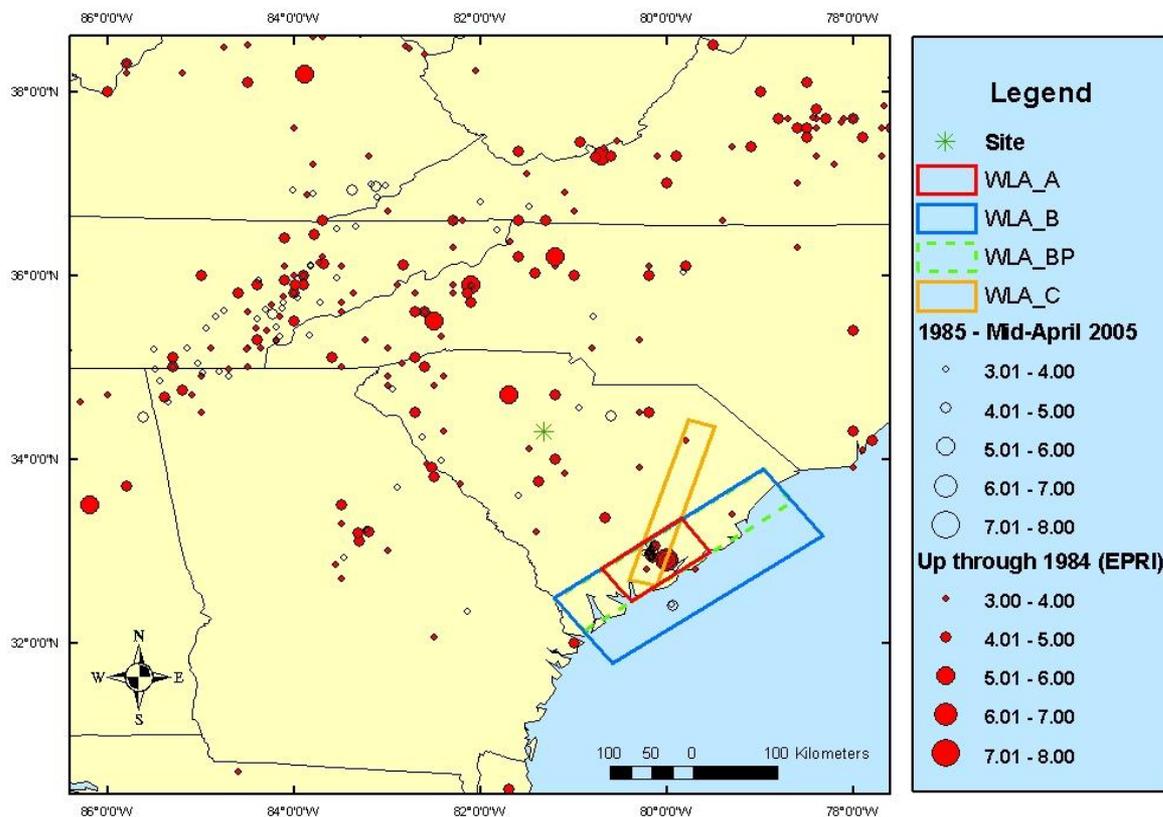
Probabilistic Seismic Hazard Analysis

- 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



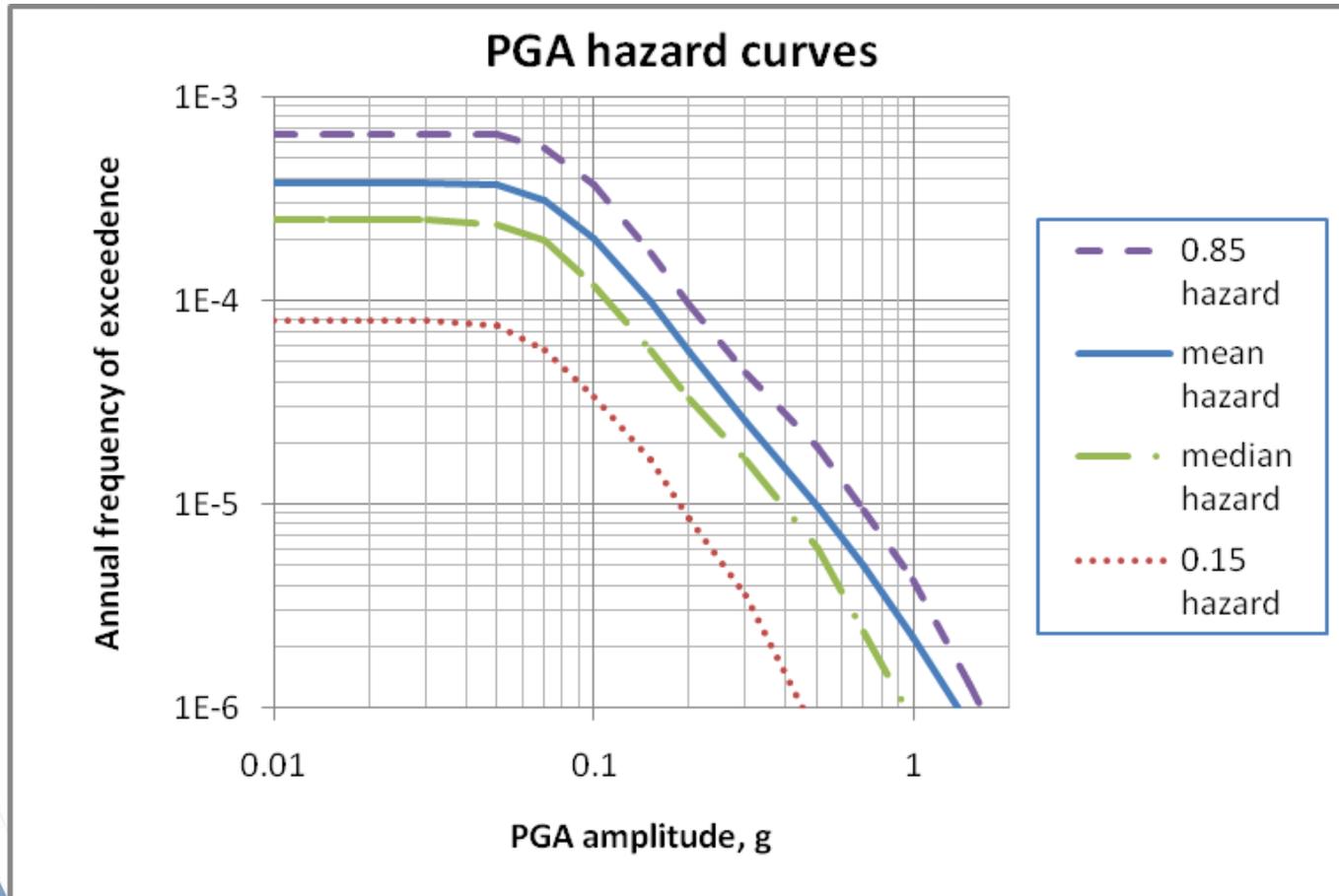
Geometry of Four Sources Used in Updated Charleston Seismic Source (UCSS) Model



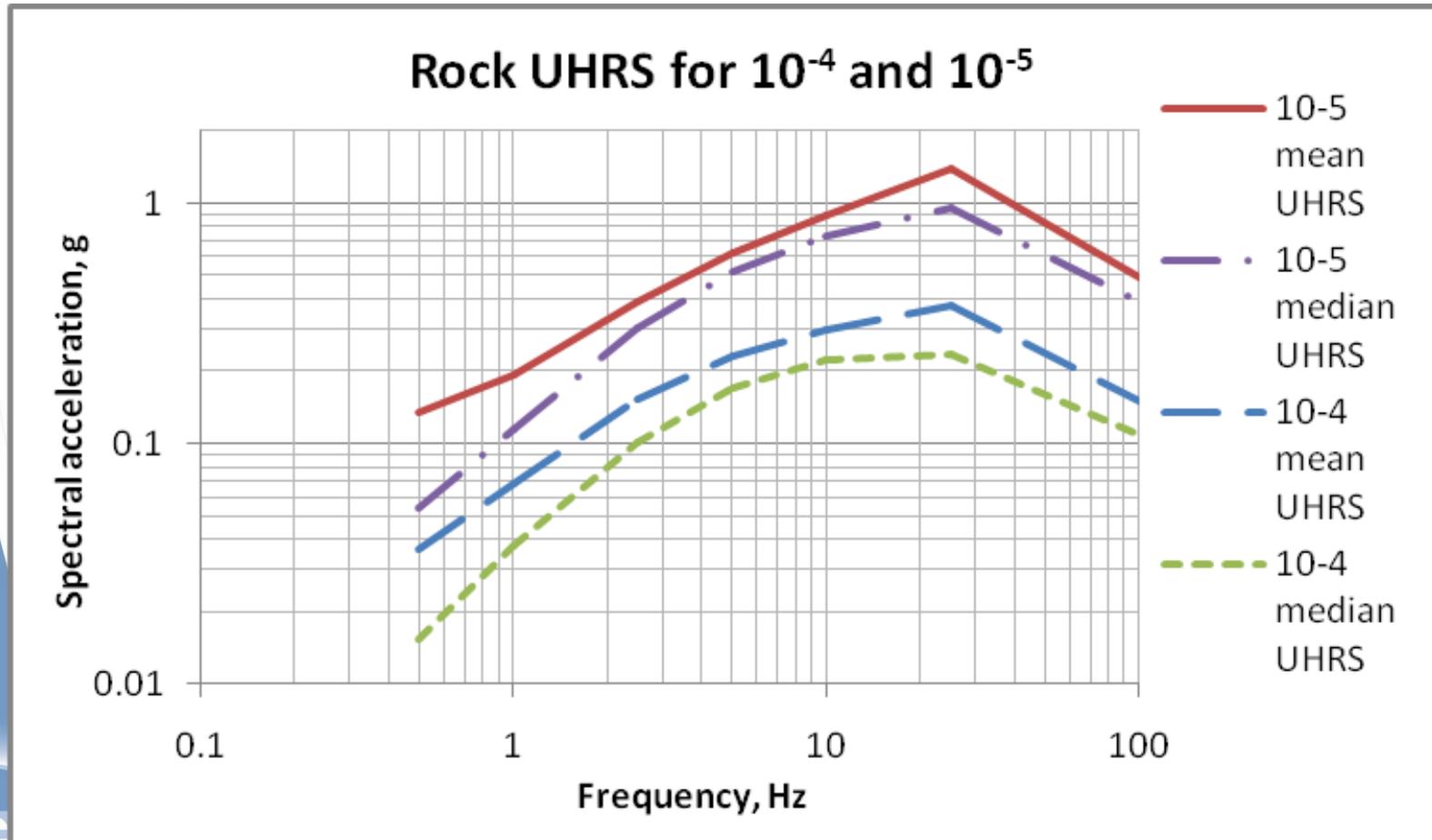
Summary of VC Summer Seismic Source Model

- 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)

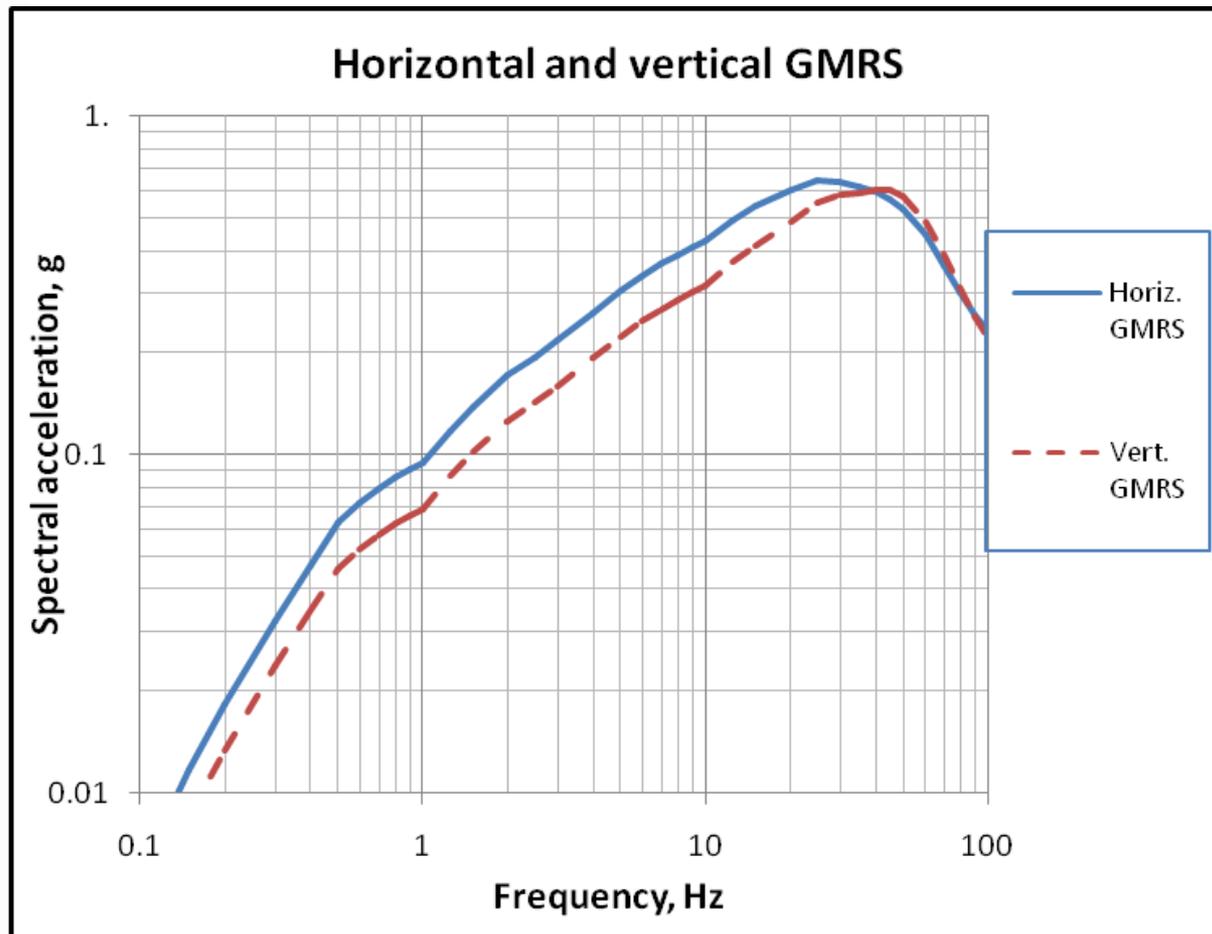
Mean and Fractile PGA Seismic Hazard Curves



Mean and Median Uniform Hazard Response Spectra



Horizontal and Vertical GMRS



V. C. Summer Nuclear Station, Units 2 and 3
COL Application
Part 2, FSAR

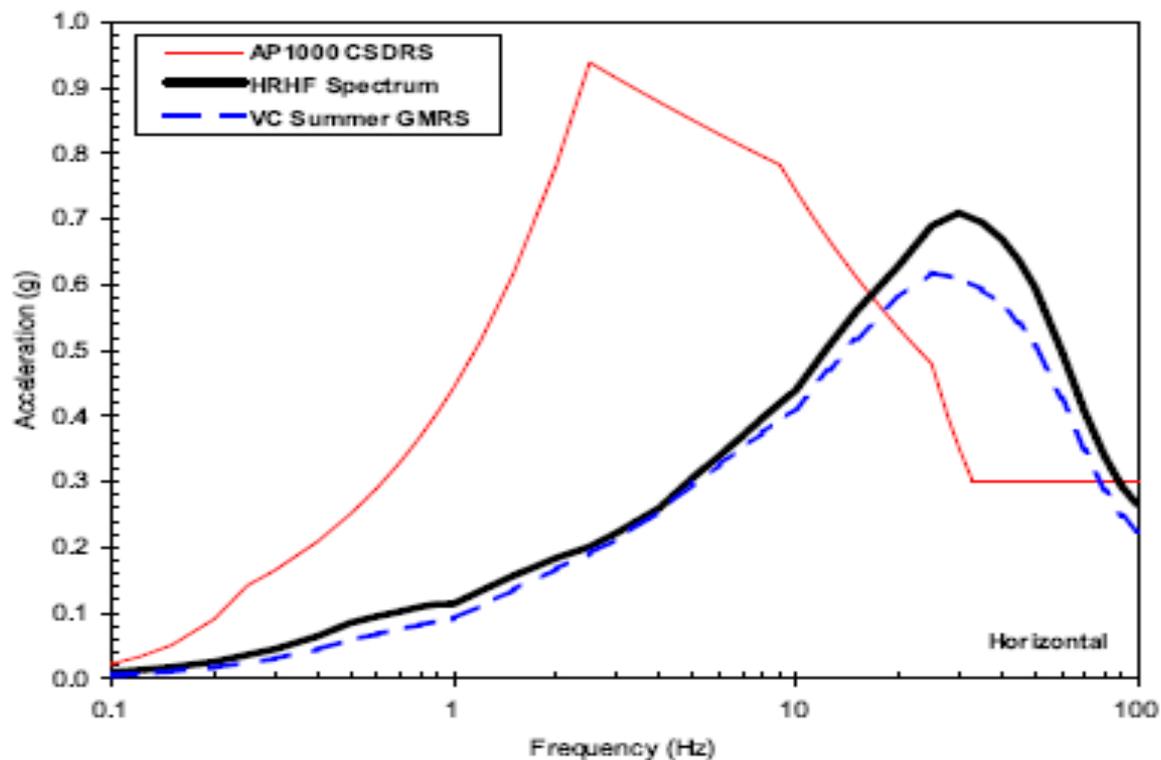


Figure 2.0-201. Comparison Plot of V. C. Summer GMRs and HRHF Spectra for the Horizontal Component of Motion



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FSAR Sections 2.5.4

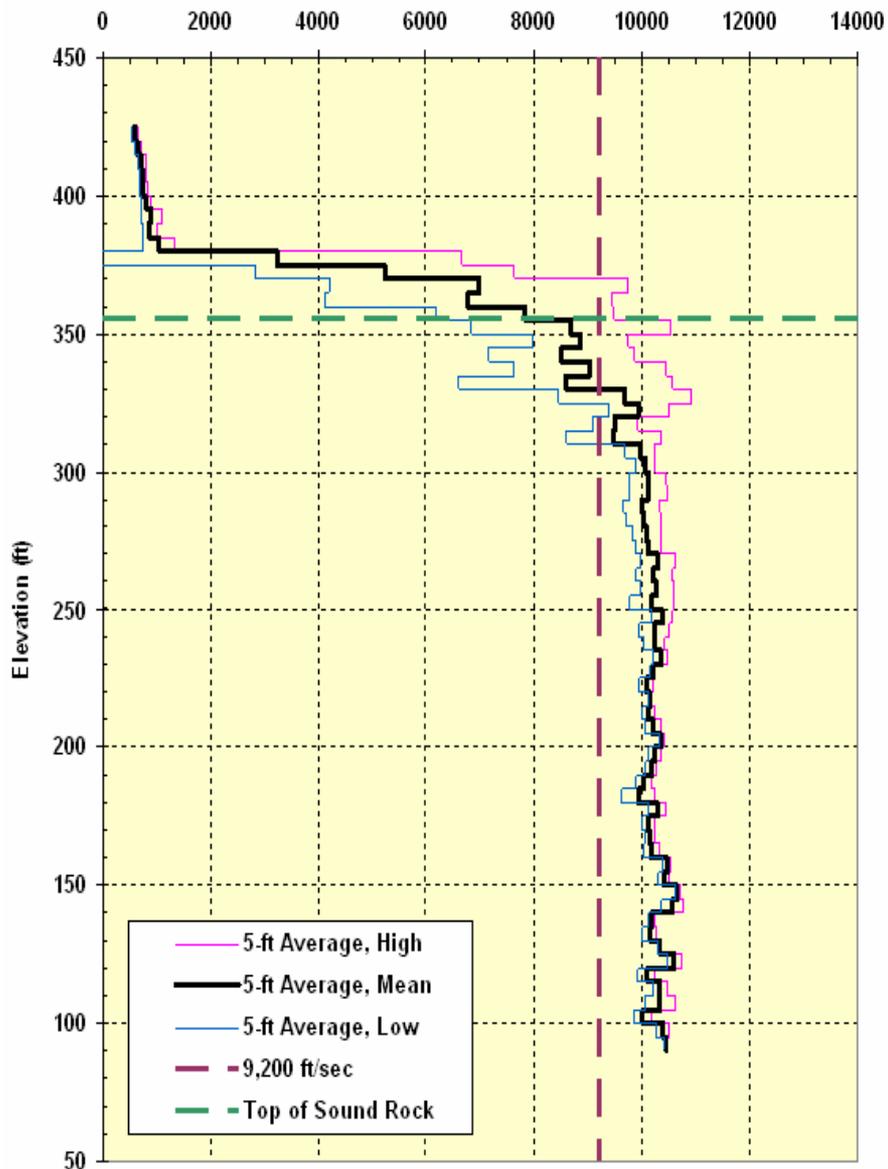
Site Geotechnical Characterization/ Foundations

Description of Subsurface Materials

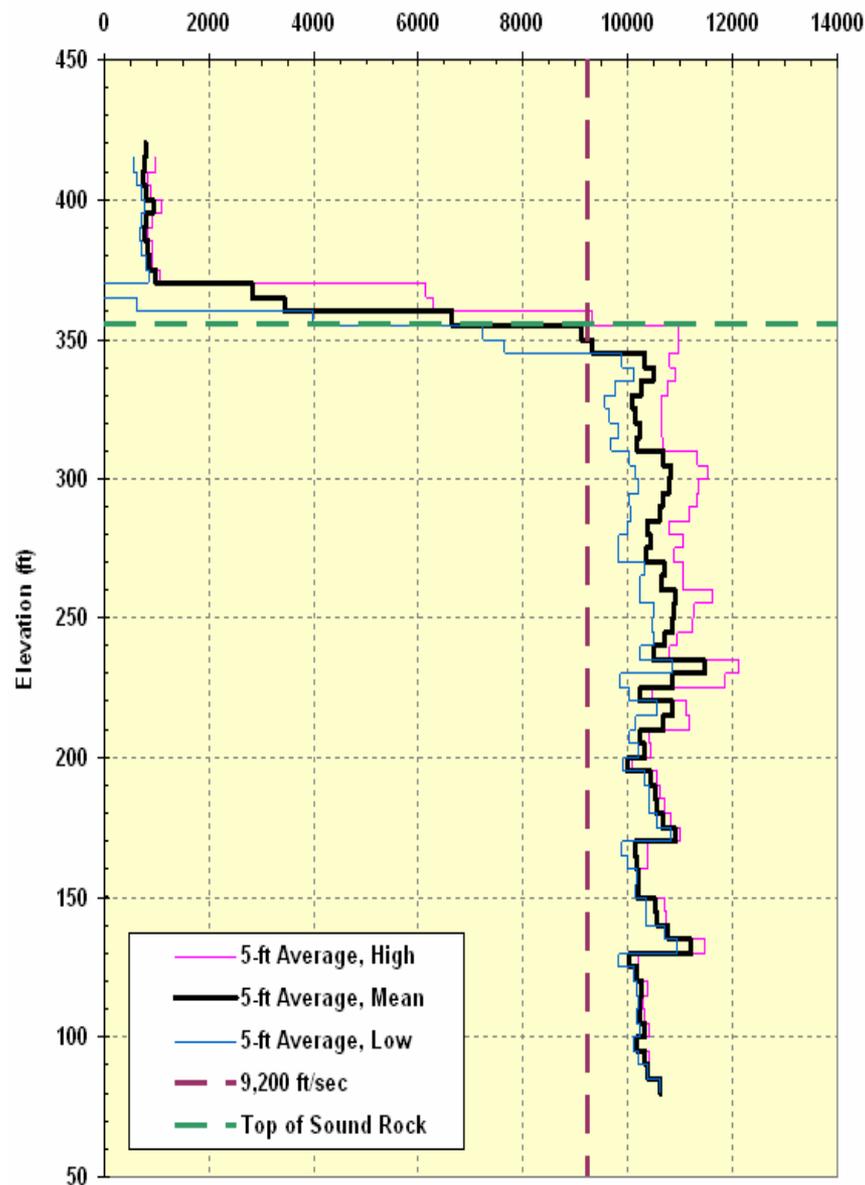
- **Residual Soil** – reddish silty sands and sandy silts with variable clay content
- **Saprolite** – completely weathered rock but w/preserved relict rock structure, mainly silty sands
- **Partially Weathered Rock (PWR)** – decomposed rock matrix mixed w/semi-hard rock fragments
- **Moderately Weathered 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

Shear Wave Velocity (ft/sec) - Unit 2

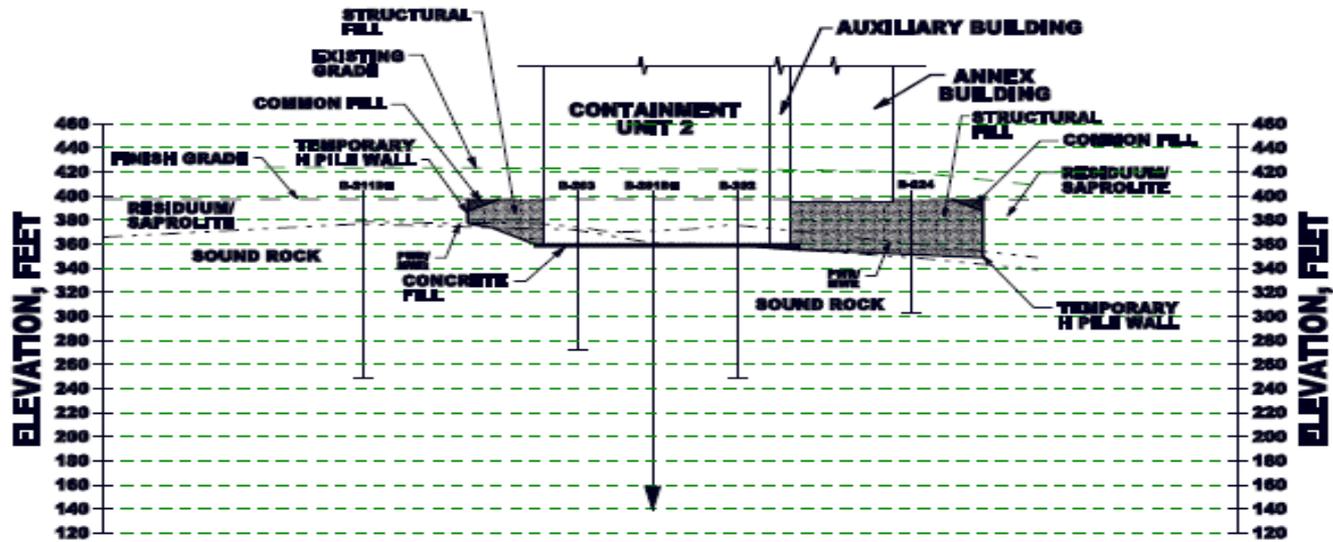


Shear Wave Velocity (ft/sec) - Unit 3



Excavation Cross-Section

V. C. Summer Nuclear Station, Units 2 and 3
COL Application
Part 2, FSAR



SECTION 1 A

- LEGEND**
- STRUCTURAL FILL**
 - CONCRETE FILL**
 - COMMON FILL**
 - BORING DESIGNATION**
 - PARTIALLY WEATHERED ROCK**
 - MODERATELY WEATHERED ROCK**

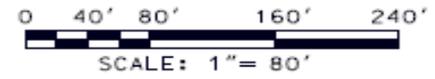


Figure 2.5.4-220. Cross-Section of Structure Foundation A-A



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

CONCLUSION: Liquefaction can not impact plant safety

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 Diffraction 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**

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)**

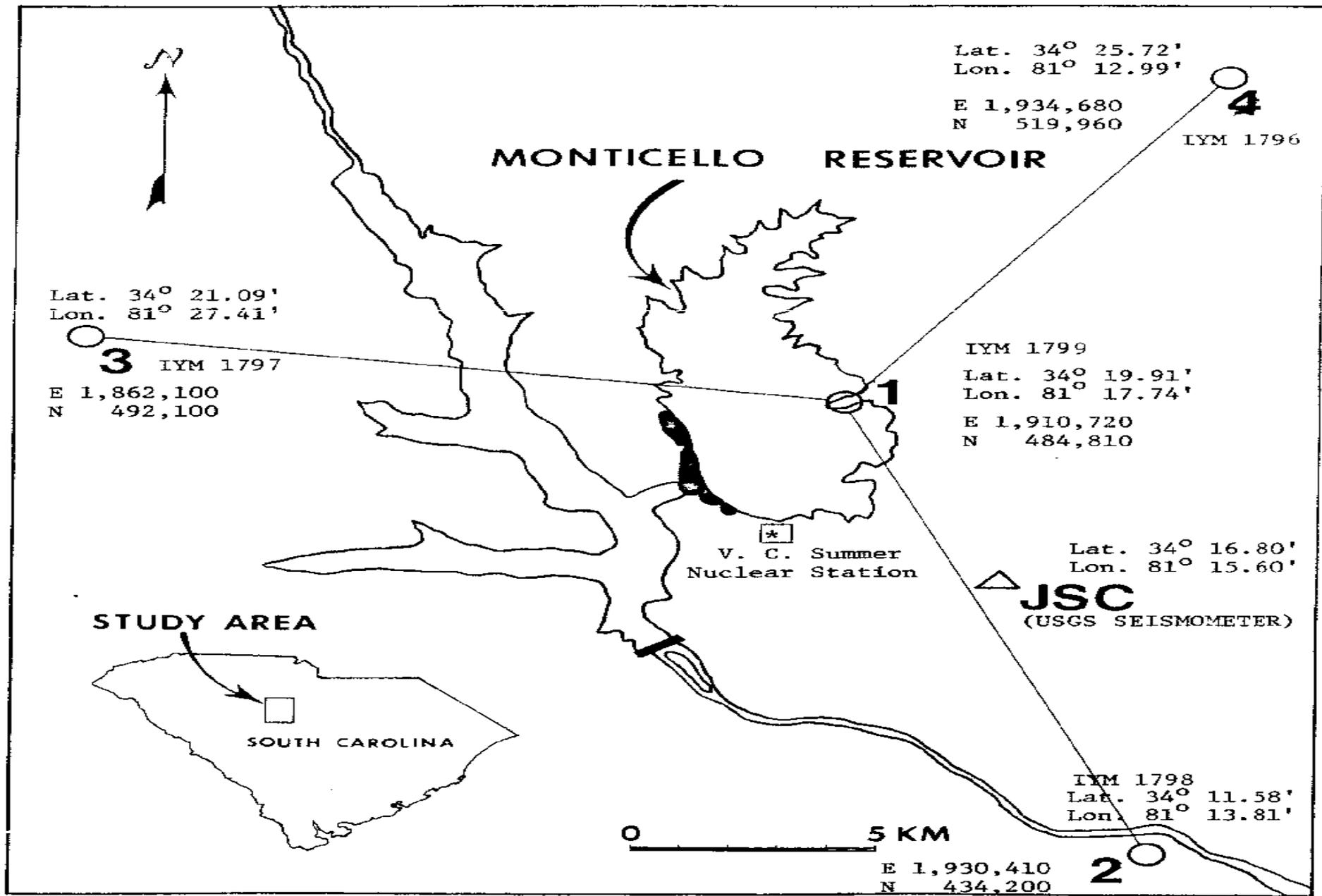
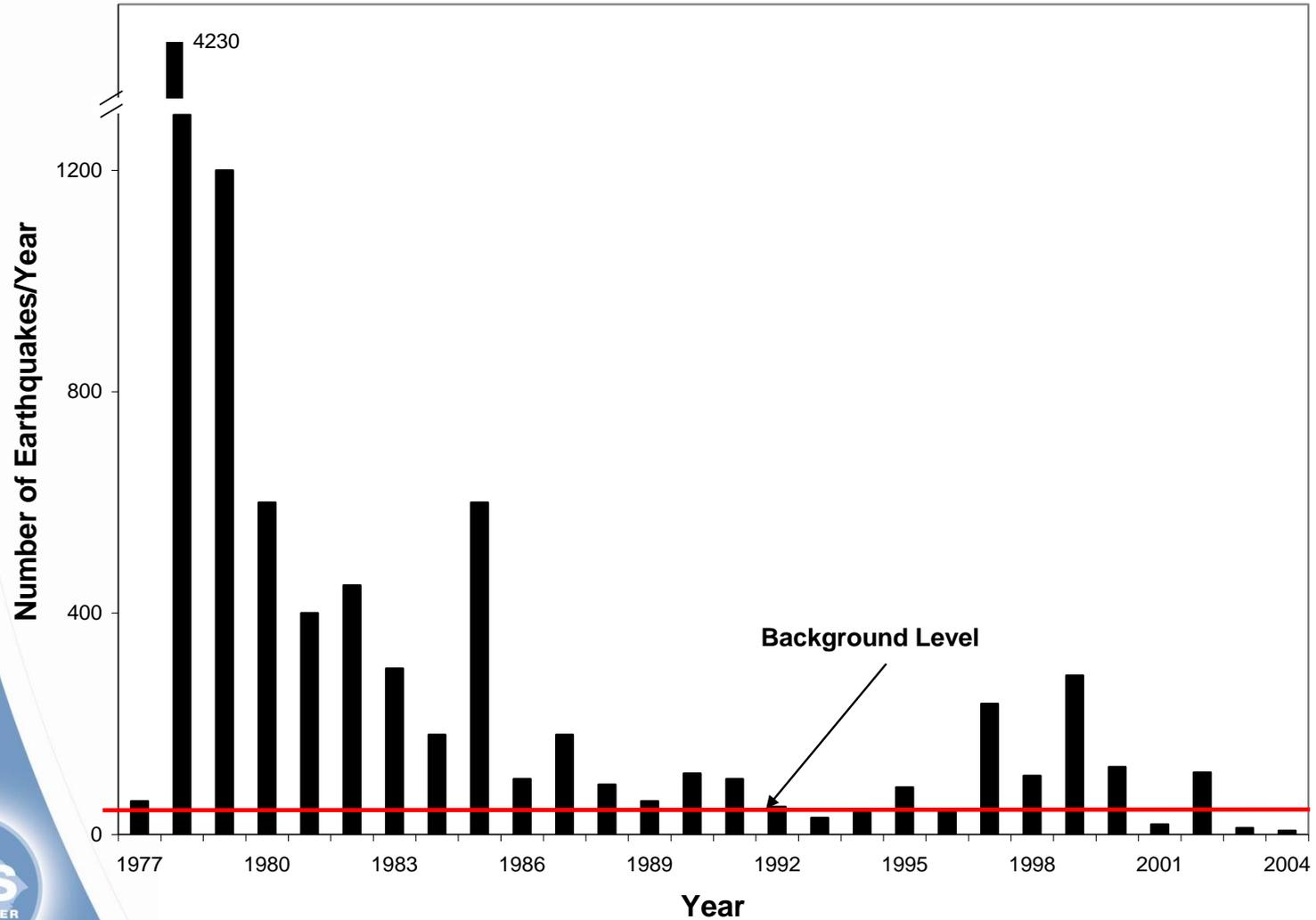


Figure 3
 ORIGINAL LOCATIONS OF SCE&G 4-STATION MICROSEISMIC NETWORK

RIS Histogram (1977 – 2004)

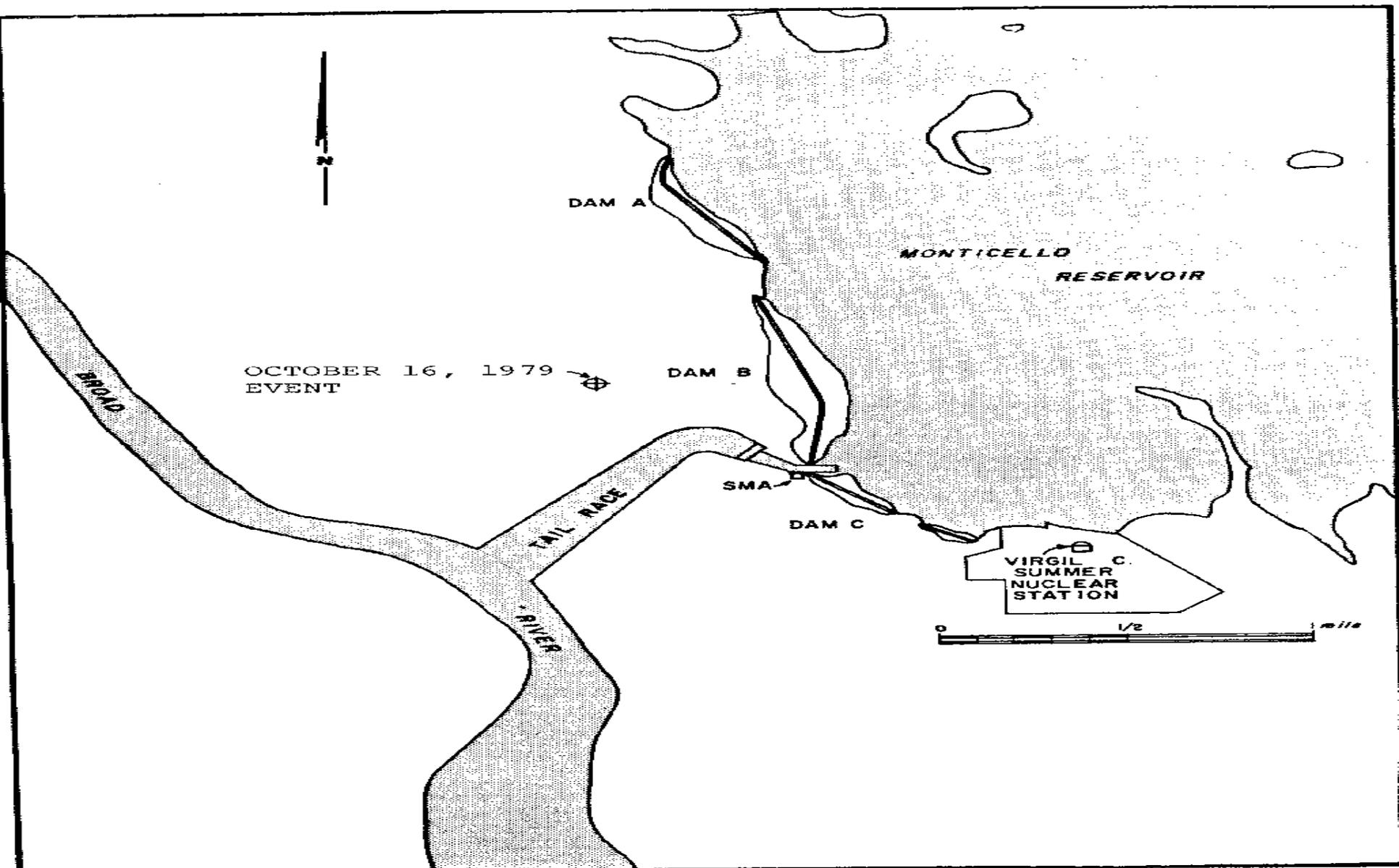


SEISMIC MONITORING PROGRAM

- **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
- 
 LOCATION OF STRONG MOTION ACCELEROGRAPH

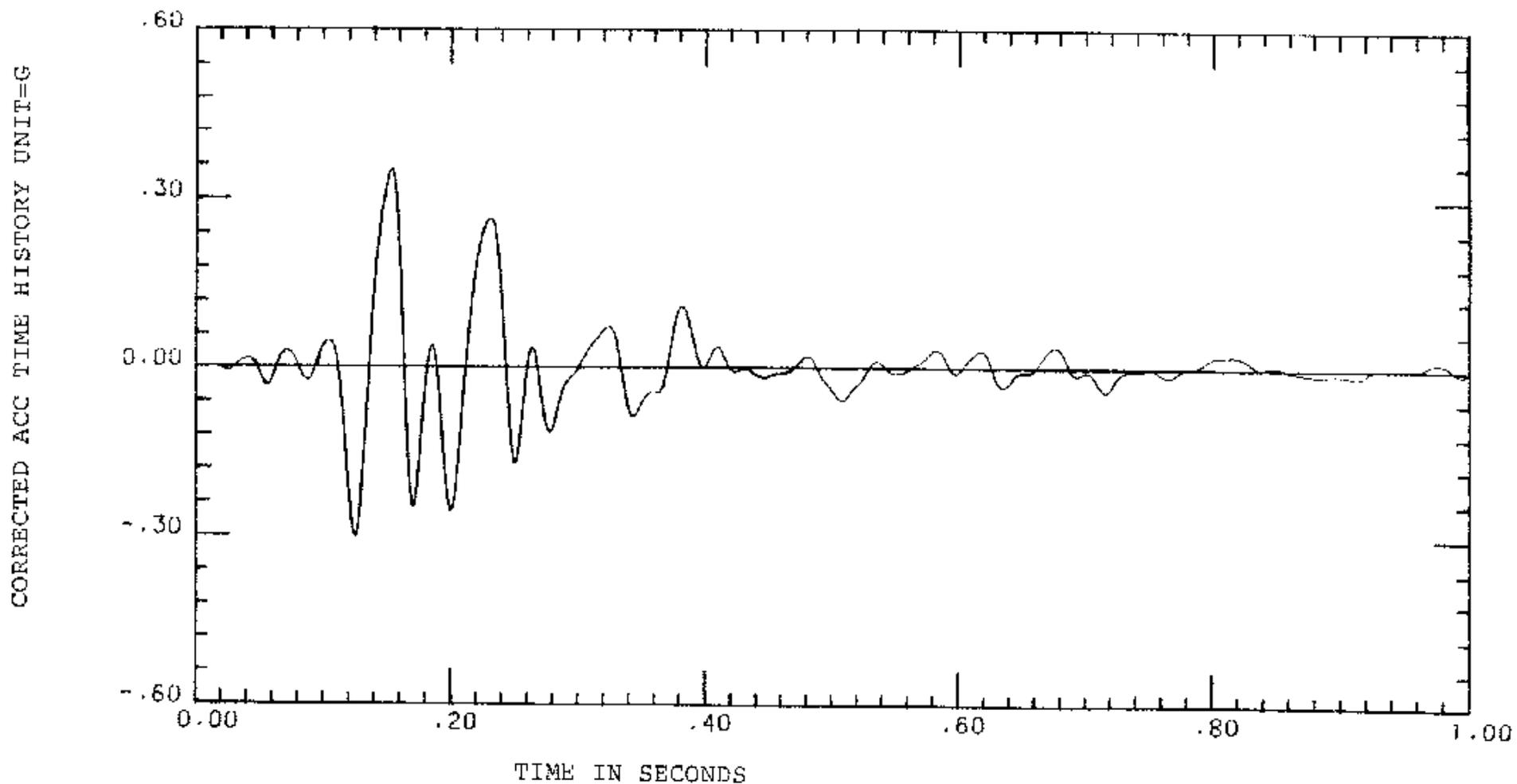
South Carolina Electric & Gas Co.
Virgil C. Summer Nuclear Station

OCTOBER 16, 1979
EARTHQUAKE

Figure 9

SOUTH CAROLINA EQ 16OCT79 CORR ACC T-H

MONTICELLO CEN CREST 180 DEG



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**

*SCE&G • Santee Cooper
Shaw • Westinghouse Electric Company*

(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





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

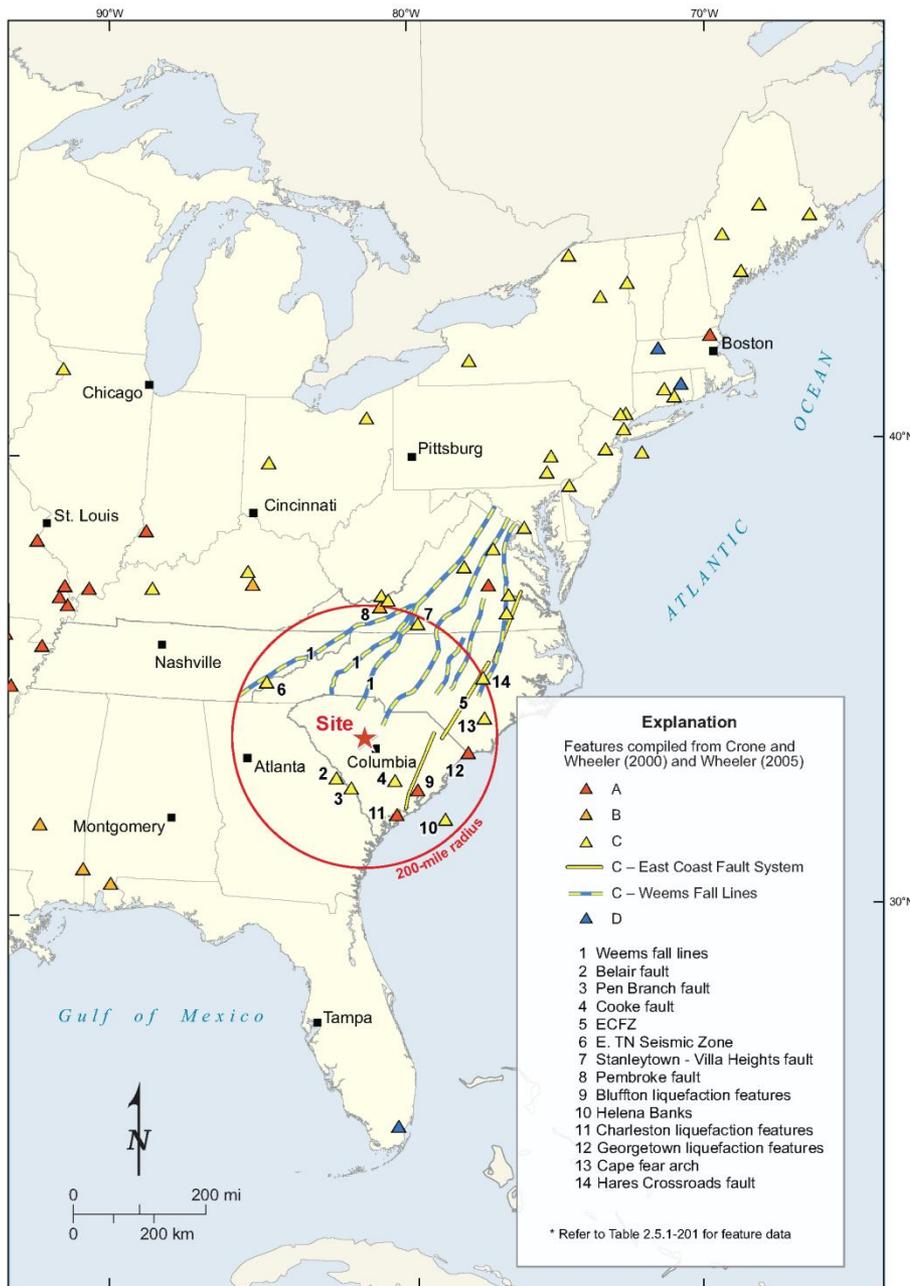
- Section 2.5 of the VCSNS AFSER issued with two Confirmatory Items and one License Condition
 - All COL Information Items (11 for AFSER Section 2.5.4 and two for AFSER Section 2.5.5) resolved based on FSAR Revision 2.
 - All Confirmatory Items resolved based on FSAR Revision 2, except 2.5.2-1 related 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

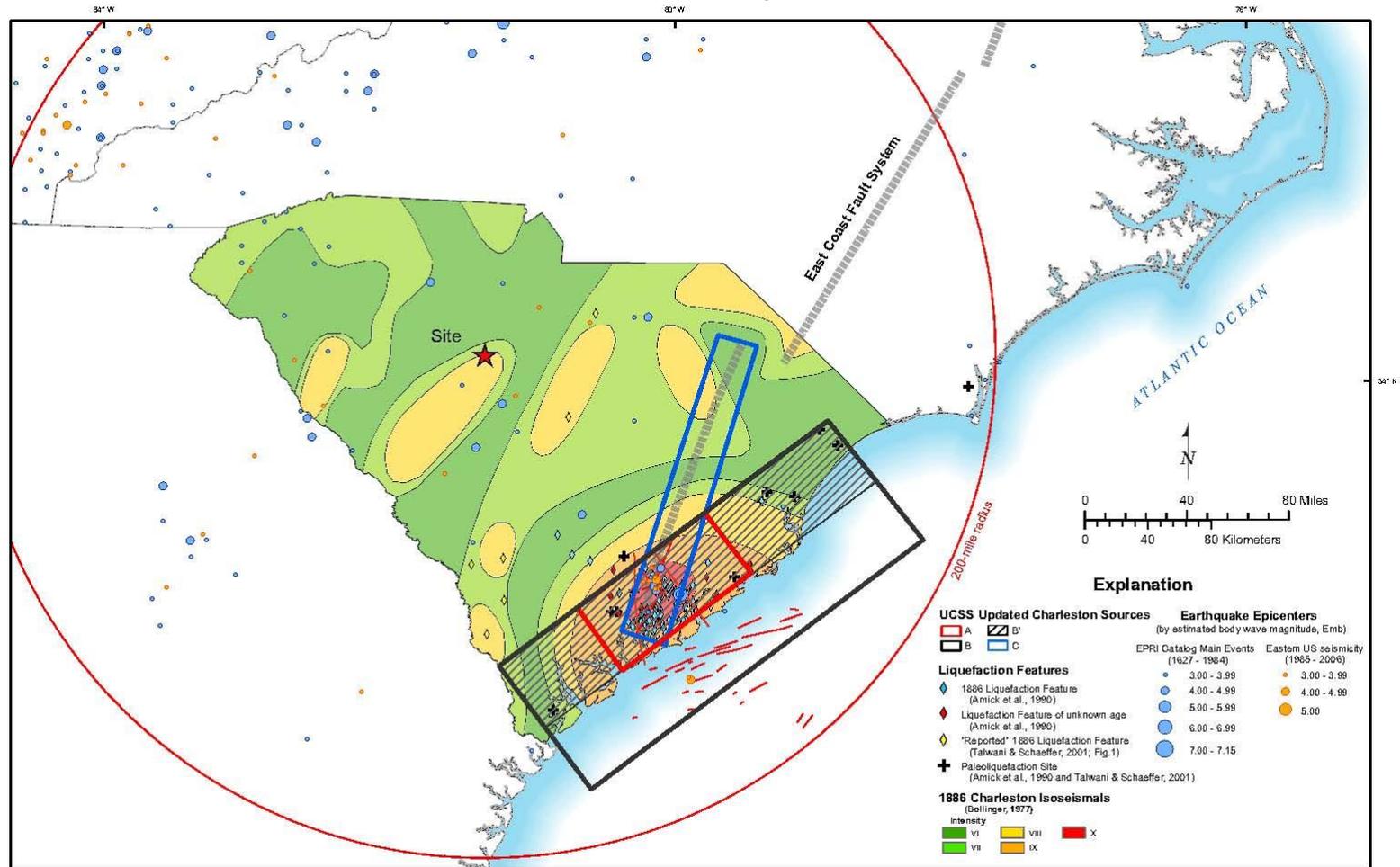
- **Reservoir-Induced Seismicity (RIS)**
 - Issue: Staff was concerned about the largest potential seismic event associated with the Monticello reservoir due to RIS, and whether water level changes in the reservoir have been correlated with seismicity.
 - Resolution: Applicant documented that the two 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.

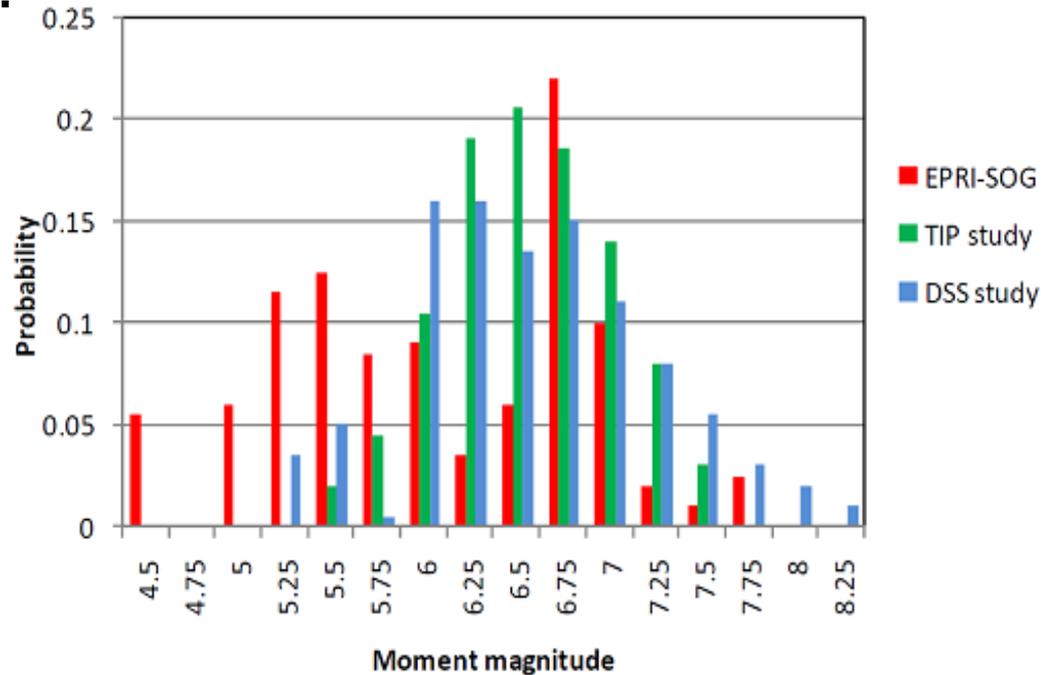
Section 2.5.2–Vibratory Ground Motion



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**

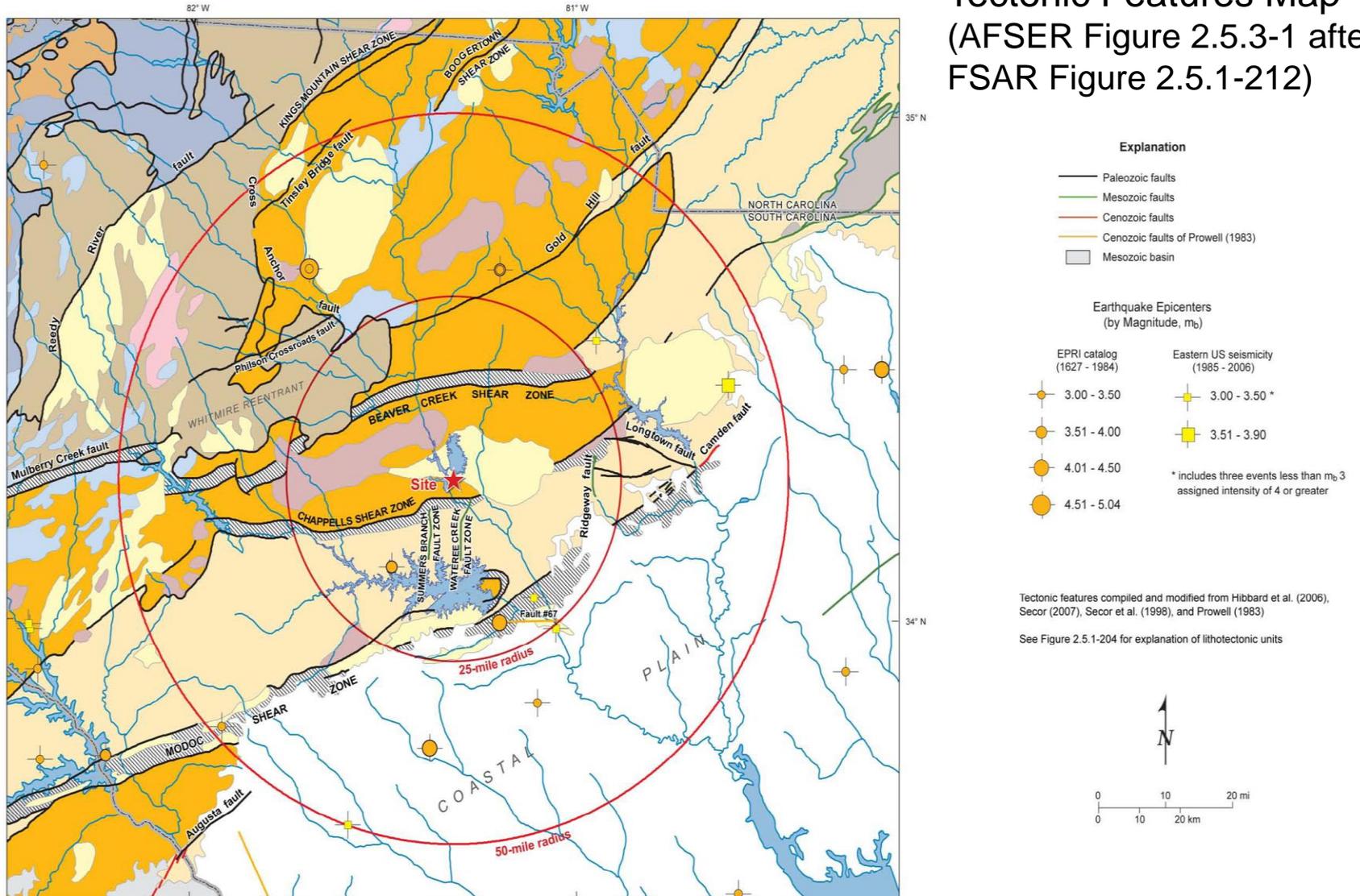
- Resolution: Applicant referred to a sensitivity study conducted by NEI for the ETSZ (2008) and concluded, based on results of that generic study for a hypothetical site in the middle of the ETSZ, that changes resulting from updating the 1986 EPRI study were not significant.
 - Staff performed an independent 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)



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.