



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001

December 18, 2007

MEMORANDUM TO: David C. Fischer, Senior Staff Engineer  
Technical Support Staff, ACRS

FROM: Dana A. Powers, Chairman  
Early Site Permits Subcommittee

SUBJECT: CERTIFICATION OF THE MINUTES OF THE ACRS EARLY SITE  
PERMITS SUBCOMMITTEE MEETING ON THE VOGTLE EARLY SITE  
PERMIT APPLICATION AND ASSOCIATED NRC SAFETY  
EVALUATION REPORT WITH OPEN ITEMS, OCTOBER 24, 2007,  
ROCKVILLE, MARYLAND

I hereby certify, to the best of my knowledge and belief, that the minutes of the subject meeting on October 24, 2007, are an accurate record of the proceedings for that meeting.

*Dana A. Powers* 19/Dec/07

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Dana A. Powers, Chairman                      Date  
Early Site Permits Subcommittee



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001

December 19, 2007

MEMORANDUM TO: ACRS Members

FROM: David C. Fischer, Senior Staff Engineer  
Technical Support Staff  
ACRS

A handwritten signature in black ink that reads "David C. Fischer".

SUBJECT: CERTIFICATION OF THE MINUTES OF THE ACRS EARLY SITE  
PERMITS SUBCOMMITTEE MEETING ON THE VOGTLE EARLY SITE  
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ROCKVILLE, MARYLAND

The minutes of the subject meeting were certified on December 18, 2007, as the official record of the proceedings of that meeting. A copy of the certified minutes is attached.

Attachment: As stated

cc w/o Attachment:

C. Santos  
S. Duraiswamy

Issued: 12/18/2007

**ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
EARLY SITE PERMITS SUBCOMMITTEE MEETING MINUTES  
October 24, 2007  
ROCKVILLE, MARYLAND**

**INTRODUCTION**

The ACRS Subcommittee on Early Site Permits met on October 24, 2007, at 11545 Rockville Pike, Rockville, Maryland, in Room T-2B3. The purpose of this meeting was to review and discuss the application submitted by Southern Nuclear Operating Company (Southern Nuclear or the applicant) for the Vogtle early site permit, and the associated NRC staff safety evaluation report (SER) with open items. The Subcommittee also discussed with the NRC staff the efficiency and effectiveness of staff's implementation of lessons learned from its review activities performed pursuant to 10 CFR Part 52. The Subcommittee planned to gather information, analyze relevant issues and facts to formulate proposed positions, as appropriate, for deliberation by the full Committee. The entire meeting was open to public attendance. Mr. David C. Fischer was the cognizant staff engineer and the Designated Federal Official for this meeting. The Subcommittee received no written comments, or requests for time to make oral statements from any members of the public regarding this meeting. The meeting was convened at 8:30 am and adjourned at 4:45 pm.

**ATTENDEES**

**ACRS**

D. Powers, Chairman  
J. Sam Armijo, Member  
D. Fischer, ACRS Staff

O. Maynard, Member  
W. Shack, Member

**NRC**

N. Chokshi, NRO/DSER  
C. Araguas, NRO/DNRL  
S. Coffin, NRO/DNRL  
R. Karas, NRO/DSER  
C. Munson, NRO/DSER  
M. Hart, NRO/DSER  
J. Hoch, NRO/DSER  
G. Bagchi, NRO/DSER  
M. Concepcion, NRO/DCIP  
H. Ahn, NRO/DSER

S. Monarque, NRO/DNRL  
L. Bauer, NRO/DSER  
S. Gonzalez, NRO/DSER  
G. Stirewalt, NRO/DSER  
Y. Li, NRO/DSER  
B. Harvey, NRO/DSER  
B. Musico, NRC/NSIR  
T. Cheng, NRO/DSER  
M. Lee, ACNW&M  
T. Terry, NRO/DSER

**ATTENDEES (CONT'D)**

**OTHERS**

C. Mueller, USGS	R. Wheeler, USGS
R. Prasad, PNNL	C. Costantell, BNL
T. Amundson, Southern Nuclear	J. Damm, Bechtel
A. Aughtman, Southern Nuclear	D. Fenster, Bechtel
C. Boone, Southern Nuclear	G. McLane, Bechtel
J. Davis, Southern Nuclear	D. Patton, Bechtel
D. Lloyd, Southern Nuclear	J. Prebula, Bechtel
T. McCallum, Southern Nuclear	B. Prunty, Bechtel
J. Miller, Southern Nuclear	R. McGuire, Risk Engineering Inc.
D. Moore, Southern Nuclear	B. Stokes, SCE&G
T. Moorer, Southern Nuclear	B. Whorton, SCE&G
C. Pierce, Southern Nuclear	A. Sterdis, Westinghouse
A. Spears, Southern Nuclear	S. Lindvall, William Lettis & Associates

A complete list of attendees is in the ACRS Office file and will be made available upon request. The presentation slides and handouts used during the meeting are attached to the Office copy of these minutes.

**OPENING REMARKS BY THE SUBCOMMITTEE CHAIRMAN**

Dr. Dana A. Powers, Chairman of the Early Site Permits Subcommittee, stated that the purpose of this meeting was to review and discuss the application submitted by Southern Nuclear for the Vogtle early site permit, and the associated NRC staff safety evaluation report (SER) with open items. The Committee must review the application and the staff's SER to fulfill the requirement of 10 CFR Part 52.23 that the ACRS report on those portions of an early site permit application that concern safety. Dr. Powers said that the Subcommittee would also discuss with the NRC staff the efficiency and effectiveness of staff's implementation of lessons learned from its review activities performed pursuant to 10 CFR Part 52.

**SOUTHERN NUCLEAR OPERATING COMPANY PRESENTATION** (Applicant slides 1 to 41)

Mr. Chuck Pierce, Southern Nuclear's licensing manager for Vogtle deployment introduced the Vogtle deployment organization; identified the contractors being used to help develop the Vogtle early site permit (ESP) and combined license (COL) applications; and outlined their schedule for licensing, constructing, and starting-up Vogtle Units 3 and 4. This included a discussion of Southern Nuclear's schedule for completing site preparation work and excavation activities (LWA-1) as well as backfill placement and nuclear island basemat preparation activities (LWA-2).

Mr. Jim Davis, Southern Nuclear, described the Vogtle electric generating plant (VEGP) site. The 3,169-acre VEGP site is located on a coastal plain bluff on the southwest side of the Savannah River in eastern Burke County Georgia. The site is directly across the river from the

Department of Energy's Savannah River Site (Barnwell County, South Carolina). It is about 150 river miles from the mouth of the Savannah River and approximately 26 miles southeast of Augusta, Georgia. Mr. Davis also described the new plant layout. The site currently occupied by Units 1 and 2 of the VEGP was approved originally for four units, but only two were built. The units now present at the site are 3,565 MWt Westinghouse pressurized water reactors. Also on the site is Plant Wilson which is a six-unit, oil-fueled combustion turbine facility.

Southern Nuclear has proposed to locate two Westinghouse AP1000 advanced nuclear power plants on the site. The AP1000 has a thermal power of 3,400 MWt. These power plants, designated Vogtle Units 3 and 4, will be located adjacent to and west of the existing Vogtle units. The Vogtle ESP application is unusual in that the applicant has selected a specific nuclear power plant design rather than relying on a plant parameter envelope as has been the case in previous applications for an ESP. The applicant has also provided a complete and integrated emergency plan, including an emergency planning Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC), rather than providing only the major features of an emergency plan, as has been the case in previous ESP applications. This provided the staff with a finer level-of-detail in certain areas (e.g., power output, cooling water design, intake design, water consumption, discharge flow) than was provided by earlier ESP applicants and will afford Southern Nuclear with a greater level of finality in these areas. It also probably resulted in fewer permit conditions arising in the SER on the application.

The initial Vogtle ESP application was submitted in August 2006 and contained Southern Nuclear's LWA-1 request. Revision 2 to the Vogtle ESP application was submitted in August 2007 and contained Southern Nuclear's LWA-2 request. The Vogtle ESP application consists of five parts: 1) introduction, 2) site safety analysis report, 3) environmental report, 4) redress plan, and 5) emergency plan. The subcommittee meeting focused on parts 2 and 5 of the Southern Nuclear's ESP application. The ESP application addresses portions of the following chapters of the site safety analysis report (SSAR): Introduction and General Description (Chapter 1), Site Characteristics (Chapter 2), Aircraft Hazards (Chapter 3), Liquid and Gaseous Releases (Chapter 11), Emergency Planning and Security (Chapter 13), Accident Analyses (Chapter 15), and Quality Assurance (Chapter 17). The applicant mentioned several NRC site safety visits that have been done as part of the staff's review of the Vogtle ESP application. The applicant provided a list showing how many requests for additional information (RAIs) it had received from the NRC for each specific SSAR section. The list totaled 189 RAIs. The applicant also provided a list showing how many SER open items were associated with each specific SSAR section. The list totaled 40 open items: one related to meteorology, four related to hydrology, twenty two related to geology/seismic, and thirteen related to emergency planning. The applicant indicated that Southern Nuclear had submitted responses to all 40 open items.

#### Potential Hazards (Applicant slides 21 and 22)

Mr. Davis stated that the exclusion area boundary for Vogtle Units 3 and 4 would be the same as that already established for Units 1 and 2. He said the population density near the plant is low and that they had used the most recent census data and the past growth rate to project the population out to 2070. This projection showed a four fold increase in population. The applicant considered threats to Vogtle Units 3 and 4 from: industrial and mining facilities (gas

lines), transportation routes (airports, roads, rails, water), military facilities, and Vogtle Units 1 and 2. Dr. Powers noted that a similar (i.e., four fold) increase in air traffic in and out of nearby Bush Field was not assumed. The applicant stated that the available air traffic projections from Federal Aviation Administration (FAA) only went out 20 years, so Southern Nuclear used the FAA projections to calculate the potential threat to the plant site from air traffic. Mr. Tammara, an NRC staff reviewer, said that the staff also used the FAA data but calculated the probability of a aircraft impact at the site to be an order of magnitude less than that calculated by the applicant. Dr. Powers asked if there was a nearby ammonia plant and whether Bush Field was used to train Delta Airlines pilots. The applicant was unaware of either. Dr. Powers questioned the applicant about the transient population at the Savannah River Site (e.g., from the potential construction of an actinide burner facility). Mr. Amundson, Southern Nuclear, said he knew of no plans to build such a facility at the Savannah River Site. Mr. Davis indicated that Southern Nuclear's emergency plan with the Savannah River Site is well coordinated and fluid. Dr. Powers noted that the Vogtle emergency plan included the plutonium fabrication facility at the Savannah River Site but not the Pit extraction facility. Mr. Boone, Southern Nuclear, said that the Savannah River Site is treated like a local entity in their emergency plan. Mr. Davis said that there was no threat to the site from barge traffic on the Savannah River because there is no barge traffic on the river at this time. With regard to the potential threat to the plant from rail traffic, Dr. Powers questioned the listing of carbon monoxide (on page 2.2-13 of the SSAR) as an asphyxiant. He said carbon monoxide is better characterized as a nerve or blood poison and asked if the applicant might have meant carbon dioxide, which he said is an asphyxiant. Dr. Powers also said that he was surprised that hydrochloric acid, chlorine, and sulfur dioxide were not moved along the CSX rail line. He said that these chemical are routinely transported on most rail lines. Dr. Powers questioned the applicant on the potential hazard associated with several chemicals stored on site (e.g., sodium bromide, sodium hypochlorite). Finally, Dr. Powers noted that the SSAR indicated that an analysis of tree fires surrounding the site indicates that there is no problem. He asked where he might find that analysis (no reference was provided in the SSAR). Mr. Moore indicated that Southern Nuclear pro-actively manages the timber on site (e.g., using controlled burns) to minimize the potential adverse effect to the plants from fires. Mr. Moore stated that other than the plant fire brigade, Southern Nuclear had agreements with several local volunteer fire departments as well as with the City of Waynesboro fire department.

Dr. Powers asked the applicant about the hazards posed to VEGP from the nearby Wilson fossil fuel generating plant. Mr. Davis told Dr. Powers that their analysis showed the hazard to be within limits. He said that the hazards are acceptable for Units 1 & 2, which are closer to plant Wilson than Units 3 & 4 will be. Dr. Powers asked if smoke from the combustion 9 million gallons of diesel fuel (i.e., three 3-million gallon tanks) posed a constraint on the design of the control room air filtration system (i.e., assuming the worst possible wind conditions). Dr. Powers questioned whether this should be addressed by the applicant at the ESP stage, at the COL stage, or both. Dr. Powers note that the discussion of this threat, and smoke from a forest fire, in the Vogtle ESP SSAR was minimal. Mr. Prunty said that Southern Nuclear had looked at the existing plant analyses for Vogtle Units 1 & 2 and evaluated them to determine whether or not they were suitable and reached the same conclusion for the new units. However, he said that they do not yet have a detailed HVAC design for the new units. Mr. Araguas said that these events should be addressed at the COL stage.

Meteorology (Applicant slides 23 and 24)

Southern Nuclear used five years of local and regional weather data to develop site-specific diffusion estimates for use in dose calculations. This data was apparently adjusted slightly to eliminate bad or erroneous data. Information from national weather stations within a 50-mile radius of the plant was used to help estimate weather extremes. The applicant based estimates of temperature extremes on a database covering a period of thirty years. Dr. Powers questioned the applicant's use of 30-year data sets to come up with 100-year return values. He asked the applicant if, when they looked at 30-years of weather to project forward, they were in fact capturing the relatively well known 50-year cycles of hurricane frequency, which he said also has an impact on tornado frequencies. Mr. Patton, Bechtel, explained that for severe weather, they went back as far as they had recorded information. He said that they only had reliable hourly data that went back 30-years for things like precipitation. Mr. Prunty, Bechtel, said that for tornado frequencies they did not do a plant-specific analysis. Rather, they used draft Regulatory Guide DG-1143 which contains a probability of  $10^{-7}$ . Mr. Prunty said the estimated tornado frequency at the Vogtle site was enveloped by the frequency assumed for the AP1000 certified design.

Hydrologic Engineering (Applicant slides 25 and 26)

In this section the applicant evaluated the potential for floods, dam failures, storm surges, ice effects, low water events, groundwater impacts, and accidental releases of liquids. Groundwater data from new and existing onsite wells was collected. Based on the AP1000 design, a site-specific radioactivity release analysis was performed. The fact that the VEGP site is 140 feet above the normal river level had a significant impact on the results of the aforementioned evaluations.

Geology and Seismic (Applicant slide 27)

Mr. Davis mentioned three key areas that would be discussed in greater detail latter in the applicant's presentation: the soil rock profile, the safe shutdown earthquake (SSE) curve, and the applicant's excavation plan.

Aircraft Traffic (Applicant slides 28 and 29)

Mr. Davis mentioned that the August-Savannah air traffic for flight path V185 went over (or nearly over) the Vogtle plant site. He said that, based on an analysis of the air traffic data associated with this route, the potential hazard to the Vogtle site was within acceptable frequency limits. While the Bulldog military operating areas have been getting closer to the Vogtle plant site (been expanded), air traffic in them seems to be declining and poses an insignificant risk to the Vogtle plant site.

Liquid and Gaseous Releases (Applicant slides 30 and 31)

Mr. Davis said that potential liquid and gaseous radioactive releases from normal operation were calculated, put into the SSAR, and determined to be well within the 10 CFR Part 50, Appendix I, regulatory limits. For accidents, the applicant reviewed the AP1000 accidents with

site specific parameters to calculate offsite doses. Mr Davis said that the Westinghouse DCD analysis was compared to the site specific estimates and that the VEGP generated dose estimates for accidents were bounded by the DCD analysis. Dr. Powers asked whether elevated or ground-level releases were more limiting, in light of the fact that the population in the immediate vicinity of the plant is very low and that some lofting might lead to a greater hazard further away from the site. The applicant said that they did sensitivity analyses when doing these calculations, that elevated releases had greater dispersion, and that ground-level releases are more conservative (maximizes the  $\chi/Q$  values). Dr. Powers noted that most of the codes used for making these calculations assume a flat earth and indicated that he thought most releases would track down the Savannah River basin.

#### Quality Assurance (Applicant slide 33)

Mr. Davis described applicants quality assurance (QA) program used to develop the ESP application, perform calculations, and gather data. Portions of the site investigation work were done to Appendix B standards so that they could be used directly in plant design. Most other analyses were not "safety-related" but QA controls were applied. In its recent submittal, the applicant expanded its QA program to also cover its early limited work authorization (LWA) activities. Mr. Maynard asked if the applicant used internet data in gathering information for the ESP application. Mr. Davis said that they did. Mr. Prunty said that they used internet data from national authority type sites (e.g., National Weather Service, Corps of Engineers), captured the data with screen shot, and validated that it was what it said it was. They did not just do a google search for the data. After some probing, the applicant admitted that it relies on the web controls of the official web site organization to police the validity of the data on its site.

#### Emergency Planning (Applicant slides 34 through 41)

Mr. Ted Amundson, lead engineer for the emergency planning aspects of the Vogtle ESP application, said that the physical characteristics of the site were evaluated against the security and emergency planning requirements. He also said that the details of emergency planning were provided in a separate portion (Part 5) of the ESP application. Consistent with 10 CFR 52.17(b)(1), the application identifies significant impediments to emergency planning. As allowed by 10 CFR 52.17(b)(2), the Vogtle ESP application proposes complete and integrated emergency plans, including an emergency planning ITAAC, as opposed to merely identifying the major features of their emergency plans. Mr. Amundson said that they chose to submit complete and integrated emergency plans because Vogtle Units 1 and 2 were two of the most recently licensed plants in the country and consequently they have a high degree of compliance with the latest emergency planning regulations (10 CFR 50.47 and Appendix E to Part 50) and standards (e.g., NUREG-0654, FEMA-REP-1). In preparing its ESP application, Southern Nuclear used the guidance in DG-1145, "Guidance for Combined License Applications" but not that contained in the final RG 1.206, as the latter had not yet been published when the application was submitted. Mr. Amundson said that Southern Nuclear had obtained new state and local certifications as required by 10 CFR 50.17(b)(4) to certify that: 1) their proposed emergency plans are practicable, 2) the state and local agencies are committed to further emergency plan development, and 3) the agencies are committed to executing their responsibilities under the plans. Mr. Amundson said that Southern Nuclear encountered no resistance in obtaining these certifications and that Southern Nuclear had a long and ongoing

positive relationship with the nearby state and local agencies. Dr. Powers asked about Southern Nuclear's philosophy about evacuation versus sheltering. Mr. Boone indicated that Southern Nuclear makes recommendations to state and local agencies regarding evacuation versus sheltering (consistent with guidance documents) but that the decision on an appropriate course of action lies with the state and local agencies. Mr. Amundson said that Southern Nuclear had developed some new evacuation time estimates base on a contractor's model and methodology. He said that the results of the new study were consistent with the study that had been done for Vogtle Units 1 & 2. The applicant's updated emergency plans use existing 10-mile emergency planning zones (EPZ), both plume exposure and ingestion pathway zones. The emergency planning zones within 10-miles of VEGP correspond to geopolitical boundaries surrounding the site and are the same as those used for the Savannah River Site emergency plans. Only the small village of Girard, with a population of 200 to 250, lies within 10-miles of the plant. Mr. Amundson showed where the evacuation centers (outside the 10-mile EPZ) were located. The VEGP emergency plans have been modified to include the two new units and no new impediments to emergency planning were identified. The plans call for building a new common Technical Support Center (TSC) for all four units and the use of the existing Emergency Operations Facility (EOF). The new TSC will be located west of Vogtle Unit 1 & 2 site and east of the Unit 3 & 4 site. The EOF is located in Birmingham, Alabama. Dr. Powers asks how the applicant's emergency plan addressed transient population (e.g., hunters). Mr. Amundson said that the areas surrounding the plants, including the wildlife management area, are adequately posted (i.e., at siren locations) to explain what to do in the event of an emergency. The staff has asked the applicant to ensure that local agencies review these time estimates since they may affect the actions of the agencies in the event of an emergency.

**NRC STAFF PRESENTATION** (Staff slides 1 through 37)

Mr. Chokshi made some very brief opening remarks. Mr. Araguas, the staff's project manager for the Vogtle ESP review, briefed the subcommittee on the status of the staff's safety review of the Vogtle ESP application. He said that the staff expected an interim letter from the Committee on the Vogtle ESP application and associated staff safety evaluation with open items. He provided the Subcommittee with an outline of his presentation.

**Schedule Milestones** (Staff slides 3 through 5)

The staff received the Vogtle ESP application on August 15, 2006. The acceptance review was completed on September 19, 2006. The staff conducted several site inspections and audits in support of the ESP application (e.g., QA, EP, meteorology, hydrology, geology). Requests for additional information (RAIs) were issued to the applicant by March 15, 2007. The SER with open items was issued on August 30, 2007. The staff has recently received responses to the RAIs. The staff plans on meeting with the ACRS full Committee in November 2007. The staff plans on providing the ACRS with an advanced copy of the SER with no open items by May 16, 2008 and meet again with the Committee in June 2008. The staff would like a final letter on the Vogtle ESP application and associated staff SER in July 2008. The staff hopes to issue the final SER on the Vogtle ESP application by August 6, 2008. The mandatory hearing on the Vogtle ESP application would then be conducted in the spring of 2009 and a Commission decision on the Vogtle ESP application would be made in the summer of 2009.

Vogle ESP Application (Staff slides 6 through 10)

Mr. Araguas identified the principal contributors to the staff's Vogle ESP application SER with open items (including contractors). He described the proposed ESP location, identified the applicants, and outlined the content of the application. Southern Nuclear requested that the ESP be approved for a 20-year period. Southern Nuclear also seeks approval of two limited work authorizations (i.e., LWA-1 and LWA-2) and its fitness for duty program for construction activities. Mr. Araguas described the activities associated with each LWA. LWA-1 activities would start immediately because recent revisions to Part 52. LWA-2 activities would start in mid to late 2009, after the ESP has been approved. Mr. Araguas mentioned that Southern Nuclear also seeks approval of its complete and integrated emergency plans with ITAAC as part of the ESP.

Key Review Areas / Open Items (Staff slides 11 through 37)

In this section the staff touched on some of the open items it felt were important to mention during the meeting.

Section 2.1, Geography and Demography (Staff slide 11)

Mr. Araguas said that the staff looked at the site location and description, particularly at the coordinates for the site, identifying the site boundaries and the orientation of principal plant structures, locations of highways, railroads, and waterways that traverse the exclusion area boundary (EAB). He said that none traversed the EAB. Mr. Araguas said that Southern Nuclear has full authority and control over activities in the exclusion area. The only activities that occur on site unrelated to nuclear power plant operation are associated with the visitor center and Plant Wilson. The closest population center is Augusta, approximately 26 miles away. Dr. Powers noted that the applicant had used previous census data and extrapolated population growth out to 2070. He asked if the applicant's population growth estimates were backed up by university studies, as had been done by previous ESP applicants. Mr. Tammara said that the staff had done its own confirmatory estimate and came up with very similar results. The staff checked to ensure the applicant's population density calculation was done correctly and to see if the projections were reasonably accurate. The staff did not do a more detailed confirmatory analysis because the population density was well below regulatory acceptance criteria of less than an average of 500 people per square mile within 10 miles of the site.

Section 2.2, Nearby Industrial, Transportation, and Military Facilities (Staff slides 12 and 13)

Mr. Araguas said that the staff looked for potential hazards in the vicinity of the site so they could evaluate potential accidents due to those hazards. They looked at the maps of the site and the nearby significant facilities and transportation routes. They looked at the description of the facilities, products, materials, and number of people employed. They also looked at the description of the pipelines with respect to how far away they were, what kind of materials are traveling down the pipeline or have the potential of going down the pipeline, what highways are nearby the site, and what waterway that are nearby the site. Mr. Araguas said there were two airports near the site. The Burke County airport is about 156 miles from Vogle site and the Bush Field Augusta airport is about 17 miles from the site. He said that the staff also looked at

industrial growth. Dr. Powers said that there is remarkably little industrial activity up and down the Savannah River but mentioned that there is a proposal to develop a hydrogen production facility at the Savannah River Site. However, such a facility would be outside the area of interest to the VEGP.

Mr. Araguas said that the staff looked for any event that could be considered a design basis event (DBE). He defined DBE as an accident that has a probability of occurrence on the order of 10<sup>-7</sup> per year or greater and potential consequences exceeding to 10 CFR Part 100 dose guidelines. He said that the staff looked at potential accidents in four key areas. The first is explosions and flammable vapor clouds from truck traffic, pipelines, mining facilities, waterway traffic, and railroad traffic. Mr. Araguas said that there is truck traffic carrying gasoline and fuel oil near the site but none that could produce a 1 psi over-pressure at the site (reference Regulatory Guide 1.91). He said the nearest pipeline was about 19 mile away and outside the 10-mile area of interest specified in Regulatory Guide 1.70. He said that there were no mining facilities near the site and that the Savannah River was not navigable. Dr. Powers said he thought it was unusual that neither chlorine nor sulfur dioxide were transported on the nearby (four and a half miles) railroad line. Both the staff and applicant relied on the information provided to Southern Nuclear by CSX. Dr. Powers also question the listing of carbon monoxide, as an asphyxiant, was a misprint, and that perhaps it should have been carbon dioxide. He also noted that neither the applicant nor staff considered the potential for a major railroad accident involving multiple cars. The second type of accident considered by the staff was hazardous chemicals. For these, the staff looked at transportation accidents, major depots, storage areas, and onsite storage tanks. The staff said it did look at the applicant's fuel oil storage accident analysis for Plant Wilson to determine that the concentration of the toxicity limit specified in Regulatory Guide 1.78 would not be exceeded. Similarly, the staff analyzed a potential spill of hydrazine, stored at Unit 1, to ensure the toxicity limit specified in Regulatory Guide 1.78 would not be exceeded. Basically, the applicant made the argument that since Units 3 and 4 are further away from the tanks than they are for Units 1 and 2, it would be okay. And the staff found that to be acceptable. The staff has a COL Action item at the COL stage to verify that there is no adverse effect from spills and fires on site (including particulate burden) on control room habitability. Fires were the third type of accident considered by the staff. Dr. Powers noted that the consideration associated with fires on site and the magnitude of potential impacts of fires on site were not very well documented by either the applicant or the staff (e.g., heat loads, smoke loads, access problems). The fourth type of accident considered by the staff are radiological hazards i.e., from either the Savannah River Site or Vogtle Units 1 & 2. The staff verified that there are measures in place to detect any sort of hazard from those sites , and found them to be acceptable.

### Section 2.3, Meteorology (Staff slides 14 through 18)

The staff looked at the meteorology at the VEGP site in terms of regional climatology, local meteorology, onsite meteorological measurement program, short-term atmospheric dispersion estimates for accidental releases, and long-term dispersion estimates for routine releases. Dr. Powers indicated that the tendency for any dispersion under mild atmospheric turbulence conditions would be straight down the river and not in a random direction such as one might assume using a "flat-earth" model.

Mr. Araguas said that the applicant identified meteorological site characteristic related to climatic extremes and severe weather as well as those related to atmospheric dispersion from both accident and routine releases. Specifically, the staff reviewed the applicant's assessment of extreme winds, tornados, precipitation (for roof design), and ambient design temperature. Dr. Powers explained that there is evidence that we are going through long-term weather cycles on the Atlantic seaboard. He elaborated by stating that there are two shorter-term cycles (El Nino and the North Atlantic Oscillation each with a different period) that affect the longer-term cycle which are currently in phase. As a result, he postulated that the frequency of hurricanes, and possibly intense hurricanes (Category 4 or 5), will go up. Therefore, Dr. Powers questioned the applicant's use of historical data to project extreme weather for the next 70 years. Mr. Hoch said that he looked at 154-years of National Oceanic and Atmospheric Administration (NOAA) data and concluded that there is indication of an increase in either the frequency or the intensity of hurricanes within a hundred-mile radius of this site. He also said that the staff used a forward-looking approach by considering information from the International Government Panel on Climate Change. Finally, Mr. Hoch indicated that the applicant used DG-1143's 300 mile an hour wind speed in its analyses, which the staff said will be bounding for any hurricane that may impact the site.

For short-term dispersion estimates for accident releases, the staff assessed the adequacy of the  $\chi/Q$  values used by the applicant at the exclusion area boundary and in the low population zone. For long-term dispersion estimates for normal releases, the staff assessed the adequacy of the  $\chi/Q$  values used by the applicant at the exclusion area boundary, at the nearest resident, at the nearest meat animal, and at the nearest vegetable garden. The staff identified one meteorological open item for the applicant to provide a justification for using a 30-year period of record (1966 to 1995) to define the AP1000 maximum safety design temperature. The staff believes these temperatures should be based on a 100-year return interval. Mr. Hoch said that the applicant had used 30-years of data and linear extrapolation to arrive at its 100-year return temperature. He said that the staff used more data than the applicant had used (i.e., 17 weather stations, as opposed to 10 used by the applicant). He also noted that the American Society of Heating, Refrigeration, and Air Conditioning Engineering (ASHRAE) puts out a standard that gives examples on how to calculate 100-year return period temperatures.

#### Section 3.5.1.6, Aircraft Hazards (Staff slide 19)

Mr. Araguas explained that the plant design should consider that aircraft accidents that could lead to radiological consequences in excess of the exposure guidelines of 10 CFR 50.34(a)(1) with a probability of occurrence greater than  $10^{-7}$  per year. The guidance say that federal airways, holding patterns, or approach patterns should be at least 2 statute miles away. Military installations or any airspace usage (former bombing ranges) should be at least 20 miles from the site. All airports should be at least 5 miles from the site. Airports between 5 and 10 miles of the site should have projected operations less than  $500 d^2$ , where  $d$  is the distance from the site to the airport. Airports greater than 10 miles from the site should have projected operations less than  $1000d^2$ .

Mr. Araguas said that the only aircraft hazard of concern was that associated with airway V185, approximately 1.5 miles from the ESP site. The applicant was unable to get flight data on that airway from the FAA but calculated that it would take 51,000 flights a year along that flight path

to reach the  $10^{-7}$  probability threshold. The staff obtained data from the FAA and calculated the probability to be  $6 \times 10^{-7}$ . Dr. Powers questioned the applicants projection of air traffic into/out-of Bush Field in light of the projected population growth in the area. He asked if the staff had evaluated that. The staff said that the projected number of flights into/out-of Bush Field varied but range from about 47,000 in 1990 to approximately 36,000 in 2025. The staff said that Bush Field was about 17 miles from the site (i.e., so flight operations would have to be less than 289,000 flights to meet the guidelines). So the staff concluded that even if projected flight operations were ratioed up by conservative population growth estimates, flight operations would still be within the acceptance guidelines. Dr. Powers asked if Bush Field was a training airfield for Delta Airlines pilots. The staff said that it had not looked into that prospect.

#### Chapter 11, Doses from Routine Liquid and Gaseous Effluent Releases (Staff slides 20 and 21)

The staff confirmed the applicant's liquid and gaseous release estimates as well as the appropriate exposure pathways. The staff looked at the appropriate liquid dilution and atmospheric dispersion and deposition. It also confirmed the use of appropriate land usage factors. The staff verified the applicant's calculated doses using NRC recommended models and performed an independent dose assessment for liquid pathways showing the applicant's doses to be conservative. Mr. Araguas showed a table that compared the applicant's and staff's estimated doses to the regulatory criteria. In all cases the estimated doses were less than the specified regulatory criteria. Dr. Powers asked why these estimates were required of the North Anna and Vogtle ESP applicant but not the grand Gulf or Clinton ESP applicant. Mr. Schaffer, from the Office of New Reactor's Health Physics Branch, said that the staff and Office of the General Counsel recently determined that 10 CFR Part 52 requires the ESP applicant to look at both gaseous and liquid effluents and their potential impact.

#### Section 13.3, Emergency Planning (Staff slides 22 through 27)

Southern Nuclear submitted a complete and integrated emergency plan (EP) as part of its ESP application. The staff is looking at the applicant's agency certifications to make sure the state and local organizations have coordinated with the applicant with respect to emergency plans for offsite response. The staff is trying to determine if the applicant's complete and integrated emergency plan provides reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency. This will provide the applicant with finality in that at the COL stage there will be no EP review other than that necessary to close out the proposed ITAAC. Mr. Araguas identified the NRC and FEMA regulations and guidance related to EP. He also identified the various state and local jurisdictions with which Southern Nuclear has coordinated. The staff said that the applicant's EP has also been coordinated with Savannah River Site EP. The staff's review focused on the 10-mile emergency planning zone (EPZ), almost half of which is occupied by the Savannah River Site. The staff presumed that the adequacy of the Savannah River Site EP. The staff did however evaluate the adequacy of the memorandum of understanding between Southern Nuclear and the Department of Energy (a copy of which was submitted as part of Southern Nuclear's ESP application and provided to the Subcommittee members at the meeting). Mr. Musico also provided the Subcommittee with a photograph of the posting or sign that tells people in the EPZ what to do in the event of an emergency.

Southern Nuclear proposed an EP ITAAC for those aspects of EP that reasonably be completed prior to construction of the plant. This is the first time the staff is reviewing an EP ITAAC as part of an ESP application. The applicant's proposed EP ITAAC is based on a generic EP ITAAC in SECY-05-197 and NUREG-0800. Both ESP and COL applicants will need to provide site-specific EP ITAAC based on the generic guidance.

Mr. Araguas said that an issue that still needs to be resolved on the Vogtle ESP application has to do with emergency action levels (EALs). The staff is currently reviewing NEI-99-01 (EAL Guidelines for light-water reactors) and NEI-07-01 (EAL guidelines for passive plant designs and advanced light-water reactors). The staff said that there is a lot of overlap between the two NEI guides. The Vogtle EALs are based on and reference NEI-07-01. The staff plans on completing its review of the NEI guidelines before it approves the Vogtle EALs. Options for completing the Vogtle ESP review before the staff completes its review of NEI's EAL guidelines were briefly discussed. Another EP related open item has to do with state and local agencies reviewing the applicant's revised evacuation time estimates (ETEs) to ensure they do not adversely effect off-site response in some way. The agencies need to review and comment on the revised ETEs and Southern Nuclear needs to discuss the resolution of those comments with the agencies.

#### Section 13.6, Physical Security (Staff slide 28)

Mr. Araguas said that the staff needed to determine whether site characteristics were such that adequate security plans and measures could be developed. In order to make this determination, the staff considered pedestrian and vehicular land approaches to the site, railroad and water approaches, potential "high-ground" adversary advantage point, integrated response provisions, and nearby road transportation routes. The staff identified an existing rail spur at the site. The applicant said that any road or railroad that penetrates the required vehicle denial system will be provided with appropriate access control measures in accordance with the existing regulations and the physical security plan that will be provided with the COL application. This is a COL Action item on which the staff will follow up.

#### Chapter 17, ESP Quality Assurance Measures (Staff slide 29)

The staff reviewed ESP application to verify that it included within the scope of its quality assurance (QA) program, activities that would affect the capability of structures, systems, and components (SSC) important to safety. The staff completed an on-site QA inspection in August 2006 during which the staff reviewed the QA manual, plans, and implementing procedures of the applicant and its major contractors. They also reviewed data collection analyses, and evaluation methodologies, including those associated with site characterization. The staff's in-house review of the applicant's QA submittal was completed in January 2007 and verified the applicant adequately applied the guidance in Section 17.1.1 of review standard RS-002 to demonstrate the integrity and reliability of the data that were obtained during ESP activities. The applicant used NEI 06-14A, "Quality Assurance Program Description," as a template for its nuclear data quality assurance manual (NDQAM). The applicant submitted a revised NDQAM in August 2007 to include LWA-2 activities within the scope of the ESP. Dr. Powers asked how the staff used or handled internet data. Mr. Araguas said that previously, for the North Anna ESP application review, the staff reviewed Bechtel's measures for storing internet data and felt

that they were adequate. So they thought applying the same controls for Vogtle ESP application review would also be acceptable. Mr. Concepcion said that for previous ESP reviews the staff verified samples of internet data that was used by the applicants. He said that verification procedures were performed by engineering analysis or independent verifications or by certificates of validity from the source that provided the data. He said that was the process the applicant used to validate the information that was used. Mr. Maynard said that he got the impression that applicants had merely relied on the integrity of the source internet site. Mr. Prunty clarified that the procedure described by Mr. Concepcion calls for the independent validation of safety-related data. Mr. Prunty said that most of the site characterization data does not really fall into that category. Based on discussion at the Subcommittee meeting it was clear that there currently is not any staff guidance on how applicants should verify the validity and integrity of internet data that is not used for safety-related purposes. Mr. Araguas said that the staff would consider the need for developing such guidance.

#### Section 2.4, Hydrologic Engineering (Staff slides 30 through 37)

Mr. Prasad from PNNL identified the various sections of the applicant's SSAR and staff's SER related to hydrologic engineering. Dr. Powers asked the staff what it did to validate the applicant's assertion that the water level following dam failures on the Savannah River would not threaten VEGP the site. Mr. Prasad said the staff assessed the adequacy of the applicant's flooding models and data and determined that they were reasonable. They also did sensitivity studies to assess the water level if some of the applicant's key assumptions were changed. Section 2.4.2 deals with floods and what the controlling flood for the site should be. The staff independently estimated local intense precipitation based on NOAA guidelines and use that as a site characteristic that will be used at the COL stage for site grade design and site drainage design. In Section 2.4.3 the staff independently assessed the probable maximum flood using a bounding approach and verified the applicant's conclusion that the site remains dry following the probable maximum flood on the Savannah River. It turned out that the probable maximum flood was not as severe as the flood water level that would result from a dam failure. In Section 2.4.4 the staff verified the applicant's dam failure analysis and carried out an independent sensitivity analysis to verify that the site remained dry. In Section 2.4.5 the staff assessed the probable maximum surge and seiche flooding. Seiche are not an issue for the Vogtle site. The staff did an independent assessment of the potential impact of hurricane storm surge at the site and concluded that the site would remain dry.

In Section 2.4.6 of the staff' SER with open items, the staff concluded that a probable maximum tsunamis near the mouth of the Savannah River will not reach site grade. Dr. Powers asked the staff about the potential tsunamis threat to the site from an underwater landslide in the Cape Verde Islands. Mr. Prasad said that the size of tsunamis caused by such a slide depends on the volume and speed of the slide as well as on the dispersion effects. The dispersion effects depend in large part on whether the wave produced by the slide is an intermediate wave as opposed to a shallow wave with a long wavelength that basically does not lose any energy during its travel across the ocean. The staff's technical expert believe that the latter is a very unlikely scenario. However, the staff's research into potential tsunamis sources affecting the Atlantic and Gulf Coasts of the United States is ongoing. Dr. Powers asked about the potential for tsunamis from other sea slides. Mr. Prasad said that tsunamis generated by sea slides typically have only local effects. He also said that it is difficult to assess the tsunamis threat

probabilistically because of the lack of data. Dr. Powers commended the staff for its ongoing research in this area.

Southern Nuclear did not identify any safety-related canals or reservoirs in its ESP application because Vogtle Units 3 and 4 will not rely on any external water source for safety-related cooling. The staff determined that a design parameter is needed related to initial filling of and occasional makeup to their safety-related tanks (Open Item 2.4-1). The staff also identified a permit condition that VEGP Units 3 and 4 will not rely on any external water source for safety-related cooling water other than for initial filling and occasional makeup.

Mr. Prasad said that there was no flood protection requirements for any SSC which is located at or above site grade. He also said that safety-related SSC will not be affected by low water conditions in the Savannah River.

Ground-water motion on the site will be affected by the construction of nuclear power plants on the site. The ground-water motion could affect transport of radionuclides. The applicant has analyzed the ground-water motion. The staff has, however, identified an alternative pathway for water flow and has asked the applicant to consider this alternative. In addition, there is a design criterion that the highest ground-water can not be higher than two feet below grade. The applicant described the site characteristics related to ground-water elevation but failed to convince the staff that the design criterion would be satisfied. The staff determined that the applicant should provide an improved and complete description of the current and future local hydrological conditions, including alternate conceptual models, to demonstrate that the design bases related to ground-water-induced loadings on subsurface portions of safety-related SSCs would not be exceeded. Alternatively, the applicant could provide design parameters for buoyancy evaluation of the plant structures.

## **GEOLOGY, SEISMOLOGY, AND GEOTECHNICAL ENGINEERING**

### **Southern Nuclear Presentation (Applicant slides 42 through 69)**

Mr. McCallum gave a brief overview of his presentation. Then he described Southern Nuclear's seismic program organization including the technical support Southern Nuclear received (is receiving) from Bechtel, William Lettis & Associates, Risk Engineering, Bechtel San Francisco, and the Savannah River Site. Southern Nuclear's seismic program organization also received technical advice from a four person Ground Motion Review and Advisory Panel.

Mr. McCallum showed how the site will be laid out. Units 3 and 4 will be located side-by-side (800 feet apart) about 2000 feet west of the existing Units 1 and 2. Site grade elevation is 220 feet above mean sea level.

Southern Nuclear's evaluation of the tectonic features in the region involved a literature review, contacting local researchers, aerial reconnaissance, air photo interpretation, field reconnaissance, review of seismicity, seismic reflection profiles at Vogtle, and geomorphic analysis of river terraces. It took the better part of a year to complete. The last two items were

done to locate and assess the capability of the Pen Branch fault, located below the site. From south of the plant looking northeast, the fault runs from left to right, at a 45° down angle, from a depth of about 550 feet below sea level (i.e., the fault tip) down to a depth of roughly 2000 feet below sea level. On the left side of the fault (again looking northeast from just south of the plant) there is Paleozoic crystalline basement rock. On the right side of the fault is Triassic Dunbarton Basin sandstone. Each subsurface material has different shear wave velocities. If the fault passed underneath the site, one plant could be on crystalline rock while the other might be over sandstone, and that would affect the applicant's model for seismic ground motion. Bedrock is at a depth of about 1050 feet below grade. Coastal plain sediments lie above the bedrock. However, there is a large layer of marl directly below the VEGP site. The top of the Blue Bluff Marl lies about 86 feet below grade and is an approximately 76 foot thick layer of very hard clay. There is a layer of upper sands above the Blue Bluff Marl. Directly below and to the left of the fault tip there is 100-foot slip in the bedrock. Above the fault slip there is a 40-50 foot monocline in the Blue Bluff Marl sloping down and to the left. The applicants deep boring (B1003) went down to a depth of 1338 feet and was located just below the proposed Unit 3 site. Southern Nuclear determined that the Pen Branch fault lies about 670 feet north west of Unit 4. They also determined that the Pen Branch fault is non-active not capable. Dr. Powers questioned the use of river surveys and looking for terraces (e.g., the Ellenton Terrace) to conclude that there has no movement of the Pen Branch fault in quite some time. Mr. Lindvall explained that the fact that the terracing is preserved and that it is directly over the Pen Branch fault was key to helping the applicant reach its conclusion. Because there is no capable fault underneath the site the applicant can focus on the seismic threat from the Charleston seismic zone. In summary, Mr. McCallum said that none of the tectonic features within the site vicinity (25 miles) or site area (5 miles) are capable tectonic sources and that non-tectonic deformation and related features can be mitigated by the removal of strata overlying the Blue Bluff Marl. These are the same conclusions that the applicant reached when licensing Units 1 and 2. Dr. Powers questioned whether certain features in the Rappahannock River might be indicative of tectonic activity (i.e., Weems' ridges). Mr. Lindvall said that Mr. Robert Weems from USGS postulated in 1998 that certain features in the Rappahannock River (where the coastal plain meets the Piedmont seismic zone) could have been caused by tectonic activity, fluctuations in sea level, or differences in the erodability of different types of rock. Mr. Lindvall said that the fact that Pliocene Age deposits across these features showed no measurable deformation precluded them from being tectonic in nature. He offered several other reasons that precluded these from being tectonic features as well (e.g. similar expressions are not seen across the nearby countryside, the direction of the slip as compared to other faults in the Appalachians).

Mr. Lindvall, William Lettis & Associates, described how the applicant determined the seismic ground motion. Southern Nuclear's probabilistic seismic hazards analysis (PSHA) was developed using Regulatory Guide 1.165. The applicant assessed the additional effects of seismicity from 1985 through mid-2005 and then updated the Electric Power Research Institute - Seismicity Owners' Group (EPRI-SOG) seismic sources to account for new source information. Finally, the applicant used the actual updated ground motion models that were provided in the EPRI-SOG (EPRI 2004). Southern Nuclear updated the Charleston seismic source by taking a weighted average of four postulated sources. Most estimates of the Charleston seismic source place the source on shore in the meizoseismal region. Dr. Powers asked about the completeness of the paleoliquefaction observations (i.e., negative indications

as well as positive indications). Mr. Lindvall showed curves that represent the mean uniform hazard spectrum for rock for Vogtle. The curve dropped off sharply from 25 to 100 hertz (somewhat an artifact of how the data was plotted). Mr. McCallum described how Southern Nuclear took the uniform hazard rock curves and developed the soil hazard curves. First they developed the soil profile and properties. Then they determined soil amplitudes for multiple rock input amplitudes (frequencies from 100 Hz to 0.1 Hz) (1D SHAKE analysis) using M and R from de-aggregation (high- and low-frequency spectra). Finally, they combined the rock hazard with the site amplification (including uncertainties in input motion and soil properties) to obtain the soil uniform hazard spectra for multiple mean annual frequencies of exceedance (i.e., in accordance with Approach 2A in NUREG/CR-6728). Mr. McCallum showed a graph that displayed the soil-rock shear wave velocities down to about 2200 feet. The Blue Bluff Marl, lower sands, bedrock, and below were clearly evident. From that the applicant developed the safe shutdown earthquake (SSE) at Vogtle using ASCE 43-05 performance-based procedures. The SSE presented in the ESP was defined at a ground surface at a hypothetical outcrop of the highest competent in-situ material (i.e., top of the Blue Bluff Marl at approximately 86 foot depth). The applicant then calculated the vertical ground motion spectra from that horizontal spectra by taking a ratio of the two. That is: Vertical SSE = V/H times Horizontal SSE.

Mr. McCallum described the subsurface investigation that was done at the Vogtle ESP site. The applicant did 14 borings for the ESP, one to a depth of 1,338 feet (290 feet into hard rock). The applicant also did 12 cone penetration tests, three of which were seismic cone penetration tests. The applicant did geophysical testing in three of the boreholes (suspension P-S velocity logging, caliper/natural gamma measurements, resistivity/spontaneous potential measurements, boring deviation measurements). Southern Nuclear also put in 15 new ground-water observation wells, 10 in the upper aquifer and 5 in the lower aquifer (below the Blue Bluff Marl). They did laboratory testing on the soil from the 14 borings. They also used the soils information they had developed when licensing Units 1 and 2 as well as data from the Savannah River Site. Using all this data the applicant characterized the upper sands (Barnwell Group) as very loose to very dense sands with an average thickness of about 90 feet. The ground-water elevation in the upper sands is at 165 feet above mean sea level (or 55-60 feet below grade). So there is about 30-35 feet of ground-water above the Blue Bluff Marl. The Blue Bluff Marl (Lisbon formation) is very hard, slightly sandy, cemented, calcareous silt/clay with an average thickness of 76 feet. The lower sands (costal plain deposits) are dense with a thickness of about 900 feet. Bedrock is at about 1050 feet and below this level is Dunbarton Basin triassic sandstone. The applicant proposes to remove the upper sands and replace it with a compacted engineered fill, as was done for Units 1 and 2. Mr. McCallum showed top and side views of the planned excavation, which will include the excavation of a 45° zone-of-influence below where the nuclear island, turbine building, rad waste building, etc. will be placed. Mr. McCallum repeated that the Vogtle ESP SSE is defined at the free ground surface of a hypothetical outcrop of the highest competent in-situ layer (top of the Blue Bluff Marl). This is called the site-specific ground motion response spectra (GMRS). At the COL stage, the applicant will propagate the GMRS through the engineered backfill to a depth of 40 feet, where the AP1000 nuclear island will be placed. This will be called the foundation input response spectra (FIRS). The shape of the FIRS will be similar to the shape of the GMRS, but it will be slightly amplified. The AP1000 plants placed on the Vogtle site will be designed to the AP1000 certified design response spectra and not the FIRS. Any exceedances of the FIRS over the certified design response spectra would need to be evaluated. However, Mr. Moore said that

preliminary indications suggest that the FIRS at Vogtle will fall below the certified design response spectra. Ms. Sterdis said that the AP1000 standard plant piping would be designed to a bounding spectra and not to a site-specific spectra.

#### **NRC Staff Presentation (Second set of staff slides 1 through 33)**

Mr. Stirewalt presented the staff's basic geologic and seismic information. He said that since the Pen Branch fault dipped beneath the ESP site the staff wanted to make absolutely certain that the fault was not capable. He characterized the Pen Branch fault as being approximately 25 miles in length, exhibits no expression of surface displacement, and exhibits no seismic activity. Mr. Stirewalt said that applicant found that there was no stratigraphic evidence of fault movement in the last 33.7 my (post-Eocene). He said the applicant evaluated the Savannah River terraces for evidence of local fault displacement during the past 1.8 my (Quaternary) and found none. He said that it is only when they have seen fault displacement within the last 1.8 my that they start to be concerned. Mr. Stirewalt agreed with the applicant's conclusion that field evidence indicates that the Pen Branch fault is not a capable fault. Dr. Powers asked the staff if they agreed with the applicant that the Eastern Tennessee zone is outside the domain of interest. Ms. Gonzalez said that applicant did not include the Eastern Tennessee zone because it contributed to less than 1% of the total hazard.

Ms. Gonzalez said that the staff had two open items related to the applicant's update to the Charleston seismic source zone. The applicant's update of the 1986 EPRI source model involved significant changes in geometry, maximum magnitudes ( $M_{max}$ ), and recurrence interval. She said that the average recurrence interval of  $M_{max}$  earthquakes decreased significantly, thus increasing the overall hazard. The update was based on liquefaction features from historic and pre-historic earthquakes.

Ms. Bauer provided the Subcommittee with a brief discussion of liquefaction. Liquefaction can occur in response to strong ground motion. She said that susceptibility to liquefaction is a function of the site characteristics and that they commonly occur in the form of sand blows and associated sand dikes. Ms. Bauer said there is abundant liquefaction features from both historic and prehistoric earthquakes along the South Carolina coast for about 130 miles northeast to southwest, and then there are a few along the Edisto River approximately 65 miles inland from Charleston. Paleoliquefaction features formed from prehistoric earthquakes. Dr. Powers asked how one dates a liquefaction feature. Ms. Bauer explained the sand blows often cross cut layers of subsurface material and entrain organic materials which can then be dated (e.g., by luminescence or carbon dating). Archeology can sometimes also be used to help date the liquefaction. Again, Dr. Powers asked what the probability of detecting the liquefaction is versus the number of places where it actually occurred. He noted that you can only find them where you can see them. Ms. Bauer said that sandblows can sometimes be detected using aerial photography, archeology, or ground-penetrating radar. Ms. Bauer showed several photos of liquefaction features from the Charleston earthquake of 1886. paleoliquefaction features, documented since the 1989 EPRI study, contributed to the update to the Charleston source zone. Liquefaction features suggest 5 similar magnitude earthquakes (in addition to the 1886 event) during the past approximately 5,000 years. Consequently, the estimated recurrence interval for large earthquakes in the Charleston area has been revised to every 500-600 years based on a complete 2,000 year history and every 900-1,000 years based on a

complete 5,000 year history. The staff concluded that the applicant did not provide sufficient paleoliquefaction evidence to rule out the occurrence of large inland earthquakes. In addition, the occurrence of a large earthquake, inland from the coast, may necessitate a different Charleston source zone model.

Ms. Gonzalez said that the staff has a second open item related to the applicant's process for updating the Charleston seismic source. The applicant used a Senior Seismic Hazard Analysis Committee (SSHAC) Level 2 process to perform the update. The applicant designated a technical intergator who was responsible for conducting the literature review and contacting the appropriate experts. The technical integrator was also responsible for integrating current literature and expert's views into a final model. The staff requested additional details regarding the expert elicitation process (i.e., the questions asked of the experts and the their responses, the process used to combine the expert's responses). Ms. Gonzalez said that the applicant did not update either the regional seismic source zones that encompass the ESP site or the eastern Tennessee seismic zone located just outside the 200-mile radius from the site. The applicant did not update the eastern Tennessee seismic source zone because it contributed to less than 1% of the hazard, not because it was outside the 200-mile radius. Because the staff believes that new information exists that suggests that updates to these sources may be warranted, the staff made each update an open item. The EPRI seismic source zones were determined by six Earth Science Teams during the 1980s. The Dames and Moore team assigned low weights for larger  $M_{max}$  values (and low probabilities of activity) to two of their regional source zones. In fact, 10-Hz total mean hazard curve produces by the Dames and Moore team was about an order of magnitude lower than those produced by the other five teams. Therefore, the staff believes the Dames and Moore hazard curves for the ESP site may not adequately characterize the regional hazard. Ms Gonzales said that following the development of its open item, it found the following quote in DOE Standard 1024-92:

Risk engineering, Inc. has also found that the EPRI team of Dames and Moore does not fully account for historic seismicity near the Savannah River Site (SRS). One reason for this is the fact that the SRS host source zone was given a low probability of activity. Risk Engineering, Inc. recommended that the Dames and Moore seismic source input not be used to calculate the seismic hazard at SRS."

Mr. Davis said that he thought this quote might have been taken out of context. Mr. McGuire, Risk Engineering, Inc., said that his firm had been asked to review the seismic hazard at the SRS shortly after the EPRI study, and a similar study by Lawrence Livermore, were published in 1989. Risk Engineering, Inc. was evaluate the differences in the two studies and come up with a common set of seismic hazard curves for the SRS. Their conclusion was that if you dropped the Dames and Moore seismic hazard curve from the EPRI study and dropped two or three of the high curves from the Lawrence Livermore study, the remaining curves overlapped and could be used for decision making at SRS. He also said that a subsequent SSHAC project (1997) recommended that the data/information from all teams be used. However, subjective probabilities could be assigned to the information, so long as the basis for assigning the probabilities is documented. He added that this latter SSHAC recommendation was incorporated into the EPRI-SOG documents and endorsed in Regulatory Guide 1.165. Dr. Munson clarified that Regulatory Guide 1.176 calls for updating the EPRI seismic source model if there are new interpretations or new data. He added that while there is no new data, the staff considered the quoted text above to be a new interpretation.

With regard to updating the eastern Tennessee seismic zone  $M_{max}$  values, the applicant concluded that no new information has been developed since 1986 that would require significant revision to the EPRI seismic source model. The staff, on the other hand, concludes that recent studies suggest significant revisions to the EPRI seismic source model are warranted. The staff cited analyses of earthquake focal mechanisms and hypocenter locations (Chapman et. Al., 1997; Dunn and Chapman, 2005) which indicates a series of northeast trending basement faults, intersected by several east-trending faults. Ms. Gonzalez said that the inferred fault lengths (approximately 20 to 50 km) are large enough to produce significant earthquakes (approximately  $M_w$  7+). She said that while the largest recorded earthquake in the eastern Tennessee seismic zone is only a magnitude 4.6, a recent study by Chapman concluded that the historical record is too short to rule out the possibility of larger (greater than magnitude 5) earthquakes. Furthermore, the mean  $M_{max}$  values for the EPRI study (approximately 6.2) are significantly lower than more recent mean  $M_{max}$  values, which ranged from  $M_{max}$  6.3 to  $M_{max}$  7.5. Ms. Gonzalez said the  $M_{max} = 7.5$  came from the USGS National Hazard map 2002 and the  $M_{max} = 6.3$  came from South Carolina Department of Transportation (SCDOT). Therefore, the staff concluded that the applicant was not adequately justified in its decision not to update the eastern Tennessee seismic zone or perform sensitivity studies to determine the impact of updating the seismic zone. Mr. McGuire, Risk Engineering, Inc., said that they had contacted Dames and Moore within the last two weeks to confirm their opinion that there are certain sources in the coastal plain and in the Piedmont that with some probability are not active in the sense of producing or generate earthquakes with a magnitude of 5 or greater.

Ms. Gonzalez said that the applicant described three post-EPRI PSHA studies which involved the characterization of seismic sources within the ESP site region (i.e., USGS, 2002; SCDOT, 2002; and the NRC TIP study, NUREG/CR-6607). The applicant dismissed the NRC's TIP study because it focused on the implementation of the SSHAC PSHA methodology. The staff believes that much of the data and results contained in the TIP study report may be applicable to the ESP site.

In discussing surface faulting, Mr. Stirewalt said that there is stratigraphic information which suggests certain sand dikes may be as young as 1.8 my to 10,000 years (Pleistocene). He said that the applicant did not clearly show that these sand dikes are spatially related to dissolution depressions. The staff believes that these fluid/plastic injections of sand could be associated with seismicity and liquefaction. Therefore, the staff has asked the applicant for a detailed description of the dike characteristics, the spatial associations, and the stratigraphic age of the dikes.

Mr. Li indicated that the staff has a total of about 12 open items on the subsurface material static and dynamic properties. He said that the applicant performed limited borings and tests to characterize the static properties of the load-bearing layer. He noted that only 3 of the 14 boring done by the applicant for the ESP penetrated through the Blue Bluff Marl. The applicant relied on results from the Unit 1 and 2 investigations (1970) for soil properties such as internal friction angle, unit weight, and undrained shear strength. Mr. Li said that the regulatory requirements and testing technology have changed since that time. Mr. Munson said that is also significant differences between the Unit 1 and 2 data and the ESP data (e.g., the

undrained shear strength of the Blue Bluff Marl was on the order of 10,000 psf for Units 1 and 2 and on the order of 150 to 4,300 psf for the ESP site). The applicant did not conduct laboratory tests on soil samples to determine the soil dynamic properties. Mr. Li said that these dynamic properties are needed to determine the site-specific ground motion response spectra (GMRS). The GMRS is equivalent to the SSE and is compared to the DCD design spectra at the COL stage. The staff acknowledged that the applicant has conducted more explorations and testing of the subsurface materials after submission of the ESP application (e.g., an additional 174 borings in support of LWA-2).

### **RADIOLOGICAL CONSEQUENCES OF DESIGN BASIS ACCIDENTS (DBAS)**

#### **Southern Nuclear Presentation (Applicant slides 70 through 73)**

Mr. Davis said that Southern Nuclear's methodology was to take the accident doses developed in the AP1000 analyses and adjust them using their site-specific diffusion estimates (own meteorological data) to arrive at the dose estimates. That is, they multiplied the DCD doses by the ratio of the site versus DCD  $\chi/Q$  values. The VEGP generated dose estimates were bounded by the DCD analysis. Mr. Davis showed a table that DCD  $\chi/Q$  values, site  $\chi/Q$  values, and ratio for loss of coolant accidents and other accidents at both the exclusion area boundary (EAB) and in the low population zone (LPZ). He also showed a table that listed the Vogtle-specific doses at the EAB and LPZ for various accidents and compared them to the regulatory limit.

#### **NRC Staff Presentation (Third set of staff slides 1 through 9)**

Ms. Hart started her presentation by identifying the applicable regulations (i.e., 10 CFR 50.17, Part 100, 10 CFR 50.34) and dose limits (i.e., 25 rem total whole body dose equivalent for any 2-hour period at the EAB after the onset of an accident, 25 rem total whole body dose equivalent for the duration of the accident in the LPZ). She said that the applicant used the AP1000 DCD Tier 1 design reference atmospheric dispersion factors ( $\chi/Q$  values) for the EAB and LPZ. Ms. Hart said that Westinghouse had used accident-specific release rates, obtained in a response to an request for additional information, and the guidance in Regulatory Guide 1.183, to arrive at accident-specific source terms for the AP1000 design. Ms. Hart said that site-specific short-term  $\chi/Q$  values for each offsite receptor were less than the AP1000 design reference  $\chi/Q$  values for each time averaging period. Her example showed one to be much less. As stated by the applicant, the accident dose for the site is the DCD dose adjusted by a factor to account for the difference in site-specific  $\chi/Q$  values to design reference  $\chi/Q$  values. Therefore, the dose for each time averaging period is directly related to the  $\chi/Q$  value for that period. The ratio for each averaging period is less than one, therefore the dose for the site is always less than the dose specified in the DCD. The staff said that this can be confirmed by taking the source release from the proposed plant for each DBA and calculating site-specific DBA doses using site-specific  $\chi/Q$  values. The staff finding was that since the AP1000, Revision 15, DBA radiological analyses was shown to meet the 10 CFR50.34(a)(1) siting dose criteria and since the site-specific accident doses were shown to be less than the AP1000, Revision 15 doses, then the Vogtle ESP site meets the 10 CFR50.34(a)(1) siting dose criteria for DBAs. The staff concluded by saying that if the COL applicant chooses to use the next

revision of the AP1000 DCD (which could change the AP1000 accident source terms or reference  $\chi/Q$  values), the staff would reevaluate that and make sure the applicant stays within the Vogtle ESP source terms and  $\chi/Q$  values.

**NRC STAFF'S CONCLUSIONS** (First set of staff slides 38 through 41)

Mr. Araguas said that the SER defers the general regulatory conclusion regarding site safety and suitability until all open items have been addressed and the staff issues its final SER. He mentioned several conclusions from SER sections without any open items:

- The applicant has provided appropriate quality assurance measures equivalent to those in Appendix B to 10 CFR Part 50.
- The applicant has demonstrated that radiological effluent release limits associated with normal operation, from the type of facility proposed to be located at the site, can be met for any individual located offsite (10 CFR 100.21(c)(1)).
- The radiological consequences of postulated accidents meet the criteria set forth in 10 CFR 50.34(a)(1) for the type of facility proposed to be located at the site (10 CFR 100.21(c)(2)).
- Potential hazards associated with nearby transportation routes, industrial, and military facilities pose no undo risk to facilities that might be constructed on the site (10 CFR 100.21(e)).
- Site characteristics are such that adequate security plans and measures can be developed (10 CFR 100.21(f)).

Mr. Araguas said that the SER with open items was issued on August 30, 2007, with 40 open items, 2 permit conditions, and 19 COL action items. He said that the number of permit conditions were fewer than for previous ESP applicants, probably because Southern Nuclear referenced a specific reactor design. The applicant responded to the open items on October 15, 2007. The staff is reviewing the applicant's responses and supplemental information associated with LWA-2. Mr. Araguas said that the staff hoped to complete its review of the Vogtle ESP application in the March time frame and that the next interaction with the ACRS will tentatively be in June 2008 for review of the staff's final SER. Dr. Power suggested a half day subcommittee meeting in advance of a full Committee session might be appropriate in light of seismic issues associated with the Vogtle ESP application.

**STATUS OF IMPLEMENTING LESSONS LEARNED WHILE CONDUCTING LICENSING ACTIVITIES PURSUANT TO 10 CFR PART 52**

Dr. Powers introduced the discussion by saying that the Commission had asked for the Committee's assessment of the staff's implementation of lessons learned (i.e., in a Staff

Requirements Memorandum dated November 8, 2006). He acknowledged that by this time he did not expect that the staff would have fully assimilated all the lessons learned and implemented them flawlessly.

In the way of background, Mr. Araguas said that the staff had ostensibly completed three ESP reviews and has one still ongoing, the Vogtle ESP review. He acknowledged that the staff had met with the ACRS and ESP applicants in September 2006 on ESP lessons learned. He summarized ten ESP lessons learned, as documented in the Committee's September 22, 2006, letter to the Executive Director for Operations. Then for each lesson learned, he listed activities the staff has completed, is currently working on, or has planned to implement that lesson learned.

The lessons and synoptic accounts of staff actions are provided below.

**Develop common understanding between the staff and applicants concerning expectations.**

The staff has completed pertinent updates to NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants;" issued Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants;" and has developed Office Instruction NRO-REG-100, "Acceptance Review Process for Design Certifications and Combined License Applications." Furthermore, the staff has been interacting with the nuclear industry and potential applicants through the Design-Centered Working Groups.

The staff has done much to facilitate the development of common understandings. This is a most important undertaking and will continue to need attention. An incomplete understanding of staff expectations by the applicant resulted in many requests for additional information and open items in the staff's Safety Evaluation Report (SER) for the ongoing Vogtle early site permit application.

**Clarify the applicability of 10 CFR Part 21, "Reporting of Defects and Noncompliance," requirements for early site permit applications.**

10 CFR Part 52 makes it clear that 10 CFR Part 21 is applicable to early site permit applicants.

**Clarify the applicability of 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants," requirements for early site permit applications.**

Again, 10 CFR Part 52 makes it clear that the Appendix B quality assurance requirements are applicable to early site permit applicants.

**Develop improved guidance on electronic submission of applications.**

The staff has improved and clarified the process for electronic submission of applications. This has included documentation and even video clips of the process. However, additional progress can still be made in this area.

**Incorporate into staff guidance definitions of terms such as “License Conditions” and “COL action items.”**

The staff has incorporated these definitions into the Standard Review Plan and has trained reviewers regarding the definitions.

**Develop guidance for the review of the performance-based methodology for assessing seismic hazards.**

The staff has issued Regulatory Guide 1.208, “A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion.”

**Review the development and study of long-term weather cycles for periods of up to 100 years.**

The staff has made appropriate modifications to the Standard Review Plan to recognize that there are cycles in the weather. Such cycles are especially well known for the east coast of the United States. The staff has made contact with knowledgeable technical societies, will be attending pertinent scientific conferences, and is proposing research studies of trends in the frequencies and intensities of hurricanes.

**Update guidance for the review of site hydrology.**

The staff has updated the Standard Review Plan. It is updating its regulatory guide on analysis of flooding. The staff is also investigating possible threats to coastal nuclear power plants posed by tsunamis including tsunamis that might come from submarine landslides in the Cape Verde islands.

**Develop guidance for the treatment of the high frequency component of seismic ground motion.**

The staff has provided guidance in both the Standard Review Plan and in Regulatory Guide 1.208.

**Develop guidance on the use of Internet data.**

The staff had not taken action on the Committee’s recommendation that they develop guidance to ensure that data obtained from the Internet are valid now and retrievable in the future. At many points in the early site permit applications data derived from the Internet are used. The Committee expects increased reliance on Internet databases in the future. Data obtained from the Internet do not have the immutable quality of the printed page. Such data can be altered by intent, through misadventure or through malice. Therefore, the NRC needs to provide applicants with guidance to ensure that data they obtain from the Internet are valid in the sense that they reflect the intent of the developer of the database. The data may be needed long after an early site permit has been approved and after many revisions of the electronic site from which the data were originally obtained. Consequently, guidance on ensuring the retrievability

of the data is also needed. Furthermore, based on the Committee's recent review of the Vogtle early site permit application, it may be necessary for the NRC to interact with other government agencies to assist applicants in obtaining the validation that the staff feels is necessary for the data provided by these agencies via the Internet.

### **General Questions and Observations from the Subcommittee Members**

The staff has undertaken a thorough review and, where appropriate, independent analysis of the Vogtle early site permit application.

The staff has requested that the applicant further assess the post-construction hydrology of the site, the seismic hazard at the site, and weather extremes at the site.

The decision by the applicant to propose a specific nuclear power plant design in conjunction with the early site permit application has probably resulted in fewer permit conditions in the SER on the application.

The NRC staff has moved effectively to address within the regulatory process many of the lessons learned from the reviews of early site permit applications.

The staff still needs to provide guidance to applicants on adequate measures to ensure the quality, integrity, and retrievability of data obtained from the Internet.

### **Subcommittee's Action**

The staff and the applicant plan to provide a briefing on Vogtle ESP application to the full Committee during the November 1-3, 2007, ACRS meeting. Dr. Powers asked the staff to present the same lessons learned presentation that it made to the Subcommittee to the full Committee during the November 1-3, 2007, ACRS meeting.

### **Documents Provided to the Subcommittee**

1. Memorandum dated November 8, 2006, from Annette L. Vietti-Cook, Secretary, NRC, to John T. Larkins, Executive Director, ACRS, Subject: Staff Requirements — Meeting with Advisory Committee on Reactor Safeguards, 2:30 p.m., Friday, October 20, 2006, Commissioners' Conference Room, One White Flint North, Rockville, Maryland (Open to Public Attendance).
2. Southern Nuclear Operating Company, Vogtle Early Site Permit Application, Revision 2, April 2007, NRC Docket No. 52-00011.
3. U.S. Nuclear Regulatory Commission, Safety Evaluation Report With Open Items, "Safety Evaluation Report For The Vogtle Early Site Permit Application," August 30, 2007.
4. Status Report dated October 2, 2007, from David C. Fischer, Senior Staff Engineer,

ACRS, to Dana Powers, ACRS, Subject: Meeting of the Early Site Permit Subcommittee, October 24, 2007 - Rockville, Maryland.

5. Report dated October 12, 2007, from William J. Hinze, Advisory Committee on Nuclear Waste and Materials, to Dana Powers, ACRS, Subject: Review of Vogtle Early Site Permit Application and NRC's Safety Evaluation Report for the Vogtle Application.

\*\*\*\*\*

**NOTE :** Additional details of this meeting can be obtained from a transcript of this meeting available for downloading or viewing on the Internet at <http://www.nrc.gov/reading-rm/adams.html> or <http://www.nrc.gov/reading-rm/doc-collections/> can be purchased from Neal R. Gross and Co., 1323 Rhode Island Ave., N.W., Washington, DC 20005 (202) 234-4433.

NRC EXPORT LICENSE APPLICATION FOR HIGH-ENRICHED URANIUM

Name of applicant, date of application, date received, application No., docket No.	Description of material		Description of amendment end use	Country of destination
	Material type	Total qty		
Transnuclear, Inc., September 18, 2007, September 20, 2007, XSNM03060/03, 11005070.	High-Enriched Uranium (HEU) (93.60%).	Total quantity of HEU authorized for export remains unchanged.	License is amended to: (1) transfer the current license from Transnuclear, Inc. to BWXT NOD-L as licensee; (2) remove BWXT and insert DOE/NNSA and BWXT Y-12, LLC as "Other Parties to Export"; and (3) extend the license expiration date from 12/31/07 to 12/31/12. HEU is used to produce medical radioisotopes.	Canada.

Dated this 27th day of September 2007 at Rockville, Maryland.

For the U.S. Nuclear Regulatory Commission.

Scott W. Moore,

Deputy Director, Office of International Programs.

[FR Doc. E7-19492 Filed 10-2-07; 8:45 am]

BILLING CODE 7590-01-P

NUCLEAR REGULATORY COMMISSION

Advisory Committee on Nuclear Waste and Materials Meeting on Planning and Procedures; Notice of Meeting

The Advisory Committee on Nuclear Waste and Materials (ACNW&M) will hold a Planning and Procedures meeting on October 17, 2007, Room T-2B3, 11545 Rockville Pike, Rockville, Maryland. The entire meeting will be open to public attendance, with the exception of a portion that may be closed pursuant to 5 U.S.C. 552b(c)(2) and (6) to discuss organizational and personnel matters that relate solely to internal personnel rules and practices of ACNW&M, and information the release of which would constitute a clearly unwarranted invasion of personal privacy.

The agenda for the subject meeting shall be as follows:

Wednesday, October 17, 2007—4 p.m.—5:30 p.m.

The Committee will discuss proposed ACNW&M activities and related matters. The purpose of this meeting is to gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full Committee.

Members of the public desiring to provide oral statements and/or written comments should notify the Designated Federal Officer, Dr. Antonio F. Dias (Telephone: 301/415-6805) between 8:15 a.m. and 5 p.m. (ET) 5 days prior

to the meeting, if possible, so that appropriate arrangements can be made. Electronic recordings will be permitted only during those portions of the meeting that are open to the public. Detailed procedures for the conduct of and participation in ACNW&M meetings were published in the Federal Register on September 26, 2007 (72 FR 54693).

Further information regarding this meeting can be obtained by contacting the Designated Federal Officer between 8:15 a.m. and 5 p.m. (ET). Persons planning to attend this meeting are urged to contact the above named individual at least 2 working days prior to the meeting to be advised of any potential changes in the agenda.

Dated: September 27, 2007.

Antonio F. Dias,

Chief, Nuclear Waste & Materials Branch.

[FR Doc. E7-19502 Filed 10-2-07; 8:45 am]

BILLING CODE 7590-01-P

NUCLEAR REGULATORY COMMISSION

Advisory Committee on Reactor Safeguards (ACRS) Meeting of the Subcommittee on Early Site Permits; Notice of Meeting

The ACRS Subcommittee on Early Site Permits will hold a meeting on October 24, 2007, Room T-2B3, 11545 Rockville Pike, Rockville, Maryland.

The entire meeting will be open to public attendance.

The agenda for the subject meeting shall be as follows:

Wednesday, October 24, 2007—8:30 a.m. until 5 p.m.

The Subcommittee will review and discuss the application submitted by Southern Nuclear Operating Company (Southern Company or SNC—the applicant) for the Vogtle early site permit and the associated NRC staff safety evaluation report (SER) with open

items. The Committee must review the application and the final SER to fulfill the requirement of 10 CFR 52.23 that the ACRS report on those portions of an early site permit application that concern safety. The Subcommittee will hear presentations by and hold discussions with representatives of the NRC staff, Southern Nuclear Operating Company, and other interested persons regarding this matter. The Subcommittee will also discuss with the NRC staff the efficiency and effectiveness of staff's implementation of lessons learned from its review activities performed pursuant to 10 CFR part 52. The Subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full Committee.

Members of the public desiring to provide oral statements and/or written comments should notify the Designated Federal Officer, David C. Fischer (telephone 301/415-6889) 5 days prior to the meeting, if possible, so that appropriate arrangements can be made. Electronic recordings will be permitted. Detailed procedures for the conduct of and participation in ACRS meetings were published in the Federal Register on September 26, 2007 (72 FR 54695).

Further information regarding this meeting can be obtained by contacting the Designated Federal Officer between 7:15 a.m. and 4 p.m. (ET). Persons planning to attend this meeting are urged to contact the above named individual at least two working days prior to the meeting to be advised of any potential changes to the agenda.

Dated: September 26, 2007.

Cayetano Santos,

Chief, Reactor Safety Branch.

[FR Doc. E7-19494 Filed 10-2-07; 8:45 am]

BILLING CODE 7590-01-P



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, D. C. 20555

September 26, 2007

MEMORANDUM TO: Cayetano Santos, Chief  
Reactor Safety Branch, ACRS

FROM: David C. Fischer, Senior Staff Engineer 

SUBJECT: FEDERAL REGISTER NOTICE REGARDING THE  
MEETING OF THE ACRS SUBCOMMITTEE ON EARLY  
SITE PERMITS, OCTOBER 24, 2007, ROCKVILLE,  
MARYLAND

Attached is a *Federal Register* Notice regarding the subject meeting. Please have this Notice transmitted for publication as soon as possible.

Attachment:  
FR Notice

cc with Attachment:  
D. Powers, ACRS  
J. Szabo, OGC  
A. Bates, SECY  
D. Pelton, OEDO  
S. Burnell, OPA  
C. Araguas, NRO  
S. Coffin, NRO  
W. Reckley, NRO  
Y. Li, NRR  
M. Hart, NRR  
PMNS  
Public Document Room

NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)  
MEETING OF THE SUBCOMMITTEE ON EARLY SITE PERMITS

Notice of Meeting

The ACRS Subcommittee on Early Site Permits will hold a meeting on October 24, 2007, Room T-2B3, 11545 Rockville Pike, Rockville, Maryland.

The entire meeting will be open to public attendance.

The agenda for the subject meeting shall be as follows:

Wednesday, October 24, 2007 – 8:30 a.m. until 5:00 p.m.

The Subcommittee will review and discuss the application submitted by Southern Nuclear Operating Company (Southern Company or SNC – the applicant) for the Vogtle early site permit and the associated NRC staff safety evaluation report (SER) with open items. The Committee must review the application and the final SER to fulfill the requirement of 10 CFR 52.23 that the ACRS report on those portions of an early site permit application that concern safety. The Subcommittee will hear presentations by and hold discussions with representatives of the NRC staff, Southern Nuclear Operating Company, and other interested persons regarding this matter. The Subcommittee will also discuss with the NRC staff the efficiency and effectiveness of staff's implementation of lessons learned from its review activities performed pursuant to 10 CFR Part 52. The Subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full Committee.

Members of the public desiring to provide oral statements and/or written comments should notify the Designated Federal Officer, David C. Fischer (telephone 301/415-6889) 5 days prior to the meeting, if possible, so that appropriate arrangements can be made. Electronic recordings will be permitted. Detailed procedures for the

conduct of and participation in ACRS meetings were published in the *Federal Register* on September 26, 2007 (72 FR 54695).

Further information regarding this meeting can be obtained by contacting the Designated Federal Officer between 7:15 a.m. and 4:00p.m. (ET). Persons planning to attend this meeting are urged to contact the above named individual at least two working days prior to the meeting to be advised of any potential changes to the agenda.

Date: 9/26/07

Cayetano Santos Sr  
Cayetano Santos, Chief, Reactor Safety Branch

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE MEETING ON EARLY SITE PERMITS

October 24, 2007

Date

NRC STAFF SIGN IN FOR ACRS MEETING

PLEASE PRINT

	<u>NAME</u>	<u>ORGANIZATION</u>
1	Kenneth See	NRO/DSEER/RHEB
2	CHRISTOPHER CODIL	NRO/DSEER/RHEB
3	ALBERT TARDIFF	NSIR/DSP/RSLPB
4	Christopher E. Bane	SNC-EP
5	THEODORE AMUNDSON	SNC
6	Seshagiri Rao Tammana	NRO/DSEER/RSAC
7	MILTON CONCEPCION	NRO/DCIP/CAVP
8	Tomika Terry	NRO/DSEER/RGS1
9	Meralis Plaza-Tokdo	NRO/DSEER/RGS1
10	Laurel Bauer	NRO/DSEER/RGS2
11	Wayne Breganowsky	NRO/DSEER/RGS2
12	Rebecca Keras	NRO/DSEER/RGS1
13	JAMES GEORGE	NRO/DSEER/RGS1
14	Sarah Gonzalez	NRO/DSEER/RGS1
15	Cliff Munson	NRO/DSEER/RGS1
16	Tom Nicholson	RFS/DCA
17	Yong Li	NRO
18	Thomas Cheng	NRO
19	Paul Costantini	BAOL
20	Zahira Cruz Perez	NRO/DSEER/RGS2
	Mike Lee	ACNATH

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE MEETING ON EARLY SITE PERMITS

October 24, 2007

Date

NRC STAFF SIGN IN FOR ACRS MEETING

PLEASE PRINT

	<u>NAME</u>	<u>ORGANIZATION</u>
1	Charles Cox	NRO/DSER/RSAC
2	Frankie G. Vega	NRO/DSER/RGS2
3	Prosanta Chowdhury	NSIR/DPF/LIB
4	Nilesh Chokshi	NRO/DER
5	Stephanie Coffin	NRO/DNRC/NWE1
6	MARK NOTICY	NRO/DSER/RAP1
7	Joseph Hoch	NRO/DSER/RSAC
8	Charles Mueller	U.S. Geological Survey
9	Russell Wheeler	USGS
10	Brad Harney	NRO/DSER/RSAC
11	G. STEWART	NRO/DSER/RGS2
12	WEIJUN WANG	NRO/DSER/RGS1
13	Jonathan Rund	NRC/OGC
14	Geertam Bagchi	NRC/NRO
15	Hosung Ahn	NRC/NRO/DSER
16	Thomas Galletta	NRC/NRO/DSER/RSAC
17	Mark Thaggard	NRC/NRO/DSER/RHEB
18	Michelle Hart	NRC/DSER/RSAC
19	Bruce Musico	NRC/NSIR/EPD
20	Stephan R Monague	NRC/NRO/DNRC

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE MEETING ON EARLY SITE PERMITS

October 24, 2007

Date

**NRC STAFF SIGN IN FOR ACRS MEETING**

**PLEASE PRINT**

NAME

ORGANIZATION

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JERRY Wilson

NRC / NRO / DNRL

STEVEN SCHAFFER

NRC/NRO / DCIP / EHPB

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE MEETING ON EARLY SITE PERMITS

October 24, 2007

Date

~~MEMBER~~ SIGN IN FOR ACRS MEETING

PLEASE PRINT

	<u>NAME</u>	<u>NRC ORGANIZATION</u>
1	JOSEPH (BOB) MILLER	SOUTHERN NUCLEAR
2	Amy Aughtman	Southern Nuclear
3	Charles Pierce	Southern Nuclear
4	Andrew Sterdis	Westinghouse
5	David Fenster	Bechtel
6	ROBIN MCGUIRE	RISK ENGINEERING INC
7	SCOTT LINDVALL	William Lettis & Assoc.
8	Bob Prunty	Bechtel
9	TOM PREBYLA	BECHTEL
10	Dale L. Leedy	Southern Nuclear
11	TOM McCallum	SNC
12	Dan Patton	Bechtel
13	GERAUD McLANE	Bechtel
14	Bob Whorton	SCE + G
15	BOB SOKES	SCE + G
16	RAJIV PRASAD	PNNL
17	Annie Spears	Southern Nuclear
18	Jim Davis	Southern Nuclear
19	Don Moore	Southern Nuclear
20	TOM MOORE	Southern Nuclear



**Advisory Committee on Reactor Safeguards  
Early Site Permits Subcommittee  
Vogtle Early Site Permit Application  
October 24, 2007  
Rockville, Maryland**

-PROPOSED AGENDA-

Cognizant Staff Engineer: David C. Fischer [DCF@NRC.GOV](mailto:DCF@NRC.GOV) (301) 415-6889

Topics		Lead	Presentation Time
I	Introduction	Dr. D. Powers, ACRS	8:30 am - 8:35 am
II	Southern Nuclear Operating Company - Overview of Application - Response to NRC Issues - Schedule	Mr. C. Pierce, SNC SNC Rep.	8:35 am - <del>10:15 am</del> <sup>8:44</sup> 8:44 am - 9:40 am
	BREAK		<del>10:15</del> <sup>10:18</sup> am - <del>10:30</del> <sup>10:34</sup> am
III	NRC Presentation - Status and Overview - DSER Review - Open Items - Upcoming Milestones - Schedule	N. Chokshi, NRO/DNRL C. Araguas, NRO/DNRL	<del>10:30</del> <sup>10:34</sup> am - <del>12:00</del> <sup>12:23</sup> pm
	LUNCH		<del>12:00</del> <sup>12:23</sup> pm - <del>1:00</del> <sup>1:22</sup> pm
IV	Geology, Seismology, and Geotechnical Engineering	SNC Rep. Y. Li, NRO/DNRL	<del>1:00</del> <sup>1:22</sup> pm - 3:00 pm
	Break		<del>3:00</del> <sup>2:24</sup> pm - <del>3:15</del> <sup>2:31</sup> pm
	Geology, Seismology and Geotechnical (Cont)	Y. Li, et. al. NRO	2:31 pm - 3:25
V	Radiological Consequences of DBAs	SNC Rep. M. Hart, NRO/DNRL	<del>3:15</del> <sup>3:30</sup> pm - <del>3:30</del> <sup>3:35</sup> pm 3:35 pm - 3:42 pm
VI	NRC Staff's Conclusions	C. Araguas, NRO/DNRL	<del>3:30</del> <sup>3:38</sup> pm - <del>3:45</del> <sup>4:00</sup> pm
VII	Public Comments		3:45 pm - 4:00 pm
VIII	Status of Implementing Lessons Learned While Conducting Licensing Activities Pursuant to 10 CFR Part 52	C. Araguas, NRO/DNRL	4:00 pm - <del>4:50</del> <sup>4:38</sup> pm
IX	General discussion / Adjourn	Dr. D. Powers, ACRS	<del>4:50</del> <sup>4:38</sup> pm - <del>5:00</del> <sup>4:47</sup> pm

**NOTE:**

- Presentation time should not exceed 50 percent of the total time allocated for a specific item. The remaining 50 percent of the time is reserved for discussion.
- 35 copies of the presentation materials to be provided to the Subcommittee.

INTRODUCTORY STATEMENT BY THE CHAIRMAN  
OF THE  
ACRS SUBCOMMITTEE ON EARLY SITE PERMITS  
11545 ROCKVILLE PIKE, ROOM T-2B3  
ROCKVILLE, MARYLAND  
OCTOBER 24, 2007

The meeting will now come to order. This is a meeting of the Advisory Committee on Reactor Safeguards Subcommittee on Early Site Permits. I am Dana Powers, Chairman of the Subcommittee.

Members in attendance are Sam Armijo, Otto Maynard, and William Shack. The purpose of the meeting is to review and discuss the application submitted by Southern Nuclear Operating Company for the Vogtle early site permit, and the associated NRC staff draft safety evaluation report (DSER) with open items. The Committee must review the application and the staff's safety evaluation report (SER) to fulfill the requirement of 10 CFR Part 52.23 that the ACRS report on those portions of an early site permit application that concern safety. The Subcommittee will also discuss with the NRC staff the efficiency and effectiveness of staff's implementation of lessons learned from its review activities performed pursuant to 10 CFR Part 52.

The Subcommittee will hear presentations by and hold discussions with representatives of the NRC staff, Southern Nuclear Operating Company, and other interested persons regarding this matter. The Subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full Committee. Mr. David Fischer is the Designated Federal Official for this meeting.

The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register on September 26, 2007.

A transcript of the meeting is being kept and will be made available as stated in the Federal Register Notice. It is requested that speakers first identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

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

**(Chairman's Comments, if any)**

Copies of the meeting agenda and handouts are available in the back of the meeting room.

We will now proceed with the meeting, and I call upon Mr. Chuck Pierce of Southern Company to begin.

**Advisory Committee on Reactor Safeguards  
Early Site Permits Subcommittee  
Vogtle Early Site Permit Application  
October 24, 2007  
Rockville, Maryland**

-PROPOSED AGENDA-

Cognizant Staff Engineer: David C. Fischer [DCF@NRC.GOV](mailto:DCF@NRC.GOV) (301) 415-6889

	<b>Topics</b>	<b>Lead</b>	<b>Presentation Time</b>
I	Introduction	Dr. D. Powers, ACRS	8:30 am - 8:35 am
II	Southern Nuclear Operating Company - Overview of Application - Response to NRC Issues - Schedule	Mr. C. Pierce, SNC SNC Rep.	8:35 am -10:15 am
	BREAK		10:15 am - 10:30 am
III	NRC Presentation - Status and Overview - DSER Review - Open Items - Upcoming Milestones - Schedule	N. Chokshi, NRO/DNRL C. Araguas, NRO/DNRL	10:30 am - 12:00 pm
	LUNCH		12:00 pm - 1:00 pm
IV	Geology, Seismology, and Geotechnical Engineering	SNC Rep. Y. Li, NRO/DNRL	1:00 pm - 3:00 pm
	Break		3:00 pm - 3:15 pm
V	Radiological Consequences of DBAs	SNC Rep. M. Hart, NRO/DNRL	3:15 pm - 3:30 pm
VI	NRC Staff's Conclusions	C. Araguas, NRO/DNRL	3:30 pm - 3:45 pm
VII	Public Comments		3:45 pm - 4:00 pm
VIII	Status of Implementing Lessons Learned While Conducting Licensing Activities Pursuant to 10 CFR Part 52	C. Araguas, NRO/DNRL	4:00 pm - 4:50 pm
IX	General discussion / Adjourn	Dr. D. Powers, ACRS	4:50 pm - 5:00 pm

**NOTE:**

- Presentation time should not exceed 50 percent of the total time allocated for a specific item. The remaining 50 percent of the time is reserved for discussion.
- 35 copies of the presentation materials to be provided to the Subcommittee.



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001

December 7, 2007

MEMORANDUM TO: Dana A. Powers, Chairman  
Early Site Permits Subcommittee

FROM: David C. Fischer, Senior Staff Engineer /RA/  
Technical Support Staff  
ACRS

SUBJECT: WORKING COPY OF THE MINUTES OF THE ACRS EARLY SITE  
PERMITS SUBCOMMITTEE MEETING ON THE VOGTLE EARLY SITE  
PERMIT APPLICATION AND ASSOCIATED NRC SAFETY  
EVALUATION REPORT WITH OPEN ITEMS, OCTOBER 24, 2007,  
ROCKVILLE, MARYLAND

A working copy of the minutes of the subject meeting is attached for your review.

Please review and comment on them at your earliest convenience. If you are satisfied with these minutes please sign, date and return the attached certification letter.

Attachment: Certification Letter  
Minutes (Working Copy)

cc w/o Attachment:

C. Santos  
S. Duraiswamy



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001

December , 2007

MEMORANDUM TO: David C. Fischer, Senior Staff Engineer  
Technical Support Staff, ACRS

FROM: Dana A. Powers, Chairman  
Early Site Permits Subcommittee

SUBJECT: CERTIFICATION OF THE MINUTES OF THE ACRS EARLY SITE  
PERMITS SUBCOMMITTEE MEETING ON THE VOGTLE EARLY SITE  
PERMIT APPLICATION AND ASSOCIATED NRC SAFETY  
EVALUATION REPORT WITH OPEN ITEMS, OCTOBER 24, 2007,  
ROCKVILLE, MARYLAND

I hereby certify, to the best of my knowledge and belief, that the minutes of the subject meeting on October 24, 2007, are an accurate record of the proceedings for that meeting.

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Dana A. Powers, Chairman                      Date  
Early Site Permits Subcommittee

Issued: 12/07/2007

**ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
EARLY SITE PERMITS SUBCOMMITTEE MEETING MINUTES  
October 24, 2007  
ROCKVILLE, MARYLAND**

**INTRODUCTION**

The ACRS Subcommittee on Early Site Permits met on October 24, 2007, at 11545 Rockville Pike, Rockville, Maryland, in Room T-2B3. The purpose of this meeting was to review and discuss the application submitted by Southern Nuclear Operating Company (Southern Nuclear or the applicant) for the Vogtle early site permit, and the associated NRC staff safety evaluation report (SER) with open items. The Subcommittee also discussed with the NRC staff the efficiency and effectiveness of staff's implementation of lessons learned from its review activities performed pursuant to 10 CFR Part 52. The Subcommittee planned to gather information, analyze relevant issues and facts to formulate proposed positions, as appropriate, for deliberation by the full Committee. The entire meeting was open to public attendance. Mr. David C. Fischer was the cognizant staff engineer and the Designated Federal Official for this meeting. The Subcommittee received no written comments, or requests for time to make oral statements from any members of the public regarding this meeting. The meeting was convened at 8:30 am and adjourned at 4:45 pm.

**ATTENDEES**

**ACRS**

D. Powers, Chairman  
J. Sam Armijo, Member  
D. Fischer, ACRS Staff

O. Maynard, Member  
W. Shack, Member

**NRC**

N. Chokshi, NRO/DSER  
C. Araguas, NRO/DNRL  
S. Coffin, NRO/DNRL  
R. Karas, NRO/DSER  
C. Munson, NRO/DSER  
M. Hart, NRO/DSER  
J. Hoch, NRO/DSER  
G. Bagchi, NRO/DSER  
M. Concepcion, NRO/DCIP  
H. Ahn, NRO/DSER

S. Monarque, NRO/DNRL  
L. Bauer, NRO/DSER  
S. Gonzalez, NRO/DSER  
G. Stirewalt, NRO/DSER  
Y. Li, NRO/DSER  
B. Harvey, NRO/DSER  
B. Musico, NRC/NSIR  
T. Cheng, NRO/DSER  
M. Lee, ACNW&M  
T. Terry, NRO/DSER

**ATTENDEES (CONT'D)**

**OTHERS**

C. Mueller, USGS	R. Wheeler, USGS
R. Prasad, PNNL	C. Costantell, BNL
T. Amundson, Southern Nuclear	J. Damm, Bechtel
A. Aughtman, Southern Nuclear	D. Fenster, Bechtel
C. Boone, Southern Nuclear	G. McLane, Bechtel
J. Davis, Southern Nuclear	D. Patton, Bechtel
D. Lloyd, Southern Nuclear	J. Prebula, Bechtel
T. McCallum, Southern Nuclear	B. Prunty, Bechtel
J. Miller, Southern Nuclear	R. McGuire, Risk Engineering Inc.
D. Moore, Southern Nuclear	B. Stokes, SCE&G
T. Moorer, Southern Nuclear	B. Whorton, SCE&G
C. Pierce, Southern Nuclear	A. Sterdis, Westinghouse
A. Spears, Southern Nuclear	S. Lindvall, William Lettis & Associates

A complete list of attendees is in the ACRS Office file and will be made available upon request. The presentation slides and handouts used during the meeting are attached to the Office copy of these minutes.

**OPENING REMARKS BY THE SUBCOMMITTEE CHAIRMAN**

Dr. Dana A. Powers, Chairman of the Early Site Permits Subcommittee, stated that the purpose of this meeting was to review and discuss the application submitted by Southern Nuclear for the Vogtle early site permit, and the associated NRC staff safety evaluation report (SER) with open items. The Committee must review the application and the staff's SER to fulfill the requirement of 10 CFR Part 52.23 that the ACRS report on those portions of an early site permit application that concern safety. Dr. Powers said that the Subcommittee would also discuss with the NRC staff the efficiency and effectiveness of staff's implementation of lessons learned from its review activities performed pursuant to 10 CFR Part 52.

**SOUTHERN NUCLEAR OPERATING COMPANY PRESENTATION** (Applicant slides 1 to 41)

Mr. Chuck Pierce, Southern Nuclear's licensing manager for Vogtle deployment introduced the Vogtle deployment organization; identified the contractors being used to help develop the Vogtle early site permit (ESP) and combined license (COL) applications; and outlined their schedule for licensing, constructing, and starting-up Vogtle Units 3 and 4. This included a discussion of Southern Nuclear's schedule for completing site preparation work and excavation activities (LWA-1) as well as backfill placement and nuclear island basemat preparation activities (LWA-2).

Mr. Jim Davis, Southern Nuclear, described the Vogtle electric generating plant (VEGP) site. The 3,169-acre VEGP site is located on a coastal plain bluff on the southwest side of the Savannah River in eastern Burke County Georgia. The site is directly across the river from the

Department of Energy's Savannah River Site (Barnwell County, South Carolina). It is about 150 river miles from the mouth of the Savannah River and approximately 26 miles southeast of Augusta, Georgia. Mr. Davis also described the new plant layout. The site currently occupied by Units 1 and 2 of the VEGP was approved originally for four units, but only two were built. The units now present at the site are 3,565 MWt Westinghouse pressurized water reactors. Also on the site is Plant Wilson which is a six-unit, oil-fueled combustion turbine facility.

Southern Nuclear has proposed to locate two Westinghouse AP1000 advanced nuclear power plants on the site. The AP1000 has a thermal power of 3,400 MWt. These power plants, designated Vogtle Units 3 and 4, will be located adjacent to and west of the existing Vogtle units. The Vogtle ESP application is unusual in that the applicant has selected a specific nuclear power plant design rather than relying on a plant parameter envelope as has been the case in previous applications for an ESP. The applicant has also provided a complete and integrated emergency plan, including an emergency planning Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC), rather than providing only the major features of an emergency plan, as has been the case in previous ESP applications. This provided the staff with a finer level-of-detail in certain areas (e.g., power output, cooling water design, intake design, water consumption, discharge flow) than was provided by earlier ESP applicants and will afford Southern Nuclear with a greater level of finality in these areas. It also probably resulted in fewer permit conditions arising in the SER on the application.

The initial Vogtle ESP application was submitted in August 2006 and contained Southern Nuclear's LWA-1 request. Revision 2 to the Vogtle ESP application was submitted in August 2007 and contained Southern Nuclear's LWA-2 request. The Vogtle ESP application consists of five parts: 1) introduction, 2) site safety analysis report, 3) environmental report, 4) redress plan, and 5) emergency plan. The subcommittee meeting focused on parts 2 and 5 of the Southern Nuclear's ESP application. The ESP application addresses portions of the following chapters of the site safety analysis report (SSAR): Introduction and General Description (Chapter 1), Site Characteristics (Chapter 2), Aircraft Hazards (Chapter 3), Liquid and Gaseous Releases (Chapter 11), Emergency Planning and Security (Chapter 13), Accident Analyses (Chapter 15), and Quality Assurance (Chapter 17). The applicant mentioned several NRC site safety visits that have been done as part of the staff's review of the Vogtle ESP application. The applicant provided a list showing how many requests for additional information (RAIs) it had received from the NRC for each specific SSAR section. The list totaled 189 RAIs. The applicant also provided a list showing how many SER open items were associated with each specific SSAR section. The list totaled 40 open items: one related to meteorology, four related to hydrology, twenty two related to geology/seismic, and thirteen related to emergency planning. The applicant indicated that Southern Nuclear had submitted responses to all 40 open items.

#### Potential Hazards (Applicant slides 21 and 22)

Mr. Davis stated that the exclusion area boundary for Vogtle Units 3 and 4 would be the same as that already established for Units 1 and 2. He said the population density near the plant is low and that they had used the most recent census data and the past growth rate to project the population out to 2070. This projection showed a four fold increase in population. The applicant considered threats to Vogtle Units 3 and 4 from: industrial and mining facilities (gas

lines), transportation routes (airports, roads, rails, water), military facilities, and Vogtle Units 1 and 2. Dr. Powers noted that a similar (i.e., four fold) increase in air traffic in and out of nearby Bush Field was not assumed. The applicant stated that the available air traffic projections from Federal Aviation Administration (FAA) only went out 20 years, so Southern Nuclear used the FAA projections to calculate the potential threat to the plant site from air traffic. Mr. Tammara, an NRC staff reviewer, said that the staff also used the FAA data but calculated the probability of a aircraft impact at the site to be an order of magnitude less than that calculated by the applicant. Dr. Powers asked if there was a nearby ammonia plant and whether Bush Field was used to train Delta Airlines pilots. The applicant was unaware of either. Dr. Powers questioned the applicant about the transient population at the Savannah River Site (e.g., from the potential construction of an actinide burner facility). Mr. Amundson, Southern Nuclear, said he knew of no plans to build such a facility at the Savannah River Site. Mr. Davis indicated that Southern Nuclear's emergency plan with the Savannah River Site is well coordinated and fluid. Dr. Powers noted that the Vogtle emergency plan included the plutonium fabrication facility at the Savannah River Site but not the Pit extraction facility. Mr. Boone, Southern Nuclear, said that the Savannah River Site is treated like a local entity in their emergency plan. Mr. Davis said that there was no threat to the site from barge traffic on the Savannah River because there is no barge traffic on the river at this time. With regard to the potential threat to the plant from rail traffic, Dr. Powers questioned the listing of carbon monoxide (on page 2.2-13 of the SSAR) as an asphyxiant. He said carbon monoxide is better characterized as a nerve or blood poison and asked if the applicant might have meant carbon dioxide, which he said is an asphyxiant. Dr. Powers also said that he was surprised that hydrochloric acid, chlorine, and sulfur dioxide were not moved along the CSX rail line. He said that these chemical are routinely transported on most rail lines. Dr. Powers questioned the applicant on the potential hazard associated with several chemicals stored on site (e.g., sodium bromide, sodium hypochlorite). Finally, Dr. Powers noted that the SSAR indicated that an analysis of tree fires surrounding the site indicates that there is no problem. He asked where he might find that analysis (no reference was provided in the SSAR). Mr. Moore indicated that Southern Nuclear pro-actively manages the timber on site (e.g., using controlled burns) to minimize the potential adverse effect to the plants from fires. Mr. Moore stated that other than the plant fire brigade, Southern Nuclear had agreements with several local volunteer fire departments as well as with the City of Waynesboro fire department.

Dr. Powers asked the applicant about the hazards posed to VEGP from the nearby Wilson fossil fuel generating plant. Mr. Davis told Dr. Powers that their analysis showed the hazard to be within limits. He said that the hazards are acceptable for Units 1 & 2, which are closer to plant Wilson than Units 3 & 4 will be. Dr. Powers asked if smoke from the combustion 9 million gallons of diesel fuel (i.e., three 3-million gallon tanks) posed a constraint on the design of the control room air filtration system (i.e., assuming the worst possible wind conditions). Dr. Powers questioned whether this should be addressed by the applicant at the ESP stage, at the COL stage, or both. Dr. Powers note that the discussion of this threat, and smoke from a forest fire, in the Vogtle ESP SSAR was minimal. Mr. Prunty said that Southern Nuclear had looked at the existing plant analyses for Vogtle Units 1 & 2 and evaluated them to determine whether or not they were suitable and reached the same conclusion for the new units. However, he said that they do not yet have a detailed HVAC design for the new units. Mr. Araguas said that these events should be addressed at the COL stage.

#### Meteorology (Applicant slides 23 and 24)

Southern Nuclear used five years of local and regional weather data to develop site-specific diffusion estimates for use in dose calculations. This data was apparently adjusted slightly to eliminate bad or erroneous data. Information from national weather stations within a 50-mile radius of the plant was used to help estimate weather extremes. The applicant based estimates of temperature extremes on a database covering a period of thirty years. Dr. Powers questioned the applicant's use of 30-year data sets to come up with 100-year return values. He asked the applicant if, when they looked at 30-years of weather to project forward, they were in fact capturing the relatively well known 50-year cycles of hurricane frequency, which he said also has an impact on tornado frequencies. Mr. Patton, Bechtel, explained that for severe weather, they went back as far as they had recorded information. He said that they only had reliable hourly data that went back 30-years for things like precipitation. Mr. Prunty, Bechtel, said that for tornado frequencies they did not do a plant-specific analysis. Rather, they used draft Regulatory Guide DG-1143 which contains a probability of  $10^{-7}$ . Mr. Prunty said the estimated tornado frequency at the Vogtle site was enveloped by the frequency assumed for the AP1000 certified design.

#### Hydrologic Engineering (Applicant slides 25 and 26)

In this section the applicant evaluated the potential for floods, dam failures, storm surges, ice effects, low water events, groundwater impacts, and accidental releases of liquids. Groundwater data from new and existing onsite wells was collected. Based on the AP1000 design, a site-specific radioactivity release analysis was performed. The fact that the VEGP site is 140 feet above the normal river level had a significant impact on the results of the aforementioned evaluations.

#### Geology and Seismic (Applicant slide 27)

Mr. Davis mentioned three key areas that would be discussed in greater detail latter in the applicant's presentation: the soil rock profile, the safe shutdown earthquake (SSE) curve, and the applicant's excavation plan.

#### Aircraft Traffic (Applicant slides 28 and 29)

Mr. Davis mentioned that the August-Savannah air traffic for flight path V185 went over (or nearly over) the Vogtle plant site. He said that, based on an analysis of the air traffic data associated with this route, the potential hazard to the Vogtle site was within acceptable frequency limits. While the Bulldog military operating areas have been getting closer to the Vogtle plant site (been expanded), air traffic in them seems to be declining and poses an insignificant risk to the Vogtle plant site.

#### Liquid and Gaseous Releases (Applicant slides 30 and 31)

Mr. Davis said that potential liquid and gaseous radioactive releases from normal operation were calculated, put into the SSAR, and determined to be well within the 10 CFR Part 50, Appendix I, regulatory limits. For accidents, the applicant reviewed the AP1000 accidents with

site specific parameters to calculate offsite doses. Mr Davis said that the Westinghouse DCD analysis was compared to the site specific estimates and that the VEGP generated dose estimates for accidents were bounded by the DCD analysis. Dr. Powers asked whether elevated or ground-level releases were more limiting, in light of the fact that the population in the immediate vicinity of the plant is very low and that some lofting might lead to a greater hazard further away from the site. The applicant said that they did sensitivity analyses when doing these calculations, that elevated releases had greater dispersion, and that ground-level releases are more conservative (maximizes the  $\chi/Q$  values). Dr. Powers noted that most of the codes used for making these calculations assume a flat earth and indicated that he thought most releases would track down the Savannah River basin.

#### Quality Assurance (Applicant slide 33)

Mr. Davis described applicants quality assurance (QA) program used to develop the ESP application, perform calculations, and gather data. Portions of the site investigation work were done to Appendix B standards so that they could be used directly in plant design. Most other analyses were not "safety-related" but QA controls were applied. In its recent submittal, the applicant expanded its QA program to also cover its early limited work authorization (LWA) activities. Mr. Maynard asked if the applicant used internet data in gathering information for the ESP application. Mr. Davis said that they did. Mr. Prunty said that they used internet data from national authority type sites (e.g., National Weather Service, Corps of Engineers), captured the data with screen shot, and validated that it was what it said it was. They did not just do a google search for the data. After some probing, the applicant admitted that it relies on the web controls of the official web site organization to police the validity of the data on its site.

#### Emergency Planning (Applicant slides 34 through 41)

Mr. Ted Amundson, lead engineer for the emergency planning aspects of the Vogtle ESP application, said that the physical characteristics of the site were evaluated against the security and emergency planning requirements. He also said that the details of emergency planning were provided in a separate portion (Part 5) of the ESP application. Consistent with 10 CFR 52.17(b)(1), the application identifies significant impediments to emergency planning. As allowed by 10 CFR 52.17(b)(2), the Vogtle ESP application proposes complete and integrated emergency plans, including an emergency planning ITAAC, as opposed to merely identifying the major features of their emergency plans. Mr. Amundson said that they chose to submit complete and integrated emergency plans because Vogtle Units 1 and 2 were two of the most recently licensed plants in the country and consequently they have a high degree of compliance with the latest emergency planning regulations (10 CFR 50.47 and Appendix E to Part 50) and standards (e.g., NUREG-0654, FEMA-REP-1). In preparing its ESP application, Southern Nuclear used the guidance in DG-1145, "Guidance for Combined License Applications" but not that contained in the final RG 1.206, as the latter had not yet been published when the application was submitted. Mr. Amundson said that Southern Nuclear had obtained new state and local certifications as required by 10 CFR 50.17(b)(4) to certify that: 1) their proposed emergency plans are practicable, 2) the state and local agencies are committed to further emergency plan development, and 3) the agencies are committed to executing their responsibilities under the plans. Mr. Amundson said that Southern Nuclear encountered no resistance in obtaining these certifications and that Southern Nuclear had a long and ongoing

positive relationship with the nearby state and local agencies. Dr. Powers asked about Southern Nuclear's philosophy about evacuation versus sheltering. Mr. Boone indicated that Southern Nuclear makes recommendations to state and local agencies regarding evacuation versus sheltering (consistent with guidance documents) but that the decision on an appropriate course of action lies with the state and local agencies. Mr. Amundson said that Southern Nuclear had developed some new evacuation time estimates base on a contractor's model and methodology. He said that the results of the new study were consistent with the study that had been done for Vogtle Units 1 & 2. The applicant's updated emergency plans use existing 10-mile emergency planning zones (EPZ), both plume exposure and ingestion pathway zones. The emergency planning zones within 10-miles of VEGP correspond to geopolitical boundaries surrounding the site and are the same as those used for the Savannah River Site emergency plans. Only the small village of Girard, with a population of 200 to 250, lies within 10-miles of the plant. Mr. Amundson showed where the evacuation centers (outside the 10-mile EPZ) were located. The VEGP emergency plans have been modified to include the two new units and no new impediments to emergency planning were identified. The plans call for building a new common Technical Support Center (TSC) for all four units and the use of the existing Emergency Operations Facility (EOF). The new TSC will be located west of Vogtle Unit 1 & 2 site and east of the Unit 3 & 4 site. The EOF is located in Birmingham, Alabama. Dr. Powers asks how the applicant's emergency plan addressed transient population (e.g., hunters). Mr. Amundson said that the areas surrounding the plants, including the wildlife management area, are adequately posted (i.e., at siren locations) to explain what to do in the event of an emergency. The staff has asked the applicant to ensure that local agencies review these time estimates since they may affect the actions of the agencies in the event of an emergency.

#### **NRC STAFF PRESENTATION** (Staff slides 1 through 37)

Mr. Chokshi made some very brief opening remarks. Mr. Araguas, the staff's project manager for the Vogtle ESP review, briefed the subcommittee on the status of the staff's safety review of the Vogtle ESP application. He said that the staff expected an interim letter from the Committee on the Vogtle ESP application and associated staff safety evaluation with open items. He provided the Subcommittee with an outline of his presentation.

#### Schedule Milestones (Staff slides 3 through 5)

The staff received the Vogtle ESP application on August 15, 2006. The acceptance review was completed on September 19, 2006. The staff conducted several site inspections and audits in support of the ESP application (e.g., QA, EP, meteorology, hydrology, geology). Requests for additional information (RAIs) were issued to the applicant by March 15, 2007. The SER with open items was issued on August 30, 2007. The staff has recently received responses to the RAIs. The staff plans on meeting with the ACRS full Committee in November 2007. The staff plans on providing the ACRS with an advanced copy of the SER with no open items by May 16, 2008 and meet again with the Committee in June 2008. The staff would like a final letter on the Vogtle ESP application and associated staff SER in July 2008. The staff hopes to issue the final SER on the Vogtle ESP application by August 6, 2008. The mandatory hearing on the Vogtle ESP application would then be conducted in the spring of 2009 and a Commission decision on the Vogtle ESP application would be made in the summer of 2009.

Vogle ESP Application (Staff slides 6 through 10)

Mr. Araguas identified the principal contributors to the staff's Vogle ESP application SER with open items (including contractors). He described the proposed ESP location, identified the applicants, and outlined the content of the application. Southern Nuclear requested that the ESP be approved for a 20-year period. Southern Nuclear also seeks approval of two limited work authorizations (i.e., LWA-1 and LWA-2) and its fitness for duty program for construction activities. Mr. Araguas described the activities associated with each LWA. LWA-1 activities would start immediately because recent revisions to Part 52. LWA-2 activities would start in mid to late 2009, after the ESP has been approved. Mr. Araguas mentioned that Southern Nuclear also seeks approval of its complete and integrated emergency plans with ITAAC as part of the ESP.

Key Review Areas / Open Items (Staff slides 11 through 37)

In this section the staff touched on some of the open items it felt were important to mention during the meeting.

Section 2.1, Geography and Demography (Staff slide 11)

Mr. Araguas said that the staff looked at the site location and description, particularly at the coordinates for the site, identifying the site boundaries and the orientation of principal plant structures, locations of highways, railroads, and waterways that traverse the exclusion area boundary (EAB). He said that none traversed the EAB. Mr. Araguas said that Southern Nuclear has full authority and control over activities in the exclusion area. The only activities that occur on site unrelated to nuclear power plant operation are associated with the visitor center and Plant Wilson. The closest population center is Augusta, approximately 26 miles away. Dr. Powers noted that the applicant had used previous census data and extrapolated population growth out to 2070. He asked if the applicant's population growth estimates were backed up by university studies, as had been done by previous ESP applicants. Mr. Tammara said that the staff had done its own confirmatory estimate and came up with very similar results. The staff checked to ensure the applicant's population density calculation was done correctly and to see if the projections were reasonably accurate. The staff did not do a more detailed confirmatory analysis because the population density was well below regulatory acceptance criteria of less than an average of 500 people per square mile within 10 miles of the site.

Section 2.2, Nearby Industrial, Transportation, and Military Facilities (Staff slides 12 and 13)

Mr. Araguas said that the staff looked for potential hazards in the vicinity of the site so they could evaluate potential accidents due to those hazards. They looked at the maps of the site and the nearby significant facilities and transportation routes. They looked at the description of the facilities, products, materials, and number of people employed. They also looked at the description of the pipelines with respect to how far away they were, what kind of materials are traveling down the pipeline or have the potential of going down the pipeline, what highways are nearby the site, and what waterway that are nearby the site. Mr. Araguas said there were two airports near the site. The Burke County airport is about 156 miles from Vogle site and the Bush Field Augusta airport is about 17 miles from the site. He said that the staff also looked at

industrial growth. Dr. Powers said that there is remarkably little industrial activity up and down the Savannah River but mentioned that there is a proposal to develop a hydrogen production facility at the Savannah River Site. However, such a facility would be outside the area of interest to the VEGP.

Mr. Araguas said that the staff looked for any event that could be considered a design basis event (DBE). He defined DBE as an accident that has a probability of occurrence on the order of  $10^{-7}$  per year or greater and potential consequences exceeding to 10 CFR Part 100 dose guidelines. He said that the staff looked at potential accidents in four key areas. The first is explosions and flammable vapor clouds from truck traffic, pipelines, mining facilities, waterway traffic, and railroad traffic. Mr. Araguas said that there is truck traffic carrying gasoline and fuel oil near the site but none that could produce a 1 psi over-pressure at the site (reference Regulatory Guide 1.91). He said the nearest pipeline was about 19 mile away and outside the 10-mile area of interest specified in Regulatory Guide 1.70. He said that there were no mining facilities near the site and that the Savannah River was not navigable. Dr. Powers said he thought it was unusual that neither chlorine nor sulfur dioxide were transported on the nearby (four and a half miles) railroad line. Both the staff and applicant relied on the information provided to Southern Nuclear by CSX. Dr. Powers also question the listing of carbon monoxide, as an asphyxiant, was a misprint, and that perhaps it should have been carbon dioxide. He also noted that neither the applicant nor staff considered the potential for a major railroad accident involving multiple cars. The second type of accident considered by the staff was hazardous chemicals. For these, the staff looked at transportation accidents, major depots, storage areas, and onsite storage tanks. The staff said it did look at the applicant's fuel oil storage accident analysis for Plant Wilson to determine that the concentration of the toxicity limit specified in Regulatory Guide 1.78 would not be exceeded. Similarly, the staff analyzed a potential spill of hydrazine, stored at Unit 1, to ensure the toxicity limit specified in Regulatory Guide 1.78 would not be exceeded. Basically, the applicant made the argument that since Units 3 and 4 are further away from the tanks than they are for Units 1 and 2, it would be okay. And the staff found that to be acceptable. The staff has a COL Action item at the COL stage to verify that there is no adverse effect from spills and fires on site (including particulate burden) on control room habitability. Fires were the third type of accident considered by the staff. Dr. Powers noted that the consideration associated with fires on site and the magnitude of potential impacts of fires on site were not very well documented by either the applicant or the staff (e.g., heat loads, smoke loads, access problems). The fourth type of accident considered by the staff are radiological hazards i.e., from either the Savannah River Site or Vogtle Units 1 & 2. The staff verified that there are measures in place to detect any sort of hazard from those sites , and found them to be acceptable.

### Section 2.3, Meteorology (Staff slides 14 through 18)

The staff looked at the meteorology at the VEGP site in terms of regional climatology, local meteorology, onsite meteorological measurement program, short-term atmospheric dispersion estimates for accidental releases, and long-term dispersion estimates for routine releases. Dr. Powers indicated that the tendency for any dispersion under mild atmospheric turbulence conditions would be straight down the river and not in a random direction such as one might assume using a "flat-earth" model.

Mr. Araguas said that the applicant identified meteorological site characteristic related to climatic extremes and severe weather as well as those related to atmospheric dispersion from both accident and routine releases. Specifically, the staff reviewed the applicant's assessment of extreme winds, tornados, precipitation (for roof design), and ambient design temperature. Dr. Powers explained that there is evidence that we are going through long-term weather cycles on the Atlantic seaboard. He elaborated by stating that there are two shorter-term cycles (El Nino and the North Atlantic Oscillation each with a different period) that affect the longer-term cycle which are currently in phase. As a result, he postulated that the frequency of hurricanes, and possibly intense hurricanes (Category 4 or 5), will go up. Therefore, Dr. Powers questioned the applicant's use of historical data to project extreme weather for the next 70 years. Mr. Hoch said that he looked at 154-years of National Oceanic and Atmospheric Administration (NOAA) data and concluded that there is indication of an increase in either the frequency or the intensity of hurricanes within a hundred-mile radius of this site. He also said that the staff used a forward-looking approach by considering information from the International Government Panel on Climate Change. Finally, Mr. Hoch indicated that the applicant used DG-1143's 300 mile an hour wind speed in its analyses, which the staff said will be bounding for any hurricane that may impact the site.

For short-term dispersion estimates for accident releases, the staff assessed the adequacy of the  $\chi/Q$  values used by the applicant at the exclusion area boundary and in the low population zone. For long-term dispersion estimates for normal releases, the staff assessed the adequacy of the  $\chi/Q$  values used by the applicant at the exclusion area boundary, at the nearest resident, at the nearest meat animal, and at the nearest vegetable garden. The staff identified one meteorological open item for the applicant to provide a justification for using a 30-year period of record (1966 to 1995) to define the AP1000 maximum safety design temperature. The staff believes these temperatures should be based on a 100-year return interval. Mr. Hoch said that the applicant had used 30-years of data and linear extrapolation to arrive at its 100-year return temperature. He said that the staff used more data than the applicant had used (i.e., 17 weather stations, as opposed to 10 used by the applicant). He also noted that the American Society of Heating, Refrigeration, and Air Conditioning Engineering (ASHRAE) puts out a standard that gives examples on how to calculate 100-year return period temperatures.

#### Section 3.5.1.6, Aircraft Hazards (Staff slide 19)

Mr. Araguas explained that the plant design should consider that aircraft accidents that could lead to radiological consequences in excess of the exposure guidelines of 10 CFR 50.34(a)(1) with a probability of occurrence greater than  $10^{-7}$  per year. The guidance say that federal airways, holding patterns, or approach patterns should be at least 2 statute miles away. Military installations or any airspace usage (former bombing ranges) should be at least 20 miles from the site. All airports should be at least 5 miles from the site. Airports between 5 and 10 miles of the site should have projected operations less than  $500 d^2$ , where  $d$  is the distance from the site to the airport. Airports greater than 10 miles from the site should have projected operations less than  $1000d^2$ .

Mr. Araguas said that the only aircraft hazard of concern was that associated with airway V185, approximately 1.5 miles from the ESP site. The applicant was unable to get flight data on that airway from the FAA but calculated that it would take 51,000 flights a year along that flight path

to reach the  $10^{-7}$  probability threshold. The staff obtained data from the FAA and calculated the probability to be  $6 \times 10^{-7}$ . Dr. Powers questioned the applicants projection of air traffic into/out-of Bush Field in light of the projected population growth in the area. He asked if the staff had evaluated that. The staff said that the projected number of flights into/out-of Bush Field varied but range from about 47,000 in 1990 to approximately 36,000 in 2025. The staff said that Bush Field was about 17 miles from the site (i.e., so flight operations would have to be less than 289,000 flights to meet the guidelines). So the staff concluded that even if projected flight operations were ratioed up by conservative population growth estimates, flight operations would still be within the acceptance guidelines. Dr. Powers asked if Bush Field was a training airfield for Delta Airlines pilots. The staff said that it had not looked into that prospect.

#### Chapter 11, Doses from Routine Liquid and Gaseous Effluent Releases (Staff slides 20 and 21)

The staff confirmed the applicant's liquid and gaseous release estimates as well as the appropriate exposure pathways. The staff looked at the appropriate liquid dilution and atmospheric dispersion and deposition. It also confirmed the use of appropriate land usage factors. The staff verified the applicant's calculated doses using NRC recommended models and performed an independent dose assessment for liquid pathways showing the applicant's doses to be conservative. Mr. Araguas showed a table that compared the applicant's and staff's estimated doses to the regulatory criteria. In all cases the estimated doses were less than the specified regulatory criteria. Dr. Powers asked why these estimates were required of the North Anna and Vogtle ESP applicant but not the grand Gulf or Clinton ESP applicant. Mr. Schaffer, from the Office of New Reactor's Health Physics Branch, said that the staff and Office of the General Counsel recently determined that 10 CFR Part 52 requires the ESP applicant to look at both gaseous and liquid effluents and their potential impact.

#### Section 13.3, Emergency Planning (Staff slides 22 through 27)

Southern Nuclear submitted a complete and integrated emergency plan (EP) as part of its ESP application. The staff is looking at the applicant's agency certifications to make sure the state and local organizations have coordinated with the applicant with respect to emergency plans for offsite response. The staff is trying to determine if the applicant's complete and integrated emergency plan provides reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency. This will provide the applicant with finality in that at the COL stage there will be no EP review other than that necessary to close out the proposed ITAAC. Mr. Araguas identified the NRC and FEMA regulations and guidance related to EP. He also identified the various state and local jurisdictions with which Southern Nuclear has coordinated. The staff said that the applicant's EP has also been coordinated with Savannah River Site EP. The staff's review focused on the 10-mile emergency planning zone (EPZ), almost half of which is occupied by the Savannah River Site. The staff presumed that the adequacy of the Savannah River Site EP. The staff did however evaluate the adequacy of the memorandum of understanding between Southern Nuclear and the Department of Energy (a copy of which was submitted as part of Southern Nuclear's ESP application and provided to the Subcommittee members at the meeting). Mr. Musico also provided the Subcommittee with a photograph of the posting or sign that tells people in the EPZ what to do in the event of an emergency.

Southern Nuclear proposed an EP ITAAC for those aspects of EP that reasonably be completed prior to construction of the plant. This is the first time the staff is reviewing an EP ITAAC as part of an ESP application. The applicant's proposed EP ITAAC is based on a generic EP ITAAC in SECY-05-197 and NUREG-0800. Both ESP and COL applicants will need to provide site-specific EP ITAAC based on the generic guidance.

Mr. Araguas said that an issue that still needs to be resolved on the Vogtle ESP application has to do with emergency action levels (EALs). The staff is currently reviewing NEI-99-01 (EAL Guidelines for light-water reactors) and NEI-07-01 (EAL guidelines for passive plant designs and advanced light-water reactors). The staff said that there is a lot of overlap between the two NEI guides. The Vogtle EALs are based on and reference NEI-07-01. The staff plans on completing its review of the NEI guidelines before it approves the Vogtle EALs. Options for completing the Vogtle ESP review before the staff completes its review of NEI's EAL guidelines were briefly discussed. Another EP related open item has to do with state and local agencies reviewing the applicant's revised evacuation time estimates (ETEs) to ensure they do not adversely effect off-site response in some way. The agencies need to review and comment on the revised ETEs and Southern Nuclear needs to discuss the resolution of those comments with the agencies.

#### Section 13.6, Physical Security (Staff slide 28)

Mr. Araguas said that the staff needed to determine whether site characteristics were such that adequate security plans and measures could be developed. In order to make this determination, the staff considered pedestrian and vehicular land approaches to the site, railroad and water approaches, potential "high-ground" adversary advantage point, integrated response provisions, and nearby road transportation routes. The staff identified an existing rail spur at the site. The applicant said that any road or railroad that penetrates the required vehicle denial system will be provided with appropriate access control measures in accordance with the existing regulations and the physical security plan that will be provided with the COL application. This is a COL Action item on which the staff will follow up.

#### Chapter 17, ESP Quality Assurance Measures (Staff slide 29)

The staff reviewed ESP application to verify that it included within the scope of its quality assurance (QA) program, activities that would affect the capability of structures, systems, and components (SSC) important to safety. The staff completed an on-site QA inspection in August 2006 during which the staff reviewed the QA manual, plans, and implementing procedures of the applicant and its major contractors. They also reviewed data collection analyses, and evaluation methodologies, including those associated with site characterization. The staff's in-house review of the applicant's QA submittal was completed in January 2007 and verified the applicant adequately applied the guidance in Section 17.1.1 of review standard RS-002 to demonstrate the integrity and reliability of the data that were obtained during ESP activities. The applicant used NEI 06-14A, "Quality Assurance Program Description," as a template for its nuclear data quality assurance manual (NDQAM). The applicant submitted a revised NDQAM in August 2007 to include LWA-2 activities within the scope of the ESP. Dr. Powers asked how the staff used or handled internet data. Mr. Araguas said that previously, for the North Anna ESP application review, the staff reviewed Bechtel's measures for storing internet data and felt

that they were adequate. So they thought applying the same controls for Vogtle ESP application review would also be acceptable. Mr. Concepcion said that for previous ESP reviews the staff verified samples of internet data that was used by the applicants. He said that verification procedures were performed by engineering analysis or independent verifications or by certificates of validity from the source that provided the data. He said that was the process the applicant used to validate the information that was used. Mr. Maynard said that he got the impression that applicants had merely relied on the integrity of the source internet site. Mr. Prunty clarified that the procedure described by Mr. Concepcion calls for the independent validation of safety-related data. Mr. Prunty said that most of the site characterization data does not really fall into that category. Based on discussion at the Subcommittee meeting it was clear that there currently is not any staff guidance on how applicants should verify the validity and integrity of internet data that is not used for safety-related purposes. Mr. Araguas said that the staff would consider the need for developing such guidance.

#### Section 2.4, Hydrologic Engineering (Staff slides 30 through 37)

Mr. Prasad from PNNL identified the various sections of the applicant's SSAR and staff's SER related to hydrologic engineering. Dr. Powers asked the staff what it did to validate the applicant's assertion that the water level following dam failures on the Savannah River would not threaten VEGP the site. Mr. Prasad said the staff assessed the adequacy of the applicant's flooding models and data and determined that they were reasonable. They also did sensitivity studies to assess the water level if some of the applicant's key assumptions were changed. Section 2.4.2 deals with floods and what the controlling flood for the site should be. The staff independently estimated local intense precipitation based on NOAA guidelines and use that as a site characteristic that will be used at the COL stage for site grade design and site drainage design. In Section 2.4.3 the staff independently assessed the probable maximum flood using a bounding approach and verified the applicant's conclusion that the site remains dry following the probable maximum flood on the Savannah River. It turned out that the probable maximum flood was not as severe as the flood water level that would result from a dam failure. In Section 2.4.4 the staff verified the applicant's dam failure analysis and carried out an independent sensitivity analysis to verify that the site remained dry. In Section 2.4.5 the staff assessed the probable maximum surge and seiche flooding. Seiche are not an issue for the Vogtle site. The staff did an independent assessment of the potential impact of hurricane storm surge at the site and concluded that the site would remain dry.

In Section 2.4.6 of the staff' SER with open items, the staff concluded that a probable maximum tsunamis near the mouth of the Savannah River will not reach site grade. Dr. Powers asked the staff about the potential tsunamis threat to the site from an underwater landslide in the Cape Verde Islands. Mr. Prasad said that the size of tsunamis caused by such a slide depends on the volume and speed of the slide as well as on the dispersion effects. The dispersion effects depend in large part on whether the wave produced by the slide is an intermediate wave as opposed to a shallow wave with a long wavelength that basically does not lose any energy during its travel across the ocean. The staff's technical expert believe that the latter is a very unlikely scenario. However, the staff's research into potential tsunamis sources affecting the Atlantic and Gulf Coasts of the United States is ongoing. Dr. Powers asked about the potential for tsunamis from other sea slides. Mr. Prasad said that tsunamis generated by sea slides typically have only local effects. He also said that it is difficult to assess the tsunamis threat

probabilistically because of the lack of data. Dr. Powers commended the staff for its ongoing research in this area.

Southern Nuclear did not identify any safety-related canals or reservoirs in its ESP application because Vogtle Units 3 and 4 will not rely on any external water source for safety-related cooling. The staff determined that a design parameter is needed related to initial filling of and occasional makeup to their safety-related tanks (Open Item 2.4-1). The staff also identified a permit condition that VEGP Units 3 and 4 will not rely on any external water source for safety-related cooling water other than for initial filling and occasional makeup.

Mr. Prasad said that there was no flood protection requirements for any SSC which is located at or above site grade. He also said that safety-related SSC will not be affected by low water conditions in the Savannah River.

Ground-water motion on the site will be affected by the construction of nuclear power plants on the site. The ground-water motion could affect transport of radionuclides. The applicant has analyzed the ground-water motion. The staff has, however, identified an alternative pathway for water flow and has asked the applicant to consider this alternative. In addition, there is a design criterion that the highest ground-water can not be higher than two feet below grade. The applicant described the site characteristics related to ground-water elevation but failed to convince the staff that the design criterion would be satisfied. The staff determined that the applicant should provide an improved and complete description of the current and future local hydrological conditions, including alternate conceptual models, to demonstrate that the design bases related to ground-water-induced loadings on subsurface portions of safety-related SSCs would not be exceeded. Alternatively, the applicant could provide design parameters for buoyancy evaluation of the plant structures.

## **GEOLOGY, SEISMOLOGY, AND GEOTECHNICAL ENGINEERING**

### **Southern Nuclear Presentation (Applicant slides 42 through 69)**

Mr. McCallum gave a brief overview of his presentation. Then he described Southern Nuclear's seismic program organization including the technical support Southern Nuclear received (is receiving) from Bechtel, William Lettis & Associates, Risk Engineering, Bechtel San Francisco, and the Savannah River Site. Southern Nuclear's seismic program organization also received technical advice from a four person Ground Motion Review and Advisory Panel.

Mr. McCallum showed how the site will be laid out. Units 3 and 4 will be located side-by-side (800 feet apart) about 2000 feet west of the existing Units 1 and 2. Site grade elevation is 220 feet above mean sea level.

Southern Nuclear's evaluation of the tectonic features in the region involved a literature review, contacting local researchers, aerial reconnaissance, air photo interpretation, field reconnaissance, review of seismicity, seismic reflection profiles at Vogtle, and geomorphic analysis of river terraces. It took the better part of a year to complete. The last two items were

done to locate and assess the capability of the Pen Branch fault, located below the site. From south of the plant looking northeast, the fault runs from left to right, at a 45° down angle, from a depth of about 550 feet below sea level (i.e., the fault tip) down to a depth of roughly 2000 feet below sea level. On the left side of the fault (again looking northeast from just south of the plant) there is Paleozoic crystalline basement rock. On the right side of the fault is Triassic Dunbarton Basin sandstone. Each subsurface material has different shear wave velocities. If the fault passed underneath the site, one plant could be on crystalline rock while the other might be over sandstone, and that would affect the applicant's model for seismic ground motion. Bedrock is at a depth of about 1050 feet below grade. Coastal plain sediments lie above the bedrock. However, there is a large layer of marl directly below the VEGP site. The top of the Blue Bluff Marl lies about 86 feet below grade and is an approximately 76 foot thick layer of very hard clay. There is a layer of upper sands above the Blue Bluff Marl. Directly below and to the left of the fault tip there is 100-foot slip in the bedrock. Above the fault slip there is a 40-50 foot monocline in the Blue Bluff Marl sloping down and to the left. The applicants deep boring (B1003) went down to a depth of 1338 feet and was located just below the proposed Unit 3 site. Southern Nuclear determined that the Pen Branch fault lies about 670 feet north west of Unit 4. They also determined that the Pen Branch fault is non-active not capable. Dr. Powers questioned the use of river surveys and looking for terraces (e.g., the Ellenton Terrace) to conclude that there has no movement of the Pen Branch fault in quite some time. Mr. Lindvall explained that the fact that the terracing is preserved and that it is directly over the Pen Branch fault was key to helping the applicant reach its conclusion. Because there is no capable fault underneath the site the applicant can focus on the seismic threat from the Charleston seismic zone. In summary, Mr. McCallum said that none of the tectonic features within the site vicinity (25 miles) or site area (5 miles) are capable tectonic sources and that non-tectonic deformation and related features can be mitigated by the removal of strata overlying the Blue Bluff Marl. These are the same conclusions that the applicant reached when licensing Units 1 and 2. Dr. Powers questioned whether certain features in the Rappahannock River might be indicative of tectonic activity (i.e., Weems' ridges). Mr. Lindvall said that Mr. Robert Weems from USGS postulated in 1998 that certain features in the Rappahannock River (where the coastal plain meets the Piedmont seismic zone) could have been caused by tectonic activity, fluctuations in sea level, or differences in the erodability of different types of rock. Mr. Lindvall said that the fact that Pliocene Age deposits across these features showed no measurable deformation precluded them from being tectonic in nature. He offered several other reasons that precluded these from being tectonic features as well (e.g. similar expressions are not seen across the nearby countryside, the direction of the slip as compared to other faults in the Appalachians).

Mr. Lindvall, William Lettis & Associates, described how the applicant determined the seismic ground motion. Southern Nuclear's probabilistic seismic hazards analysis (PSHA) was developed using Regulatory Guide 1.165. The applicant assessed the additional effects of seismicity from 1985 through mid-2005 and then updated the Electric Power Research Institute - Seismicity Owners' Group (EPRI-SOG) seismic sources to account for new source information. Finally, the applicant used the actual updated ground motion models that were provided in the EPRI-SOG (EPRI 2004). Southern Nuclear updated the Charleston seismic source by taking a weighted average of four postulated sources. Most estimates of the Charleston seismic source place the source on shore in the meizoseismal region. Dr. Powers asked about the completeness of the paleoliquefaction observations (i.e., negative indications

as well as positive indications). Mr. Lindvall showed curves that represent the mean uniform hazard spectrum for rock for Vogtle. The curve dropped off sharply from 25 to 100 hertz (somewhat an artifact of how the data was plotted). Mr. McCallum described how Southern Nuclear took the uniform hazard rock curves and developed the soil hazard curves. First they developed the soil profile and properties. Then they determined soil amplitudes for multiple rock input amplitudes (frequencies from 100 Hz to 0.1 Hz) (1D SHAKE analysis) using M and R from de-aggregation (high- and low-frequency spectra). Finally, they combined the rock hazard with the site amplification (including uncertainties in input motion and soil properties) to obtain the soil uniform hazard spectra for multiple mean annual frequencies of exceedance (i.e., in accordance with Approach 2A in NUREG/CR-6728). Mr. McCallum showed a graph that displayed the soil-rock shear wave velocities down to about 2200 feet. The Blue Bluff Marl, lower sands, bedrock, and below were clearly evident. From that the applicant developed the safe shutdown earthquake (SSE) at Vogtle using ASCE 43-05 performance-based procedures. The SSE presented in the ESP was defined at a ground surface at a hypothetical outcrop of the highest competent in-situ material (i.e., top of the Blue Bluff Marl at approximately 86 foot depth). The applicant then calculated the vertical ground motion spectra from that horizontal spectra by taking a ratio of the two. That is: Vertical SSE = V/H times Horizontal SSE.

Mr. McCallum described the subsurface investigation that was done at the Vogtle ESP site. The applicant did 14 borings for the ESP, one to a depth of 1,338 feet (290 feet into hard rock). The applicant also did 12 cone penetration tests, three of which were seismic cone penetration tests. The applicant did geophysical testing in three of the boreholes (suspension P-S velocity logging, caliper/natural gamma measurements, resistivity/spontaneous potential measurements, boring deviation measurements). Southern Nuclear also put in 15 new ground-water observation wells, 10 in the upper aquifer and 5 in the lower aquifer (below the Blue Bluff Marl). They did laboratory testing on the soil from the 14 borings. They also used the soils information they had developed when licensing Units 1 and 2 as well as data from the Savannah River Site. Using all this data the applicant characterized the upper sands (Barnwell Group) as very loose to very dense sands with an average thickness of about 90 feet. The ground-water elevation in the upper sands is at 165 feet above mean sea level (or 55-60 feet below grade). So there is about 30-35 feet of ground-water above the Blue Bluff Marl. The Blue Bluff Marl (Lisbon formation) is very hard, slightly sandy, cemented, calcareous silt/clay with an average thickness of 76 feet. The lower sands (costal plain deposits) are dense with a thickness of about 900 feet. Bedrock is at about 1050 feet and below this level is Dunbarton Basin triassic sandstone. The applicant proposes to remove the upper sands and replace it with a compacted engineered fill, as was done for Units 1 and 2. Mr. McCallum showed top and side views of the planned excavation, which will include the excavation of a 45° zone-of-influence below where the nuclear island, turbine building, rad waste building, etc. will be placed. Mr. McCallum repeated that the Vogtle ESP SSE is defined at the free ground surface of a hypothetical outcrop of the highest competent in-situ layer (top of the Blue Bluff Marl). This is called the site-specific ground motion response spectra (GMRS). At the COL stage, the applicant will propagate the GMRS through the engineered backfill to a depth of 40 feet, where the AP1000 nuclear island will be placed. This will be called the foundation input response spectra (FIRS). The shape of the FIRS will be similar to the shape of the GMRS, but it will be slightly amplified. The AP1000 plants placed on the Vogtle site will be designed to the AP1000 certified design response spectra and not the FIRS. Any exceedances of the FIRS over the certified design response spectra would need to be evaluated. However, Mr. Moore said that

preliminary indications suggest that the FIRS at Vogtle will fall below the certified design response spectra. Ms. Sterdis said that the AP1000 standard plant piping would be designed to a bounding spectra and not to a site-specific spectra.

**NRC Staff Presentation** (Second set of staff slides 1 through 33)

Mr. Stirewalt presented the staff's basic geologic and seismic information. He said that since the Pen Branch fault dipped beneath the ESP site the staff wanted to make absolutely certain that the fault was not capable. He characterized the Pen Branch fault as being approximately 25 miles in length, exhibits no expression of surface displacement, and exhibits no seismic activity. Mr. Stirewalt said that applicant found that there was no stratigraphic evidence of fault movement in the last 33.7 my (post-Eocene). He said the applicant evaluated the Savannah River terraces for evidence of local fault displacement during the past 1.8 my (Quaternary) and found none. He said that it is only when they have seen fault displacement within the last 1.8 my that they start to be concerned. Mr. Stirewalt agreed with the applicant's conclusion that field evidence indicates that the Pen Branch fault is not a capable fault. Dr. Powers asked the staff if they agreed with the applicant that the Eastern Tennessee zone is outside the domain of interest. Ms. Gonzalez said that applicant did not include the Eastern Tennessee zone because it contributed to less than 1% of the total hazard.

Ms. Gonzalez said that the staff had two open items related to the applicant's update to the Charleston seismic source zone. The applicant's update of the 1986 EPRI source model involved significant changes in geometry, maximum magnitudes ( $M_{max}$ ), and recurrence interval. She said that the average recurrence interval of  $M_{max}$  earthquakes decreased significantly, thus increasing the overall hazard. The update was based on liquefaction features from historic and pre-historic earthquakes.

Ms. Bauer provided the Subcommittee with a brief discussion of liquefaction. Liquefaction can occur in response to strong ground motion. She said that susceptibility to liquefaction is a function of the site characteristics and that they commonly occur in the form of sand blows and associated sand dikes. Ms. Bauer said there is abundant liquefaction features from both historic and prehistoric earthquakes along the South Carolina coast for about 130 miles northeast to southwest, and then there are a few along the Edisto River approximately 65 miles inland from Charleston. Paleoliquefaction features formed from prehistoric earthquakes. Dr. Powers asked how one dates a liquefaction feature. Ms. Bauer explained the sand blows often cross cut layers of subsurface material and entrain organic materials which can then be dated (e.g., by luminescence or carbon dating). Archeology can sometimes also be used to help date the liquefaction. Again, Dr. Powers asked what the probability of detecting the liquefaction is versus the number of places where it actually occurred. He noted that you can only find them where you can see them. Ms. Bauer said that sandblows can sometimes be detected using aerial photography, archeology, or ground-penetrating radar. Ms. Bauer showed several photos of liquefaction features from the Charleston earthquake of 1886. paleoliquefaction features, documented since the 1989 EPRI study, contributed to the update to the Charleston source zone. Liquefaction features suggest 5 similar magnitude earthquakes (in addition to the 1886 event) during the past approximately 5,000 years. Consequently, the estimated recurrence interval for large earthquakes in the Charleston area has been revised to every 500-600 years based on a complete 2,000 year history and every 900-1,000 years based on a

complete 5,000 year history. The staff concluded that the applicant did not provide sufficient paleoliquefaction evidence to rule out the occurrence of large inland earthquakes. In addition, the occurrence of a large earthquake, inland from the coast, may necessitate a different Charleston source zone model.

Ms. Gonzalez said that the staff has a second open item related to the applicant's process for updating the Charleston seismic source. The applicant used a Senior Seismic Hazard Analysis Committee (SSHAC) Level 2 process to perform the update. The applicant designated a technical intergator who was responsible for conducting the literature review and contacting the appropriate experts. The technical integrator was also responsible for integrating current literature and expert's views into a final model. The staff requested additional details regarding the expert elicitation process (i.e., the questions asked of the experts and the their responses, the process used to combine the expert's responses). Ms. Gonzalez said that the applicant did not update either the regional seismic source zones that encompass the ESP site or the eastern Tennessee seismic zone located just outside the 200-mile radius from the site. The applicant did not update the eastern Tennessee seismic source zone because it contributed to less than 1% of the hazard, not because it was outside the 200-mile radius. Because the staff believes that new information exists that suggests that updates to these sources may be warranted, the staff made each update an open item. The EPRI seismic source zones were determined by six Earth Science Teams during the 1980s. The Dames and Moore team assigned low weights for larger  $M_{max}$  values (and low probabilities of activity) to two of their regional source zones. In fact, 10-Hz total mean hazard curve produces by the Dames and Moore team was about an order of magnitude lower than those produced by the other five teams. Therefore, the staff believes the Dames and Moore hazard curves for the ESP site may not adequately characterize the regional hazard. Ms Gonzales said that following the development of its open item, it found the following quote in DOE Standard 1024-92:

Risk engineering, Inc. has also found that the EPRI team of Dames and Moore does not fully account for historic seismicity near the Savannah River Site (SRS). One reason for this is the fact that the SRS host source zone was given a low probability of activity. Risk Engineering, Inc. recommended that the Dames and Moore seismic source input not be used to calculate the seismic hazard at SRS."

Mr. Davis said that he thought this quote might have been taken out of context. Mr. McGuire, Risk Engineering, Inc., said that his firm had been asked to review the seismic hazard at the SRS shortly after the EPRI study, and a similar study by Lawrence Livermore, were published in 1989. Risk Engineering, Inc. was evaluate the differences in the two studies and come up with a common set of seismic hazard curves for the SRS. Their conclusion was that if you dropped the Dames and Moore seismic hazard curve from the EPRI study and dropped two or three of the high curves from the Lawrence Livermore study, the remaining curves overlapped and could be used for decision making at SRS. He also said that a subsequent SSHAC project (1997) recommended that the data/information from all teams be used. However, subjective probabilities could be assigned to the information, so long as the basis for assigning the probabilities is documented. He added that this latter SSHAC recommendation was incorporated into the EPRI-SOG documents and endorsed in Regulatory Guide 1.165. Dr. Munson clarified that Regulatory Guide 1.176 calls for updating the EPRI seismic source model if there are new interpretations or new data. He added that while there is no new data, the staff considered the quoted text above to be a new interpretation.

With regard to updating the eastern Tennessee seismic zone  $M_{max}$  values, the applicant concluded that no new information has been developed since 1986 that would require significant revision to the EPRI seismic source model. The staff, on the other hand, concludes that recent studies suggest significant revisions to the EPRI seismic source model are warranted. The staff cited analyses of earthquake focal mechanisms and hypocenter locations (Chapman et. Al., 1997; Dunn and Chapman, 2005) which indicates a series of northeast trending basement faults, intersected by several east-trending faults. Ms. Gonzalez said that the inferred fault lengths (approximately 20 to 50 km) are large enough to produce significant earthquakes (approximately  $M_w$  7+). She said that while the largest recorded earthquake in the eastern Tennessee seismic zone is only a magnitude 4.6, a recent study by Chapman concluded that the historical record is too short to rule out the possibility of larger (greater than magnitude 5) earthquakes. Furthermore, the mean  $M_{max}$  values for the EPRI study (approximately 6.2) are significantly lower than more recent mean  $M_{max}$  values, which ranged from  $M_{max}$  6.3 to  $M_{max}$  7.5. Ms. Gonzalez said the  $M_{max} = 7.5$  came from the USGS National Hazard map 2002 and the  $M_{max} = 6.3$  came from South Carolina Department of Transportation (SCDOT). Therefore, the staff concluded that the applicant was not adequately justified in its decision not to update the eastern Tennessee seismic zone or perform sensitivity studies to determine the impact of updating the seismic zone. Mr. McGuire, Risk Engineering, Inc., said that they had contacted Dames and Moore within the last two weeks to confirm their opinion that there are certain sources in the coastal plain and in the Piedmont that with some probability are not active in the sense of producing or generate earthquakes with a magnitude of 5 or greater.

Ms. Gonzalez said that the applicant described three post-EPRI PSHA studies which involved the characterization of seismic sources within the ESP site region (i.e., USGS, 2002; SCDOT, 2002; and the NRC TIP study, NUREG/CR-6607). The applicant dismissed the NRC's TIP study because it focused on the implementation of the SSHAC PSHA methodology. The staff believes that much of the data and results contained in the TIP study report may be applicable to the ESP site.

In discussing surface faulting, Mr. Stirewalt said that there is stratigraphic information which suggests certain sand dikes may be as young as 1.8 my to 10,000 years (Pleistocene). He said that the applicant did not clearly show that these sand dikes are spatially related to dissolution depressions. The staff believes that these fluid/plastic injections of sand could be associated with seismicity and liquefaction. Therefore, the staff has asked the applicant for a detailed description of the dike characteristics, the spatial associations, and the stratigraphic age of the dikes.

Mr. Li indicated that the staff has a total of about 12 open items on the subsurface material static and dynamic properties. He said that the applicant performed limited borings and tests to characterize the static properties of the load-bearing layer. He noted that only 3 of the 14 boring done by the applicant for the ESP penetrated through the Blue Bluff Marl. The applicant relied on results from the Unit 1 and 2 investigations (1970) for soil properties such as internal friction angle, unit weight, and undrained shear strength. Mr. Li said that the regulatory requirements and testing technology have changed since that time. Mr. Munson said that is also significant differences between the Unit 1 and 2 data and the ESP data (e.g., the

undrained shear strength of the Blue Bluff Marl was on the order of 10,000 psf for Units 1 and 2 and on the order of 150 to 4,300 psf for the ESP site). The applicant did not conduct laboratory tests on soil samples to determine the soil dynamic properties. Mr. Li said that these dynamic properties are needed to determine the site-specific ground motion response spectra (GMRS). The GMRS is equivalent to the SSE and is compared to the DCD design spectra at the COL stage. The staff acknowledged that the applicant has conducted more explorations and testing of the subsurface materials after submission of the ESP application (e.g., an additional 174 borings in support of LWA-2).

## **RADIOLOGICAL CONSEQUENCES OF DESIGN BASIS ACCIDENTS (DBAS)**

### **Southern Nuclear Presentation (Applicant slides 70 through 73)**

Mr. Davis said that Southern Nuclear's methodology was to take the accident doses developed in the AP1000 analyses and adjust them using their site-specific diffusion estimates (own meteorological data) to arrive at the dose estimates. That is, they multiplied the DCD doses by the ratio of the site versus DCD  $\chi/Q$  values. The VEGP generated dose estimates were bounded by the DCD analysis. Mr. Davis showed a table that DCD  $\chi/Q$  values, site  $\chi/Q$  values, and ratio for loss of coolant accidents and other accidents at both the exclusion area boundary (EAB) and in the low population zone (LPZ). He also showed a table that listed the Vogtle-specific doses at the EAB and LPZ for various accidents and compared them to the regulatory limit.

### **NRC Staff Presentation (Third set of staff slides 1 through 9)**

Ms. Hart started her presentation by identifying the applicable regulations (i.e., 10 CFR 50.17, Part 100, 10 CFR 50.34) and dose limits (i.e., 25 rem total whole body dose equivalent for any 2-hour period at the EAB after the onset of an accident, 25 rem total whole body dose equivalent for the duration of the accident in the LPZ). She said that the applicant used the AP1000 DCD Tier 1 design reference atmospheric dispersion factors ( $\chi/Q$  values) for the EAB and LPZ. Ms. Hart said that Westinghouse had used accident-specific release rates, obtained in a response to an request for additional information, and the guidance in Regulatory Guide 1.183, to arrive at accident-specific source terms for the AP1000 design. Ms. Hart said that site-specific short-term  $\chi/Q$  values for each offsite receptor were less than the AP1000 design reference  $\chi/Q$  values for each time averaging period. Her example showed one to be much less. As stated by the applicant, the accident dose for the site is the DCD dose adjusted by a factor to account for the difference in site-specific  $\chi/Q$  values to design reference  $\chi/Q$  values. Therefore, the dose for each time averaging period is directly related to the  $\chi/Q$  value for that period. The ratio for each averaging period is less than one, therefore the dose for the site is always less than the dose specified in the DCD. The staff said that this can be confirmed by taking the source release from the proposed plant for each DBA and calculating site-specific DBA doses using site-specific  $\chi/Q$  values. The staff finding was that since the AP1000, Revision 15, DBA radiological analyses was shown to meet the 10 CFR50.34(a)(1) siting dose criteria and since the site-specific accident doses were shown to be less than the AP1000, Revision 15 doses, then the Vogtle ESP site meets the 10 CFR50.34(a)(1) siting dose criteria for DBAs. The staff concluded by saying that if the COL applicant chooses to use the next

revision of the AP1000 DCD (which could change the AP1000 accident source terms or reference  $\chi/Q$  values), the staff would reevaluate that and make sure the applicant stays within the Vogtle ESP source terms and  $\chi/Q$  values.

**NRC STAFF'S CONCLUSIONS** (First set of staff slides 38 through 41)

Mr. Araguas said that the SER defers the general regulatory conclusion regarding site safety and suitability until all open items have been addressed and the staff issues its final SER. He mentioned several conclusions from SER sections without any open items:

- The applicant has provided appropriate quality assurance measures equivalent to those in Appendix B to 10 CFR Part 50.
- The applicant has demonstrated that radiological effluent release limits associated with normal operation, from the type of facility proposed to be located at the site, can be met for any individual located offsite (10 CFR 100.21(c)(1)).
- The radiological consequences of postulated accidents meet the criteria set forth in 10 CFR 50.34(a)(1) for the type of facility proposed to be located at the site (10 CFR 100.21(c)(2)).
- Potential hazards associated with nearby transportation routes, industrial, and military facilities pose no undo risk to facilities that might be constructed on the site (10 CFR 100.21(e)).
- Site characteristics are such that adequate security plans and measures can be developed (10 CFR 100.21(f)).

Mr. Araguas said that the SER with open items was issued on August 30, 2007, with 40 open items, 2 permit conditions, and 19 COL action items. He said that the number of permit conditions were fewer than for previous ESP applicants, probably because Southern Nuclear referenced a specific reactor design. The applicant responded to the open items on October 15, 2007. The staff is reviewing the applicant's responses and supplemental information associated with LWA-2. Mr. Araguas said that the staff hoped to complete its review of the Vogtle ESP application in the March time frame and that the next interaction with the ACRS will tentatively be in June 2008 for review of the staff's final SER. Dr. Power suggested a half day subcommittee meeting in advance of a full Committee session might be appropriate in light of seismic issues associated with the Vogtle ESP application.

**STATUS OF IMPLEMENTING LESSONS LEARNED WHILE CONDUCTING LICENSING ACTIVITIES PURSUANT TO 10 CFR PART 52**

Dr. Powers introduced the discussion by saying that the Commission had asked for the Committee's assessment of the staff's implementation of lessons learned (i.e., in a Staff

Requirements Memorandum dated November 8, 2006). He acknowledged that by this time he did not expect that the staff would have fully assimilated all the lessons learned and implemented them flawlessly.

In the way of background, Mr. Araguas said that the staff had ostensibly completed three ESP reviews and has one still ongoing, the Vogtle ESP review. He acknowledged that the staff had met with the ACRS and ESP applicants in September 2006 on ESP lessons learned. He summarized ten ESP lessons learned, as documented in the Committee's September 22, 2006, letter to the Executive Director for Operations. Then for each lesson learned, he listed activities the staff has completed, is currently working on, or has planned to implement that lesson learned.

The lessons and synoptic accounts of staff actions are provided below.

**Develop common understanding between the staff and applicants concerning expectations.**

The staff has completed pertinent updates to NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants;" issued Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants;" and has developed Office Instruction NRO-REG-100, "Acceptance Review Process for Design Certifications and Combined License Applications." Furthermore, the staff has been interacting with the nuclear industry and potential applicants through the Design-Centered Working Groups.

The staff has done much to facilitate the development of common understandings. This is a most important undertaking and will continue to need attention. An incomplete understanding of staff expectations by the applicant resulted in many requests for additional information and open items in the staff's Safety Evaluation Report (SER) for the ongoing Vogtle early site permit application.

**Clarify the applicability of 10 CFR Part 21, "Reporting of Defects and Noncompliance," requirements for early site permit applications.**

10 CFR Part 52 makes it clear that 10 CFR Part 21 is applicable to early site permit applicants.

**Clarify the applicability of 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants," requirements for early site permit applications.**

Again, 10 CFR Part 52 makes it clear that the Appendix B quality assurance requirements are applicable to early site permit applicants.

**Develop improved guidance on electronic submission of applications.**

The staff has improved and clarified the process for electronic submission of applications. This has included documentation and even video clips of the process. However, additional progress can still be made in this area.

**Incorporate into staff guidance definitions of terms such as “License Conditions” and “COL action items.”**

The staff has incorporated these definitions into the Standard Review Plan and has trained reviewers regarding the definitions.

**Develop guidance for the review of the performance-based methodology for assessing seismic hazards.**

The staff has issued Regulatory Guide 1.208, “A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion.”

**Review the development and study of long-term weather cycles for periods of up to 100 years.**

The staff has made appropriate modifications to the Standard Review Plan to recognize that there are cycles in the weather. Such cycles are especially well known for the east coast of the United States. The staff has made contact with knowledgeable technical societies, will be attending pertinent scientific conferences, and is proposing research studies of trends in the frequencies and intensities of hurricanes.

**Update guidance for the review of site hydrology.**

The staff has updated the Standard Review Plan. It is updating its regulatory guide on analysis of flooding. The staff is also investigating possible threats to coastal nuclear power plants posed by tsunamis including tsunamis that might come from submarine landslides in the Cape Verde islands.

**Develop guidance for the treatment of the high frequency component of seismic ground motion.**

The staff has provided guidance in both the Standard Review Plan and in Regulatory Guide 1.208.

**Develop guidance on the use of Internet data.**

The staff had not taken action on the Committee’s recommendation that they develop guidance to ensure that data obtained from the Internet are valid now and retrievable in the future. At many points in the early site permit applications data derived from the Internet are used. The Committee expects increased reliance on Internet databases in the future. Data obtained from the Internet do not have the immutable quality of the printed page. Such data can be altered by intent, through misadventure or through malice. Therefore, the NRC needs to provide applicants with guidance to ensure that data they obtain from the Internet are valid in the sense that they reflect the intent of the developer of the database. The data may be needed long after an early site permit has been approved and after many revisions of the electronic site from which the data were originally obtained. Consequently, guidance on ensuring the retrievability

of the data is also needed. Furthermore, based on the Committee's recent review of the Vogtle early site permit application, it may be necessary for the NRC to interact with other government agencies to assist applicants in obtaining the validation that the staff feels is necessary for the data provided by these agencies via the Internet.

### **General Questions and Observations from the Subcommittee Members**

The staff has undertaken a thorough review and, where appropriate, independent analysis of the Vogtle early site permit application.

The staff has requested that the applicant further assess the post-construction hydrology of the site, the seismic hazard at the site, and weather extremes at the site.

The decision by the applicant to propose a specific nuclear power plant design in conjunction with the early site permit application has probably resulted in fewer permit conditions in the SER on the application.

The NRC staff has moved effectively to address within the regulatory process many of the lessons learned from the reviews of early site permit applications.

The staff still needs to provide guidance to applicants on adequate measures to ensure the quality, integrity, and retrievability of data obtained from the Internet.

### **Subcommittee's Action**

The staff and the applicant plan to provide a briefing on Vogtle ESP application to the full Committee during the November 1-3, 2007, ACRS meeting. Dr. Powers asked the staff to present the same lessons learned presentation that it made to the Subcommittee to the full Committee during the November 1-3, 2007, ACRS meeting.

### **Documents Provided to the Subcommittee**

1. Memorandum dated November 8, 2006, from Annette L. Vietti-Cook, Secretary, NRC, to John T. Larkins, Executive Director, ACRS, Subject: Staff Requirements — Meeting with Advisory Committee on Reactor Safeguards, 2:30 p.m., Friday, October 20, 2006, Commissioners' Conference Room, One White Flint North, Rockville, Maryland (Open to Public Attendance).
2. Southern Nuclear Operating Company, Vogtle Early Site Permit Application, Revision 2, April 2007, NRC Docket No. 52-00011.
3. U.S. Nuclear Regulatory Commission, Safety Evaluation Report With Open Items, "Safety Evaluation Report For The Vogtle Early Site Permit Application," August 30, 2007.
4. Status Report dated October 2, 2007, from David C. Fischer, Senior Staff Engineer,

ACRS, to Dana Powers, ACRS, Subject: Meeting of the Early Site Permit Subcommittee, October 24, 2007 - Rockville, Maryland.

5. Report dated October 12, 2007, from William J. Hinze, Advisory Committee on Nuclear Waste and Materials, to Dana Powers, ACRS, Subject: Review of Vogtle Early Site Permit Application and NRC's Safety Evaluation Report for the Vogtle Application.

\*\*\*\*\*

**NOTE :** Additional details of this meeting can be obtained from a transcript of this meeting available for downloading or viewing on the Internet at <http://www.nrc.gov/reading-rm/adams.html> or <http://www.nrc.gov/reading-rm/doc-collections/> can be purchased from Neal R. Gross and Co., 1323 Rhode Island Ave., N.W., Washington, DC 20005 (202) 234-4433.



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001

September 6, 2007

MEMORANDUM TO: D. Powers, Chairman, Early Site Permits Subcommittee

FROM: David C. Fischer, Senior Staff Engineer, ACRS

A handwritten signature in black ink that reads "David C. Fischer".

SUBJECT: TRANSMITTAL OF MATERIALS FOR THE SUBCOMMITTEE ON  
EARLY SITE PERMITS REGARDING THE VOGTLE EARLY SITE  
PERMIT (ESP) APPLICATION ON OCTOBER 24, 2007, IN ROCKVILLE,  
MARYLAND

The purpose of this memorandum is to forward background materials for your use in preparing for the upcoming Early Site Permits Subcommittee meeting scheduled for Wednesday, October 24, 2007 in Room T-2 B3. The purpose of the meeting is to discuss the Vogtle ESP application and associated staff safety evaluation report with open items. We will also hear from the staff on their implementation of lessons learned from licensing activities under Part 52 (e.g., ESP application reviews), so the Committee can respond to a staff requirements memorandum item from its meeting with the Commission in October 2006.

Attached please find the latest revision of the Vogtle ESP application (ML071710562) and the staff's safety evaluation with open items (ML071581032).

Attachments:

As stated

cc w/attachments: ACRS Members

cc w/o attachments: C. Santos  
S. Duraiswamy

November 8, 2006

MEMORANDUM TO: John T. Larkins  
Executive Director, ACRS

FROM: Annette L. Vietti-Cook, Secretary */RA/*

SUBJECT: STAFF REQUIREMENTS - MEETING WITH ADVISORY  
COMMITTEE ON REACTOR SAFEGUARDS, 2:30 P.M., FRIDAY,  
OCTOBER 20, 2006, COMMISSIONERS' CONFERENCE ROOM,  
ONE WHITE FLINT NORTH, ROCKVILLE, MARYLAND (OPEN  
TO PUBLIC ATTENDANCE)

The Commission met with the Advisory Committee on Reactor Safeguards (ACRS) to discuss the Committee's activities and current focus.

As licensing under Part 52 continues the Committee should advise the Commission on effectiveness and efficiency of staff's implementation of lessons learned in areas it has reviewed, for example, the development of guidance documents for early site permits.

The Committee should provide its views to the Commission on staff's effort related to digital instrumentation and controls. The Committee should consider potential means for providing reasonable backup, if appropriate.

The ACRS should provide its views to the Commission with respect to staff's work on technology neutral licensing framework with a focus on ensuring the value of such an approach versus the development of a licensing framework for specific designs, such as a high temperature gas cooled reactor or a liquid metal cooled reactor.

The ACRS should provide the Commission with its recommendations and basis for areas in which NRC should perform additional long term research.

The Committee should work with the staff and external stakeholders to evaluate the different Human Reliability models in an effort to propose either a single model for the agency to use or guidance on which model(s) should to be used in specific circumstances.

cc: Chairman Klein  
Commissioner McGaffigan  
Commissioner Merrifield  
Commissioner Jaczko  
Commissioner Lyons  
OGC  
CFO  
OCA  
OIG  
OPA  
Office Directors, Regions, ACRS, ACNW, ASLBP (via E-Mail)  
PDR



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001

ACRSR-2275

November 20, 2007

Mr. Luis A. Reyes  
Executive Director for Operations  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

SUBJECT: INTERIM LETTER: SOUTHERN NUCLEAR OPERATING COMPANY  
APPLICATION FOR THE VOGTLE EARLY SITE PERMIT AND THE  
ASSOCIATED NRC SAFETY EVALUATION REPORT WITH OPEN ITEMS

Dear Mr. Reyes:

During the 547<sup>th</sup> meeting of the Advisory Committee on Reactor Safeguards (ACRS), November 1-3, 2007, we began our review of the Vogtle<sup>1</sup> early site permit application and the associated safety evaluation report (SER) with open items prepared by the NRC staff. This matter was also reviewed by our Subcommittee on Early Site Permits on October 24, 2007. During these reviews, we had the benefit of discussions with representatives of the NRC staff and Southern Nuclear Operating Company (Southern Nuclear or "applicant"). We also had the benefit of the documents referenced. We review early site permit applications to fulfill the requirement of 10 CFR 52.23 that the ACRS report on those portions of an early site permit application that concern safety.

### CONCLUSIONS

1. The staff has undertaken a thorough review and, where appropriate, independent analysis of the Vogtle early site permit application.
2. The staff has requested that the applicant further assess the post-construction hydrology of the site, the seismic hazard at the site, and weather extremes at the site. We support these requests for additional assessment.
3. The decision by the applicant to propose a specific nuclear power plant design in conjunction with the early site permit application has probably resulted in fewer permit conditions in the SER on the application.

### DISCUSSION

The site currently occupied by Units 1 and 2 of the Vogtle Electric Generating Plant was approved originally for four units, but only two were built. The units now present at the site are 3,565 MWt Westinghouse pressurized water reactors. Also on the site is Plant Wilson which is a six-unit, oil-fueled combustion turbine facility.

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<sup>1</sup> Vogtle is named for Alvin Ward Vogtle whose exploits in World War II were the inspiration for the character played by Steve McQueen in the movie The Great Escape.

Southern Nuclear has proposed to locate two Westinghouse AP1000 advanced nuclear power plants on the site. The AP1000 has a thermal power of 3,400 MWt. These power plants, designated Vogtle Units 3 and 4, will be located adjacent to and west of the existing Vogtle units. The early site permit application is unusual in that the applicant has selected a specific nuclear power plant design rather than relying on a plant parameter envelope as has been the case in previous applications for an early site permit. The applicant has also provided a complete and integrated emergency plan rather than providing only the major features of an emergency plan, as has been the case in previous early site permit applications.

### **Population in the Vicinity of the Site**

The Vogtle site is located in rural Georgia approximately 15 miles east-northeast of Waynesboro, Georgia (population 5,813), and 26 miles southeast of Augusta, Georgia (population 195,182). Augusta, Georgia, is the population center nearest the site. Numerous small towns are located within 50 miles of the site. Only the town of Girard (population 227) is within 10 miles of the Vogtle site. The site is across the Savannah River from the Department of Energy's Savannah River Site, which has several thousand employees. There are several shutdown production reactors and active facilities for processing tritium and defense wastes at the Savannah River Site. The Department of Energy is proposing to construct the Mixed Oxide (MOX) Fuel Fabrication Facility on the Savannah River Site.

Based on 2000 census data, the combined resident and transient populations within 5 miles and within 10 miles of the site (aside from those working at the Savannah River Site) are 687 and 3,560, respectively. The population within 50 miles of the site is expected to approximately quadruple over the next 60 years but will not exceed an average of 500 people per square mile within 10 miles of the site.

### **Industrial Hazards in the Site Vicinity**

With the exception of activities at the Department of Energy's Savannah River Site, there are no industrial activities of substance near the site. Hazardous material transport by rail and highway pose little threat to the site. The Savannah River is not used as a commercial transportation route at this time. Though there is a large military reservation in the vicinity of the site, projected activities do not pose significant threats to the nuclear power plant site.

### **Aircraft Hazard**

A commercial airline route passes within 2 miles of the proposed site. Projected increases in traffic along this route are not sufficient to raise site hazards to the point of regulatory concern.

### **Meteorology**

Weather at the Vogtle site is mild. Extreme cold and heavy winter precipitation are not common. Summers are hot with periods of stable ambient atmosphere. The applicant has based estimates of temperature extremes on a database covering a period of 30 years. In light of the duration of an early site permit (20 years) and the design life of any modern nuclear power plant constructed on the site (60 years), this appears to be an inadequate base of data

for estimating temperature extremes. Moreover, the well known 50-year weather cycles along the east coast of the United States make the adequacy of the applicant's database even more dubious. The staff has asked the applicant to reassess the bases for estimates of weather extremes at the site.

### **Geology and Seismicity of the Site**

The Vogtle site is located on the coastal plain below the Appalachian Piedmont. The ground is largely uncompacted sediments above the Blue Bluff Marl and compacted sands below the Blue Bluff Marl. Bedrock is at a depth of over 1000 feet. The Charleston seismic center poses the greatest threat to the site. The applicant has gone to great lengths to demonstrate that the Pen Branch Fault underlying the site is not a capable fault and does not contribute to the seismic threat to nuclear facilities on the site. The Eastern Tennessee Seismic Zone is about 200 miles from the site and poses only a modest threat to the facility.

The applicant has proposed to excavate to the Blue Bluff Marl and replace the natural materials with an engineered fill for the entire power block of each of the two proposed nuclear power plants. This is much as was done for Vogtle Units 1 and 2. The excavation and engineered fill relieve a number of erosion and seismic concerns. The applicant has relied to a large extent on the characterization of the Blue Bluff Marl done for Units 1 and 2 to characterize the basement material for Units 3 and 4. The staff has asked for more characterization of the Blue Bluff Marl immediately below the proposed locations for the new units.

The applicant has used the Electric Power Research Institute seismic hazard methodology. The applicant has updated the seismic hazard posed by the Charleston seismic zone including a significant increase in the frequency of large earthquakes to once every 500 years. Unfortunately, the Charleston seismic zone is not associated with a specific geological feature and consequently its precise location is not well known. The applicant has used a weighted average of possible regions for the seismic zone. The staff has identified data that suggest the seismic zone might be closer to the Vogtle site than considered by the applicant. Consideration of this data may move the centroid of seismic activity closer to the site and increase the seismic risk at the site. The staff has asked the applicant to provide additional information to support its conclusion that large earthquakes most likely do not occur further inland, closer to the Vogtle site.

The applicant did not update the characterization of the Eastern Tennessee Seismic Zone in the assessment of the seismic threat to the site. The staff has identified data that suggest an update of the Eastern Tennessee Seismic Zone should be done.

The estimate of local seismicity, aside from that caused by the Charleston seismic center, has been based on averaging several expert opinions. The staff questions the inclusion of one of the expert opinions in the analysis.

## **Hydrology**

Failures of dams on the Savannah River could produce floods in the vicinity of the Vogtle site. Analyses performed by the applicant and reviewed by the staff show that conservative estimates of the maximum floods do not threaten the site.

Ground-water motion on the site will be affected by the construction of nuclear power plants on the site. The ground-water motion could affect transport of radionuclides. The applicant has analyzed the ground-water motion. The staff has, however, identified an alternative pathway for water flow and has asked the applicant to consider this alternative.

## **Emergency Plan**

The applicant has developed an integrated emergency plan and provided revised evacuation time estimates. The staff has asked the applicant to ensure that local agencies review these time estimates since they may affect the actions of the agencies in the event of an emergency.

We conclude that the staff is preparing a quality SER on the Vogtle early site permit application and we look forward to reviewing the final application and SER.

ACRS member Professor Said Abdel-Khalik did not participate in the Committee's deliberations regarding this matter.

Sincerely,

/RA/

William J. Shack  
Chairman

## References:

1. U.S. Nuclear Regulatory Commission, Safety Evaluation Report With Open Items, "Safety Evaluation Report for the Vogtle Early Site Permit Application," August 30, 2007.
2. Southern Nuclear Operating Company, "Vogtle Early Site Permit Application," Revision 2, NRC Docket No. 52-00011, April 2007.
3. Report dated October 12, 2007, from William J. Hinze, Advisory Committee on Nuclear Waste and Materials, to Dana Powers, ACRS, "Review of Vogtle Early Site Permit Application and NRC's Safety Evaluation Report for the Vogtle Application."

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*/RA/*

William J. Shack  
Chairman

References:

1. U.S. Nuclear Regulatory Commission, Safety Evaluation Report With Open Items, "Safety Evaluation Report for the Vogtle Early Site Permit Application," August 30, 2007.
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Letter To: Mr. Luis A. Reyes  
Executive Director for Operations

From: William J. Shack, Chairman  
ACRS

Subject: INTERIM LETTER: SOUTHERN NUCLEAR OPERATING COMPANY  
APPLICATION FOR THE VOGTLE EARLY SITE PERMIT AND THE  
ASSOCIATED NRC STAFF'S SAFETY EVALUATION REPORT WITH OPEN  
ITEMS

Date: November 20, 2007

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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001

ACRSR-2273

November 19, 2007

The Honorable Dale E. Klein  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

SUBJECT: STAFF'S IMPLEMENTATION OF LESSONS LEARNED FROM REVIEWS OF  
EARLY SITE PERMIT APPLICATIONS

Dear Chairman Klein:

At the conclusion of our review of the North Anna, Grand Gulf, and Clinton early site permit applications, we met with the NRC staff and representatives of some applicants to discuss lessons that had been learned during the review process and that might be applicable to the review of future early site permit applications and combined license (COL) applications. We reported to the Executive Director for Operations on this meeting in a letter dated September 22, 2006.

In a November 8, 2006 Staff Requirements Memorandum, resulting from the meeting with the ACRS, the Commission requested that as licensing under 10 CFR Part 52 continues, the Committee advise the Commission on effectiveness and efficiency of staff's implementation of lessons learned in areas it has reviewed, for example, the development of guidance documents for early site permit applications. During the 547<sup>th</sup> meeting of the Advisory Committee on Reactor Safeguards, November 1-3, 2007, we met with the NRC staff to review progress on implementation of the lessons learned in the regulatory process as well as the effectiveness and efficiency of such implementation. This matter was also discussed with the NRC staff at a meeting of our Subcommittee on Early Site Permits held on October 24, 2007. We are pleased to report to you the progress the staff has made on implementation of the lessons learned.

#### CONCLUSION AND RECOMMENDATION

1. The NRC staff has moved effectively to address within the regulatory process many of the lessons learned from the reviews of early site permit applications.
2. The staff still needs to provide guidance to applicants on adequate measures to ensure the quality, integrity, and retrievability of data obtained from the Internet.

#### DISCUSSION

The staff has made more progress than we would have expected in the implementation of the lessons learned from the review of early site permit applications. The lessons and synoptic accounts of staff actions are provided below.

**Develop common understanding between the staff and applicants concerning expectations.**

The staff has completed pertinent updates to NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants;" issued Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants;" and has developed Office Instruction NRO-REG-100, "Acceptance Review Process for Design Certifications and Combined License Applications." Furthermore, the staff has been interacting with the nuclear industry and potential applicants through the Design-Centered Working Groups.

The staff has done much to facilitate the development of common understandings. This is a most important undertaking and will continue to need attention. An incomplete understanding of staff expectations by the applicant resulted in many requests for additional information and open items in the staff's Safety Evaluation Report (SER) for the ongoing Vogtle early site permit application.

**Clarify the applicability of 10 CFR Part 21, "Reporting of Defects and Noncompliance," requirements for early site permit applications.**

10 CFR Part 52 makes it clear that 10 CFR Part 21 is applicable to early site permit applicants.

**Clarify the applicability of 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants," requirements for early site permit applications.**

Again, 10 CFR Part 52 makes it clear that the Appendix B quality assurance requirements are applicable to early site permit applicants.

**Develop improved guidance on electronic submission of applications.**

The staff has improved and clarified the process for electronic submission of applications. This has included documentation and even video clips of the process. However, additional progress can still be made in this area.

**Incorporate into staff guidance definitions of terms such as "License Conditions" and "COL action items."**

The staff has incorporated these definitions into the Standard Review Plan and has trained reviewers regarding the definitions.

**Develop guidance for the review of the performance-based methodology for assessing seismic hazards.**

The staff has issued Regulatory Guide 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion."

**Review the development and study of long-term weather cycles for periods of up to 100 years.**

The staff has made appropriate modifications to the Standard Review Plan to recognize that there are cycles in the weather. Such cycles are especially well known for the east coast of the United States. The staff has made contact with knowledgeable technical societies, will be attending pertinent scientific conferences, and is proposing research studies of trends in the frequencies and intensities of hurricanes.

**Update guidance for the review of site hydrology.**

The staff has updated the Standard Review Plan. It is updating its regulatory guide on analysis of flooding. The staff is also investigating possible threats to coastal nuclear power plants posed by tsunamis including tsunamis that might come from submarine landslides in the Cape Verde islands.

**Develop guidance for the treatment of the high frequency component of seismic ground motion.**

The staff has provided guidance in both the Standard Review Plan and in Regulatory Guide 1.208.

**Develop guidance on the use of Internet data.**

The staff has not taken action on our recommendation that they develop guidance to ensure that data obtained from the Internet are valid now and retrievable in the future. At many points in the early site permit applications data derived from the Internet are used. We expect increased reliance on Internet databases in the future. Data obtained from the Internet do not have the immutable quality of the printed page. Such data can be altered by intent, through misadventure or through malice. Therefore, the NRC needs to provide applicants with guidance to ensure that data they obtain from the Internet are valid in the sense that they reflect the intent of the developer of the database. The data may be needed long after an early site permit has been approved and after many revisions of the electronic site from which the data were originally obtained. Consequently, guidance on ensuring the retrievability of the data is also needed. Furthermore, based on our recent review of the Vogtle early site permit application, it may be necessary for the NRC to interact with other government agencies to assist applicants in obtaining the validation that the staff feels is necessary for the data provided by these agencies via the Internet.

Sincerely,

*/RA/*

William J. Shack  
Chairman

References:

1. Memorandum dated November 8, 2006, from Annette L. Vietti-Cook, Secretary of the Commission, NRC, to John T. Larkins, Executive Director, ACRS; Subject: Staff Requirements — Meeting with Advisory Committee on Reactor Safeguards, 2:30 P.M., Friday, October 20, 2006, Commissioners' Conference Room, One White Flint North, Rockville, Maryland (Open to Public Attendance).
2. Letter dated September 22, 2006, from G. B. Wallis, Chairman, ACRS, to L. A. Reyes, Executive Director for Operations, NRC, Subject: "Lessons Learned From the Review of Early Site Permit Applications."
3. Draft United States Geological Survey Report, revision dated September 30, 2007, "The Current State of Knowledge Regarding Potential Tsunami Sources Affecting U.S. Atlantic and Gulf Coasts."

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William J. Shack  
Chairman

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Distribution: \*\*\*See Next Page  
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NAME	DFischer	CSantos	DFischer	FPGillespie	FPG for WJS
DATE	11/14/07	11/16/07	11/16/07	11/19/2007	11/19/2007

Letter To: The Honorable Dale E. Klein  
NRC Chairman

From: William J. Shack  
ACRS Chairman

Subject: STAFF'S IMPLEMENTATION OF LESSONS LEARNED FROM REVIEWS OF  
EARLY SITE PERMIT APPLICATIONS

Date: November 19, 2007

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To: Dana Powers, ACRS-NRC  
From: William J. Hinze, ACNW&M  
Subject: Review of Vogtle Early Site Permit Application and NRC's Safety Evaluation Report for the Vogtle Application  
Date: October 12, 2007

## **Introduction**

The objective of this brief report is to summarize the salient points of my review of the Vogtle Early Site Permit (ESP) Application (Rev. 2, April 2007) submitted by the Southern Nuclear Operating Company and the Safety Evaluation Report (SER) for this application prepared by the NRC Office of New Reactors (August 30, 2007).

Specifically at your instruction I have focused my review on Section 2.5.1, Basic Geologic and Seismic Information; Section 2.5.2, Vibratory Ground Motion; Section 2.5.3, Surface Faulting; and Appendix 2.5 B, High Resolution Compressional Seismic Survey Field Report. Sections dealing with Geotechnical Engineering as well as other sections of the Application and SER, 2.5. 4-6 were briefly perused. I was aided in the review by my experience as a member of the Rondout Earth Science Team (EST) that participated in the EPRI Probabilistic Seismic Hazard Analysis (PSHA) of eastern North America that was published in 1986. The EPRI-1986 PSHA updated according to current regulations was used as the basis for the seismic analysis presented in the Vogtle ESP Application.

The results of the review of are presented below indexed to the specific sections of the ESP Application and the SER. In the interest of brevity I have not summarized the information presented in the sections, but rather commented on issues of concern.

*My overall evaluation of Sections 2.5.1 -3 of the ESP Application is that in general these sections present the information required in the applicable regulations 10 CFR 52.17(a)(1)(vi), 10 CFR 100.23(c), and 10 CFR 100.23(d) and that the SER is a comprehensive and insightful review and analysis of the Application. However, I do have comments, questions, and different views than those specified in the Application and SER that may be useful to you and your subcommittee as the ACRS reviews the Vogtle ESP Application. These are listed below.*

### **Basic Geologic and Seismic Information (Section 2.5.1)**

1. The hypotheses dealing with the origin of the potentially seismogenic features of the Vogtle region are relatively mature and notably advanced over the status of geologic and tectonic knowledge of the region at the time of the EPRI-1986 study. These advances have been incorporated in the description of the geology and tectonic structures and their origin in the Application and SER.
2. The principal potentially seismogenic geological features of the region are: (1) the Charleston seismic zone that was the site of the ~7 (6.7-7.3) magnitude

earthquake of 1886, (2) the Eastern Tennessee seismic zone that is the second-most (to the New Madrid seismic zone) seismically active region in the eastern United States, and (3) the early to middle Triassic (~175 Ma) basins which form the basement beneath the coastal plain Cretaceous and Tertiary sediments of much of the States of Georgia and South Carolina. There is no specific evidence that faults of the Triassic basins which were formed from extension of the continental crust during the early stages of the formation of the Atlantic Ocean at the breakup of the supercontinent Pangea are seismogenic, but several authorities have noted that the normal faults of the basins are likely candidates for reactivation in the current stress pattern of the eastern United States. These potentially seismogenic features are adequately described and discussed in the Application and analyzed in the SER. There are numerous other Precambrian (>~615 Ma) faults and others formed during the subsequent Appalachian mountain building periods that are potential sites for reactivation in the current stress regime, but no evidence suggests a correlation of these faults with specific historical earthquakes.

3. The Vogtle site is underlain by the north-northeasterly striking Dunbarton Triassic basin which has been identified by drilling through the roughly 300 m of overlying sediments and geophysical studies. The basin is associated with the much more extensive and well-developed South Georgia Triassic basin. The data suggest that the Dunbarton basin is a half-graben with the greatest development of the basin along a normal fault on its northwestern side. This fault has been at least locally reactivated in Tertiary time and is recognized as the Pen Branch fault in the Savannah River Site (SRS) with a southwestern extension into the Vogtle site. There is no evidence that this fault has been active in the last 2 million years and is appropriately analyzed as a non-capable fault in the Application and SER. Its azimuth as recognized in the detailed geological/geophysical investigations of the SRS is incorrectly oriented for reactivation in the current stress field (see item 4.). Several other faults of the SRS which may extend across the Savannah River into Georgia have a similar general azimuth.

The southeastern edge of the Dunbarton basin may also be fault controlled. The Martin fault (Figure 2.51-16 of the ESP Application) that has been mapped in the SRS may be the surface extension of that fault. This fault which occurs some 30 km southeast of the Vogtle site unfortunately has not been the site of high resolution surface geophysical studies. It should be noted that the Martin fault appears to be identified on Figure 2.5.1-21 of the ESP Application as the Millett fault. Are the Martin and Millett faults the same fault? And if so why is this not made clear in the Application discussion?

4. The information available to the EPRI-1986 ESTs on the stress regime of the eastern United States is essentially equivalent to the currently available data except that regional perturbations in the stress field that were interpreted by some ESTs are not warranted by the current information. Additionally, most of the stress measurements are from the relatively near-surface (<~ 300 m) and thus are

not in the seismogenic region of the crust where earthquakes of the region occur. The maximum horizontal compressive stress is derived from ridge-push forces originating in the Mid-Atlantic Ridge and is generally directed in an N60°E direction. Accordingly, in general faults oriented at roughly 45° to this direction are subject to strike-slip movement depending on the coefficient of friction, while orthogonally oriented faults are subject to reverse faulting. This information and its implications are well treated in the Application and SER.

5. The relatively short historical seismic record and the low recurrence interval of earthquakes in the Vogtle region inhibit comprehensive characterization of the seismicity of the region. A significant development since the EPRI-1986 study is the mapping of paleoliquefaction features as a useful methodology for identifying the site of past earthquakes, especially in the last 10,000 years. These features occur in friable sediments, commonly in stream valleys, where the groundwater table is close to the surface. Liquefaction of soils occur during the passage of seismic waves originating from earthquakes that generally have a magnitude of greater than 6. Dating of carbonaceous material in these features permit approximate dating of the earthquake. Mapping and studying of paleoliquefaction features in the Charleston seismic zone has been essential to furthering our knowledge of the nature of the 1886 Charleston event.

The ESP Application and the SER explain that the mapping of paleoliquefaction features has been conducted over an extensive region of the southeastern United States including the Vogtle site vicinity. These studies have failed to identify liquefaction features in the Vogtle site vicinity, however, no information is provided on the specific stream valleys that have been studied and those that have conditions suitable for liquefaction during the passage of strong seismic waves. I consider this to be a significant omission of critical data. There is a need for confidence that the paleoliquefaction studies have been sufficiently detailed and have covered the appropriate regions in the vicinity of the Vogtle site. What are the implications of this omission to our understanding of the seismicity of the Vogtle vicinity?

6. Small long-term ground measurements using location observations from Global Positioning Satellites (GPS) have become a major source of information related to potential seismic events. Ground movements in southeastern United States are likely to be at the margin of resolution of GPS observations during the past decade. Nonetheless, it is important to identify any potentially useful GPS measurements in the region that could bear on seismic activity. Trenkamp and Talwani (2007)<sup>1</sup> have a manuscript on GPS strain measurements that is listed in the publications of Pradeep Talwani in his personal web page at the University of South Carolina site. A search of the literature on strain measurements in southeaster United States should be performed and all pertinent information included in the application and reviewed in the SER.

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<sup>1</sup> *Trenkamp, R., and Talwani, P., 2007., GPS strain and strain zonation near Charleston, South Carolina, Journal of Geophysical Research, manuscript in revision.*

7. In response to RAI 2.5.1-7 the applicant rejected the Grenville front as a potential seismic feature because it is of Precambrian age. However, there are numerous Precambrian faults throughout the eastern and central United States that are potentially seismogenic as a result of reactivation in the current stress field. Furthermore, one of the identified seismogenic regions of the eastern United States, the Anna, Ohio seismic zone (Figure 2.1-15 of the Application), has been identified as the location of the intersection of a Precambrian rift with the Grenville front (tectonic zone). See for example Hinze and Hildenbrand (1988)<sup>2</sup>. The treatment of this topic in the Application is inadequate on this point.
8. The applicant has correctly recognized the potential for distant large earthquakes in the central and eastern United States to contribute to ground motion hazards at the Vogtle site. The applicant and the SER identify the New Madrid seismic zone as the most significant to the seismic hazard characteristics of the site and the only distant seismic zone that needed updating since the EPRI-1986 study. The updating indicates the need to lower the generally accepted recurrence interval in this zone to roughly 500 years. The treatment of this topic is handled well both in the Application and the SER. However, there is no mention of the concern with “far-field triggering” of earthquakes. Recent studies and publications take note that large earthquakes may trigger earthquakes at distances of several hundreds of kilometers distance. This topic was also raised with respect to the ESP of the Clinton site. The possibility of far-field triggering of earthquakes should be noted in the Application and its implications with regard to seismic hazards considered.
9. *To summarize, in general the Application and the SER fully describe the current state of information regarding geology and seismicity of the Vogtle site region and I concur with the conclusions (2.5.1.4) of the SER with the exceptions noted above. The Pen Branch fault should not be considered a capable fault based on the current evidence. The seismic characteristics of the Charleston seismic zone control the seismic design basis ground motion.*

#### **Vibratory Ground Motion (Section 2.5.2)**

1. In the PSHA it is clear that the primary sources of ground motion in the region are the Eastern Tennessee and Charleston seismic zones. The Eastern Tennessee zone, which is included even though it occurs immediately outside the 300 km distance, is associated with unknown faults that likely strike northeasterly in the Precambrian and Cambrian rocks which underlie the folds of the Valley and Ridge geomorphic province. The Eastern Tennessee seismic zone lies between the geophysically identified New York-Alabama lineament, which has been related to a Precambrian or early Paleozoic strike slip zone, and the Appalachian Clingman-

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<sup>2</sup> *Hinze, W.J., and Hildenbrand, T.G., 1988, The utility of geopotential field data in seismotectonic studies in the eastern United States, Seismological Research Letters, 59, 289-297.*

Ocee geologic lineament. This is a zone of major release of earthquake energy but historic earthquakes do not exceed a magnitude of ~4.6 and no earthquake epicenter has been identified with a specific fault. This information has not changed significantly since EPRI-1986 study. It is appropriately identified in the Application and SER as of only minor significance to ground motion at the Vogtle site.

2. Significant new information has been obtained about the Charleston seismic zone since the EPRI-1986 study which has been incorporated into the Application and appropriately reviewed and analyzed in the SER. The new information has come about as a result of geophysical studies, liquefaction investigations, microseismicity monitoring, and continued analysis of the integrated data. It is significant to note that the 1886 Charleston event has not been identified with a particular fault in the area, but the best evidence is that it occurred near the intersection of the NNE extending Woodstock fault and the Summerville cross fault. The Woodstock fault has been related to the East Coast fault zone which is interpreted to extend NNE from the Charleston area.

The Charleston seismic zone is particularly important to the ground motion studies of the Vogtle site because of its proximity and the large magnitude of the 1886 Charleston earthquake. The recent interpretations of the Charleston seismic zone suggest a decreased recurrence interval. Based on dating of paleoliquefaction features over the past few thousand years the recurrence interval is of the order of 500 years with an uncertainty of perhaps no more than 50 years. Furthermore, there is much clearer information on the configuration of the seismic zone. In the EPRI-1986 study information on faulting in the Charleston area was only becoming available. As a result the ESTs differed considerably in their specification of the zonal boundaries. These boundaries are now much more constrained and have been used appropriately by the applicant.

3. Although microseismicity, paleoliquefaction, geologic, and geophysical investigations have identified a complex pattern of 9 faults in the Charleston seismic zone, there is no generally acceptable hypothesis to explain why this combination of geologic structures has been repeatedly active with large earthquakes in the past. Without this explanation restricting seismicity to the Charleston seismic zone, it is questionable that this is the only such set of geologic structures in the region that could cause large earthquakes. Could there be other similar structural regions that have not been identified because of the lower intensity of investigations and the lack of microseismicity and paleoliquefaction features? A positive answer to this remains a possibility but the lack of other areas in the Vogtle site region that have experienced similar large earthquakes, particularly in view of the 500 year recurrence interval of the Charleston seismic zone, suggest that the probability of this possibility must be very low.

4. In view of the paucity of information on earthquakes in the region of the Vogtle site, the relatively long recurrence interval, and short historical record, it appears likely that an earthquake may occur anywhere in the region, the so-called controlling earthquake. If indeed this is the case what is the maximum magnitude earthquake that could occur anywhere in the area and how is this “floating” earthquake magnitude established in the region?
5. The Application is based on ground motion as determined from PSHA using updated EPRI information. The applicant did not choose to use the LLNL methodology as permitted in the regulations. Why did the applicant choose the EPRI methodology over the LLNL approach? This is not discussed in the application. What are the implications to the results of the seismic hazard from the use of the EPRI methodology?
6. As noted in the SER there is inconsistent data regarding the shear wave velocity of the sediments underlying the Vogtle site. This inconsistency needs to be explained and the shear wave velocities should be verified. Open Item 2.5.4
7. The staff’s conclusion that the site is located within the Mesozoic passive margin which includes Triassic rift basins leading to Open Item 2.5-1 is thoroughly justified. The source of the difference between the applicant and the SER needs to be explained.
8. SER’s Open Item 2.5-3 regarding the possible contribution of the larger magnitude earthquakes in the Eastern Tennessee seismic zone is significant and needs to be answered by the applicant.
9. Open Item 2.5-5 of the SER dealing with limitations in the regional paleoliquefaction studies is consistent with the concerns of 2.5.1, item 5 above. This is a particularly significant open item.
10. *To summarize, the Application and the SER do a credible job of evaluating 2.5.2. The conclusions of the SER on this topic given in 2.5.2.4 are germane. However, I have some concerns as indicated above. I concur with all of the Open Items identified in the SER.*

**Surface Faulting (Section 2.5.3)**

No specific comments are required for this section, but, in summary, the SER appropriately treats the Application in dealing with the potential for surface faulting and Open-Item 2.5-10 is justified.

**Stability of Subsurface Material and Foundation (Section 2.5.4)**

This section was only briefly reviewed, but the conclusions of the SER (Section 2.5.4.4) are appropriate and the concern with insufficient supporting information is warranted.

#### **Stability of Slopes (Section 2.5.5)**

This section was only briefly reviewed, but the SER's evaluation of this section of the Application is appropriate.

#### **Embankments and Dams (Section 2.5.6)**

This section was only briefly reviewed, but the evaluation of this section of the Application is appropriate.

#### **High Resolution Compressional Seismic Survey Field Report (Section Appendix 2.5 B)**

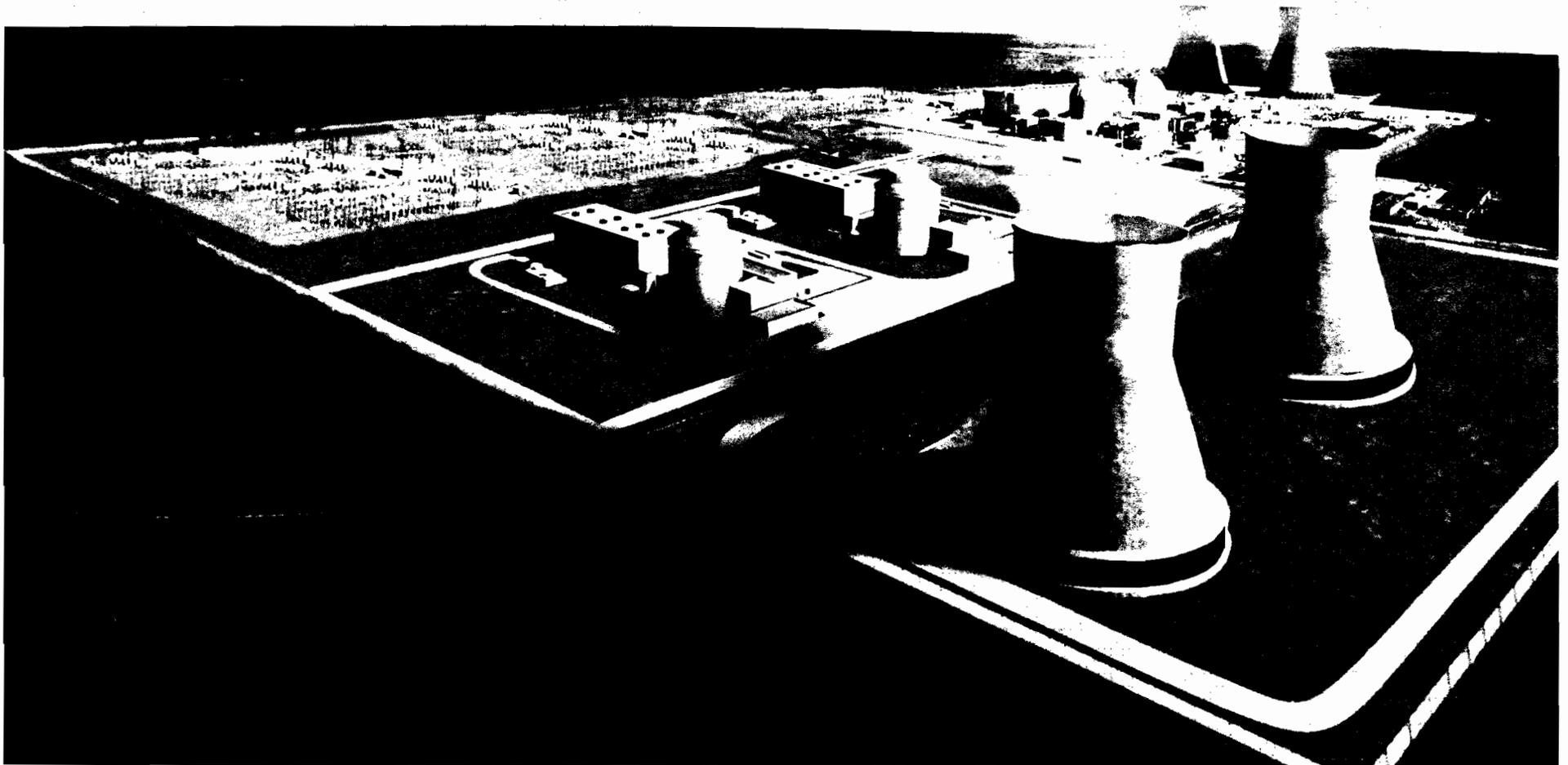
1. There is ambiguity in the interpretation of the results of the reflection seismic survey because the survey is 2-dimensional in nature requiring interpolation of the strike and nature of the Pen Branch fault between the individual survey lines. This is inevitable in a 2-dimensional survey such as conducted at the Vogtle site especially where *en echelon* faults may be present.. This problem could have been minimized by conducting a 3-dimensional survey. The resources needed for acquiring and processing a 3-dimensional survey are considerably greater than for a 2-dimensional survey. However, the importance of achieving the higher resolution in the study of this strategically located fault suggests that the state of the technology methodologies should have been considered for this important study.
2. The seismic reflection survey was limited to the Vogtle site. Consideration should have been given to extending the survey to the southeast where the basement equivalent of the Martin fault may bound the southeastern margin of the Dunbarton Triassic basin. Reactivation of the Pen Branch fault suggests that the Martin fault which is only 30 km from the site may too have been reactivated in more recent time. A seismic reflection study of this fault could have been useful in determining if this fault was active in more recent time. This is important because of the proximity of the southeastern border fault to the Vogtle site.

# Southern Nuclear

## Vogtle ESP Application

### Presentation to the ACRS Subcommittee

October 24, 2007

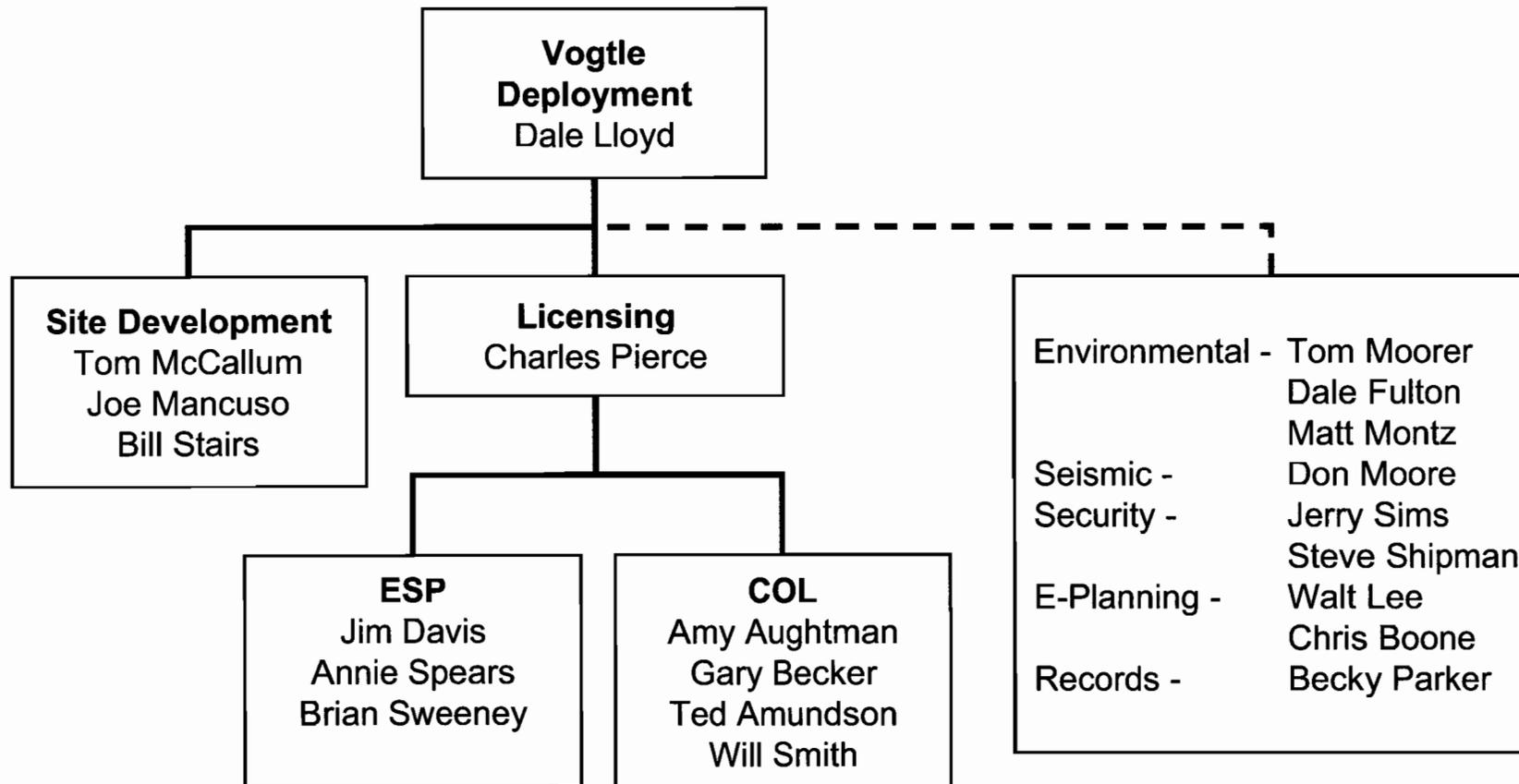


# Introduction

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**Chuck Pierce**  
Vogtle Deployment  
Licensing Manager

# Vogtle Deployment Organization

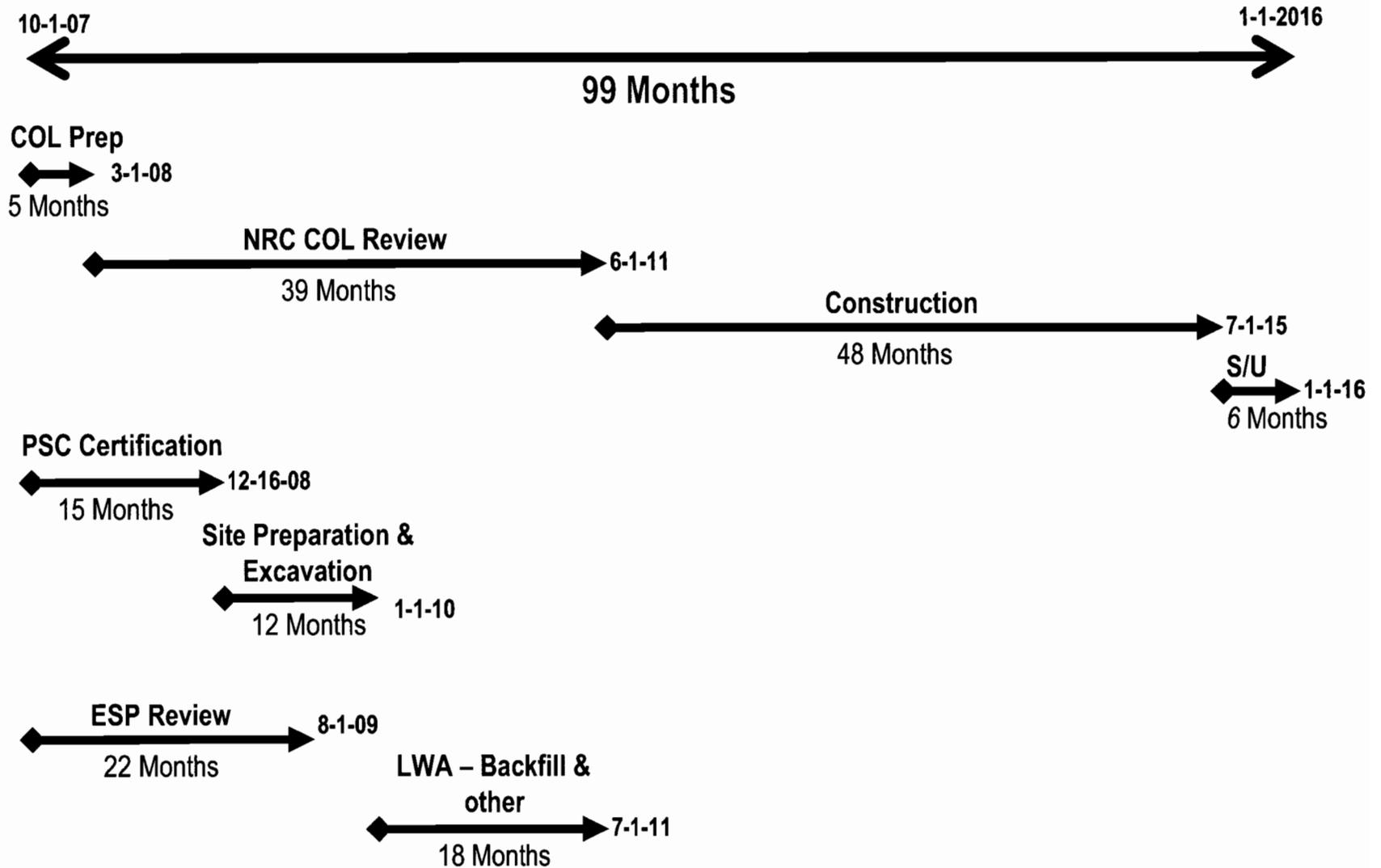


# ESP/COL Contractors

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- ◆ ABS Consulting
- ◆ Bay Geophysical
- ◆ Bechtel
- ◆ Earthquake Hazards Solutions
- ◆ Ecoscience
- ◆ Fugro
- ◆ Geomatrix
- ◆ Innovative Emergency Mgmt
- ◆ MacTec
- ◆ Risk Engineering Inc
- ◆ RPK Structural Mechanics
- ◆ SRNL
- ◆ Shaw Stone and Webster
- ◆ Tetra Tech
- ◆ TLG
- ◆ Westinghouse
- ◆ William Lettis and Associates

# Vogtle 3&4 Schedule



# Early Site Permit - Overview

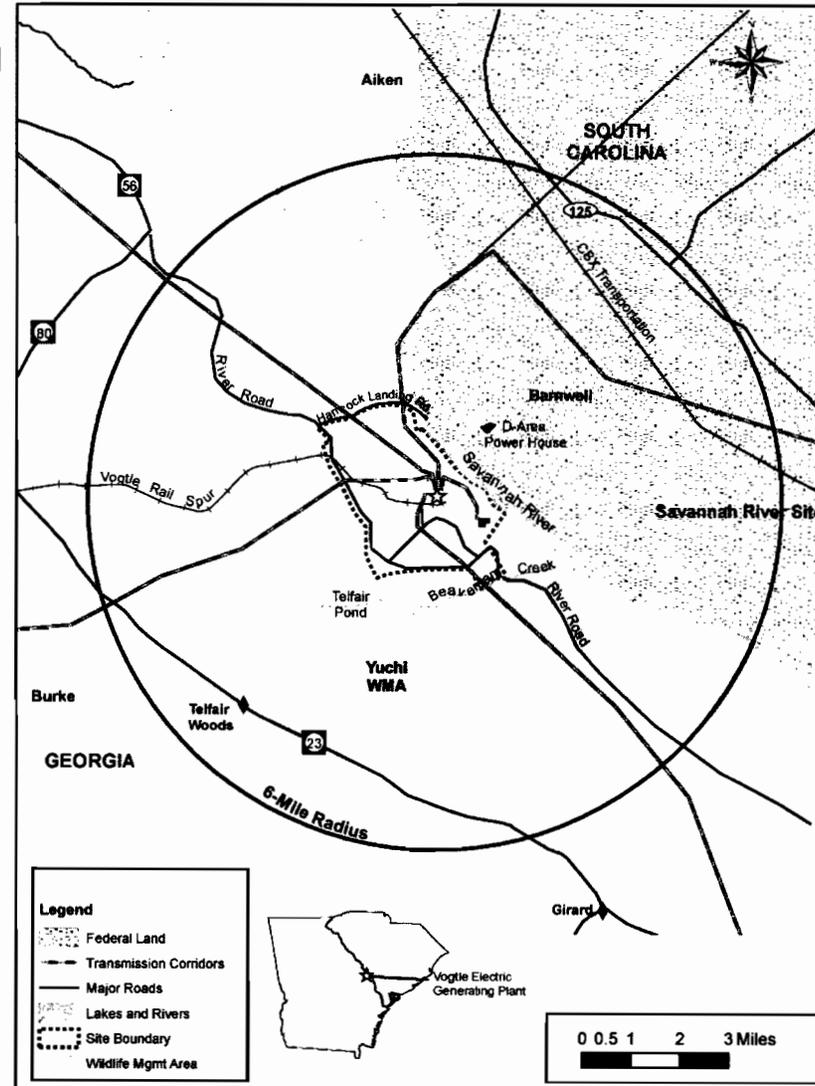
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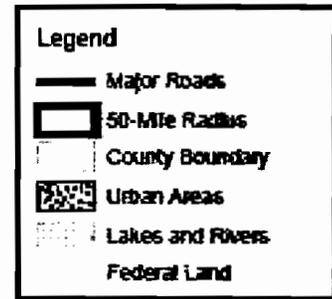
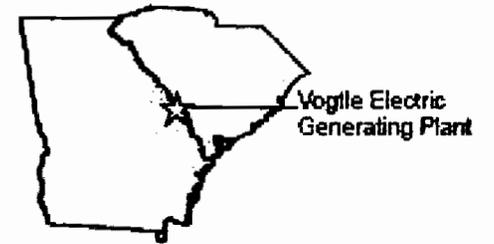
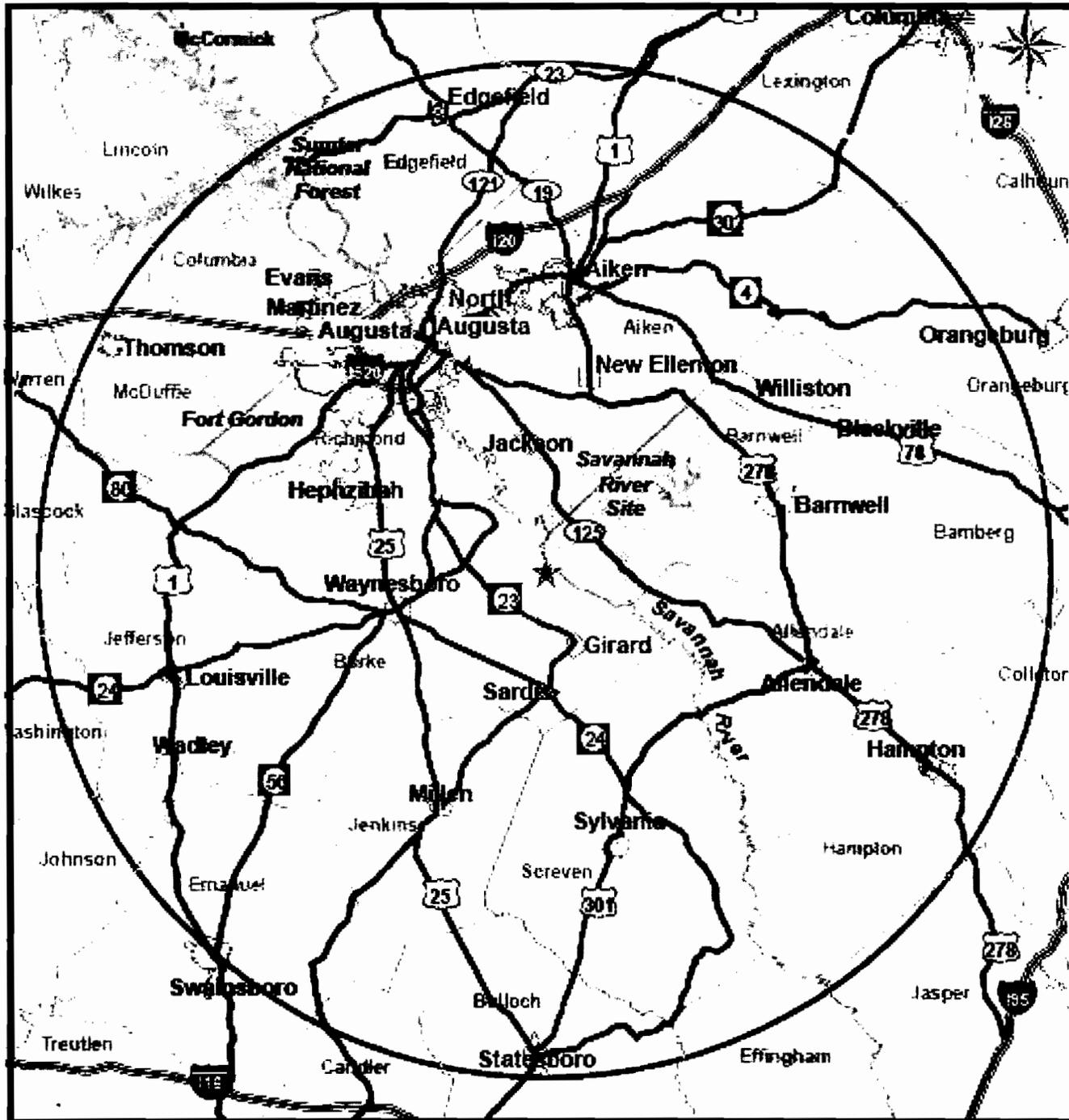


**Jim Davis**  
ESP Project Engineer

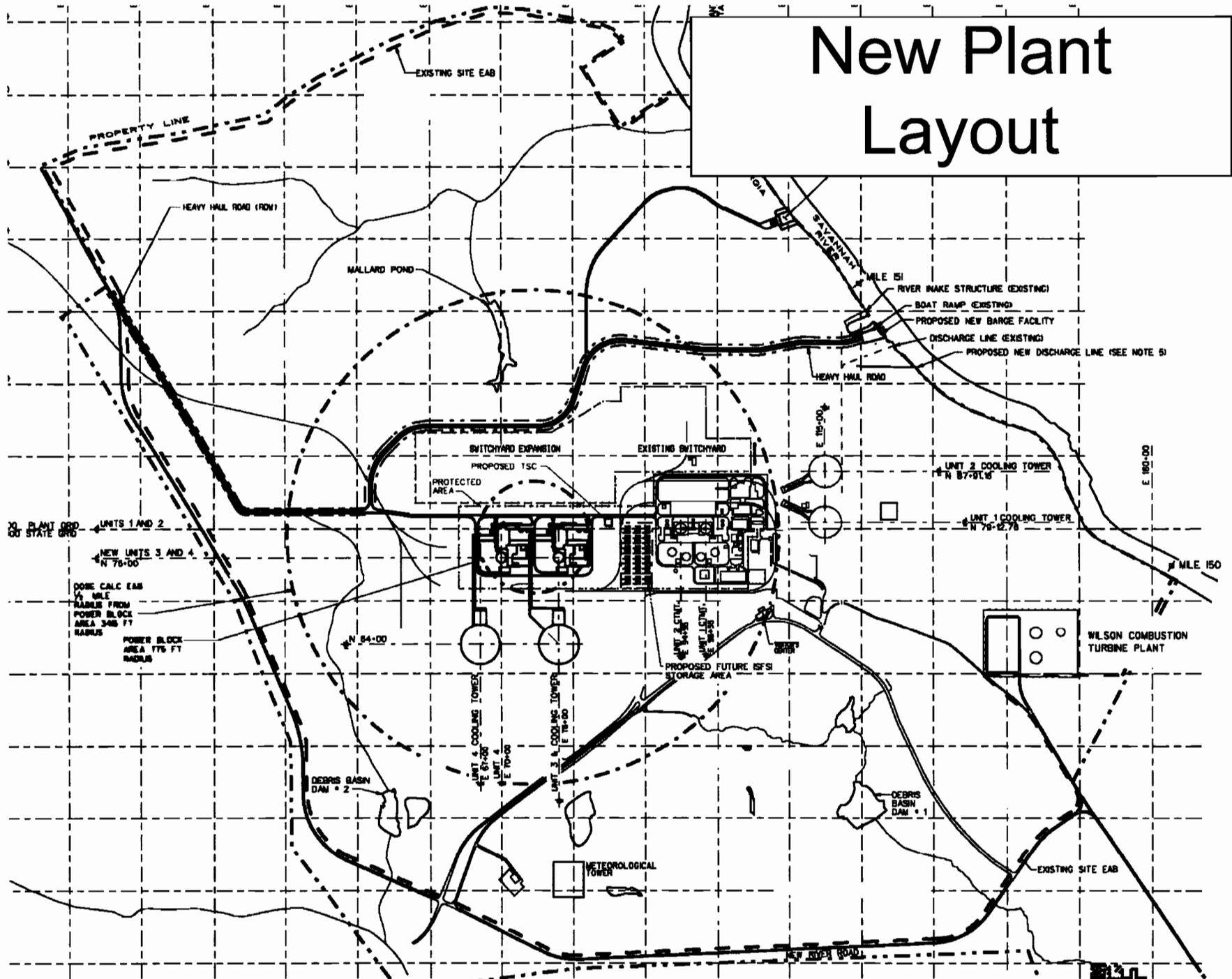
# Location

The 3,169-acre VEGP site is located on a Coastal Plain bluff on the southwest side of the Savannah River in eastern Burke County Georgia. The site is directly across the river from the Department of Energy's Savannah River Site (Barnwell County, South Carolina). It is about 150 river miles from the mouth of the Savannah River and approximately 26 miles southeast of Augusta, Georgia.





# New Plant Layout



# Application Development

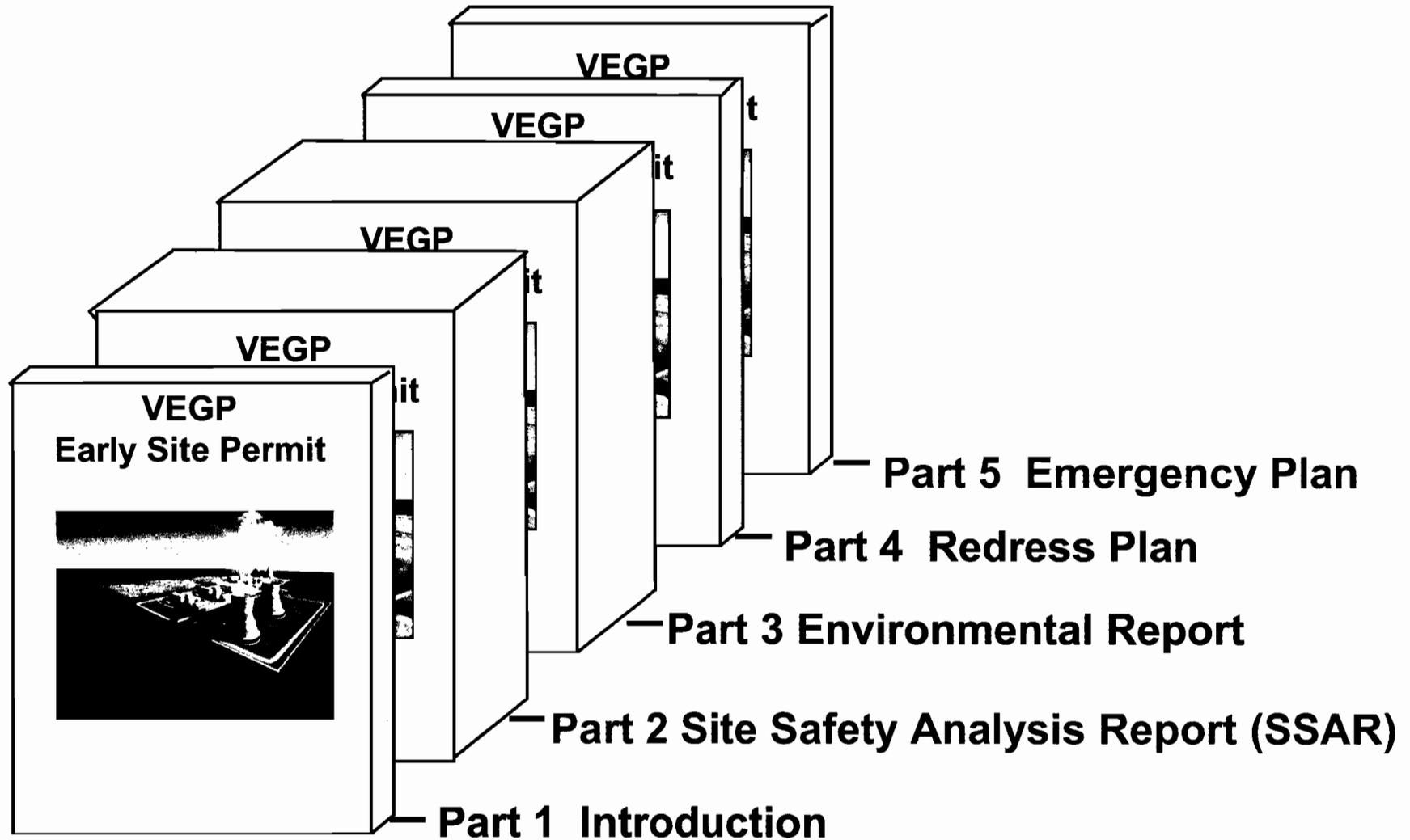
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- ◆ 10 CFR Part 52, Subpart A
- ◆ RS-002, Processing Applications for Early Site Permits
- ◆ AP1000 Site Interface Requirements
- ◆ Unit 1&2 and SRS data sources
- ◆ Site Studies and Test Programs
- ◆ Conceptual Design and Analysis

# VEGP ESP Level of Detail

<b>Example</b>	<b>Other ESPs</b>	<b>VEGP ESP</b>
Reactor Type Power Output	Options Listed	Two AP1000's at 1117 MWe Each
Plant Layout Cooling Water Design Intake Design	General Information Provided	Detailed Design and Layouts Provided
Water Consumption And Discharge Flow	Envelope Approach	Plant-Specific Numbers Provided
Normal Effluents and Accident Doses	Envelope Approach	Plant-Specific Numbers Provided
Emergency Plan	Major Features	Complete & Integrated Plan

# ESP Overview



# Application Submittal - LWA

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- ◆ Revision 0, August 2006
  - Initial Submittal contained LWA-1 request
    - Construction preparation activities
    - Including excavation of power block
- ◆ Revision 2, Supplement 1, August 2007
  - Included LWA-2 request to include backfill and all associated work on Nuclear Island basemat necessary to support first concrete placement at receipt of COL

## Part 2 Site Safety Analysis Report

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Chapter numbering follows FSAR format:

- ◆ Chapter 1 Introduction and General Description
- ◆ Chapter 2 Site Characteristics
- ◆ Chapter 3 Aircraft hazards
- ◆ Chapter 11 Liquid & Gaseous Releases
- ◆ Chapter 13 Emergency Planning & Security
- ◆ Chapter 15 Accident Analyses
- ◆ Chapter 17 Quality Assurance

# NRC Site Safety Visits

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<b>Subject</b>	<b>Date</b>
◆ Pre-Application Subsurface Investigation	10/2005
◆ Quality Assurance (corporate)	08/2006
◆ Emergency Planning	10/2006
◆ Hazards and Security	11/2006
◆ Meteorology	12/2006
◆ Hydrology and Geology	01/2007

# ESP Requests for Additional Information (RAIs)

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<b>Section</b>	<b>Subject</b>	<b>RAIs</b>
2.1	Geography and Demography	12
2.2	Potential Hazards	18
2.3	Meteorology	16
2.4	Hydrology	10
2.5	Geology and Seismic	64
3.5.1.6	Aircraft Hazards	1
11	Liquid and Gaseous Releases	16
13	Emergency Planning	48
15	Accident Analysis	1
17	Quality Assurance	3
<b>Total RAIs</b>		<b>189</b>

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# ESP SER Open Items

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<b>Section</b>	<b>Subject</b>	<b>OIs</b>
2.3	Meteorology	1
2.4	Hydrology	4
2.5	Geology and Seismic	22
13	Emergency Planning	13
	<b>Total</b>	<b>40</b>
	Responses provided	40
	Additional data scheduled	13

# Chapter 2 Site Characteristics

---

## Topics:

- ◆ 2.1 Geography and Demography
- ◆ 2.2 Potential Hazards
- ◆ 2.3 Meteorology
- ◆ 2.4 Hydrology
- ◆ 2.5 Geology and Seismic

# SSAR 2.1 Geography and Demography

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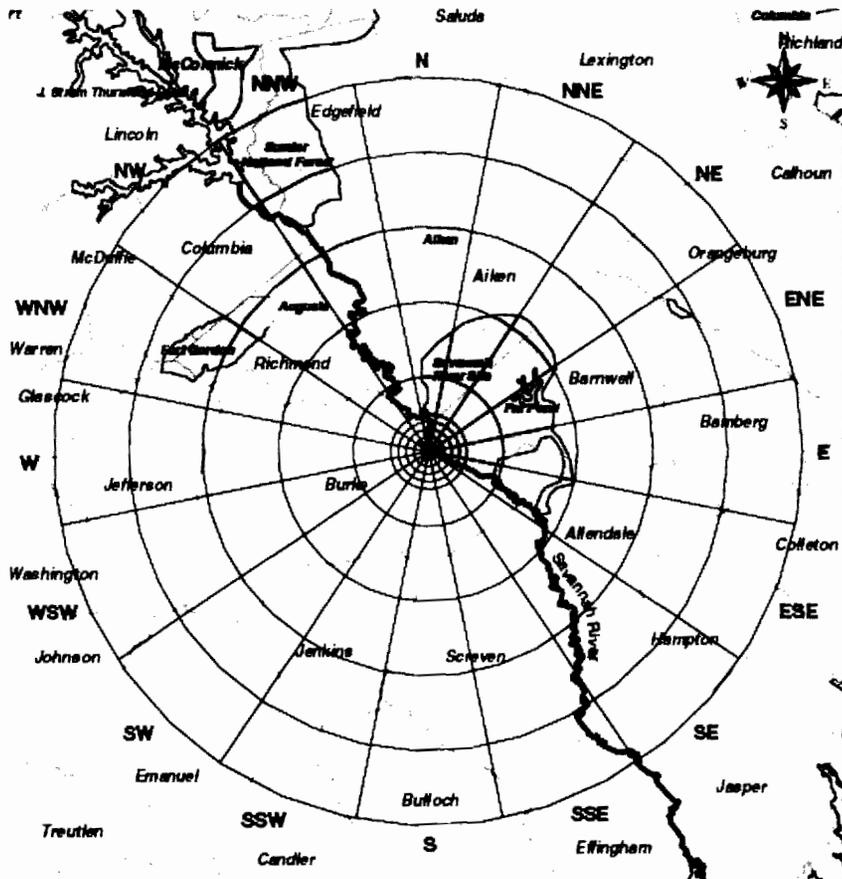
## Topics:

- ◆ Site boundaries for release limits
- ◆ Exclusion Area Boundary control
- ◆ Population distribution

## Key Items:

- ◆ *Exclusion Area Boundary already established for 1&2*
- ◆ *Used most recent census data – projections to 2070*
- ◆ *Population density near plant is low*

# Demography



## Low Population Zone (0-2 miles)

Year	2000	2010	2020	2030	2040	2070
Population	93	100	109	116	126	157

## Resident Population Zone (0-10 miles)

Year	2000	2010	2020	2030	2040	2070
Population 0-10 miles	3,560	3,822	4,108	4,406	4,737	5,877

## Resident Population Zone (0-50 miles)

Year	2000	2010	2020	2030	2040	2070
Population 0-50 miles	674,101	770,243	893,950	1,056,017	1,272,093	2,530,357

## SSAR 2.2 Potential Hazards

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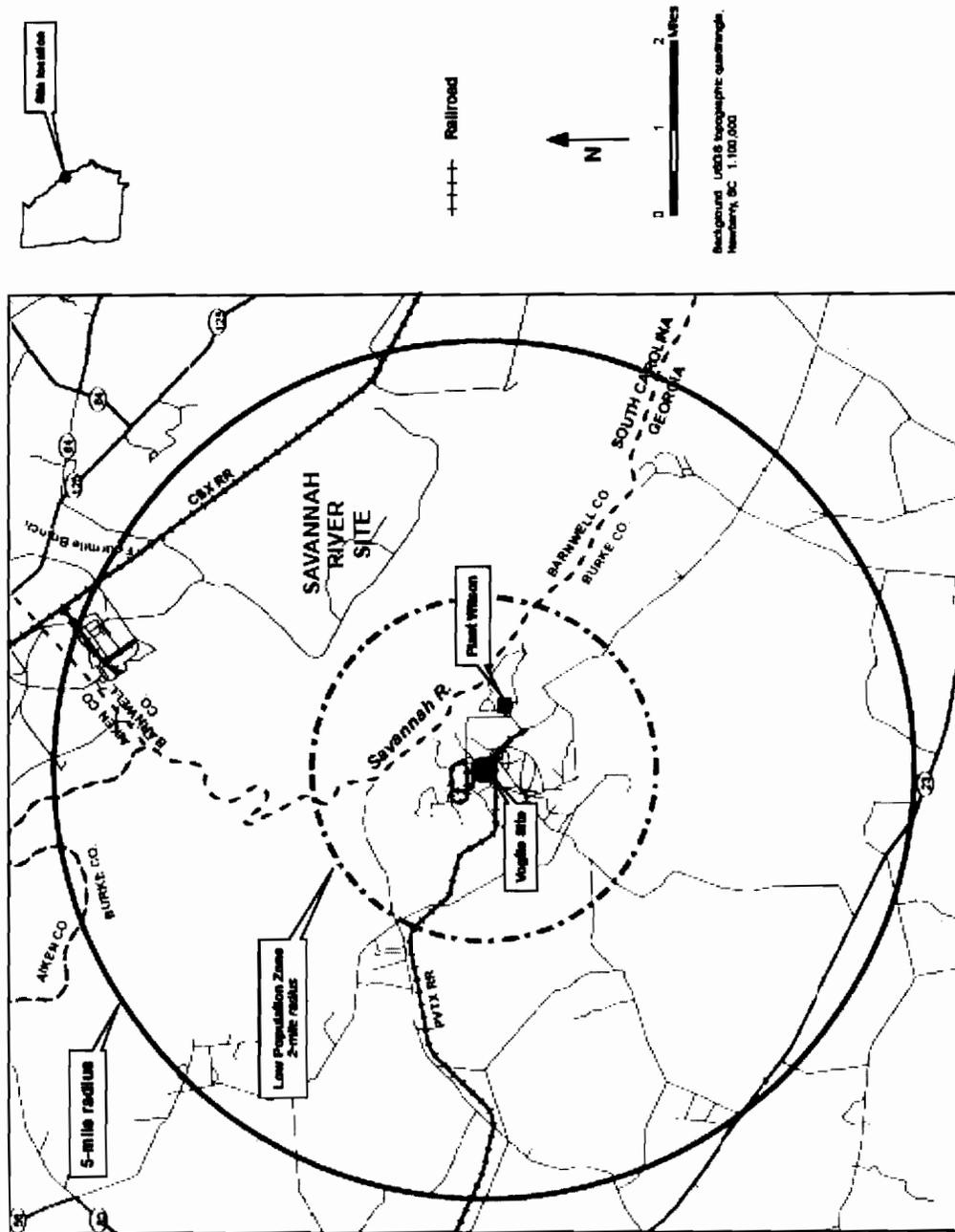
### Topics:

- ◆ Industrial & mining facilities (gas lines)
- ◆ Transportation routes (airports, roads, rails, water)
- ◆ Military facilities
- ◆ VEGP 1&2

### Key Items:

- ◆ *River traffic data*
- ◆ *SRS chemicals and locations*

# SSAR 2.2 Potential Hazards



Site Vicinity Map

## SSAR 2.3 Meteorology

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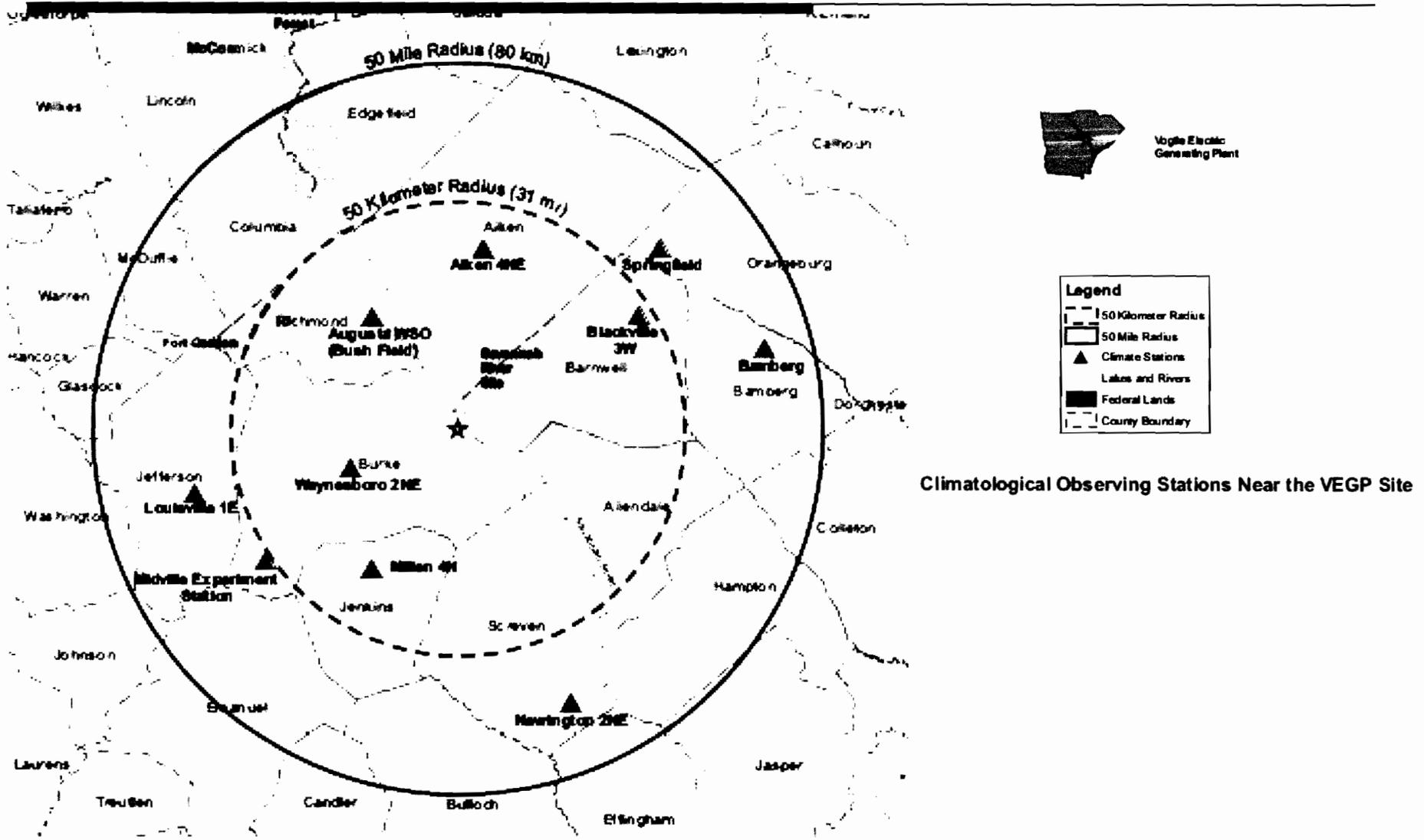
### Topics:

- ◆ Regional and local weather
- ◆ Presents 5 years of onsite data
- ◆ Site-specific diffusion estimates

### Key Items:

- ◆ *Update and QC 5 years of onsite data required*
- ◆ *Review of nearby NWS for calculation inputs*

# SSAR 2.3 Meteorology



## SSAR 2.4 Hydrologic Engineering

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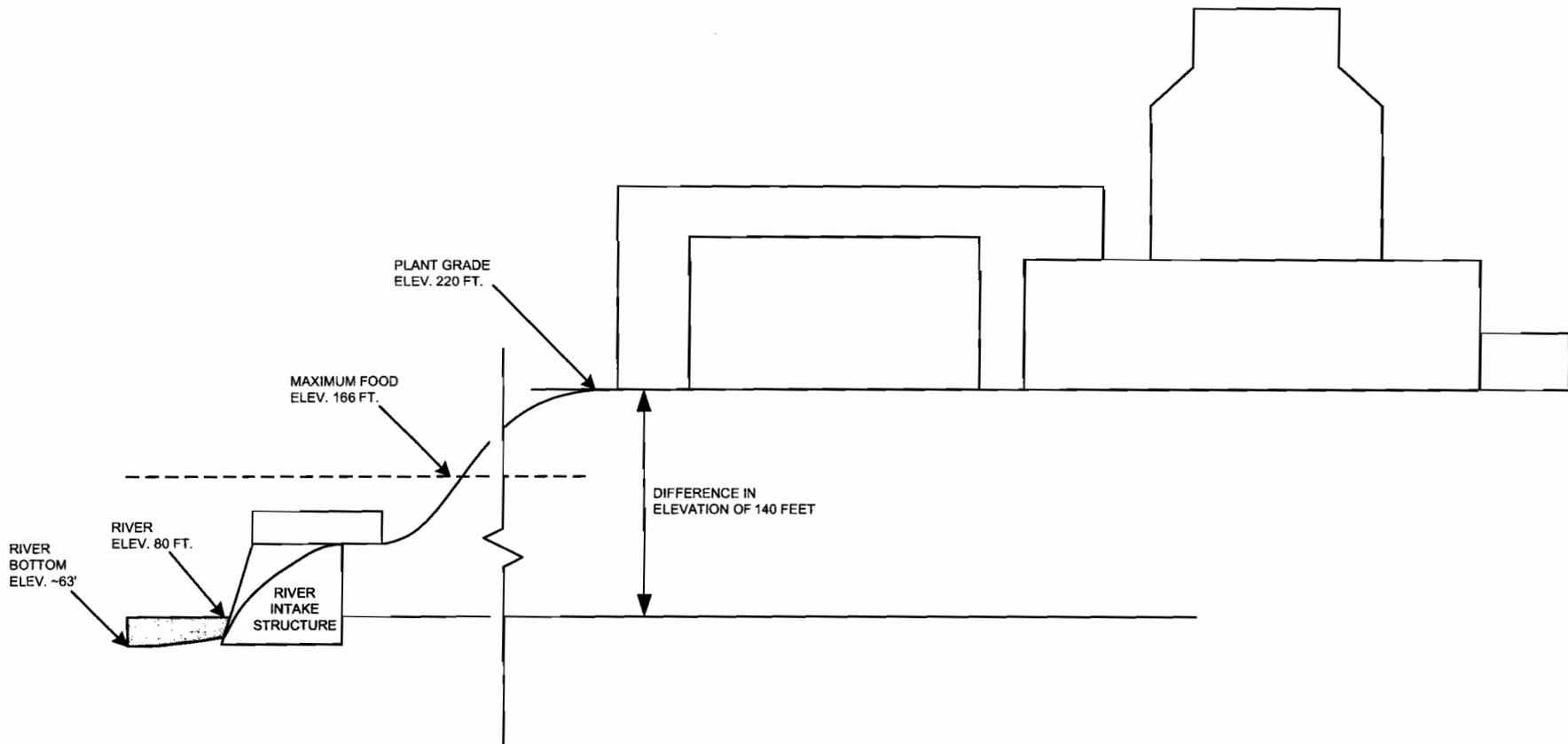
### Topics:

- ◆ Potential for floods, dam failures, storm surges, ice effects, etc.
- ◆ Low water events
- ◆ Groundwater impacts
- ◆ Accidental releases of liquids

### Key Items:

- ◆ *Groundwater data from new and existing onsite wells collected*
- ◆ *Site-specific liquid radioactive release analysis*
- ◆ *VEGP site elevation 140 feet above normal river level*

# SSAR 2.4 Hydrologic Engineering



## SSAR 2.5 Geology and Seismic

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### Topics:

- ◆ 2.5.1 Site and Regional Geology
- ◆ 2.5.2 Seismic Evaluation
- ◆ 2.5.3 Surface Faulting
- ◆ 2.5.4 Stability of Subsurface Materials
- ◆ 2.5.5 Stability of Slopes
- ◆ 2.5.6 Embankments and Dams
- ◆ 2.5A Soil Boring Report
- ◆ 2.5B Seismic Reflection Survey

### Key Items:

- ◆ *Soil Rock Profile*
- ◆ *Safe Shutdown Earthquake (SSE) Curve*
- ◆ *Excavation Plan*

# SSAR 3 Design

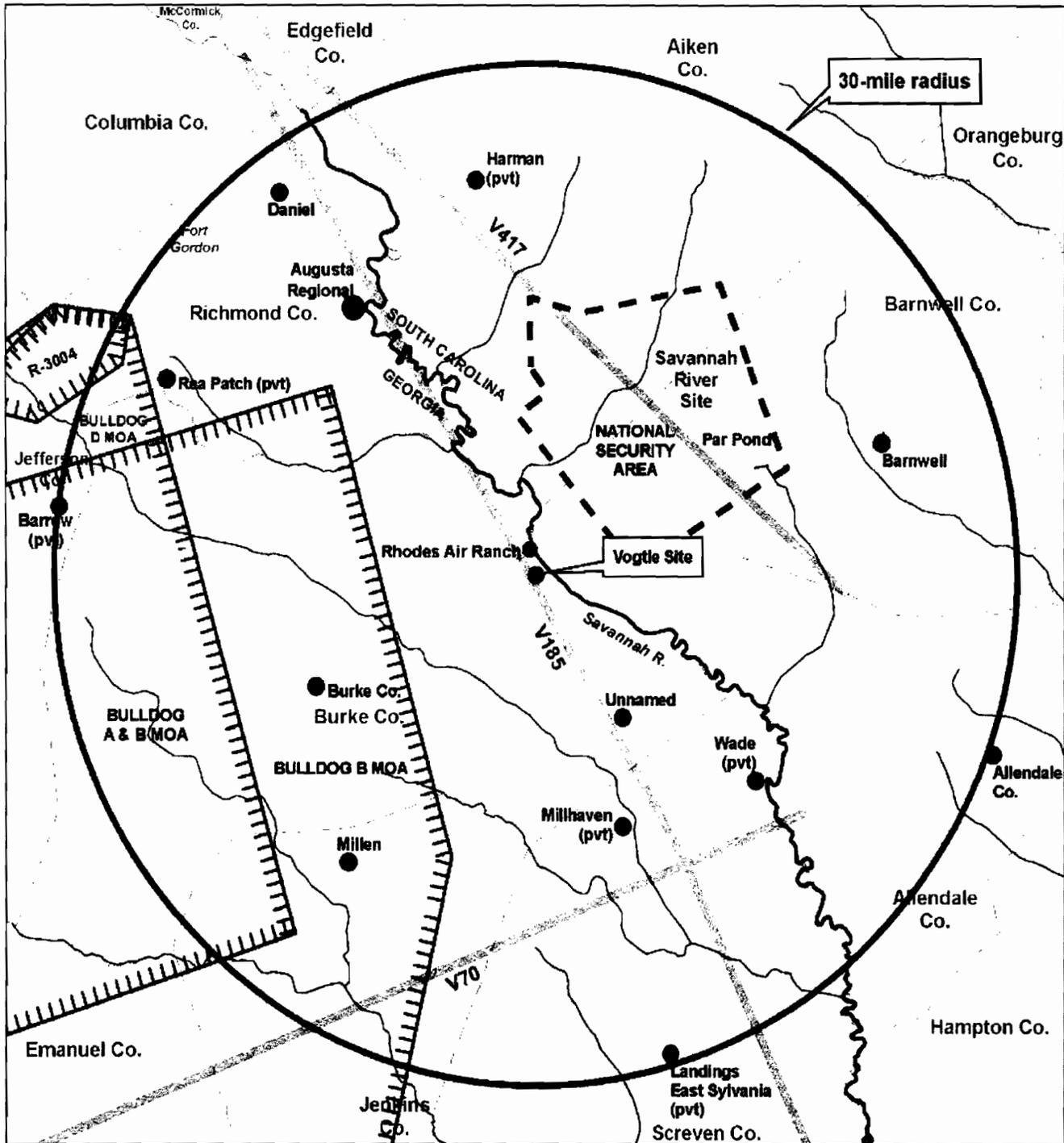
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## Topics:

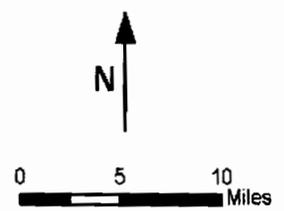
- ◆ 3.5.1.6 - Aircraft Hazards

## Key Items:

- ◆ *Data on Augusta air traffic for flight path V185*



- Airport
- Airport with Control Tower
- V53 Class B Airspace Low Altitude Federal Airways
- ▤ Military Operations Area
- ▤ Restricted Area
- ▤ National Security Area



Aiport locations derived from  
FAA Sectional Aeronautical Chart, Atlanta, 1:500,000

Southern Nuclear Operating Company  
Early Site Permit Application  
Part 2 - Site Safety Analysis Report

Revision A

# SSAR 11 Liquid & Gaseous Releases

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**Topics: To be added**

- ◆ **11.2.3 Liquid Radioactive Releases**
- ◆ **11.3.3 Gaseous Radioactive Releases**

**Key Items:**

- ◆ **New section for ESP SSAR**
- ◆ **Environmental Report analysis included**

# SSAR 11 Liquid & Gaseous Releases

## Liquid

**Table 11.2-5 Comparison of Maximally Exposed Individual Doses with 10 CFR 50, Appendix I Criteria**

	Location	Dose per Unit (mrem/yr)	
		Estimated	Limit
Total Body	Savannah River	0.017	3
Maximum Organ - Liver	Savannah River	0.021	10

## Gaseous

**Table 11.3-6 Comparison of Maximally Exposed Individual Doses with 10 CFR 50, Appendix I Criteria**

Dose Type	Location	Dose per Unit	
		Estimated	Limit
Gamma Air (mrad)	Site Boundary	0.67	10
Beta Air (mrad)	Site Boundary	2.8	20
Total Body (mrem)	Site Boundary	0.56	5
Skin (mrem)	Site Boundary	2.2	15
Iodines and Particulates Maximum Organ - Thyroid (mrem)	Maximally Exposed Individual	5.9	15

# SSAR 15 Accident Analysis

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## Topics:

- ◆ Requires review of AP1000 accidents with site specific parameters for offsite dose evaluations

## Key Items:

- ◆ *Westinghouse DCD analysis was compared to site specific estimates. VEGP generated dose estimates for accidents were bounded by the DCD analysis.*

# SSAR 17 Quality Assurance

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## Topics:

- ◆ Must describe the QA controls applied to the ESP process

## Key Items:

- ◆ *Portions of site investigative work were done to Appendix B standards so that they could be used directly in plant design*
- ◆ *Most other analyses were not “safety-related” but QA controls were applied*

# Chapter 13 and Part 5 Emergency Plan

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Ted Amundson  
Emergency Planning  
Lead Engineer

# SSAR 13 Programs

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## Topics:

- ◆ Emergency Planning (refers to Part 5)
- ◆ Industrial Security

## Key Items:

- ◆ *Physical Characteristics evaluated for Security and Emergency Planning requirements*
- ◆ *Details of Emergency Planning were provided as separate part to ESP*

## Part 5 Regulatory Considerations

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- ◆ Requirement
  - 52.17 (b)(1) – identify significant impediments to emergency planning
- ◆ Options
  - 52.17 (b)(2)
    - (i) – propose major features
    - (ii) – propose complete and integrated emergency plan
- ◆ VEGP ESP
  - Complete and Integrated Emergency Plan

# Regulatory Approach

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- ◆ 52.17 (b)(2)(ii) – Complete & Integrated Plan
  - NUREG 0654/FEMA-REP-1
- ◆ 52.17 (b)(3) - EP ITAAC
  - SECY-05-197
- ◆ 52.17 (b)(4) – State and local certifications
  - Plans are practicable
  - Agencies are committed to further emergency plan development
  - Agencies are committed to executing their responsibilities

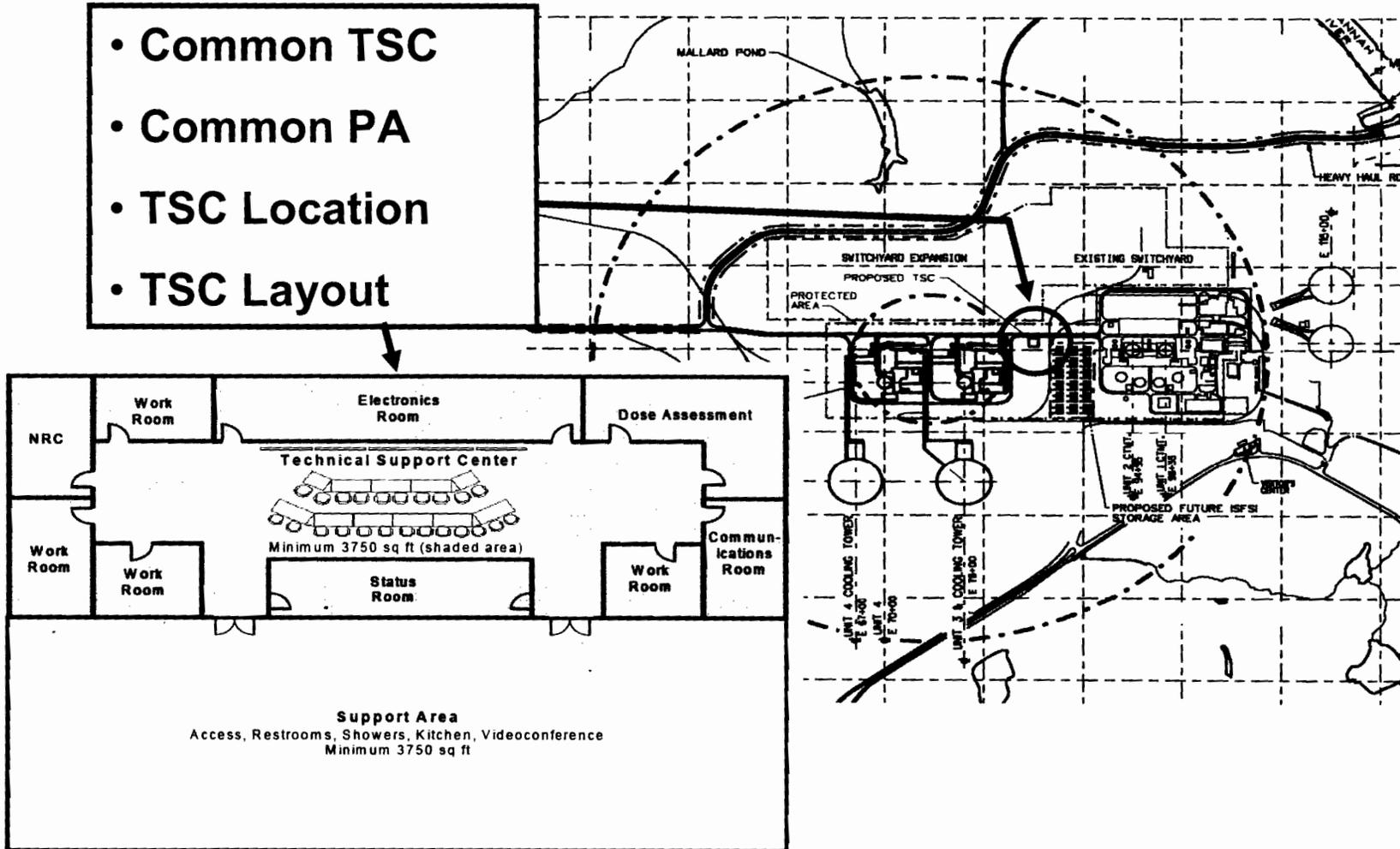
# Emergency Plan Approach

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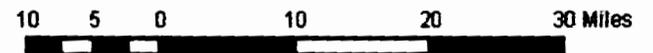
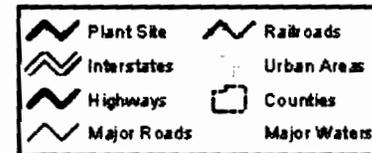
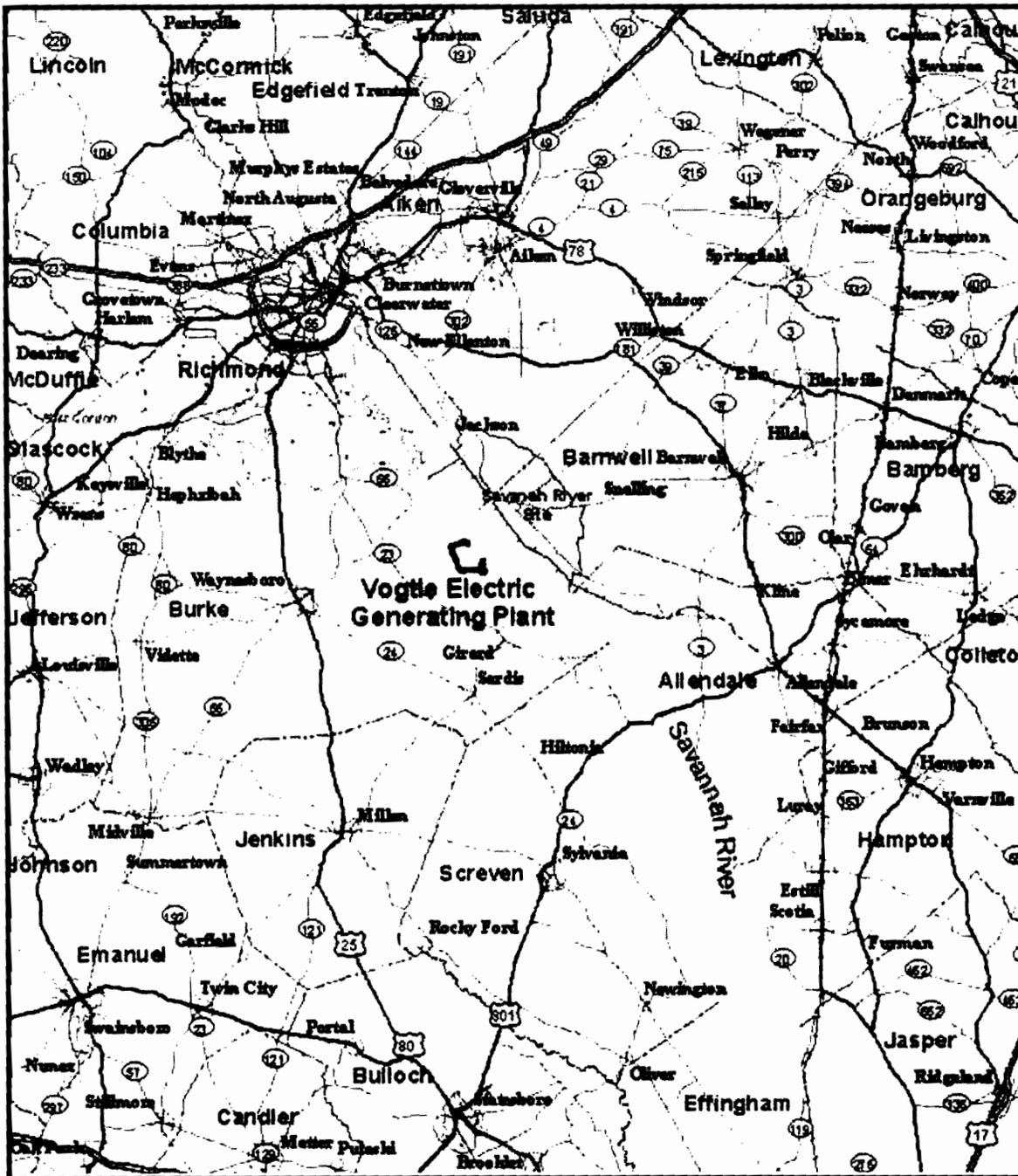
- ◆ Performed new evacuation time estimate study
- ◆ Used existing EPZ's
- ◆ Modified existing emergency plan to include new units
- ◆ Incorporated common TSC for all units
- ◆ Used existing EOF

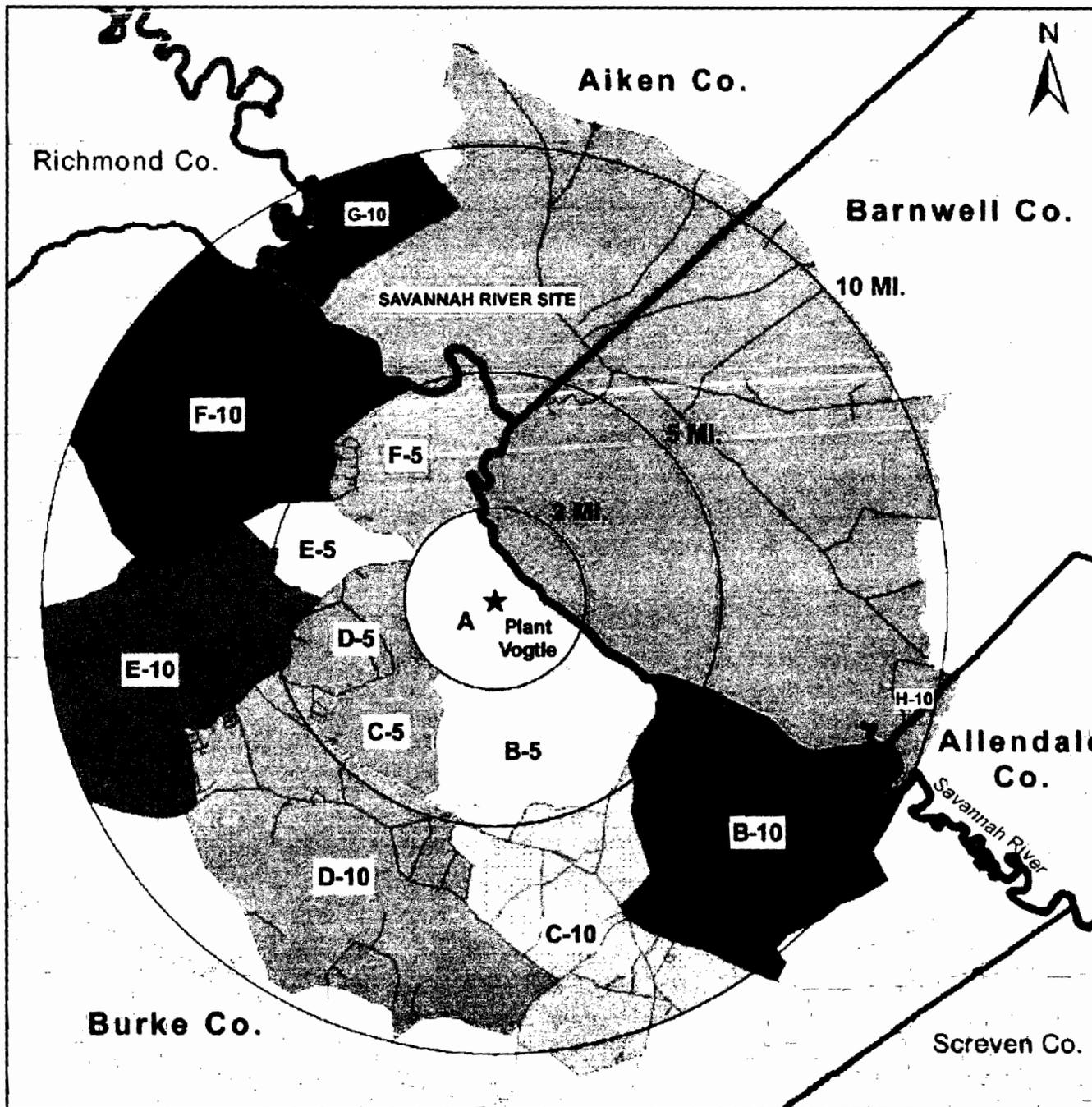
# EP Features – TSC

- Common TSC
- Common PA
- TSC Location
- TSC Layout

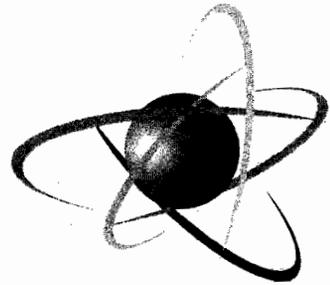


# EP Features - Area Vicinity





# EP Features- Plume Exposure EPZ



**U.S. NRC**  
UNITED STATES NUCLEAR REGULATORY COMMISSION  
*Protecting People and the Environment*

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# Presentation to the ACRS Subcommittee

## Safety Review of the Vogtle Early Site Permit Application

Presented by

Christian Araguas, Project Manager

NRO/DNRL/NWE1

October 24, 2007



# Purpose

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- Brief the Subcommittee on the status of the staff's safety review of the Vogtle early site permit (ESP) application
- Support the Subcommittee's review of the application and subsequent interim letter from the ACRS to the Commission
- Address the Subcommittee's questions



# Meeting Agenda

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- Schedule Milestones
- Vogtle ESP Application
- Key Review Areas / Open Items
- Review of Geology, Seismology and Geo-technical Engineering
- Review of Radiological Consequences of Design Basis Accidents (DBAs)
- Safety Evaluation Report (SER) Conclusions
- Presentation Conclusion
- Discussion / Questions



# Completed Milestones

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- Received Vogtle ESP Application - 8/15/2006
- Acceptance Review Completed - 9/19/2006
- Inspections / Site Audits:
  - Quality Assurance - 8/2006
  - Emergency Planning - 10/2006
  - Hazards & Security - 11/2006
  - Meteorology - 12/2006
  - Hydrology, Geology, Health Physics - 1/2007
- RAIs issued to the Applicant - 3/15/2007
- SER with Open Items issued - 8/30/2007
- Responses to Open Items Received - 10/15/2007



# Remaining Milestones

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- ACRS Full Committee Meeting – 11/1/2007
- ACRS Interim Letter Assumed – 11/2007
- Advanced SER with no Open Items due to ACRS – 5/16/2008
- ACRS Full Committee Meeting – 6/2008
- ACRS Final Letter Assumed – 7/2008
- Final SER issuance – 8/6/2008
- Mandatory Hearing – Spring 2009
- Commission Decision Assumed – Summer 2009



# Principal Contributors

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- Demography/Geography/Site Hazards: Rao Tammara
- Meteorology: Joseph Hoch, Brad Harvey
- Hydrology: Goutam Bagchi, Hosung Ahn, Kenneth See
  - Support from PNNL
- Geology/Seismology/Geo-Tech Engineering: Clifford Munson, Yong Li, Gerry Stirewalt, Sarah Gonzalez, Thomas Cheng, Laurel Bauer, Tomeka Terry, Weijun Wang, Meralis Plaza-Toledo, Zahira Cruz-Perez
  - Support from USGS and BNL



# Principal Contributors

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- Radiological Effluent Release Dose Consequences from Normal Operation: Steven Schaffer, Jean-Claude Dehmel
- Emergency Planning: Bruce Musico, Daniel Barss, Robert Moody
  - Support from FEMA and PNNL
- Physical Security: Marc Brooks, Al Tardiff
- Radiological Consequence Analysis: Michelle Hart
- Quality Assurance: Milton Concepcion-Robles



# Vogtle ESP Application

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- Proposed ESP site located in eastern Burke County, GA (26 miles southeast of Augusta, GA)
- Adjacent to and west of existing VEGP Units 1 and 2
- ESP applicant, SNC, submitted application on behalf of 4 co-owners: Georgia Power Company, Oglethorpe Power Corporation, Municipal Electric Authority of Georgia, and the City of Dalton, GA
- Application for ESP is for two additional reactors



# Vogtle ESP Application

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- SNC referenced the Westinghouse AP1000 Certified Design in its Application
- SNC requests permit approval for 20 year term
- SNC seeks approval for limited work authorization (LWA-1, LWA-2) activities
- SNC seeks approval for complete and integrated emergency plans with ITAAC as part of ESP



# Vogtle ESP Application

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- **LWA-1 Request**
  - Submitted with Original Application
  - Covers site preparation activities such as excavation for facility structures, construction of service facilities, installation of temporary construction support facilities, and construction or expansion of non-safety related SSCs
- **LWA-2 Request**
  - Submitted August 16, 2007
  - Covers placement of engineered backfill including retaining walls, preparation of nuclear island foundations (mudmats, waterproofing, rebar, foundation embedments)
    - SRP Section 2.5.4, "Stability of Subsurface Materials and Foundations"
    - SRP Section 3.8.5, "Foundations"
    - SRP Section 17.5, "QA Program Description for Design Certification, Early Site Permits and New License Applicants"
    - Fitness for Duty for Construction Activities



# Key Review Areas

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## 2.1 Geography and Demography

### ■ Site Location and Description

- Coordinates, site boundaries, orientation of principal plant structures, location of highways, railroads, waterways that traverse the exclusion area

### ■ Exclusion Area Authority and Control

- Legal authority, control of activities unrelated to plant operation, arrangements for traffic control

### ■ Population Distribution

- Current and future population projections, characteristics of the LPZ, population center distance, and population density



# Key Review Areas

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## 2.2 Nearby Industrial, Transportation, and Military Facilities

- Identification of Potential Hazards in Site Vicinity
  - Maps of site and nearby significant facilities and transportation routes
  - Description of facilities, products, materials, and number of people employed
  - Description of pipelines, highways, waterways, railroads and airports
  - Projections of industrial growth



# Key Review Areas

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## ■ Evaluation of Potential Accidents

Design-Basis Events: Accidents that a probability of occurrence on the order of magnitude of  $10^{-7}$  per year or greater and potential consequences exceeding 10 CFR 100 dose guidelines

- Explosions and Flammable Vapor Clouds - Truck Traffic, Pipelines, Mining Facilities, Waterway Traffic, Railroad Traffic
- Release of Hazardous Chemicals - Transportation Accidents, Major Depots, Storage Areas, Onsite Storage Tanks
- Fires – Transportation Accidents, Industrial Storage Facilities, Onsite Storage, Forest
- Radiological Hazards – SRS, VEGP Units 1 and 2



# Key Review Areas

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## 2.3 Meteorology

- Involves site specific information such as:
  - regional climatology
  - local meteorology
  - onsite meteorological measurements program
  - short-term atmospheric dispersion estimates for accidental releases
  - long-term dispersion estimates for routine releases



# Key Review Areas

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- **Meteorological Site Characteristics**
  - The applicant identified meteorological site characteristics related to:
    - Climatic extremes and severe weather
    - Atmospheric dispersion (accident & routine releases)



# Key Review Areas

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- Climatic Site Characteristics
  - Extreme Wind
  - Tornado
  - Precipitation (for Roof Design)
  - Ambient Design Temperature
    - Generic
    - AP1000 Specific



# Key Review Areas

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- Atmospheric Dispersion Site Characteristics
  - Short-Term Dispersion Estimates for Accident Releases
    - EAB and LPZ  $\chi/Q$  Values
  - Long-Term Dispersion Estimates for Routine Releases
    - EAB, Nearest Resident, Nearest Meat Animal, Nearest Vegetable Garden



# Key Review Areas

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- Meteorological Open Items
  - Provide a justification for using a 30-year period of record (1966 to 1995) to define the AP1000 maximum safety design temperatures. The staff believes these temperatures should be based on a 100-year return interval. (Open Item 2.3-1)



# Key Review Areas

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## 3.5.1.6 Aircraft Hazards

The plant design should consider that aircraft accidents that could lead to radiological consequences in excess of the exposure guidelines of 10 CFR 50.34(a)(1) with a probability of occurrence greater than an order of magnitude of  $10^{-7}$  per year

- Federal airways, holding patterns, or approach patterns should be at least 2 statute miles away
- Military installation or any airspace usage (ex. bombing ranges) should be at least 20 miles from site
- All airports should be at least 5 miles from site
- All airports should have projected operations less than:
  - $500d^2$  for airports within 5 to 10 miles
  - $1000d^2$  for airports outside of 10 miles



# Key Review Areas

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## Chapter 11 - Doses from Routine Liquid and Gaseous Effluent Releases

- Staff performed the following review and analysis:
  - Confirmed liquid and gaseous effluent releases
  - Confirmed appropriate exposure pathways
  - Confirmed the use of appropriate liquid dilution, and atmospheric dispersion/deposition
  - Confirmed the use of appropriate land usage parameters
  - Verified Applicant's calculated doses using NRC recommended models
  - Performed an independent dose assessment for liquid pathways showing the applicants doses to be conservative



# Key Review Areas

- Doses from Routine Liquid and Gaseous Effluent Releases and Comparison to Regulatory Criteria

Regulation	Type of Effluent	Pathway	Organ	Regulatory Limit (mrem/yr per unit)	Applicant SAR (mrem/yr per unit)	NRC SER (mrem/yr per unit)
10 CFR 50, Appendix I	Liquid	all	total body	3	0.017	0.001
		all	any organ	10	0.021	0.012
	Gaseous	all	total body	5	0.56	0.56
		all	skin	15	2.2	2.2
	Iodine & Particulate	all	any organ	15	5.9	5.9
	Gaseous	$\gamma$ air dose	n/a	10 mrad	0.67 mrad	0.67 mrad
		$\beta$ air dose	n/a	20 mrad	2.8 mrad	2.8 mrad
	40 CFR 190	all	all	total body	25 per site	2.4 (4 units)
all		all	thyroid	75 per site	12 (4 units)	12 (4 units)
all		all	other organs	25 per site	8.9 (4 units)	8.9 (4 units)



# Key Review Areas

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## 13.3 Emergency Planning

- Complete and Integrated Emergency Plan
  - Submitted by SNC as part of ESP application
  - Agency Certifications (E-plans are practicable and they will participate)
  - Complete and integrated plan provides *reasonable assurance* that adequate protective measures can and will be taken in the event of a radiological emergency



# Key Review Areas

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- **NRC Review**
  - 10 CFR 50.47 and Appendix E to Part 50
  - NUREG-0654/FEMA-REP-1(including Suppl. 2)
  - SRP Section 13.3, "Emergency Planning
  - SRP Table 14.3.10-1 (EP ITAAC)
- **Federal Emergency Management Agency (FEMA) Review**
  - FEMA Headquarters and Region IV Atlanta Office
  - 44 CFR 350 and REP program guidance
  - NUREG-0654/FEMA-REP-1(including Suppl. 2)
  - Exercise demonstrates adequacy of offsite procedures (ITAAC)



# Key Review Areas

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- Offsite State/Local Jurisdictions
  - State of Georgia
  - Burke County
  - State of South Carolina
  - Aiken County
  - Allendale County
  - Barnwell County



# Key Review Areas

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- Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)
  - First use of EP ITAAC under 10 CFR Part 52 review
  - SECY-05-197 and SRM (Generic EP ITAAC)
  - NUREG-0800 (SRP Table 14.2.10-1)
  - ESP/COL applicant proposes site-specific ITAAC



# Key Review Areas

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- **Emergency Action Levels (EALs)**
  - NEI 99-01 (LWRs) – NRC endorsement ongoing
  - NEI 07-01 (passive, advance LWRs) – NRC endorsement ongoing
  - Vogtle EALs based on NEI 07-01 – awaiting NEI 07-01 review
  - ITAAC will reflect some construction dependent EALs



# Key Review Areas

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## ■ Open Items

- 13.3-4: The review and acceptance of the application's EALs for Units 3 and 4
- 13.3-10: Discuss whether State and local agencies have reviewed the new ETE and provided comments, and discuss the resolution of those comments



# Key Review Areas

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## 13.6 Physical Security

Need to determine whether site characteristics are such that adequate security plans and measures can be developed

- Consideration for :
  - Pedestrian And Vehicular Land Approaches
  - Railroad and Water Approaches
  - Potential “high-ground” Adversary Advantage Areas
  - Integrated Response Provisions
  - Nearby Road Transportation Routes



# Key Review Areas

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## Chapter 17: ESP Quality Assurance Measures

Verify that the ESP application included within the scope of its QA program activities that would affect the capability of systems, structures, and components (SSCs) important to safety.

- Inspection completed in August 2006:
  - Review of NDQAM/plans/implementing procedures of applicant and major contractors.
  - Review of data collection, analyses, and evaluation methodologies, including site characterization.
- In-office Technical Review completed in January 2007 :
  - Verify that the applicant adequately applied the guidance in Section 17.1.1 to demonstrate the integrity and reliability of data that were obtained during ESP activities.
  - The applicant utilized NEI 06-14A, "Quality Assurance Program Description (QAPD)," as template for the NDQAM.
- Submittal of revised NDQAM on August 2007 to include LWA activities within the scope of ESP.



# Key Review Areas

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## Section 2.4: Hydrologic Engineering

### ■ Floods

- SER Section 2.4.2: Local flooding
- SER Section 2.4.3: Flooding in rivers and streams
- SER Section 2.4.4: Dam failures
- SER Section 2.4.5: Storm surges and seiche
- SER Section 2.4.6: Tsunami
- SER Section 2.4.7: Ice-induced flooding
- SER Section 2.4.8: Canals and reservoirs
- SER Section 2.4.9: Channel diversion
- SER Section 2.4.10: Flooding protection requirements



# Key Review Areas

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- Low water
  - SER Section 2.4.11: Low water considerations
- Groundwater
  - SER Section 2.4.12: Groundwater use
  - SER Section 2.4.13: Release of radionuclides in ground and surface waters



# Key Review Areas

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- **Section 2.4.2: Floods**
  - Independently estimated and verified local intense precipitation; specified as a site characteristic
- **Section 2.4.3: Probable Maximum Flood (PMF) on Streams and Rivers**
  - Independently estimated PMF using bounding approach; verified applicant's conclusion that the site is dry during PMF in Savannah River
- **Section 2.4.4: Potential Dam Failures**
  - Verified applicant's analysis; verified site is dry during dam break flood
- **Section 2.4.5: Probable Maximum Surge and Seiche Flooding**
  - Verified applicant's analysis; staff's independent bounding estimate concluded site will remain dry
- **Section 2.4.6: Probable Maximum Tsunami Hazards**
  - Hierarchical review; staff concluded that a probable maximum tsunami near the mouth of the Savannah River will not reach site grade
- **Section 2.4.7: Ice Effects**
  - Using historical data from 9 stations, staff concluded ice formation is unlikely



# Key Review Areas

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## ■ Section 2.4.8: Cooling Water Canals and Reservoirs

- No safety-related canals or reservoirs as a source for cooling water are proposed since VEGP Units 3 and 4 will not rely on any external water source for safety-related cooling water
- Staff determined that a design parameter is needed related to initial filling and occasional makeup purposes, leading to **Open Item 2.4-1**
  - Staff identified Permit Condition 2.4.8-1 stating that VEGP Units 3 and 4 will not rely on any external water source for safety-related cooling water other than initial filling and occasional make-up water
  - Alternatively, the applicant may propose a design parameter related to safety-related water use stating that no safety-related water is required for the proposed plants at the VEGP site other than initial filling and occasional make-up water

## ■ Section 2.4.9: Channel Diversion

- VEGP Units 3 and 4 will not rely on any external water source for safety-related cooling water
- Combined with staff-proposed Permit Condition 2.4.8-1, diversion of the Savannah River away from the site will not affect safe operation of the units
- Staff determined it is unlikely Savannah River could divert into the site



# Key Review Areas

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- **Section 2.4.10: Flooding Protection Requirements**
  - Not needed for a safety-related SSC if its entrances and openings are located above the proposed site grade of 220 feet MSL
  - Site drainage system will be designed such that all safety-related SSC would be safe from flooding from local intense precipitation
- **Section 2.4.11: Low Water Considerations**
  - Combined with staff-proposed Permit Condition 2.4.8-1, safety-related SSC will not be affected by low water conditions in Savannah River
- **Section 2.4.12: Groundwater**
  - Staff reviewed groundwater characteristics and data provided by the applicant
  - Staff determined that applicant should provide an improved and complete description of the current and future local hydrological conditions, including alternate conceptual models, to demonstrate that the design bases related to groundwater-induced loadings on subsurface portions of safety-related SSCs would not be exceeded; alternatively, the applicant can provide design parameters for buoyancy evaluation of the plant structures – **Open Item 2.4-2**



# Key Review Areas

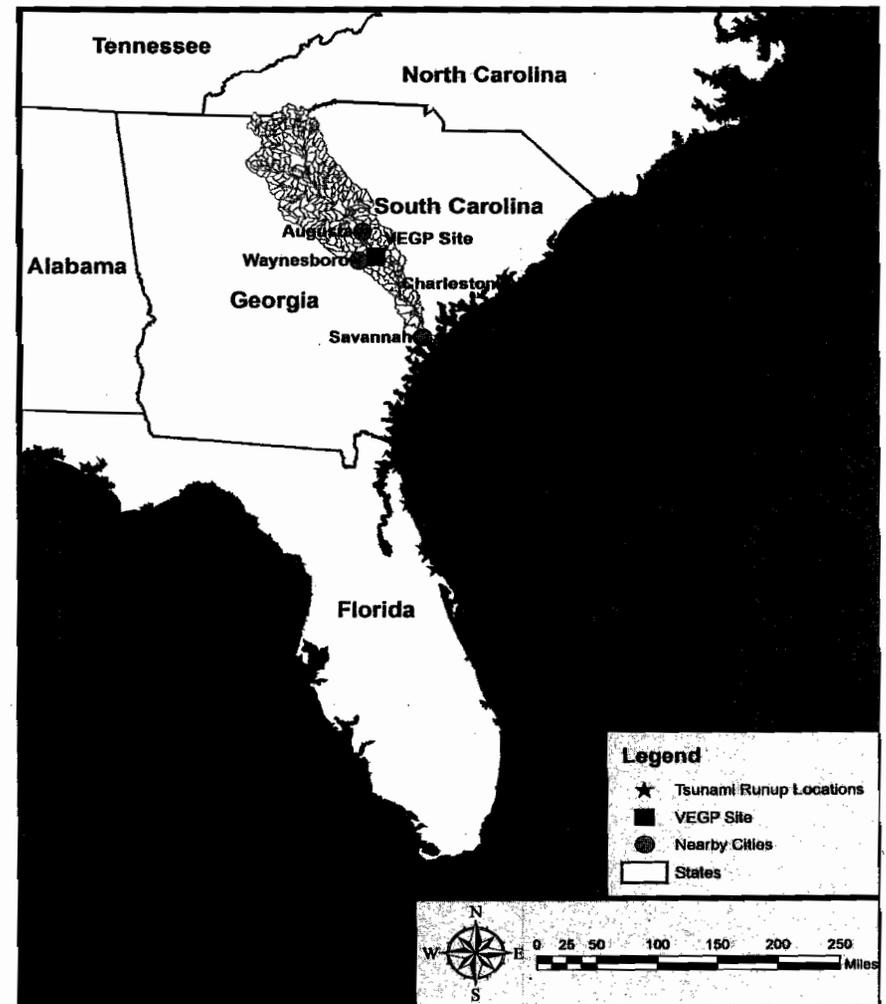
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- **Section 2.4.13: Accidental Releases of Radioactive Liquid Effluents In Ground And Surface Waters**
  - Transport of radioactive liquid effluent is a combinatorial problem with multiple possible environmental pathways – the pathway with the most severe release consequence is of interest for site suitability determination
  - Uncertainty due to spatially and temporally varying characteristics
  - Existing hydrology of the site does not necessarily represent the future hydrology; substantial change to the post-construction landscape and hydrologic features may lead to changes in distribution of recharge and the underlying water table and, therefore, changes to the groundwater pathway
  - Applicant described a single groundwater pathway to the northwest towards Mallard Pond; staff did not concur with dilution data and release points
  - Staff determined that alternate conceptual models exist that may lead to migration of radioactive liquid effluent (1) to the west and through Daniels Branch, eventually to the southeast and (2) to the east toward the Savannah River through the Tertiary aquifer because of communication between the Water Table and the Tertiary aquifers
  - An adequate number of combinations of release locations and feasible pathways has not been considered – **Open Item 2.4-3**



# Key Review Areas

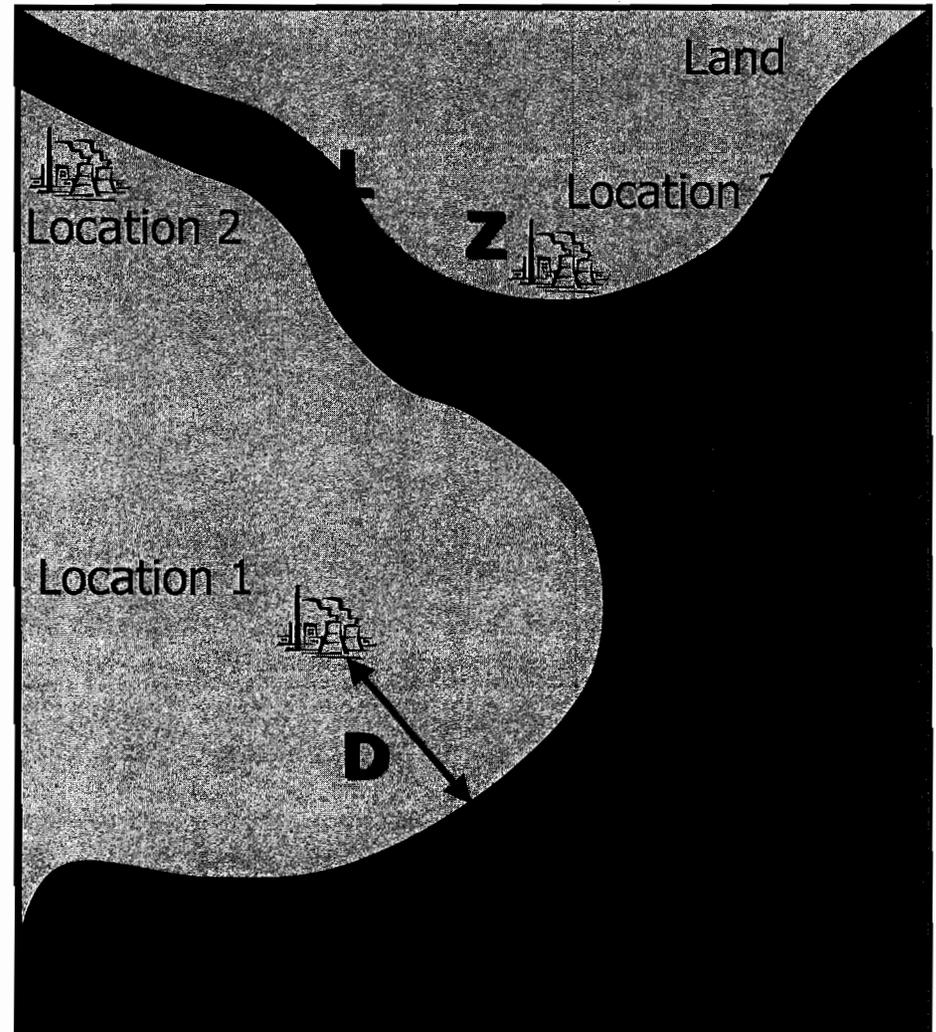
- Vogtle ESP Tsunami Assessment
  - Hierarchical review approach
    - step 1: regional screening
    - step 2: site screening
    - step 3: comprehensive tsunami hazard assessment (THA)
  - step 1: regional screening
    - Historical tsunami runup information from National Geophysical Data Center (NGDC)
    - Existing tsunami runup events north and south of the Savannah River Estuary
    - Actual runup heights missing in the NGDC database; Charleston runup less than 1 ft; estimated runup on east coast of 10 ft from 1755 Lisbon earthquake and tsunami
    - The Savannah River Estuary is subject to tsunami events

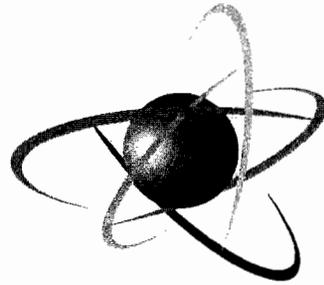




# Key Review Areas

- step 2: site screening
  - The DLZ rule
    - D: horizontal distance, L: longitudinal distance along river or stream from estuary, and Z: elevation of the site
  - The Vogle ESP site: 100 mi inland from the coast, approximately 150 river miles from the estuary, and at an elevation of 220 ft MSL
  - A tsunami would need to inundate 100 mi inland and run up to 220 ft MSL, and a tidal bore would need to travel 150 mi upstream and reach 220 ft MSL
  - In US, tidal bores occur in Cook Inlet, Alaska
- step 3: comprehensive THA
  - Not needed





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UNITED STATES NUCLEAR REGULATORY COMMISSION

*Protecting People and the Environment*

---

# Presentation to the ACRS Subcommittee

## Safety Conclusions from the Review of the Vogtle Early Site Permit Application

Presented by

Christian Araguas, Project Manager

NRO/DNRL/NWE1

October 24, 2007



# SER Conclusions

---

- SER defers general regulatory conclusion regarding site safety and suitability to FSER after open items addressed
- Some conclusions from individual sections without open items:
  - Applicant has provided appropriate quality assurance measures equivalent to those in 10 CFR Part 50 Appendix B
  - Demonstrated that radiological effluent release limits associated with normal operation from the type of facility proposed to be located at the site can be met for any individual located offsite (10 CFR 100.21(c)(1))



# SER Conclusions

---

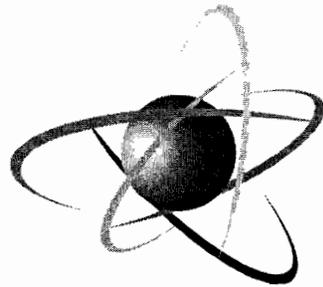
- Radiological dose consequences of postulated accidents meet the criteria set forth in 10 CFR 50.34(a)(1) for the type of facility proposed to be located at the site (10 CFR 100.21(c)(2))
- Potential Hazards associated with nearby transportation routes, industrial and military facilities pose no undue risk to facility that might be constructed on the site (10 CFR 100.21(e))
- Site characteristics are such that adequate security plans and measures can be developed (10 CFR 100.21(f))



# Presentation Conclusion

---

- SER with Open Items Issued 8/30/07
  - 40 Open Items
  - 2 Permit Conditions
  - 19 COL Action Items
- Open Item Responses Received 10/15/07
- Reviewing Supplemental Information for Approval of LWA-2
- Next Interaction with ACRS 6/2008 on FSER (tentative)



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# Radiological Consequences of Design Basis Accidents

Michelle Hart

Sr. Health Physicist



# Reference Plant

---

- AP1000 DCD, Rev. 15
  - Design reference atmospheric dispersion factors ( $\chi/Q_s$ ) for EAB and LPZ
    - Site parameters in DCD, Tier 1
  - Accident-specific source terms
    - Ci/sec release rates in Westinghouse document response to RAI for ESP
    - RG 1.183 PWR accident guidance used as applicable to AP1000 design in DCD Rev. 15



# Use of Reference Plant for Site Analysis (cont.)

---

- Accident dose for site is DCD dose adjusted by factor to account for difference in site-specific  $\chi/Q$ s to design reference  $\chi/Q$ s
- Dose for a time averaging period is directly related to  $\chi/Q$  for that period

$$\text{External Dose} = \text{Integrated Source} \times (\chi/Q) \times \text{DCF}$$

$$\text{CEDE} = \text{Integrated Source} \times (\chi/Q) \times \text{BR} \times \text{DCF}$$



# Use of Reference Plant for Site Analysis (cont.)

---

- Ratio for each averaging period is less than one, therefore dose for site is less than reported in AP1000 DCD, Rev. 15
- Can confirm by taking AP1000, Rev. 15 source term release rates for each DBA and calculating site-specific DBA dose using site-specific  $\chi/Q_s$



# Review at COL

---

- Review at COL would determine if chosen plant fits within the assumptions for the ESP
  - ESP applies to AP1000 (DCD Rev. 15)
- Permit
  - AP1000
  - Accident release rate source terms
  - Site parameters include offsite  $\chi/Q_s$



Department of Energy  
Savannah River Operations Office  
P.O. Box A  
Aiken, South Carolina 29802  
APR 12 1999



Mr. J. B. Beasley, Jr.  
Vice President - Nuclear Vogtle Project  
Southern Nuclear Operating Company  
Birmingham, Alabama 35201

Dear Mr. Beasley:

**SUBJECT: Vogtle Electric Generating Plant (VEGP) Memorandum of Agreement (MOA)**

Enclosed is your copy of the executed MOA between the Department of Energy Savannah River Operations Office and the Southern Nuclear Operating Company (SNC) for planning and responding to emergencies originating at the Vogtle Electric Generating Plant (VEGP) and the Savannah River Site (SRS).

We appreciate the continued support of SNC and the staff at VEGP in promoting effective emergency preparedness and response activities for our respective facilities. Our staffs are working together to identify more effective ways that we can communicate with the states and demonstrate that we are hearing and addressing their concerns. In the near future I intend to submit to you a revised MOA which includes provisions for notifying the states and/or each other upon the impending release of tritiated water. Our goal would be to assure that government entities with interests in downstream Savannah River water quality will not be surprised by intentional releases of tritium in the water, and there will be no need for SRS to demonstrate when tritium detected in the water is not from SRS facilities. Again, I thank you for your support,

Please contact me or Len Sjostrom of my staff at (803) 725-5562, if you have any questions.

Sincerely,

Greg Rudy  
Manager

VF-99-0033

Enclosure:  
Memorandum of Agreement

cc w/encl:  
Lawrence E. Mayo, SNC  
Merrill Maddox, SNC

**MEMORANDUM OF AGREEMENT  
BETWEEN  
UNITED STATES DEPARTMENT OF ENERGY  
SAVANNAH RIVER OPERATIONS OFFICE  
AND  
SOUTHERN NUCLEAR OPERATING COMPANY**

**I. PURPOSE**

This Memorandum of Agreement (MOA) is between the United States Department of Energy Savannah River Operations Office (DOE-SR) and the Southern Nuclear Operating Company (SNC) and provides for planning and responding to emergencies originating at the Vogtle Electric Generating Plant (VEGP), and the Savannah River Site (SRS).

**II. RESPONSIBILITIES**

WESR is the responsible authority for SRS and as such, is responsible for the protection of all persons and for the direction and control of all emergency response actions on SRS for emergencies occurring at or affecting SRS, including emergencies originating at VEGP.

SNC is responsible for the protection of all persons and for the direction and control of all emergency response actions on the VEGP site for emergencies occurring at or affecting VEGP, including emergencies originating at SRS.

**III. AGREEMENT**

SNC and DOE-SR agree as follows:

**A. In the event an emergency is declared at VEGP:**

**1. SNC will:**

- a. notify the Savannah River Site Operations Center through the Emergency Notification Network within 15 minutes of an emergency declaration;
- b. utilize the Emergency Notification form to provide information concerning the emergency, including meteorological and radiological data and any protective action ~~requirements~~ recommendations;
- c. provide periodic follow-up information to DOESR in accordance with the VEGP emergency plan;
- d. dispatch a technical liaison to the SRS Emergency Operations Center if requested by SRS.

2. DOE-SR will:

- a. provide for the prompt notification of all persons on SRS within VEGP's plume exposure pathway Emergency Planning Zone;
- b. assess the radiological hazard on SRS and decide upon and implement any protective actions necessary to protect the health and safety of affected persons on SRS, including access control;
- c. perform radiological monitoring on SRS as requested by SNC or the State of South Carolina and provide monitoring results to SNC and to the States of South Carolina and Georgia;
- d. provide resources and support as identified in the Federal Radiological Emergency Response Plan (FRERP) to address ingestion pathway concerns;
- e. provide meteorological data to SNC, as requested; and
- f. advise SNC and the States of South Carolina and Georgia of public information activities concerning the SRS to the maximum extent possible, and provide a spokesperson to the VEGP Emergency News Center when significant media/public interest in SRS activities is anticipated.
- g. as the Regional Coordinating Office for DOE Region 3, respond to requests for radiological assistance from SNC, the Nuclear Regulatory Commission (NRC), or the States of South Carolina or Georgia in the event of an incident involving the actual or potential release of radiological materials. This assistance will be provided under the Radiological Assistance Program (RAP) and will be limited to technical advice and resources for monitoring and assessment actions essential for the control of the immediate hazards to health and safety. DOE radiological assistance will be terminated when it is no longer needed or the necessary assistance is available from State, local, or commercial services.
- h. as the Regional Coordinating Office for DOE Region 3, advise SNC, the NRC, or the States of South Carolina or Georgia of additional DOE Emergency Response assets available to assist in the response.

B. In the event an emergency is declared at SRS:

1. DOE-SR will:

- a. notify VEGP personnel through the Emergency Notification Network within 15 minutes of an emergency declaration;
- b. utilize the Emergency Notification form to provide information concerning the emergency, including meteorological and radiological data and any protective action recommendations;

- c. dispatch a technical liaison to the VEGP Emergency Operations Facility, as requested by SNC;
- d. provide periodic follow-up information to SNC in accordance with the SRS emergency plan;
- e. provide resources and support as identified in the FRERP to address ingestion pathway concerns.

2. SNC will:

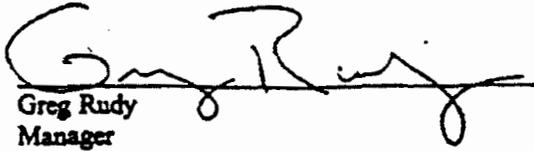
- a. provide for the prompt notification of all persons on the VEGP site within the SRS plume exposure pathway Emergency Planning Zone;
- b. assess the radiological hazard on the VEGP site, and decide upon and implement any protective actions necessary to protect the health and safety of affected persons on the VEGP site;
- c. perform radiological monitoring as requested by DOE-SR or the States of Georgia and South Carolina and provide results to DOE-SR and to the States of Georgia and South Carolina; and
- d. provide meteorological data to DOE-SR, as requested.

C. The parties will also:

- 1. provide a twenty-four hour point of contact at VEGP and SRS for notification purposes;
- 2. maintain effective lines of communication during an emergency;
- 3. participate in each other's emergency response exercises as requested and agreed upon.

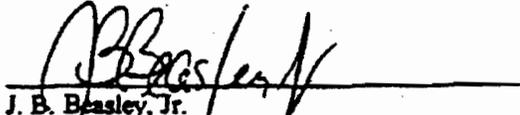
IV. TERMS OF AGREEMENT

- A. This MOA shall become effective upon the latter date of signature of the parties.
- B. This MOA supersedes a previous MOA dated January 3, 1986, between the United States Department of Energy Savannah River Operations Office and the Georgia Power Company, as assigned
- C. This MOA may be amended by mutual consent of the parties concerned or terminated by either party upon giving at least thirty (30) day, written notice to the other party.



Greg Rudy  
Manager  
Savannah River Operations Office  
United States Department of Energy

4/12/99  
Date



J. B. Beasley, Jr.  
Southern Nuclear Operating Company  
Vice President - Nuclear  
Vogtle Project

12/11/98  
Date

————— Nothing Follows —————

# WELCOME

You Are Now Inside The

## VOGTLE ELECTRIC GENERATING PLANT

### EMERGENCY PLANNING ZONE

In the unlikely event of a serious emergency at Vogtle this siren will sound. If warned of an emergency, listen to one of the following radio stations or tv stations:

WBBC-FM 104.3    WJBF(ch.6)  
WBBC-AM 1340    WRDW(ch.12)  
WKXC-FM 99.5    WAGT(ch.26)  
WDOG-FM 93.5

Stay Tuned to Find Out What to Do.

If you live or work within this area, please keep your

### Alert Radio PLUGGED IN AND TURNED ON

The Alert Radio will provide you with important instructions during an emergency.

If you live or work nearby and DO NOT HAVE an Alert Radio

Please contact VEG's Emergency Communications

706-477-706 or 800-455-706

VOGTLE

EMERGENCY PLANNING ZONE



## SAR Section 2.5

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# Geology, Seismology, and Geotechnical Engineering

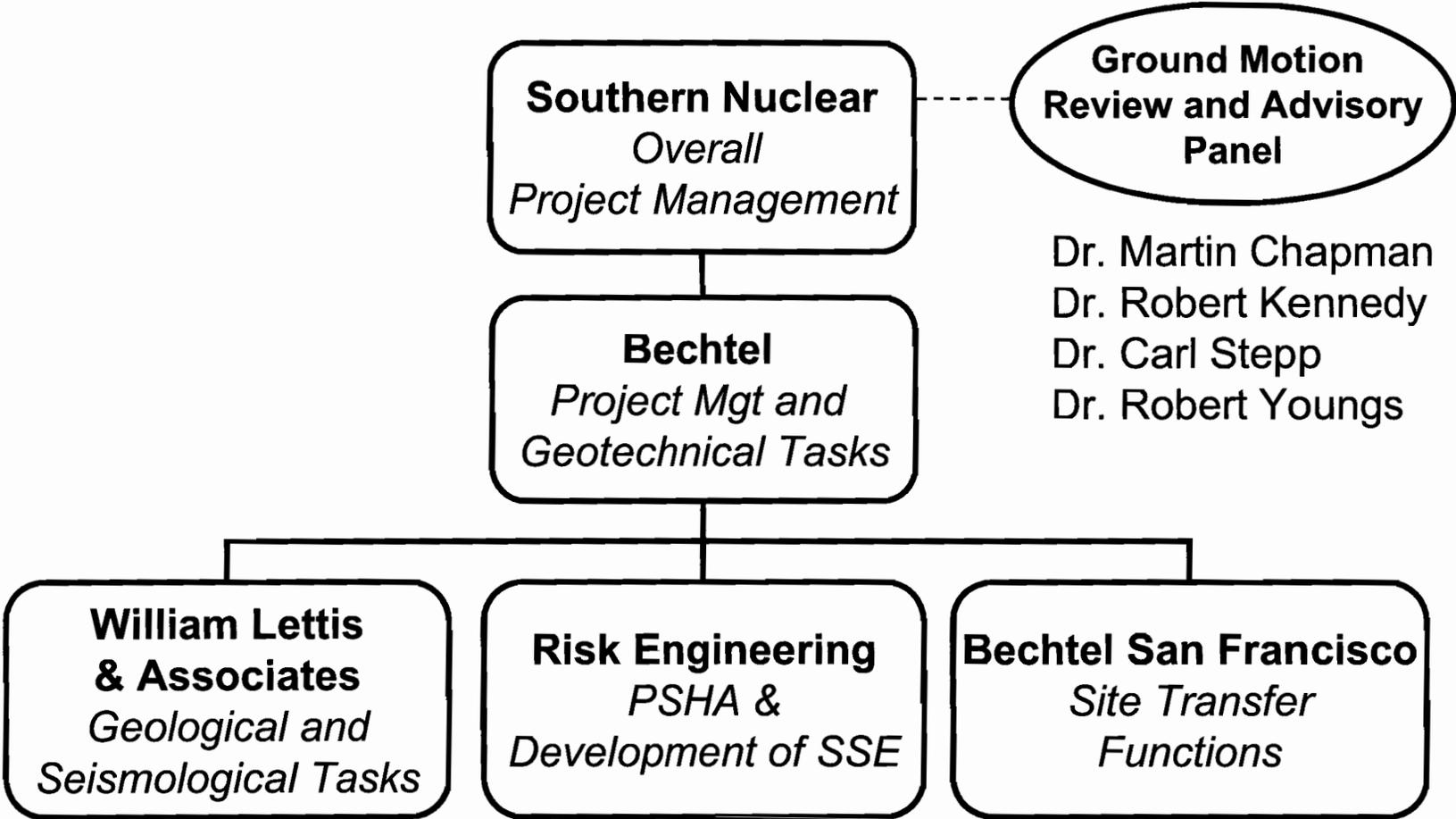
Tom McCallum  
Site Development  
Project Engineer

## Topics for Discussion

---

- ◆ Program Overview
- ◆ Site Layout and Features
- ◆ Geological and Seismological Investigations
- ◆ Seismic Ground Motion (SSE)
- ◆ Geotechnical Summary

# Seismic Program Organization

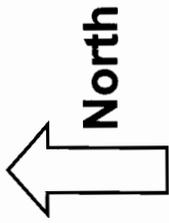


# Other Outside Assistance

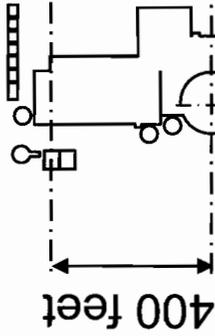
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## Savannah River Site

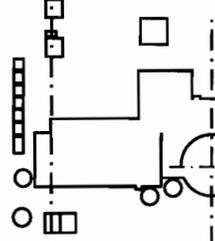
- ◆ Provided technical staff support for seismic survey and other tasks
- ◆ Provided significant amount of data from SRS geotechnical investigations



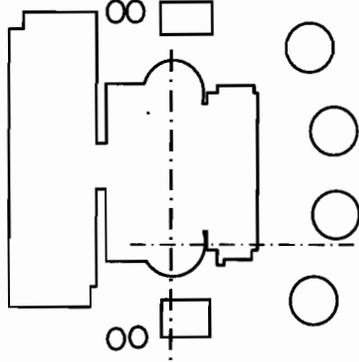
Unit 4



Unit 3



Existing  
Units 1 & 2



1695 feet

800 feet

400 feet

Site Grade - Elevation 220 MSL

# Site Layout

# Geological and Seismological Investigations

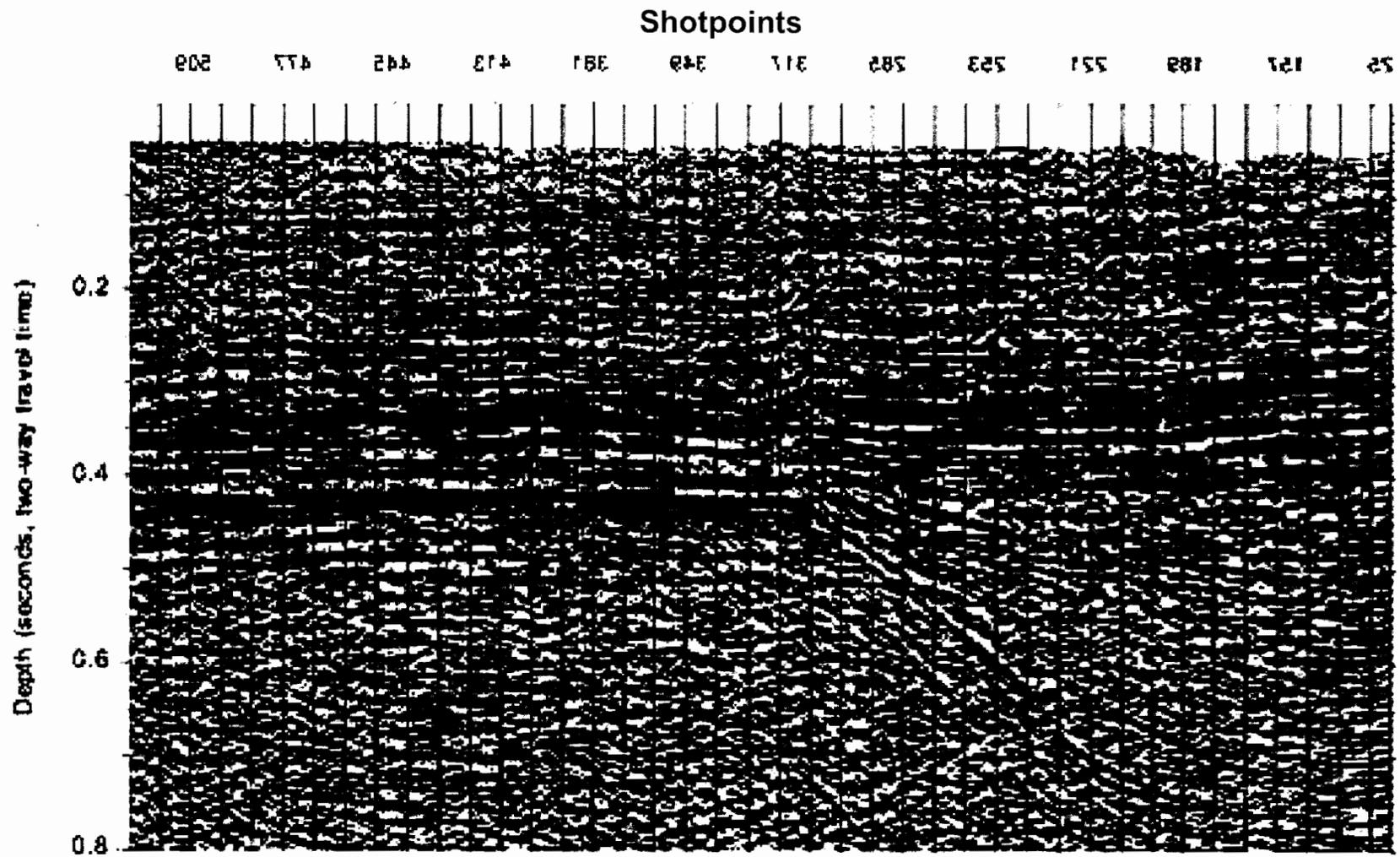
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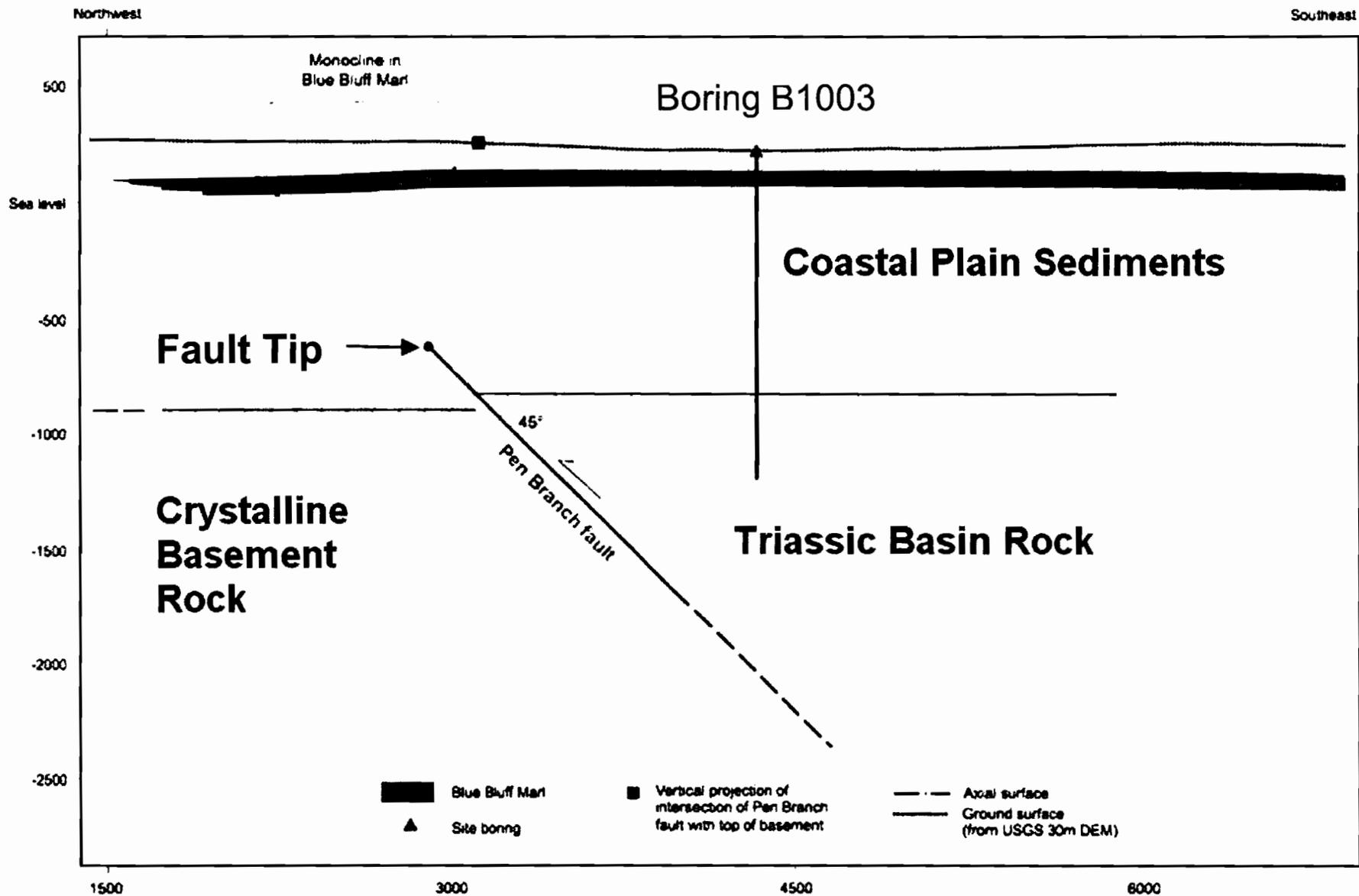
# Evaluation of Tectonic Features

---

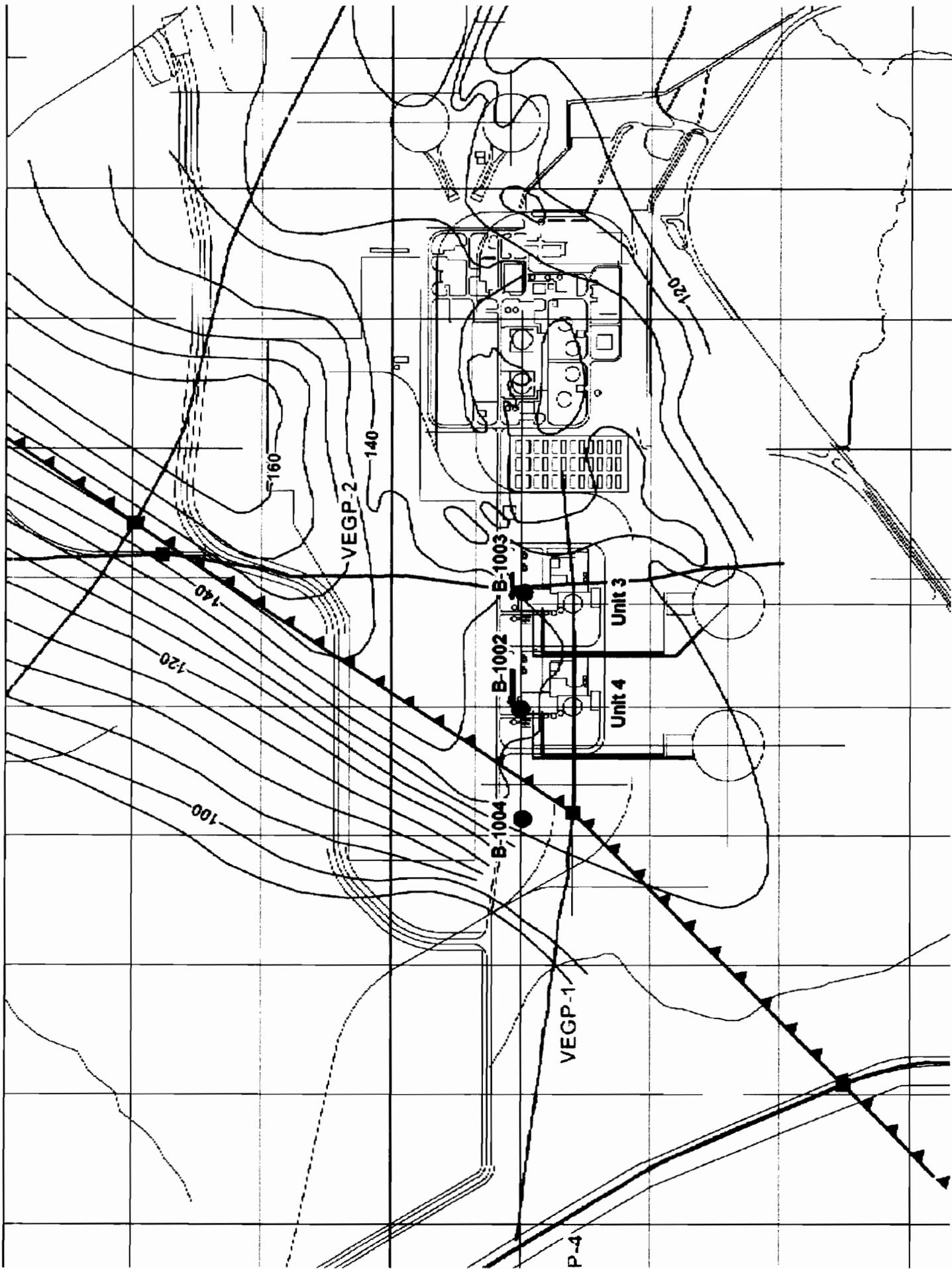
- ◆ Literature review
- ◆ Contact local researchers
- ◆ Air photo interpretation
- ◆ Aerial reconnaissance
- ◆ Field reconnaissance
- ◆ Review of seismicity
- ◆ Seismic reflection profiles at Vogtle
- ◆ Geomorphic analysis of river terraces



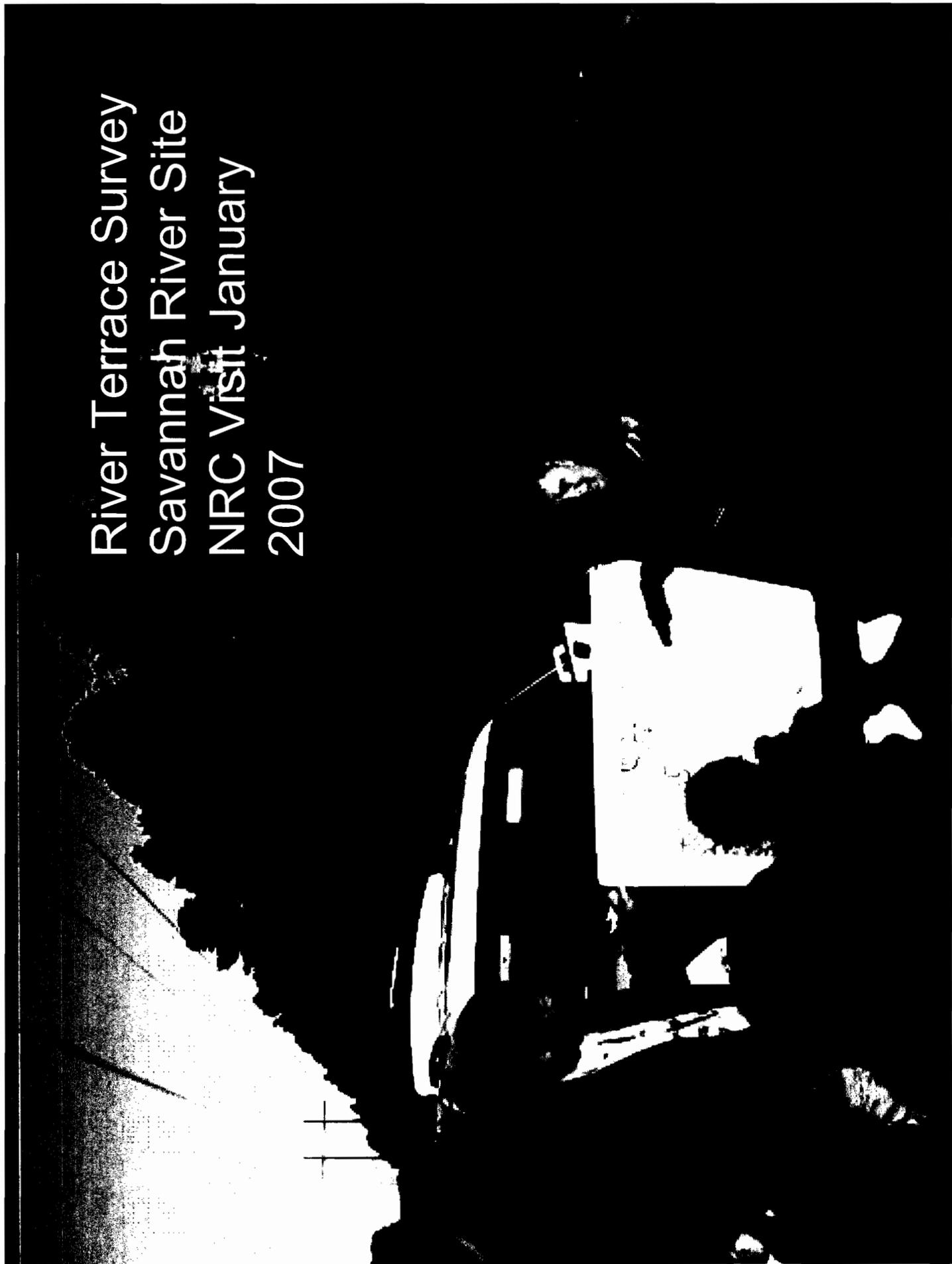
**Pen Branch Fault Image from Reflection Line 4  
Looking Northeast**



**Cross-Section Normal to Pen Branch Fault  
Looking Northeast**



River Terrace Survey  
Savannah River Site  
NRC Visit January  
2007



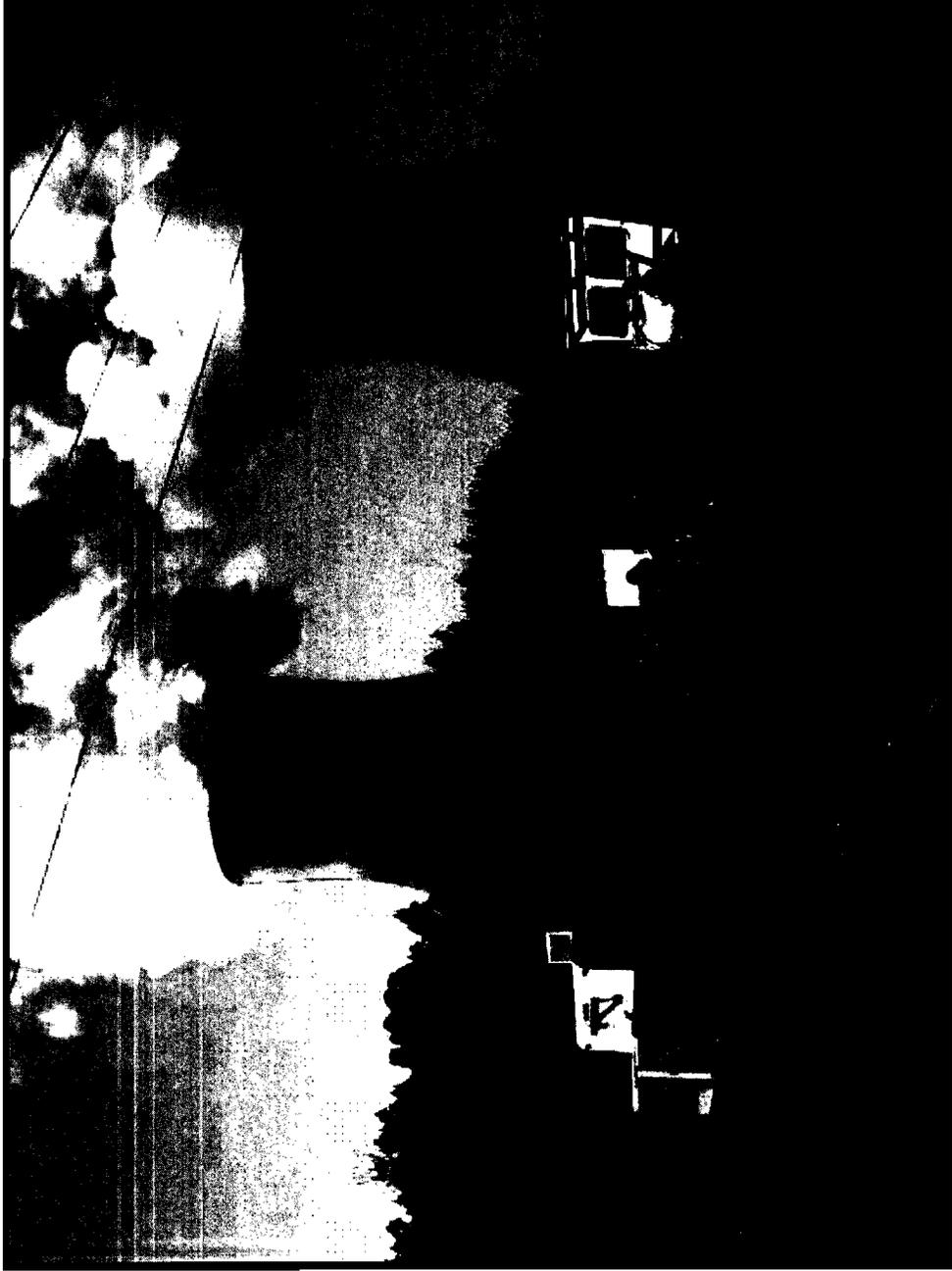
# Summary

---

- ◆ None of the tectonic features within the Site Vicinity (25 miles) or Site Area (5 miles) are capable tectonic sources
- ◆ Non-tectonic deformation and related features can be mitigated by removal of strata overlying Blue Bluff Marl

# Seismic Ground Motion (SSE)

---

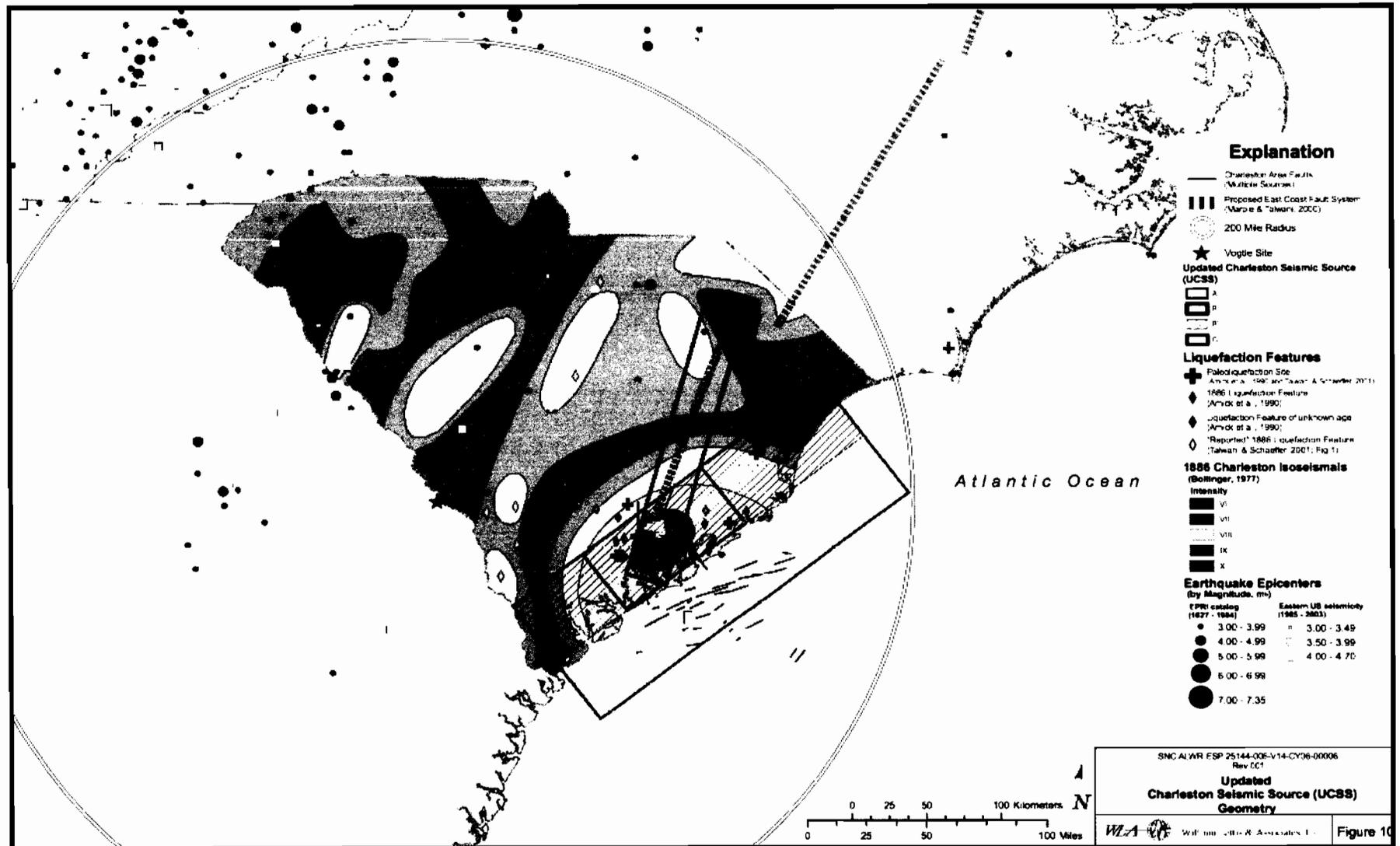


# PSHA Updated per RG 1.165

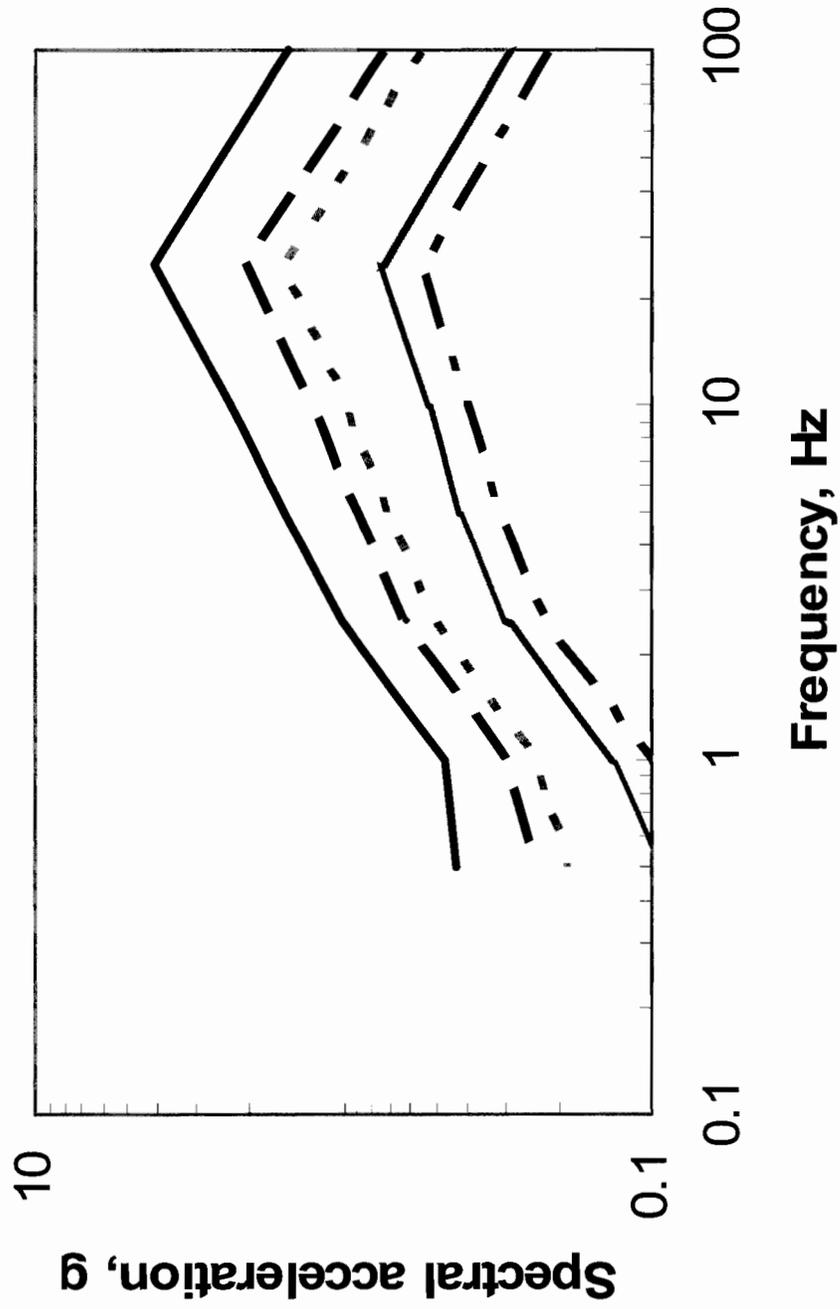
---

- ◆ Assessed effects of additional seismicity, 1985 through mid-2005
- ◆ Updated EPRI-SOG seismic sources to account for new source information
- ◆ Used updated EPRI-SOG ground motion models (EPRI 2004)

# Updated Charleston Seismic Source (UCSS)



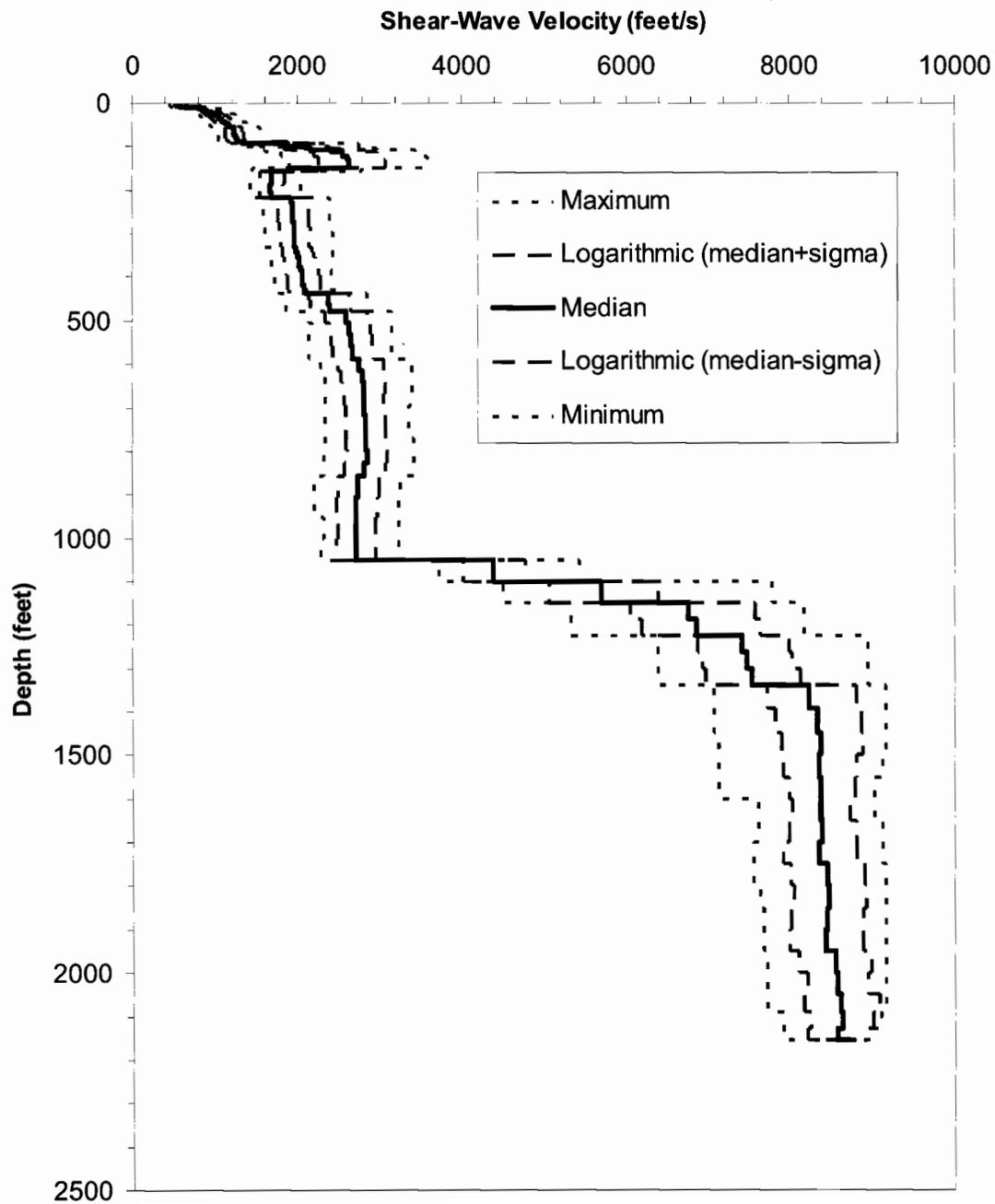
# Mean UHS, rock, Vogtle



# Calculation of Soil Hazard

---

- ◆ Developed soil profile with properties
- ◆ Determined soil amplitudes for multiple rock input amplitudes (frequencies from 100 Hz to 0.1 Hz) (1D SHAKE analysis) using M and R from deaggregation (high- and low-frequency spectra)
- ◆ Combined rock hazard with site amplification (including uncertainties in input motion and soil properties) to obtain soil UHS for multiple mean annual frequencies of exceedance (NUREG/CR-6728 Approach 2A)



## Soil-Rock Shear Wave Velocity Calculated from the 60 Shear-Wave Velocity Profiles

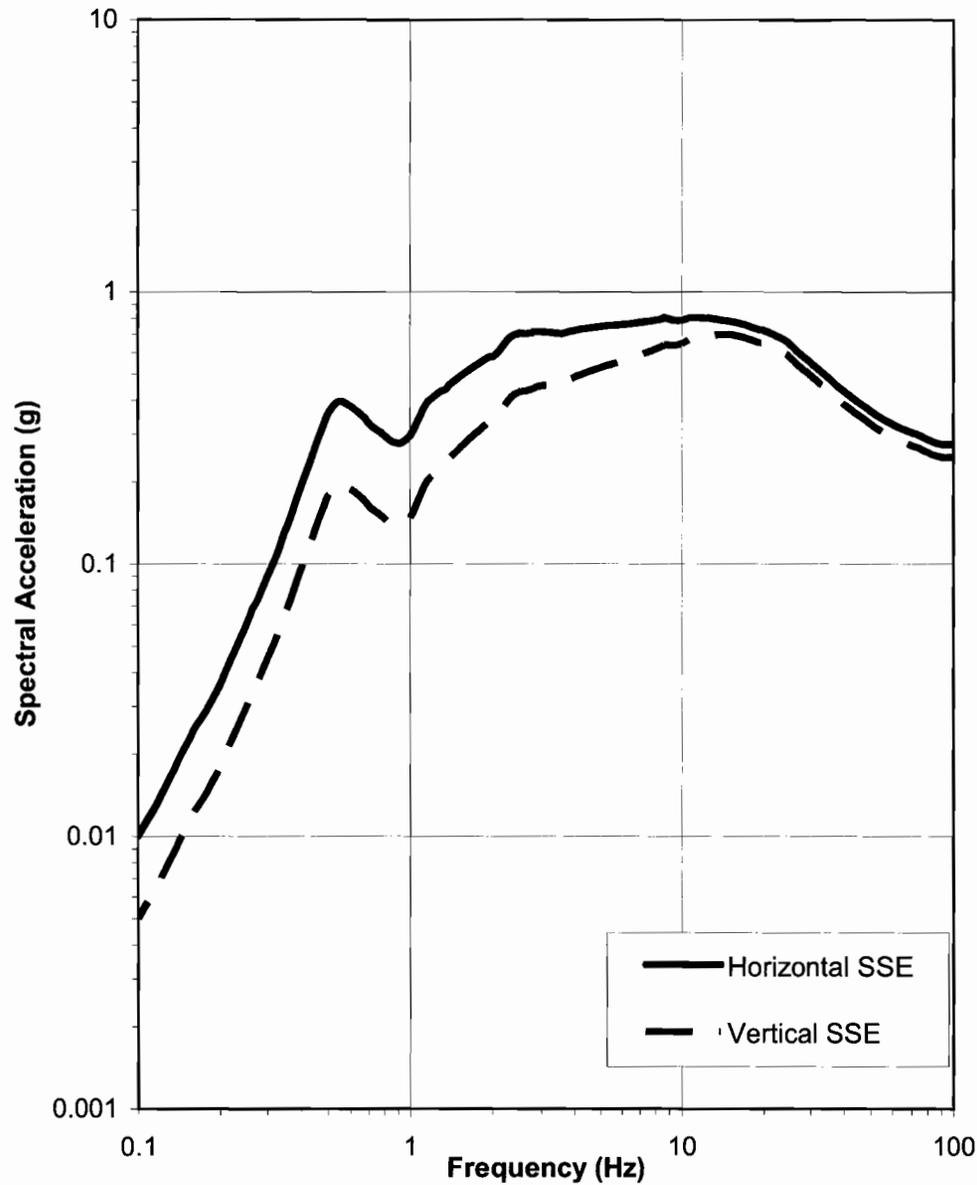
From SAR Figure 2.5.2-34

# Development of Vogtle SSE

---

- ◆ SSE developed following performance-based procedures (ASCE 43-05)
- ◆ Define SSE @ ground surface at hypothetical outcrop of highest competent in-situ material (top of Blue Bluff Marl at ~86' depth)
- ◆ Vertical SSE =  $V/H \times \text{Horiz. SSE}$

SSE at 86-foot Depth Control Point



**Vogtle ESP SSE  
at top of Blue Bluff Marl  
(86-foot Depth)  
(GMRS)**

From SAR Figure 2.5.2-44

# Geotechnical Investigations

---



# ESP Subsurface Investigation

---

- ◆ 14 borings
- ◆ One boring to a depth of 1,338 ft (290 ft into rock)
- ◆ 12 CPTs (3 seismic CPTs)
- ◆ Geophysical testing of 3 boreholes, including:
  - Suspension P-S Velocity Logging
  - Caliper/Natural Gamma Measurements
  - Resistivity/Spontaneous Potential Measurements
  - Boring Deviation Measurements
- ◆ 15 new ground water observation wells
  - 10 in upper aquifer
  - 5 in lower aquifer
- ◆ Laboratory testing
- ◆ Maximum use of data from existing units and SRS

# General Subsurface Profile

---

- ◆ Upper sands (Barnwell Group):
  - Very loose to very dense sands
  - Average thickness of about 90 ft
  - Ground water elevation is 165 ft (55-60 ft below grade)
  
- ◆ Blue Bluff Marl - (Lisbon Formation):
  - Very hard, slightly sandy, cemented, calcareous silt/clay
  - Average thickness of 76 ft
  
- ◆ Lower sands (coastal plain deposits):
  - Dense sands
  - Thickness of 900 ft
  
- ◆ Dunbarton Basin bedrock:
  - Triassic sandstone
  - 1,049 ft below grade at B-1003

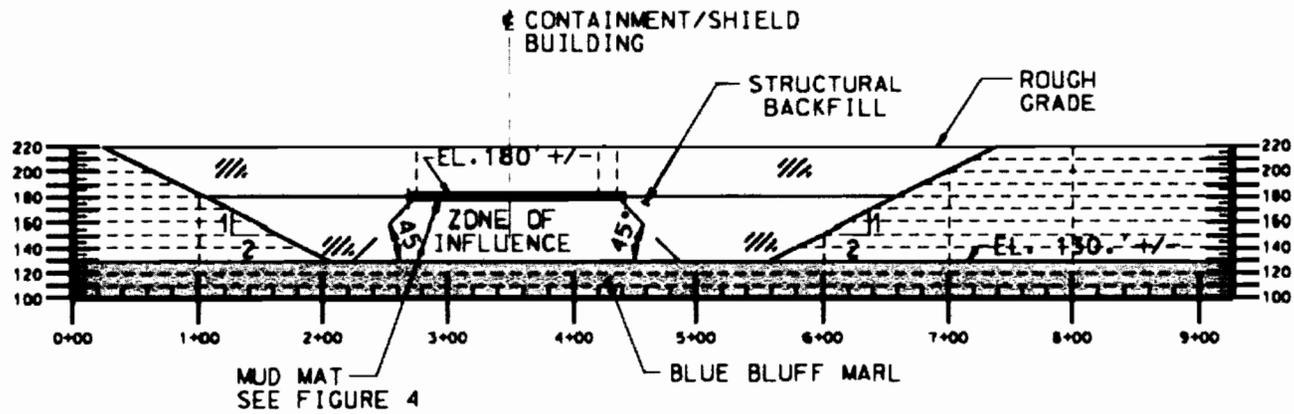
# Construction Excavation

---

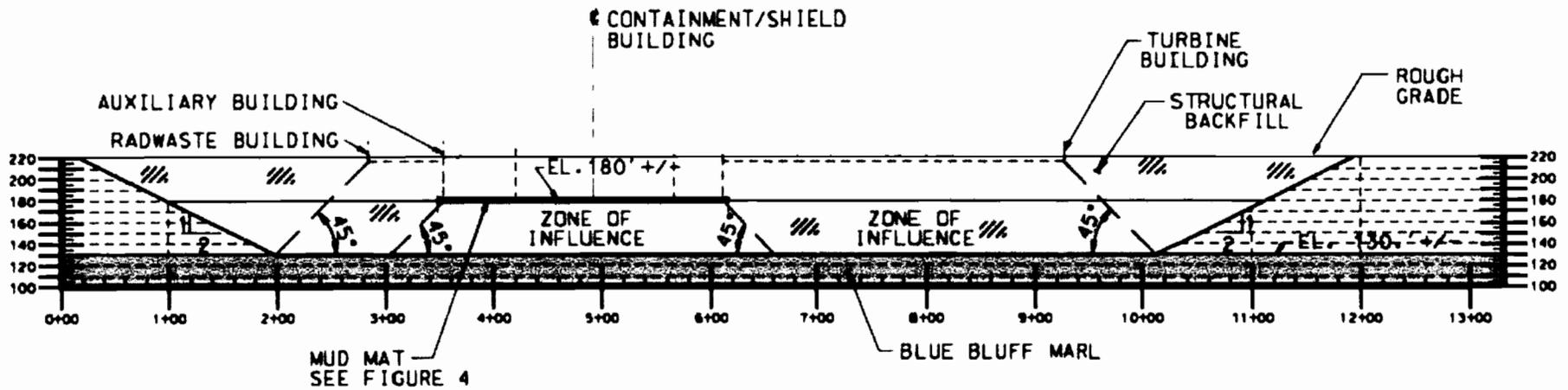
## The Upper Sands - Barnwell Group

- ◆ Have highly variable density along the depth and from borehole to borehole
- ◆ A shell-rich, very porous material was encountered at the bottom of the Barnwell Group/top of Blue Bluff Marl that caused drilling fluid losses
- ◆ These soils were completely removed and replaced with compacted granular fill for construction of existing units.
- ◆ For these reasons, these soils will be removed

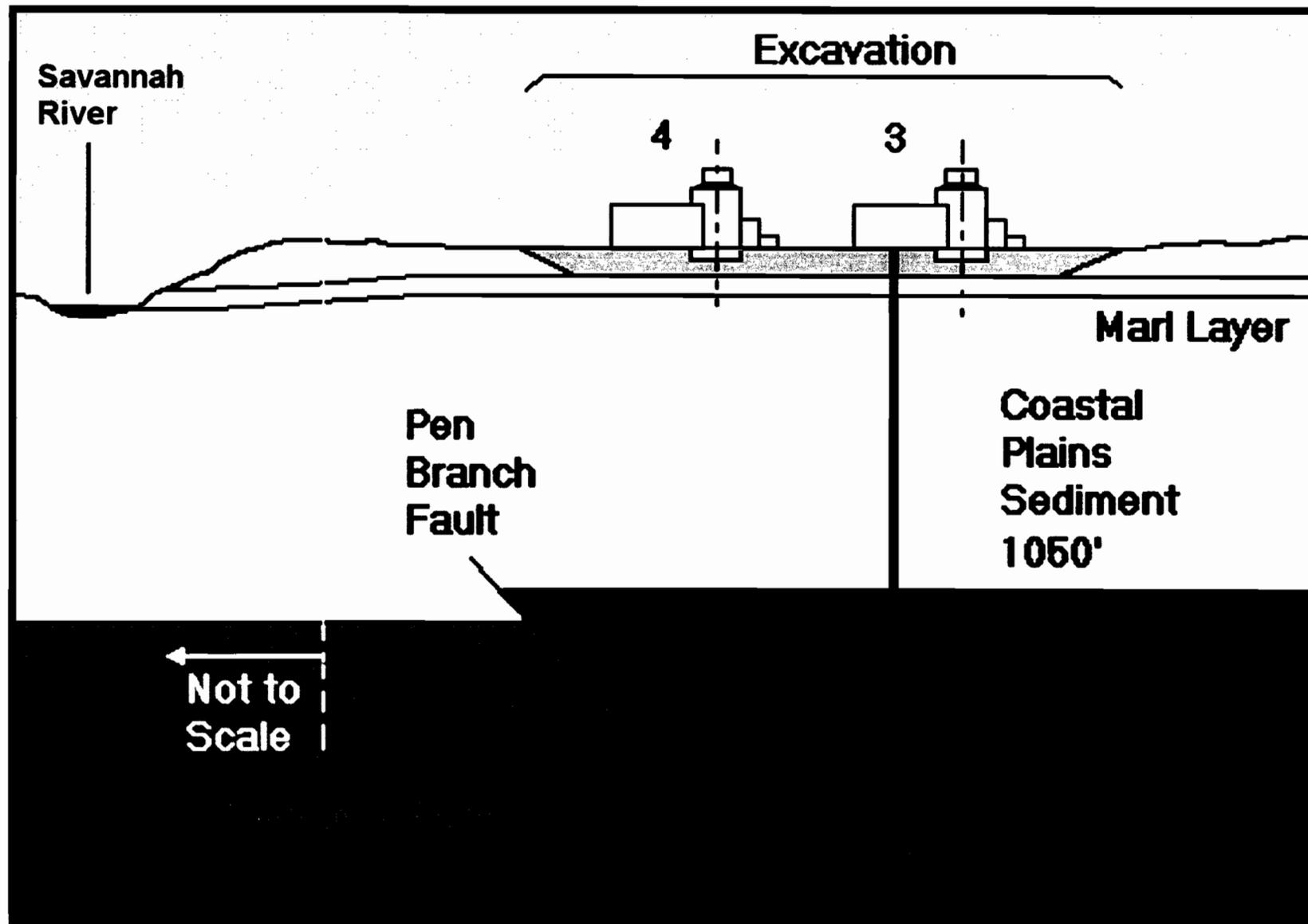




**Cross-Section Looking North**



**Cross-Section Looking West**



Site Soil/Rock Profile with Backfill

## Vogtle Site-Specific Model for AP1000 Nuclear Island

Vogtle input motion SSE at hypothetical outcrop at 40' depth for control point seismic input for site-specific SSI analysis of AP1000 nuclear island. This is a Foundation Input Response Spectra (FIRS)

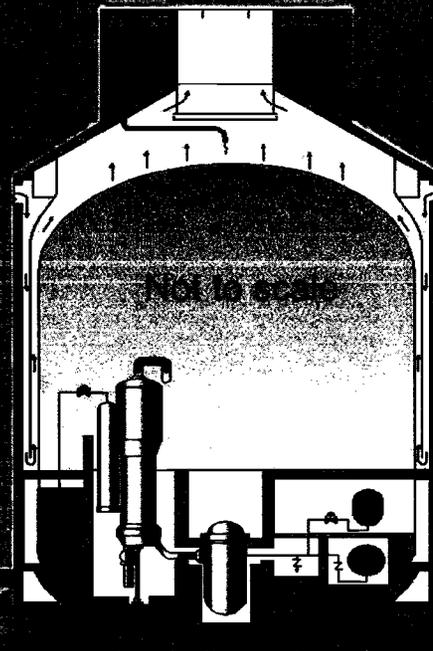
Vogtle ESP SSE defined at the free ground surface of a hypothetical outcrop of the highest competent in-situ layer (top of Blue Bluff Marl at depth of 86'). This is the Site-Specific Ground Motion Response Spectrum (GMRS)

Elevation 220

~86'  
Engineered  
Backfill

~76'  
Blue  
Bluff Marl

~900'  
Coastal Plain  
Sediments



# Early Site Permit

---



**Jim Davis**  
ESP Project Engineer

# SSAR 15 Accident Analysis

---

## Topics:

- ◆ Requires review of AP1000 accidents with site specific parameters for offsite dose evaluations

## Key Items:

- ◆ *Accident doses multiplied by the ratio of Site/DCD  $\chi/Q$  values*
- ◆ *VEGP generated dose estimates for accidents were bounded by the DCD analysis*

# SSAR 15 Accident Analysis

**Table 15-11 Atmospheric Dispersion Factors**

Accident	Location	Time (hr)	DCD $\lambda/Q$ (sec/m <sup>3</sup> )	Site $\lambda/Q$ (sec/m <sup>3</sup> )	$\lambda/Q$ Ratio (Site/DCD)
LOCA	EAB	0 – 2	5.10E-04	3.49E-04	0.684
	LPZ	0 – 8	2.20E-04	7.04E-05	0.320
		8 – 24	1.60E-04	5.25E-05	0.328
		24 – 96	1.00E-04	2.77E-05	0.277
		96 – 720	8.00E-05	1.11E-05	0.139
Other Accidents	EAB	0 – 2	8.00E-04	3.49E-04	0.436
	LPZ	0 – 8	5.00E-04	7.04E-05	0.141
		8 – 24	3.00E-04	5.25E-05	0.175
		24 – 96	1.50E-04	2.77E-05	0.185
		96 – 720	8.00E-05	1.11E-05	0.139

Note: The DCD  $\lambda/Q$  values for LOCA are consistent with AP1000 DCD Table 15A-5. Although not indicated as such in the DCD, a different set of  $\lambda/Q$  values was used by Westinghouse to calculate doses for accidents other than LOCA (Westinghouse 2006b). It is seen that the site  $\lambda/Q$  values are bounded by the DCD  $\lambda/Q$  values for all time steps.

# Radiological Consequences for DBAs

DCD/SRP Section	Accident	Site Dose (rem TEDE)			
		EAB	LPZ	Limit	Dose Table
15.1.5	<b>Steam System Piping Failure</b>				
	<b>Pre-Existing Iodine Spike</b>	0.35	0.11	25	15-13
	<b>Accident-Initiated Iodine Spike</b>	0.39	0.31	2.5	15-14
15.2.8	<b>Feedwater System Pipe Break</b>	a	a		
15.3.3	<b>Reactor Coolant Pump Shaft Seizure</b>				
	<b>No Feedwater</b>	0.31	0.05	2.5	15-15
	<b>Feedwater Available</b>	0.22	0.11	2.5	15-16
15.3.4	<b>Reactor Coolant Pump Shaft Break</b>	b	b		
15.4.8	<b>Spectrum of Rod Cluster Control Assembly Ejection Accidents</b>	1.3	0.80	6.3	15-17
15.6.2	<b>Failure of Small Lines Carrying Primary Coolant Outside Containment</b>	0.74	0.14	2.5	15-18
15.6.3	<b>Steam Generator Tube Rupture</b>				
	<b>Pre-Existing Iodine Spike</b>	0.79	0.18	25	15-19
	<b>Accident-Initiated Iodine Spike</b>	0.39	0.12	2.5	15-20
15.6.5	<b>Loss-of-Coolant Accident Resulting from a Spectrum of Postulated Piping Breaks Within the Reactor Coolant Pressure Boundary</b>	17	7.4	25	15-21
15.7.4	<b>Fuel Handling Accident</b>	2.4	0.48	6.3	15-22



# **Presentation to the ACRS Subcommittee**

**Vogtle Early Site Permit Review Status**

## **Section 2.5 Geology, Seismology and Geotechnical Engineering**

**October 24, 2007**

ACRS Subcommittee Presentation  
Vogtle ESP Review Section 2.5

**Review Team for Section 2.5:**

- Sections **2.5.1** & **2.5.3** Technical Reviewers
  - Dr. Gerry Stirewalt, Sr. Geologist
  - Meralis Plaza-Toledo, Geologist
  - Laurel Bauer, Geologist
  - Dr. Russell Wheeler and Dr. Anthony Crone, Geologists (USGS)
  
- Section **2.5.2** Technical Reviewers
  - Dr. Yong Li, Sr. Geophysicist
  - Dr. Clifford Munson, Sr. Geophysicist
  - Sarah Gonzalez, Geophysicist
  - Dr. Charles Mueller, Geophysicist (USGS)
  
- Section **2.5.4** & **2.5.5** Technical Reviewers
  - Tomeka Terry, Geotechnical Engineer
  - Zahira Cruz-Perez, Geotechnical Engineer
  - Dr. Weijun Wang, Geotechnical Engineer
  - Dr. Thomas Cheng, Sr. Geotechnical Engineer
  - Dr. Yong Li, Sr. Geophysicist
  - Dr. Carl Costantino, Geotechnical Engineer (Brookhaven N L)

# AGENDA

## ■ Discussion of Key Issues & Open Items

■ Section 2.5.1 Basic Geologic and Seismic Information  
(presented by Dr. Gerry Stirewalt)

- The Pen Branch Fault

■ Section 2.5.2 Vibratory Ground Motion (presented by  
Sarah Gonzalez and Laurel Bauer)

- Updated Charleston Seismic Source
- Seismic sources not updated by the applicant

# **AGENDA**

## **■ Discussion of Key Issues & Open Items**

■ Section 2.5.3 Surface Faulting (presented by Dr. Gerry Stirewalt)

- Injected Sand Dikes

■ Section 2.5.4 Stability of Subsurface Materials and Foundations (presented by Dr. Yong Li)

- Limited Site Investigations
- Limited Laboratory Testing

# 2.5.1 Basic Geologic & Seismic Information

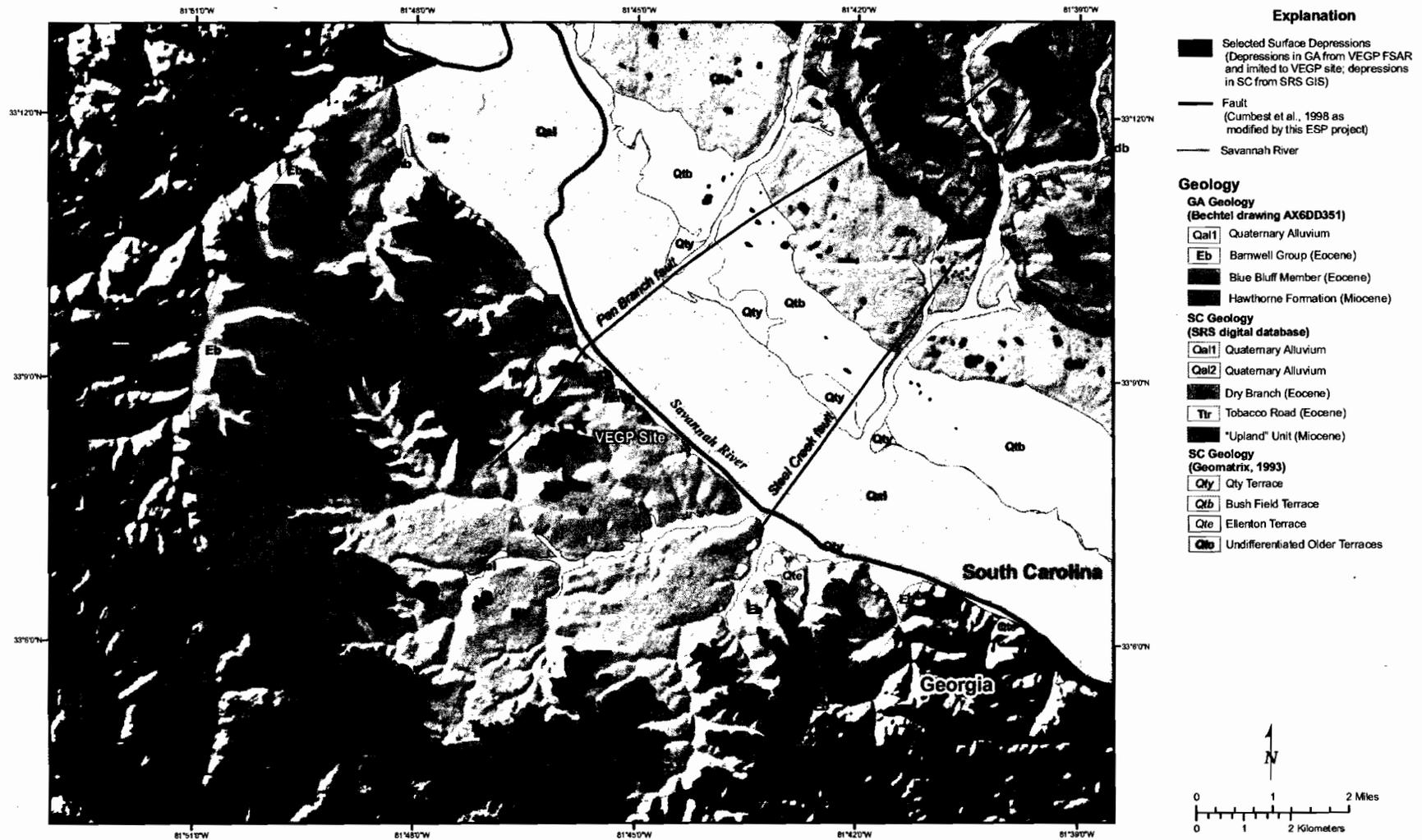
## ■ Pen Branch Fault

~25 mi. total length, strikes N46-66E, dips 60-75SE

Exhibits no expression of surface displacement

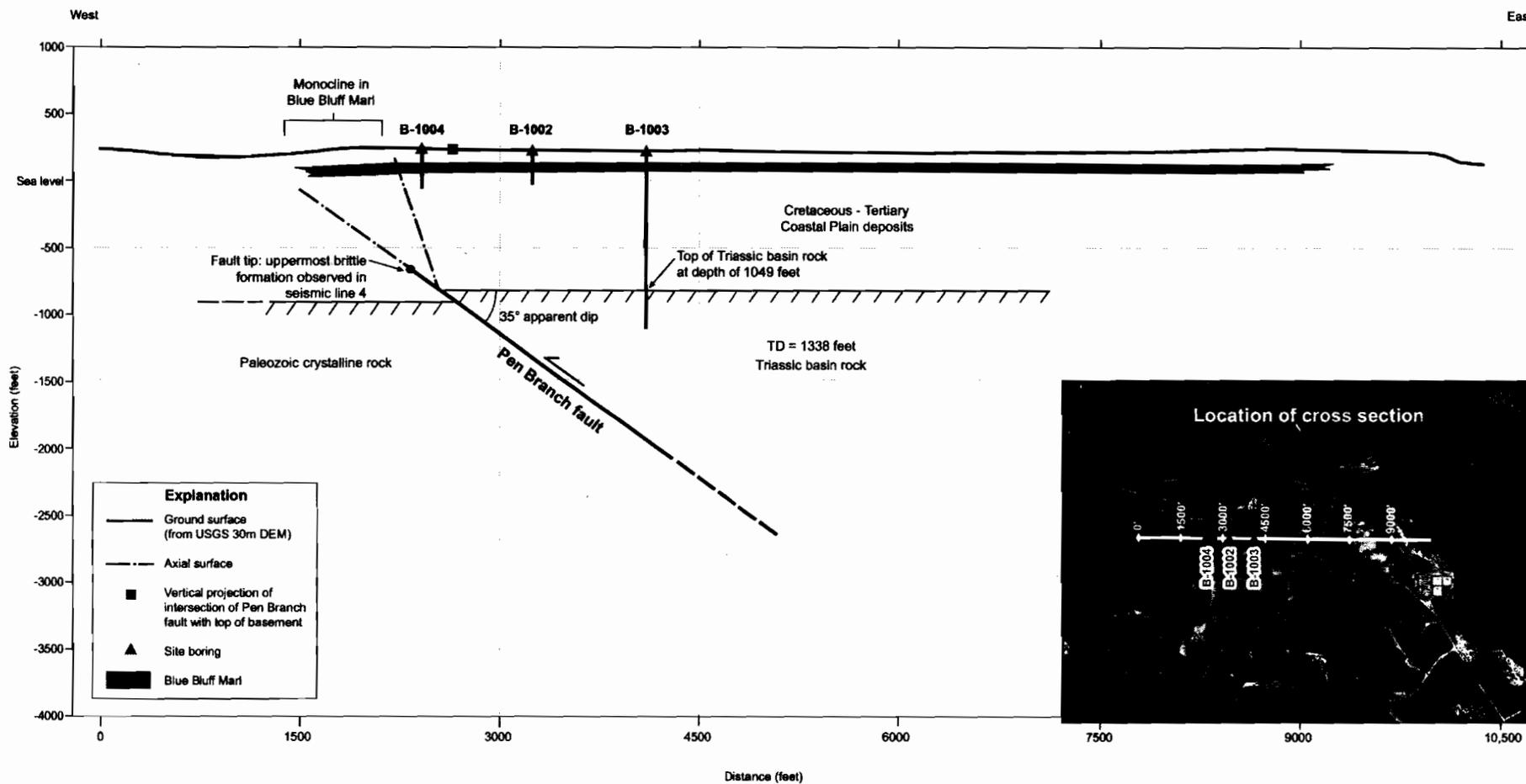
Exhibits no seismic activity

## 2.5.1 Basic Geologic & Seismic Information



The Pen Branch Fault extends beneath the ESP site based on subsurface geophysical data

## 2.5.1 Basic Geologic & Seismic Information



E-W Cross Section: Pen Branch Fault beneath VEGP site

## 2.5.1 Basic Geologic & Seismic Information

### ■ **Pen Branch Fault (Cont'd)**

- No stratigraphic evidence of fault movement < 33.7 my old (post-Eocene)

Applicant evaluated Savannah River terraces for evidence of local fault displacement during the past 1.8 my (Quaternary)

- Field evidence indicates that the Pen Branch is not a capable fault

## 2.5.1 Basic Geologic & Seismic Information



Quaternary Terrace Surface Overlying the  
Pen Branch Fault at the SRS

## 2.5.2 Vibratory Ground Motion

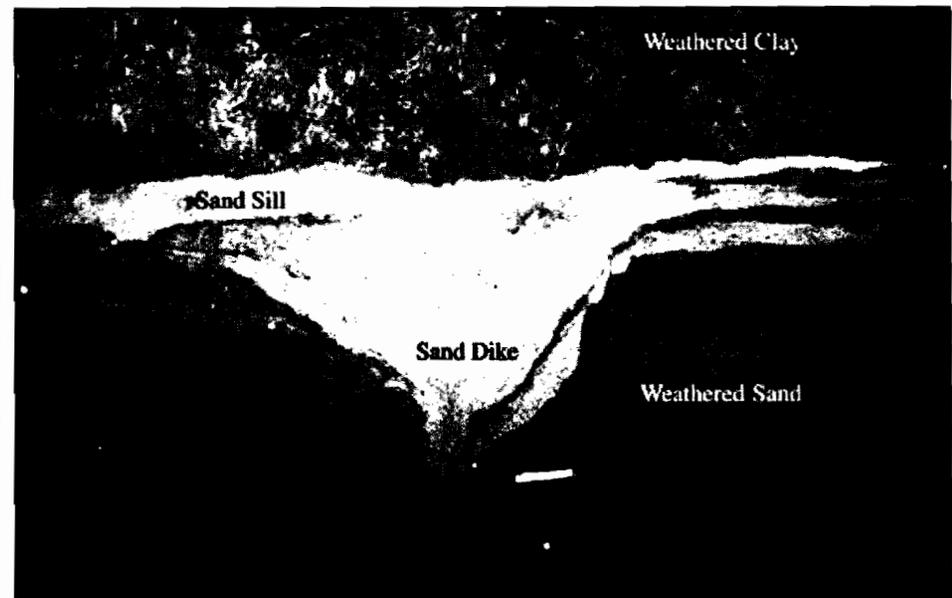
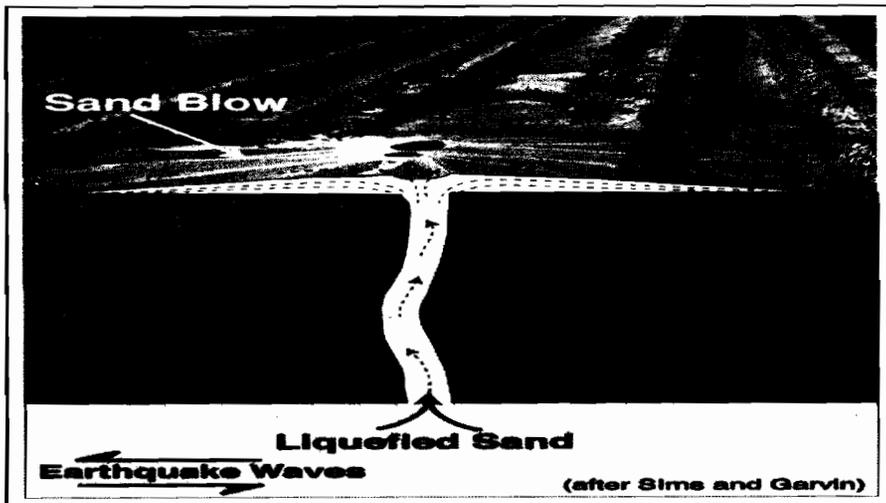
### ■ **UPDATED Charleston Seismic Source Zone**

- Applicant's update of the 1986 EPRI source model involved significant changes in geometry, and maximum magnitudes ( $M_{\max}$ ), and recurrence interval
- Average recurrence interval of  $M_{\max}$  earthquakes decreased significantly, increasing the overall hazard
- Update based on liquefaction features from historic and prehistoric earthquakes

## 2.5.2 Vibratory Ground Motion

### ■ Liquefaction

- Liquefaction features occur in response to strong ground shaking
- Liquefaction susceptibility is a function of site characteristics
- Liquefaction features commonly occur in the form of sand blows



## 2.5.2 Vibratory Ground Motion

### ■ **Charleston Liquefaction Features**

- Abundant liquefaction features from historic and prehistoric earthquakes were mapped for ~130mi. NE-SW along the South Carolina coast and >65mi. inland from coast

Paleoliquefaction features formed during prehistoric earthquakes

## 2.5.2 Vibratory Ground Motion



Illustrations of historic 1886 liquefaction features from the Charleston Area

## 2.5.2 Vibratory Ground Motion

### ■ **Charleston Paleoliquefaction Features**

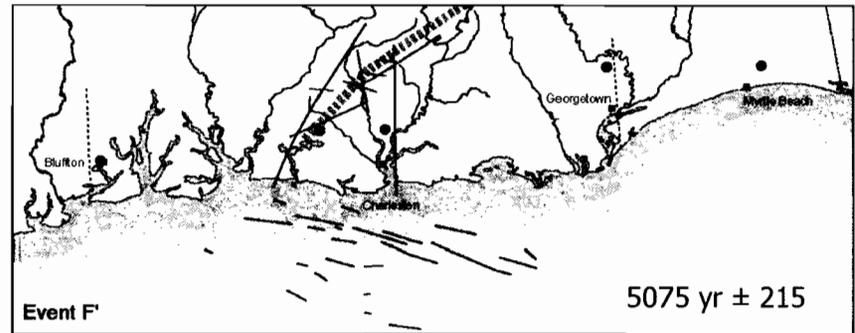
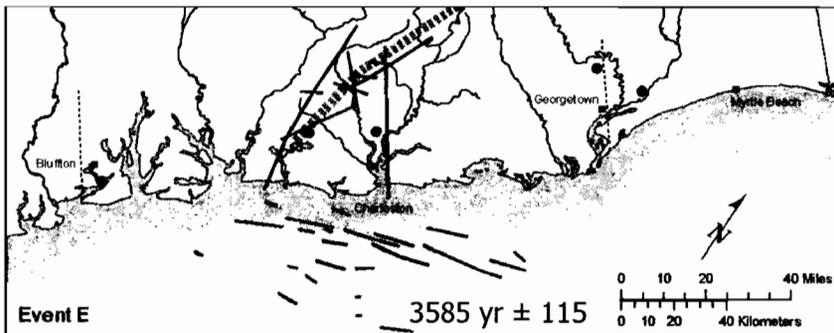
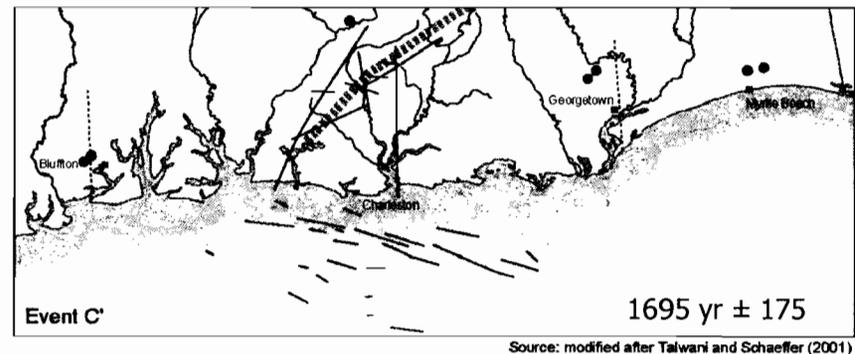
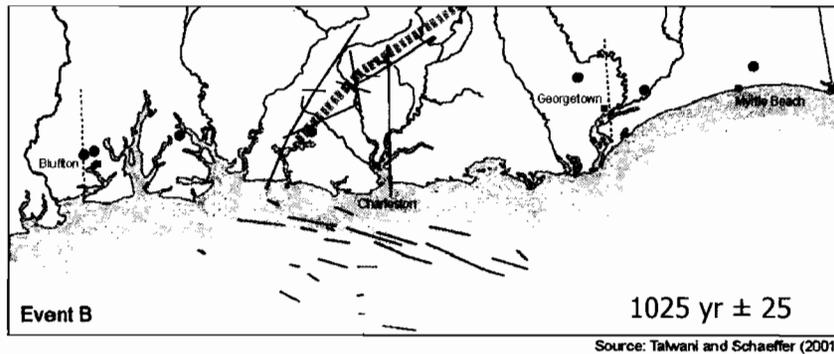
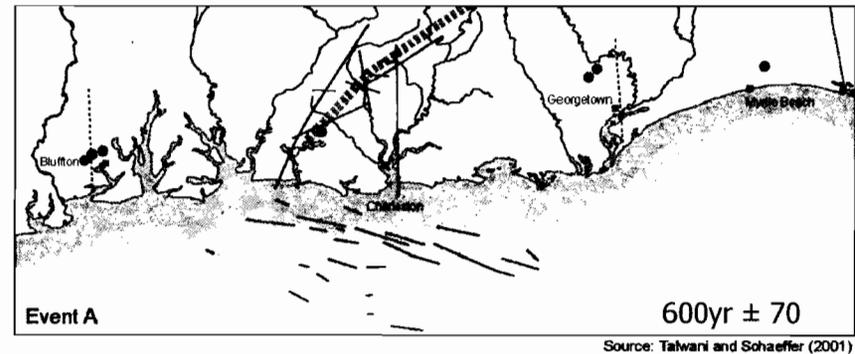
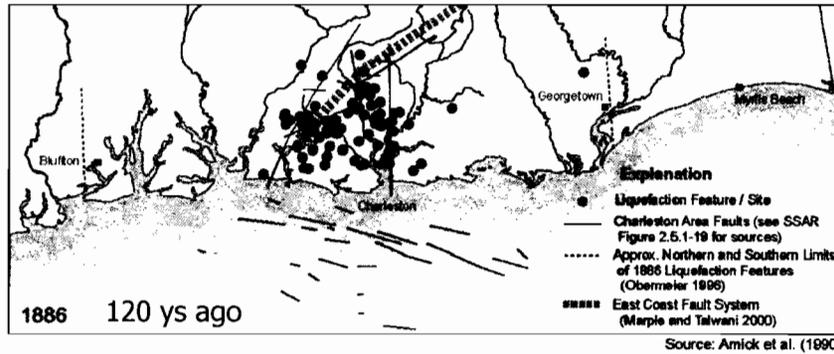
- Paleoliquefaction features, documented since the 1989 EPRI study, contributed to the update of the Charleston source zone

- Liquefaction features represent 5 similar magnitude earthquakes (in addition to 1886) during the past ~5000 years

- Estimated repeat times for large earthquakes in the Charleston area:

- 500-600 years, based on a complete 2,000 yr history
- 900-1000 yrs, based on a complete 5,000 yr history

## 2.5.2 Vibratory Ground Motion



Distribution of Charleston Source Paleoliquefaction Features

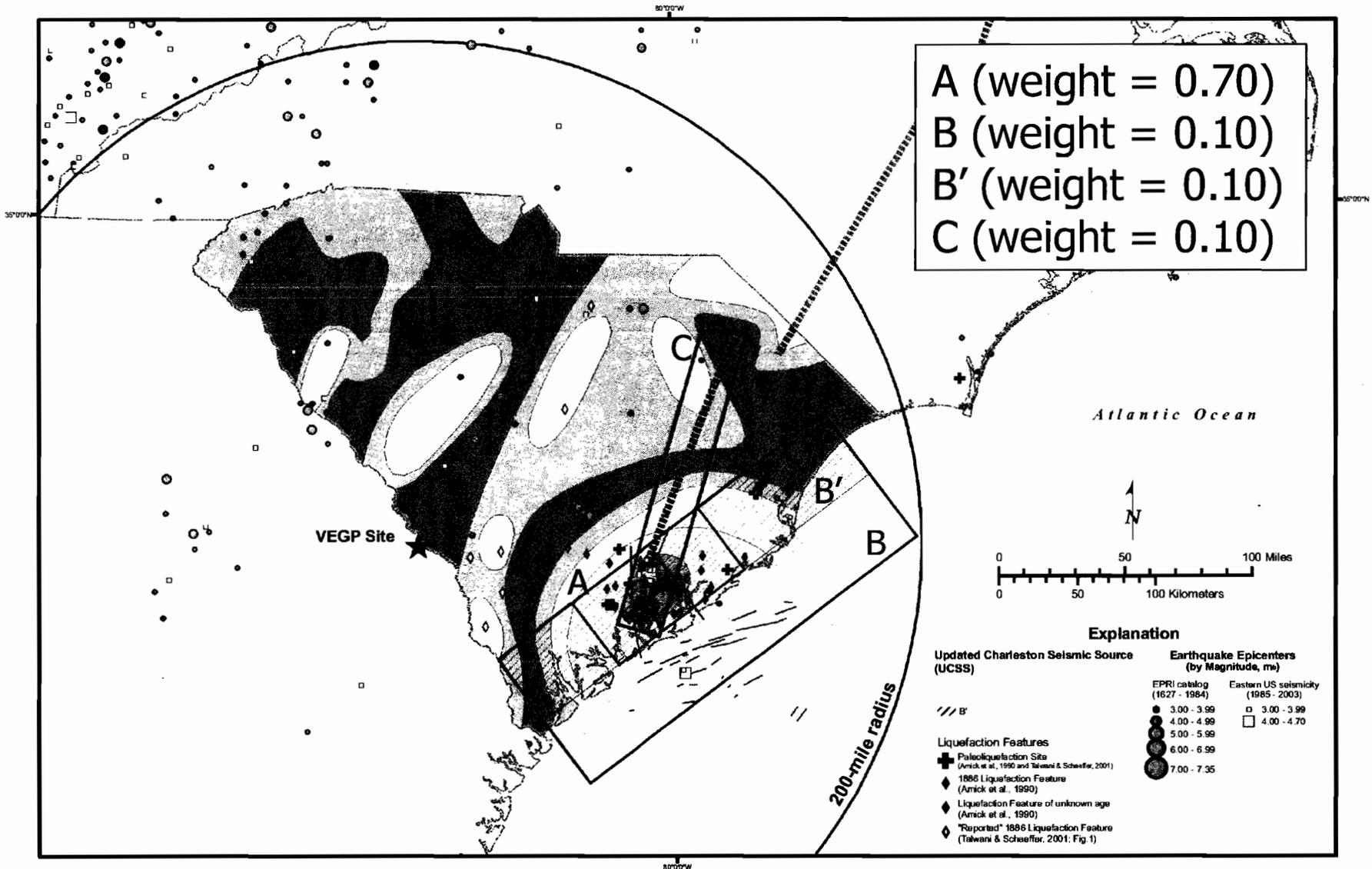
## 2.5.2 Vibratory Ground Motion

### ■ **Charleston Paleoliquefaction (Cont'd)** **(OI 2.5-5)**

• NRC Staff concluded that the applicant did not provide sufficient paleoliquefaction evidence to rule out the occurrence of large inland earthquakes (OI 2.5-5)

• The occurrence of a large earthquake, inland from the coast, may necessitate a different Charleston source zone model

## 2.5.2 Vibratory Ground Motion



Updated Charleston Seismic Source

## 2.5.2 Vibratory Ground Motion

### ■ **Charleston Seismic Source Update (OI 2.5-4)**

Applicant used a Senior Seismic Hazard Analysis Committee (SSHAC) Level 2 process to perform the update

- Designated Technical Integrator (TI) responsible for conducting literature review and contacting appropriate experts
- TI also responsible for integrating current literature and expert's views into final model

Staff requested additional details regarding expert elicitation process (RAI 2.5.2-4)

- Questions asked of the expert's and their responses
- Process used to combine the expert's responses

Staff has not yet completed its review of this information (OI 2.5-4)

## 2.5.2 Vibratory Ground Motion

- **The applicant did not update the following EPRI seismic source zones**
  - Regional seismic source zones that encompass the ESP site (OI 2.5-1)
  - Eastern Tennessee seismic zone (ETSZ) (OI 2.5-3)

## 2.5.2 Vibratory Ground Motion

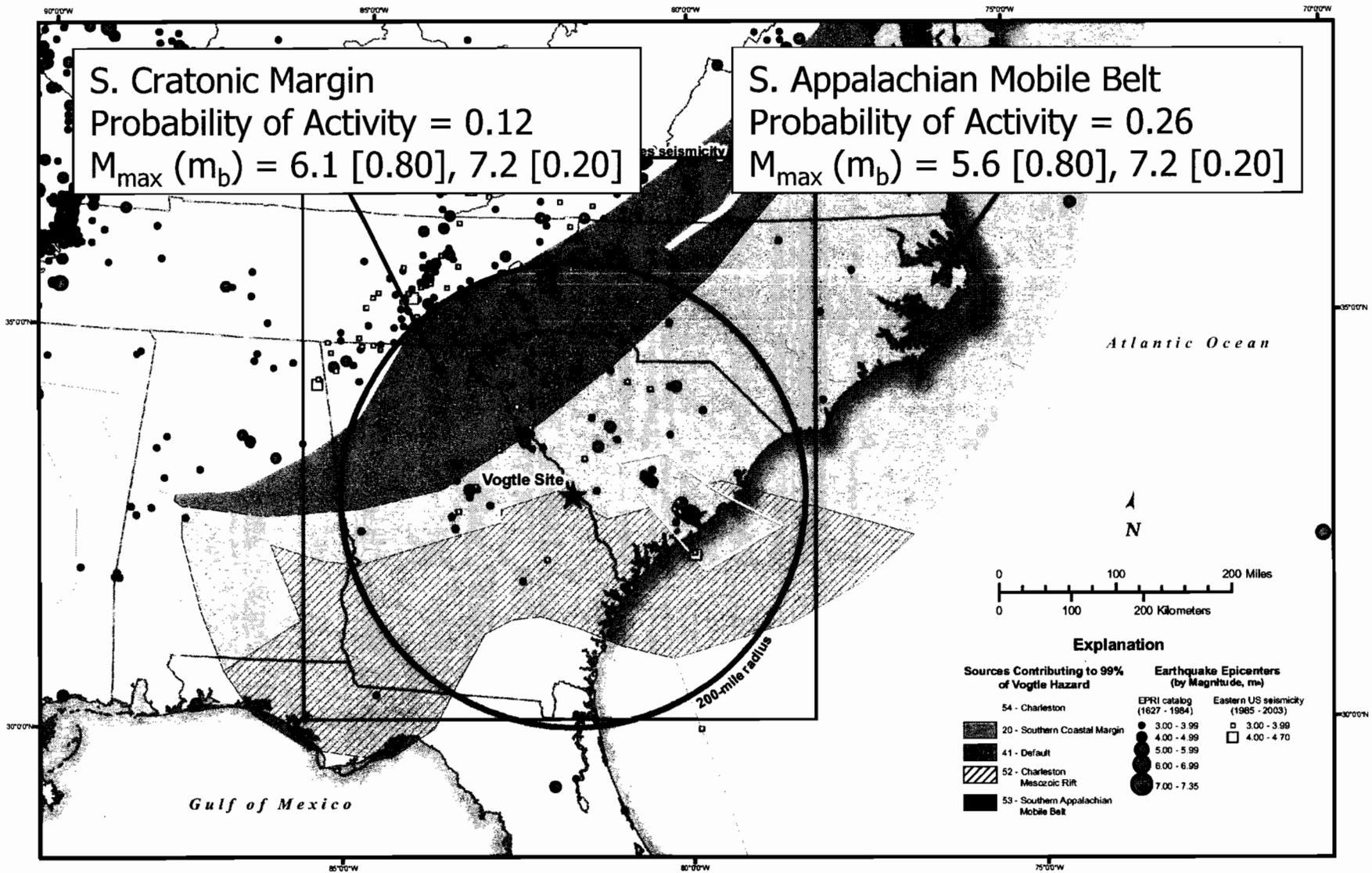
### ■ **Regional Seismic Source Zone $M_{\max}$ and Probability of Activity (OI 2.5-1)**

EPRI seismic source zones were determined by six Earth Science Teams during the 1980s

- Dames and Moore team assigned low weights for larger  $M_{\max}$  values (and low probabilities of activity) to two of their regional source zones

Resulting Dames and Moore hazard curves for the ESP site do not adequately characterize the regional hazard

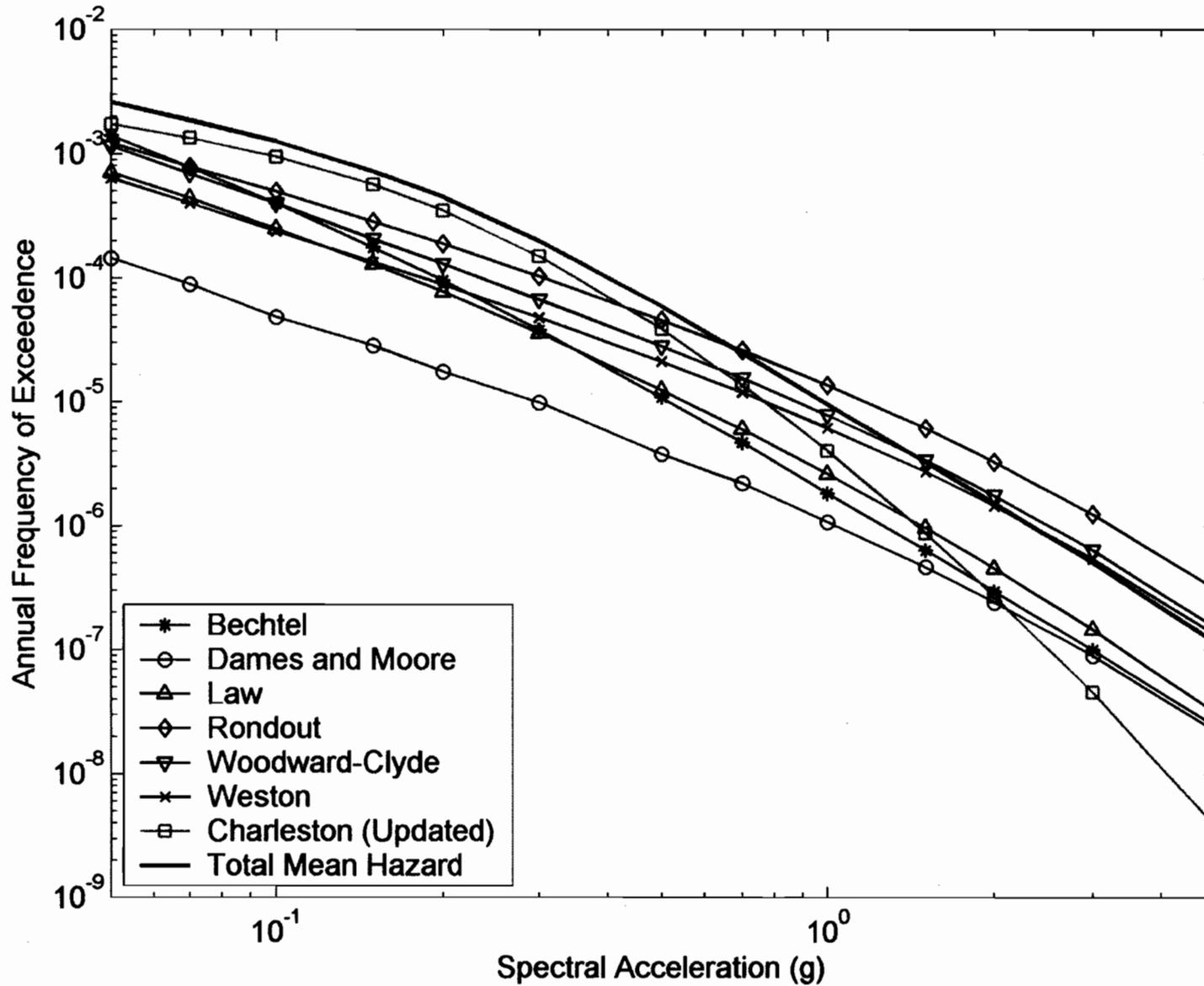
## 2.5.2 Vibratory Ground Motion



Dames and Moore EPRI Zones

## 2.5.2 Vibratory Ground Motion

### 10-Hz Total Mean Hazard Curve



## 2.5.2 Vibratory Ground Motion

- **Additional Information Related to the Low Probabilities of Activity Assigned to Regional Seismic Source Zones by the Dames and Moore EPRI team**

*(DOE-STD-1024-92) "Risk Engineering, Inc. has also found that the EPRI team of Dames and Moore does not fully account for historic seismicity near the Savannah River Site (SRS). One reason for this is the fact that the SRS host source zone was given a low probability of activity. Risk Engineering, Inc. recommended that the Dames and Moore seismic source input not be used to calculate the seismic hazard at SRS"*

## 2.5.2 Vibratory Ground Motion

### ■ **Eastern Tennessee Seismic Zone $M_{\max}$ (OI 2.5-3)**

Applicant concluded no new information has been developed since 1986 that would require significant revision to the EPRI seismic source model.

Staff concludes more recent studies suggest significant revisions to the EPRI seismic source model are warranted.

- Analyses of earthquake focal mechanisms and hypocenter locations (Chapman et al., 1997; Dunn and Chapman, 2005) indicate a series of northeast-trending basement faults, intersected by several east-trending faults
  - Inferred fault lengths ( $\sim 20\text{-}50$  km) large enough to produce significant earthquakes ( $\sim M_w 7+$ )

## 2.5.2 Vibratory Ground Motion

### ■ **Eastern Tennessee Seismic Zone $M_{\max}$ (OI 2.5-3) (Cont'd)**

Chapman (2000<sup>1</sup>; 2002<sup>2</sup>) concluded historical record too short to rule out possibility of larger ( $M > 5$ ) earthquakes

Mean  $M_{\max}$  for the 1986 EPRI study ( $\sim M_w$  6.2) is significantly lower than more recent mean  $M_{\max}$  values, which range from  $M_w$  6.3 to  $M_w$  7.5

Staff concludes that the applicant has not:

- Adequately justified decision to not update ETSZ
- Performed sensitivity analysis to determine impact of updating ETSZ

<sup>1</sup>USGS CEUS hazard mapping workshop notes, June 13-14, 2000, Saint Louis University

<sup>2</sup>TIP report (NUREG/CR-6607)

## 2.5.2 Vibratory Ground Motion

### ■ **Post EPRI PSHA Studies (OI 2.5-2)**

The applicant described three post EPRI PSHA studies, which involved the characterization of seismic sources within the ESP site region: USGS, 2002; SCDOT, 2002; NRC TIP Study (NUREG/CR-6607)

The applicant dismissed the TIP study because it focused on the implementation of the SSHAC PSHA methodology

The staff believes that much of the data and results contained in the report may be applicable to the ESP site.

## 2.5.3 Surface Faulting

### ■ **Injected sand dikes (Open Item 2.5-10)**

Stratigraphic information suggests dikes may be as young as 1.8 my to 10,000 yrs (Pleistocene age)

Applicant did not clearly show dikes are spatially related to dissolution depressions

Fluid/plastic injection of sand could be associated with seismicity and liquefaction

Detailed description of dike characteristics and spatial associations is necessary

## **2.5.4 Stability of Subsurface Materials and Foundations**

- **12 Open Items on the subsurface materials**

- Static properties
- Dynamic properties

## 2.5.4 Stability of Subsurface Materials and Foundations

- Applicant performed limited borings and tests to characterize static properties of the load-bearing layers (Open items 2.5-11-17)
  - 14 total borings were performed at the site
  - 3 of the 14 penetrated through the Blue Bluff Marl
  - Limited soil samples were obtained and lab tested
- Applicant relied on results from VEGP Unit 1 and 2 investigations (1970s) for soil properties such as internal friction angle, unit weight and undrained shear strength

## 2.5.4 Stability of Subsurface Materials and Foundations

- Applicant did not conduct laboratory tests on soil samples to determine soil dynamic properties (Open Items 2.5-19-20)
- These dynamic properties are needed to determine the site-specific Ground Motion Response Spectra (GMRS)

GMRS is equivalent to Safe Shutdown Earthquake (SSE)

GMRS is compared to DCD design spectrum at Col stage

## 2.5.4 Stability of Subsurface Materials and Foundations

The applicant conducted more explorations and testing on the subsurface materials after submission of the ESP Application

Additional geotechnical data has been submitted by the applicant as part of LWA-2 (not included here)

## ■ **CONCLUSIONS**

### **2.5.1**

- The Pen Branch fault extends beneath the ESP site but is not considered a capable fault

### **2.5.2**

- Applicant updated the Charleston Seismic source based on paleoliquefaction data
- Applicant chose not to update local seismic source zones or ETSZ

ACRS Subcommittee Presentation  
Vogtle ESP Review Section 2.5

■ **CONCLUSIONS**

■ **2.5.3**

- Additional description of injected sand dikes is necessary to complete staff review

■ **2.5.4**

- Additional static and dynamic testing, borings and field and laboratory tests are necessary to complete staff review

**CONTENTS OF OFFICIAL RECORDS FOLDERS  
OCTOBER 24, 2007, EARLY SITE PERMITS SUBCOMMITTEE MEETING**

Title: Early Site Permits Subcommittee

Date: October 24, 2007

The Federal Advisory Committee Act requires retention of certain documents related to every advisory committee meeting. The ACRS has applied this requirement to all ACRS subcommittee meetings. The cognizant engineer is responsible for assembling an official record folder for each subcommittee meeting. The folder is retained on file by the Operations Support Branch (Michele Kelton). The following is a list of the document that should be included in the official record folder.

- Federal Register Notice announcing the date and location of the meeting
- Conflict of Interest Memorandum
- Memorandum forwarding the draft minutes to the members
- The original copy of the certified meeting minutes
- ACRS Committee or Sub-committee Chairman certification sheet w/signature
- Final agenda or schedule w/markups
- List of meeting attendees
- Slides and/or handouts presented at the meeting
- Final Committee Report (if any)
- Agency Response to the Final Report
- Review Documents
- Draft Agenda
- Status Report
- Consultant Report
- NA  Member Comments

**Cognizant Staff Engineer: David C. Fischer (DCF)**