



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 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.

/RA/

12/18/07

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 **/RA/**
Technical Support Staff
ACRS

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

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 an 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 chemicals 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 of 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 later 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 χ/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 χ/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 χ/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 6×10^{-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 χ/Q values. The VEGP generated dose estimates were bounded by the DCD analysis. Mr. Davis showed a table that DCD χ/Q values, site χ/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 (χ/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 χ/Q values for each offsite receptor were less than the AP1000 design reference χ/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 χ/Q values to design reference χ/Q values. Therefore, the dose for each time averaging period is directly related to the χ/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 χ/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 χ/Q values), the staff would reevaluate that and make sure the applicant stays within the Vogtle ESP source terms and χ/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.