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**Date:** 1/30/2007 8:02:50 PM
**Subject:** Environmental RAI Response Letter AR-07-0061
**cc:** "Tom C. Moorer" <TCMOORER@southernco.com>

<<AR-07-0061 RAI Resp (ER).pdf>>

Enclosure 2: Reports and Enclosure 3: CD in Fed-X

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**Reply Requested:** No
**Return Notification:** None
None

**Concealed Subject:** No
**Security:** Standard

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SOUTHERN COMPANY
*Energy to Serve Your World*℠

Docket No. 52-011 AR-07-0061

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Southern Nuclear Operating Company
Vogtle Early Site Permit Application
Response to Reauests for Additional Information on the Environmental Report

Ladies and Gentlemen:

On October 17-19,2006, the U.S. Nuclear Regulatory Commission (NRC) performed an onsite audit of the Environmental Report (ER) that was submitted with the Early Site Permit (ESP) Application for the Vogtle site. Approximately one week prior to the audit, the NRC provided Southern Nuclear Operating Company (SNC) with a list of questions to discuss during the audit. SNC dispositioned many of these questions during the audit, and the NRC added some additional questions to the list.

The NRC requested that many of the questions receive formal answers by the second week in December to support the development of their Environmental Impact Statement (EIS). By letter dated December 11,2006, SNC responded to all but 35 of the questions, with the understanding that the NRC would restructure and reissue the open questions as formal Requests for Additional Information (RAIs). By letter dated December 29,2006, the NRC provided SNC with 101 RAIs for the ER portion of Vogtle ESP Application, including the 35 open questions from SNC's December 11th letter.

SNC's response to the NRC environmental RAIs is provided in Enclosure 1, 2 and 3 to this letter.

If you have any questions or require additional information regarding this matter, please contact T. C. Moorer at 205-992-5807 or J. T. Davis at (205) 992-7692.

Mr. J. A. (Buzz) Miller states he is a Vice President of Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company and to the best of his knowledge and belief, the facts set forth in this letter are true.

Respectfully submitted,

SOUTHERN NUCLEAR OPERATING COMPANY

Joseph A. (Buzz) Miller

*Sworn to and subscripted before me this* 30TH *day of* JANUARY, *2007*

Dorothy P. Hofmann
*Notary Public*

*My commission expires:* May 1, 2008

JAM/BJS/dmw

Enclosures:
1. Response to December 29, 2006 Requests for Additional Information on Vogtle ESP Application Environmental Report
2. Reports and Documents Provided in Support of RAI Responses
3. Electronic Files on CDs providing Data and Information Requested by RAIs

cc: Southern Nuclear Operating Company
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File AR.01.01.06

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**Southern Nuclear Operating Company**

**AR-07-0061**

**Enclosure 1**

**Response to December 29, 2006**

**Requests for Additional Information**

**On**

**Vogtle ESP Application**

**Environmental Report**

RAI Response:

## Section 2.1 Site Location

**E2.1-1** <u>Section 2.1 Site Location</u> **Figure 2.1-1 in the ER shows three small streams within the Vogtle Electric Generating Plant (VEGP) site property boundary line. Place the streams' names, if possible.**

Response:

The three streams shown on **Figure 2.1-1 VEGP Site and Proposed New Plant Footprint** are unnamed tributaries. The stream located in the northern portion of the site is an unnamed tributary from Mallard Pond that drains into the Savannah River at Hancock Landing. The stream located in the western portion of the site is an unnamed tributary that drains into Daniels Branch and the stream located in the southeast portion of the site is an unnamed tributary that drains into Beaver Dam Creek. These tributaries are also depicted in the Early Site Permit Application (ESP) on **Figure 2.3.1-3, Local Area Drainage Map.**

## Section 2.2 Land Use

**E2.2-1** <u>Section 2.2.3 The Region</u> **Page 2.2-4 of the ER states that the State of Georgia mandates that cities and counties have comprehensive land use plans. Provide a citation to the Georgia Statute that contains this mandate.**

Response:

The Georgia Planning Act of 1989 (OCGA § 50-8-1 et seq.) establishes minimum responsibilities to maintain status as a qualified local government; among them is comprehensive planning.

This document is provided in Enclosure 2.

## Section 2.3 Water

**E2.3-1** <u>Section 2.3.2 Water Use</u> **As described in NUREG-1555, Environmental Standard Review Plan (ESRP) Section 2.3.2, provide quantitative descriptions of present and known future groundwater withdrawals for distances great enough to cover aquifers that may affect or be adversely affected by the plant. For each withdrawal, the following should be provided: location and depth of the well with respect to the site, identification of the aquifer from which the well is withdrawing, and the average monthly withdrawal rate by use category, Most, but not a complete information set, has been provided for the State of Georgia (e.g., Table 2.3.2-5). Analogous well-specific data for the State of South Carolina is not contained in the ER. Provide this data, including any recovery well data, if available.**

Response:

As noted in this RAI, NUREG-1555 Section 2.3.2 indicates that quantitative descriptions of present and known future groundwater withdrawals for *distances great enough to cover aquifers that may affect or be adversely affected by the plant* [emphasis added] be provided. Because the Savannah River serves as a groundwater discharge area for aquifers in the site area, aquifers on the South Carolina side of the river cannot affect or be adversely affected by the plant. Evidence supporting this interpretation is provided in ER Section 2.3.1. In addition, Clark and West (1997) characterize the river valley as a line sink that receives discharge from both sides of the river from the Gordon, Dublin and Midville aquifer systems. Cherry (2006) presents potentiometric maps based on 1992 and 2002 data depicting the same.
ER Table 2.3.2-5 provides the complete set of groundwater users for the State of Georgia that could be affected by VEGP groundwater use. Because aquifers on the South Carolina side of the river cannot affect or be adversely affected by the plant, there was no data collected on groundwater withdrawals for the State of South Carolina for development of the ESP application, and therefore there are none to provide.

References

Cherry, G.S., 2006, Simulation and Particle-Tracking Analysis of Ground-Water Flow Near the Savannah River Site, Georgia and South Carolina, 2002, and for Selected Water-Management Scenarios, 2002 and 2020: U.S Geological Survey Scientific Investigations Report 2006-5195, 156 p.

Clarke, J.S., and West, C.T., 1997, Ground-Water Levels, Predevelopment Ground-Water Flow, and Stream-Aquifer Relations in the Vicinity of the Savannah River Site, Georgia and South Carolina: U.S Geological Survey Water-Resources Investigations Report 97-4197, 120 p.

**E2.3-2** **Section 2.3.1.2 Groundwater Resources, Section 2.3.1.2.2 Local Hydrogeology, Section 2.3.1 -2.4 Hydrogeologic Properties Describe the process used to develop the site hydrogeologic conceptual model so that the staff can understand (a) drawdown at offsite wells, (b) impacts to and loss of wetlands, and (c) alteration of groundwater gradients and degradation of water quality from their current state. Provide a thorough description and discussion of the conceptual model(s), and how the applicant's model contrasts with the conceptual models of the VEGP Updated Final Safety Analysis Report and U.S. Geological Survey studies (Clarke and West 1997, 1996; Cherry 1996). Provide complete references and describe the datasets that the site conceptual model relies upon for calculating: (1) the water budget (e.g., precipitation, runoff, pumping); (2) monitoring of well water levels during construction of VEGP Units 1 and 2; (3) tritium observed in the unconfined aquifer; (4) tritium observed in the confined aquifers; (5) trans-river flow; (6) changes in the near-field subsurface conceptual model due to changes in recharge, .fill material, and ernbedded structures; (7) continuity of the Utley Limestone; (8) continuity of the Blue Bluff Marl with respect to data from wells OW-1 001/1001A (screened at water table aquifer elevation, but with measured hydraulic head values more consistent with the Tertiary aquifer); and (9) evidence indicating that the Tertiary and Cretaceous aquifers are highly isolated in light of the potential for the Pen Branch Fault to offset the hydrologic units. This description and discussion of the conceptual model should discuss hydraulic connection of the hydrologic units to the Savannah River through river alluvium, and the location and role (e.g., conduit or barrier for transport) of the Pen Branch fault.**

Response:

Conceptual Model Description

The conceptual hydrogeological model for the VEGP site was developed using site-specific data acquired to support the ESP application, information and data included in the VEGP Updated Final Safety Analysis Report, U.S Geological Survey studies, and Georgia Geologic Survey studies. A description and discussion of the conceptual model is provided below. Many of the elements of the conceptual model are already described in SSAR Section 2.4.12 and ER Section 2.3.1 of the ESP application and are repeated in this response. An illustrative, geologic cross-section identifying the key components of the conceptual model is shown in Figure 1 of this RAI response.

The VEGP site is located in the Coastal Plain physiographic province. Coastal Plain sediments comprise three aquifer systems consisting of seven aquifers that are separated hydraulically by confining units. As discussed by Clarke and West (1997), the aquifer systems are, in descending order: (1) the Floridan aquifer system, which consists of the Upper Three Runs and Gordon aquifers in sediments of Eocene age; (2) the Dublin aquifer system, consisting of the Millers Pond, upper Dublin, and lower Dublin of Paleocene-Late Cretaceous age; and (3) the Midville aquifer system, consisting of the upper Midville and lower Midville aquifers in sediments of Late Cretaceous age. Note that nomenclature used by the U.S. Geological Survey (Clarke and West, 1997) for geologic and hydrogeologic units differs from that used in the ESP application. In the ESP application, the Water Table aquifer comprises the Upper Three Runs aquifer, the Tertiary sand aquifer comprises the Gordon aquifer, and the Cretaceous aquifer comprises the Dublin and Midville aquifers. Figure 2.3.1-11 of the ER and Figure 4 of Clarke and West (1997) can be cross-referenced for additional details.

The Upper Three Runs aquifer is the shallowest aquifer and is unconfined to semi-confined throughout most of the area. Groundwater levels in the Upper Three Runs aquifer respond to a local flow system and are affected mostly by topography and climate. Groundwater flow in the deeper, Gordon aquifer and Dublin and Midville aquifer systems is characterized by local flow near outcrop areas to the northwest, changing to intermediate flow and then regional flow downdip (southeastward) as the aquifers become more deeply buried. Water levels in these deeper aquifers show a pronounced response to topography and climate in the vicinity of outcrops that diminishes southeastward where the aquifer is more deeply buried. Stream stage and pumpage affect groundwater levels in these deeper aquifers to varying degrees throughout the area. (Clarke and West 1997)

The geologic characteristics of the Savannah River alluvial valley substantially control the configuration of potentiometric surfaces, groundwater flow directions, and stream-aquifer relations. Data from 18 shallow borings indicate incision into each aquifer by the paleo Savannah River and subsequent infill by permeable alluvium have resulted in direct hydraulic connection between the aquifers and the Savannah River along various parts of its reach. This hydraulic connection may be the cause of large groundwater discharge to the river near Jackson, South Carolina as evidenced by stream baseflow and potentiometric measurements, where the Gordon aquifer is in contact with Savannah River alluvium, and also the cause of lows or depressions in potentiometric surfaces of confined aquifers that are in contact with the alluvium. Groundwater in these aquifers flows toward the depressions. The influence of the river diminishes downstream where the aquifers become deeply buried beneath the river channel, and where upstream and downstream groundwater flow is possibly separated by a water divide or “saddle”. Water-level data indicate that saddle features probably exist in the Gordon aquifer and Dublin aquifer system, with the groundwater divide occurring just downstream of the VEGP site, and also might be present in the Midville aquifer system. (Clarke and West 1997)

Basin-wide potentiometric-surface maps for the unconfined Upper Three Runs aquifer and confined Gordon, Dublin and Midville aquifer systems have been prepared using historical data (Clarke and West 1997) and numerical simulation (Cherry 2006). Detailed discussions of these maps are provided in the cited references. Data from observation wells installed and monitored for one year at the VEGP site have also been used to develop potentiometric-surface maps on a more highly resolved, site-specific basis. These maps are presented in the ESP application. The groundwater flow directions inferred from the ESP maps are generally consistent with the larger-scale maps produced by Clarke and West (1997) and Cherry (2006), i.e., groundwater flow in the Upper Three Runs (Water Table) aquifer generally conforms with surface topography, while that in the confined Gordon (Tertiary) aquifer is towards the Savannah River.

Water Budget

As described in the ESP application and the VEGP UFSAR, recharge to the Upper Three Runs (Water Table) aquifer is almost exclusively by precipitation, while discharge is primarily to local drainages. Recharge to the confined Gordon, Dublin, and Midville (Tertiary and Cretaceous) aquifers occurs primarily by direct infiltration of rainfall in their outcrop areas northwest of the VEGP site that are generally parallel to the Fall Line (the boundary between the Coastal Plain and Piedmont physiographic provinces). Because the permeable alluvium of the Savannah River valley allows for direct hydraulic connection between aquifers and the Savannah River, the river serves as the major discharge area for the confined aquifers in hydraulic connection with the river valley alluvium. Potentiometric maps presented by Clarke and West (1997) indicate groundwater discharge from the confined Gordon, Dublin, and Midville aquifers to the Savannah River. For the shallower Gordon confined aquifer, groundwater flow directions are generally perpendicular to the river reach. In the case of the deeper Dublin and Midville aquifers, there are upriver components to the groundwater flow directions that depend on where the paleo river channel has breached confining units. Clarke and West (1997) provide a detailed discussion of this phenomenon.

Although a water budget for the VEGP site has not been quantified, recharge and discharge rates have been estimated on a basin-wide basis by other investigators. Clarke and West (1997) estimated groundwater discharge to the Savannah River based on the net gain in stream discharge for local, intermediate, and regional groundwater flow systems and for different hydrologic conditions. Groundwater discharge ranged from 910 $ft^3/s$ during a drought year (1941), to 1,670 $ft^3/s$ during a wet year (1949), and averaged 1,220 $ft^3/s$. Of the average discharge, the local flow system contributed an estimated 560 $ft^3/s$ and the intermediate and regional flow systems contributed an estimated 660 $ft^3/s$. Clarke and West (1997) approximated the long-term average recharge by weighting these values according to drainage area, and estimated the average groundwater recharge in the Savannah River basin to be 14.5 inches, of which 6.8 inches is to the local flow system, 5.8 inches is to the intermediate flow system, and 1.9 inches is to the regional flow system. Mean-annual precipitation in the basin ranges from 44 to 48 inches. Cherry (2006) presents simulated water budgets for different hydrologic conditions using a numerical model for groundwater flow near the Savannah River Site, Georgia and South Carolina. Estimates of inflow or outflow across lateral boundaries, recharge, discharge, groundwater pumpage, and vertical flow upward and downward across confining units are obtained from the numerical model.

Well Water Levels During Construction of VEGP Units 1 and 2

Temporary dewatering of the Water Table aquifer was required to construct the foundations for VEGP Units 1 and 2 as described in the VEGP UFSAR. Construction of the foundations at VEGP required excavation of the Eocene and younger sands, silts, and clays of the Water Table aquifer from about elevation 216 ft msl to elevation 130 ft msl. The portion of the excavation below the water table (approximately elevation 160 ft msl) was dewatered during excavation by a series of ditches oriented in an east-west direction and connected by a north-south ditch, which drained to a sump in the southwest corner of the excavation. Upon reaching the marl, the system of ditches and sump was replaced by a perimeter drainage system.

Dewatering of the power block excavation was in effect from June 1976 through March 1983. Hence, water levels in observation wells in the Water Table aquifer during this period were influenced by construction dewatering. Observation well data for the dewatering period is summarized in the Ground Water Supplement for VEGP Units 1 and 2 (Georgia Power 1985). Data from four of the observations wells monitored during construction dewatering are plotted as hydrographs on ER Figure 2.3.1-13 of the ESP application. These hydrographs suggest that water table elevations at distances of about 1000 ft or more were relatively unaffected by dewatering (observation well 804), and that it took about one year for the water table to recover after dewatering activities were completed.

Tritium in Unconfined Aquifer and Confined Aquifers

Several investigators have documented the presence of tritium in groundwater in eastern Burke County, Georgia. These investigations include those of Summerour et al. (1994), Summerour et al. (1998), and Georgia DNR (2004). Descriptions of the data resulting from these investigations and associated conclusions are summarized below.

Summerour et al. (1994) reports the results of seven sub-investigations conducted to investigate any possible threat to public health due to tritium in eastern Burke County. These sub-investigations included: (1) sampling and analysis of 109 domestic and public water wells; (2) baseflow studies to measure tritium abundance in local springs and creeks; (3) installing and sampling of 15 new groundwater monitoring wells at six cluster sites in eastern Burke County; (4) defining the local lithostratigraphic and hydrostratigraphic framework using core sample analyses, field mapping, and literature; (5) characterizing the hydrologic characteristics of the unconfined Upper Three Runs aquifer, the Gordon aquitard, and the confined Gordon aquifer using data from aquifer tests; (6) characterizing the geochemical characteristics of the Upper Three Runs and Gordon aquifers using analyses of water samples from public, private, and monitoring wells; and (7) conducting a seismic refraction survey of the Savannah River channel to evaluate the extension of the Pen Branch fault into the channel of the Savannah River, and investigate the thickness of the river alluvium, the possible breaching of aquitards, and the correlation of seismic stratigraphic sequences with the local stratigraphy. The main conclusions resulting from this study are as follows:

1. There is no evidence of a public health threat due to tritium pollution of aquifers in Burke County.

2. There is widespread tritium pollution of the water table aquifer in eastern Burke County, but this pollution is well below the levels of tritium allowed for drinking water by the United States Environmental Protection Agency.

3. There is no evidence of regional tritium pollution of the Gordon aquifer in eastern Burke County.

4. Existing data are not adequate to resolve fully the issue of the tritium pathway into the water table aquifer. However, the investigation shows that some pathways are more likely than others and suggests specific pathway models for future investigations.

Follow-on, Phase II sub-investigations were conducted by the Georgia Geological Survey, results of which are reported by Summerour et al. (1998). The Phase II sub-investigations, conducted in eastern Burke County, included the following: (1) continued monitoring of tritium in the unconfined aquifer; (2) conducting high-resolution tritium analyses of groundwater in confined aquifers; (3) investigating the vertical distribution of tritium in the vadose zone; (4) investigating the vertical distribution of tritium in the unconfined aquifer; (5) completing a seismic survey across the projected location of the Pen Branch fault into Georgia; (6) investigating well construction in the public water supply well in which tritium was first discovered in Burke County groundwater; and (7) revising the lithostratigraphy and hydrostratigraphy of Burke County. Conclusions resulting from these sub-investigations, pertinent to the VEGP site, are summarized below.

1. Tritium concentrations in the unconfined aquifer are declining. This decline in tritium is probably due to a combination of radioactive decay, dilution by untritiated groundwater, and recharge by untritiated (or low tritium) rainwater.

2. Very low, but measurable levels of tritium are present in all of the confined aquifers. Because the age of the water in these aquifers (11,000 to 32,000 years) is very old when compared to the half-life of tritium (12.35 years), there should be no tritium present within the confined aquifers. The tritium in these deep aquifers is due to leakage from other aquifers or to contamination from drilling and sampling. There is insufficient evidence to distinguish between these alternatives.

3. Tritium is not uniformly distributed with depth in either the unsaturated (vadose) zone or in the unconfined aquifer. Within the vadose zone, tritium concentrations generally increase with increasing depth. Within the unconfined aquifer, tritium concentrations increase with increasing depth, but then rapidly drop to below the detection limit in the basal units of the unconfined aquifer. Vertical tritium variations observed in the unsaturated zone and the upper part of the unconfined aquifer may represent a historical record of tritium influx into the water table aquifer.

4. A seismic reflection survey across the projected location of the Pen Branch fault identified a series of thirteen high-angle faults along approximately 4,550 feet of a 7,620 foot seismic line. The entire series of faults is considered to represent an extension of the Pen Branch fault zone into Georgia, from South Carolina. Figure 23 of Summerour et al. (1998) shows the locations of the seismic survey line and the projected location of the Pen Branch fault. All thirteen faults affect the basement rock and project upwards into the overlying Cretaceous-age sediments. None of these faults appear to have disturbed the Gordon aquitard, which isolates the unconfined aquifer from underlying confined aquifers. The seismic profile also shows other numerous minor fractures or faults within the Cretaceous and Tertiary Coastal Plain sediments. Summerour et al. (1998) indicate that while these minor fractures may cut the lower Midville, upper Midville, lower Dublin, upper Dublin, and Millers Pond aquitards, it is unclear whether the fractures also cut the Gordon aquitard (Lisbon Formation). The effect of the Pen Branch fault zone and other minor faults on groundwater flow patterns and pathways was not resolved in this investigation.

5. The preponderance of evidence indicates that the primary pathway for tritium into the Upper Three Runs aquifer is through recharge of the aquifer by tritiated rainfall related to atmospheric tritium releases at the Savannah River Site. A possible secondary pathway for tritium is suggested by the presence of very low levels of tritium in all confined aquifers in Burke County. This secondary pathway may be related to the Pen Branch fault.

More recently, the Georgia Department of Natural Resources (DNR) (2004) report tritium sampling results for the 2000-2002 period from monitoring wells and public water-supply wells located in the Savannah River Site / Vogtle Electric Generating Plant area. Georgia DNR (2004) conclude that no significant tritium contamination has been positively identified in any confined aquifers in Georgia, based on monitoring well data. On the other hand, they note that extensive tritium contamination was present in groundwater in the relatively shallow (up to 200 feet deep) Upper Three Runs aquifer during the 2000-2002 period, with tritium concentrations averaging less than 1,000 pCi/l. Georgia DNR (2004) indicate that contamination appears to be concentrated primarily within the Savannah River Site's downwind footprint, suggesting a possible connection with airborne (or rain-borne) tritium from the Savannah River Site.

Based on the results of the investigations described above, it is likely that tritium is present in the Upper Three Runs (Water Table) aquifer at the VEGP site, given that tritium has been detected in adjacent monitoring wells and springs and creeks. The source of the tritium is most likely associated with atmospheric releases of tritium from the Savannah River Site because the VEGP site falls within the downwind footprint of the Savannah River Site and is in an area where elevated levels of tritium have been detected in the rainfall. The same investigations suggest the possibility of very low, but measurable levels of tritium in the deeper, confined aquifers underlying the VEGP site. Possible sources of tritium in the confined aquifers of Burke County, Georgia include leakage from overlying aquifers or contamination from drilling and sampling.

Trans-river flow has also been identified as a mechanism that might allow the migration of contaminants from aquifers beneath the Savannah River Site under the Savannah River and into Georgia. The potential for trans-river flow is discussed below.

Trans-River Flow

The potential for trans-river flow in the vicinity of the Savannah River Site and VEGP site has been discussed by Clarke and West (1997). Trans-river flow is a term that describes a condition under which groundwater originating on one side of a river migrates beneath the river floodplain to the other side of the river. Although some groundwater could discharge into the river floodplain on the opposite side of the river from its point of origin, such flow would likely be discharged to the river because flow in the alluvium is toward the river. Potentiometric-surface maps developed by Clarke and West (1997) for the Upper Three Runs aquifer and Gordon aquifers do not indicate the possible occurrence of trans-river flow. However, flow lines on potentiometric-surface maps of the confined Dublin and Midville aquifer systems do suggest the possible occurrence of trans-river flow for a short distance into the Savannah River alluvial valley. The possible occurrence of trans-river flow in the Dublin aquifer system also is suggested by the chemical and isotopic composition of water from the Brighams Landing well-cluster site in Georgia. Clarke and West (1997) suggest that the potential for trans-river flow may be facilitated by groundwater withdrawal, particularly at pumping centers located near the Savannah River. Pumped wells on one side of the river could intercept groundwater that originates on the other side. For this to occur, pumping would need to be sufficient to reverse the hydraulic gradient away from the river and towards the pumping center.

Numerical simulation techniques have been used to further evaluate areas of previously documented trans-river flow on the Georgia side of the Savannah River (Clarke and West, 1998; Cherry 2006). At such areas, local head gradients might allow the migration of contaminants from the Savannah River Site into the underlying aquifers and beneath the Savannah River into Georgia. Cherry (2006) identified the area near Flowery Gap Landing (covering about 1 $mi^2$) as an area of potential trans-river discharge. Backward particle tracking analysis was conducted to better quantify trans-river flow. Between 29 and 37 percent of the particles released in this area backtracked to recharge areas on the Savannah River Site (trans-river flow), depending on the scenario being evaluated. Of the particles exhibiting trans-river flow, the median time-of-travel ranged from 366 to 507 years. For the worst case scenario evaluated (deactivation of Savannah River Site production wells), the median time-of-travel decreased to about 370 years with a shortest time-of-travel period of about 80 years.

While the potential for trans-river flow exists, it is likely that such flow would be quickly discharged to the river because flow in the river alluvium is toward the river. Also, any tritiated water originating from the Savannah River Site and participating in trans-river flow would undergo significant radioactive decay, considering its 12.35 year half-life, relative to even the worst-case 80-year time-of-travel. Furthermore, pumping of the current make-up water wells for VEGP Units 1 and 2 does not appear to have intercepted groundwater originating from the other side of the river, based on the particle tracking results presented by Cherry (2006). It is not likely that pumping the additional water needed to supply VEGP Units 3 and 4 would be sufficient to reverse that hydraulic gradient and cause groundwater originating from South Carolina to be drawn any further into Georgia, given the high transmissivities of the confined Tertiary and Cretaceous aquifers. Therefore, trans-river flow does not appear to be a mechanism that would contribute to the contamination of aquifers underlying the VEGP site.

Near-Field Subsurface Conceptual Model

As described in SSAR Section 2.5.4.5, construction of the new units will require a substantial amount of excavation and backfill. The excavation will be necessary to completely remove the Upper Sand Stratum (Barnwell Group and Utley Limestone on Figure 1). Total excavation depth to the Blue Bluff Marl bearing stratum is expected to range from approximately 80 to 90 ft below existing grade. Backfilling will be performed from the top of the Blue Bluff Marl to the bottom of the containment and auxiliary buildings at a depth of about 40 ft below final grade. Filling will continue up around these structures to final grade. The fill will primarily consist of granular materials, selected from portions of the excavated Upper Sand Stratum and from other available borrow sources. Following the guidelines used during construction of VEGP Units 1 and 2, structural fill will be a sandy or silty sand material with no more than 25 percent of the particle sizes smaller than the No. 200 sieve. This structural fill will be compacted to an average of 97 percent of the maximum dry density.

Excavating existing soils and replacing these soils with structural fill will alter the hydrogeologic characteristics of the subsurface materials within the footprint of VEGP Units 3 and 4. In situ hydraulic testing of fill material for VEGP Units 1 and 2 indicates a hydraulic conductivity range of 480 ft/yr (1.3 ft/day) to 1220 ft/yr (3.3 ft/day) based data included in Table 2.4.12-15 of the UFSAR. Values for Units 3 and 4 are expected to be similar because the borrow sources and compaction criteria for the fill will be the same. Compared to the hydraulic conductivities for the Water Table aquifer (ER Table 2.3.1-20), it can be seen that the hydraulic conductivity of the fill is generally higher than that of the in situ soils.

Development of VEGP Units 3 and 4 will also increase the impervious area across the VEGP site where power generation and associated facilities are constructed. Storm-water management facilities (e.g., catch basins, storm sewers) will be used to convey runoff from precipitation offsite. The increased impervious area and use of storm-water management facilities will tend to reduce the recharge to the Water Table aquifer in areas affected by Unit 3 and 4 construction.

Construction of VEGP Units 3 and 4 will entail the placement of relatively large and impermeable structures below grade. The base elevations of the major structures (containment and auxiliary buildings) will be at about El. 180 ft msl. This elevation is at least 20 ft above the water table. Because these structures will not extend below the water table, they would not affect the hydrogeologic characteristics of the underlying saturated zone.

RAI Response:

Continuity of Utley Limestone

As noted in ER Section 2.3.1.2.2 of the ESP application, the Utley limestone consists of sand, clay, and silt with carbonate-rich layers. The stratum is discontinuous across the VEGP site and was not encountered in several of the ESP borings. To assess its degree of discontinuity, borings logged for the hydrogeological and geotechnical investigations have been examined for the presence/absence of the Utley limestone. Logs for these borings are included in SSAR Appendices 2.4A and 2.5A. In completing this assessment, effort was made to eliminate spatial bias. Therefore, only one boring log was considered when there were adjacent borings from OW-series well pairs, or adjacent B- and OW-series borings. Results are summarized in Table 1.

**Table 1. Presence of Utley Limestone in VEGP Site Borings.**

| Boring | Northing | Easting | Utley Limestone |
|---|---|---|---|
| B-1001 | 1,142,661.92 | 620,220.42 | Present |
| B-1002 | 1,142,998.52 | 620,985.47 | Absent |
| B-1003 | 1,142,974.36 | 621,889.85 | Present |
| B-1004 | 1,142,985.41 | 620,131.44 | Present |
| B-1005 | 1,143,991.57 | 620,155.35 | Present |
| B-1006 | 1,143,810.26 | 621,342.90 | Absent |
| B-1007 | 1,142,662.29 | 621,120.13 | Present |
| B-1008 | 1,142,670.93 | 621,996.15 | Present |
| B-1009 | 1,141,000.54 | 620,361.26 | Absent |
| B-1010 | 1,141,000.12 | 621,279.68 | Absent |
| B-1011 | 1,143,741.13 | 622,378.01 | Present |
| B-1013 | 1,140,976.08 | 622,272.50 | Absent |
| OW-1006 | 1,143,817.85 | 619,179.75 | Present |
| OW-1008 | 1,142,347.94 | 619,306.69 | Present |
| OW-1009 | 1,141,891.65 | 620,888.61 | Present |
| OW-1012 | 1,139,969.50 | 621,045.92 | Absent |
| OW-1013 | 1,140,805.40 | 621,715.03 | Absent |
| OW-1015 | 1,140,550.58 | 623,086.32 | Absent |

The data presented in Table 1 indicate that the Utley limestone is absent in 8 out of 18 borings, or 44 percent of the borings. Spatial trends in the presence/absence of the Utley limestone indicate that the unit tends to be present in the power block area for VEGP Units 3 and 4 and the area to the north towards Mallard Pond. The Utley limestone tends to be absent in the cooling tower area for VEGP Units 3 and 4 and the area to the south. These results are consistent with the Utley limestone isopachs presented in the UFSAR for VEGP Units 1 and 2 (Drawing No. AX6DD376). These isopachs indicate that the limestone increases in thickness to a maximum of about 80 ft and then decreases in thickness to 10 ft or less along a profile extending from the power block to Mallard Pond, with the long axis of this unit trending in a northeast-southwest direction.

These results along with water table contour maps provided in the ESP application indicate that groundwater flow from the power block area to the north and towards Mallard Pond will occur in the Utley limestone, as the data suggest that the limestone is continuous along this pathway.

RAI Response:

Continuity of Blue Bluff Marl

Section 2.5.1.2.2.2.1.1 of the UFSAR for VEGP Units 1 and 2 indicates that the Blue Bluff marl is a distinct unit that is relatively constant in thickness over many square miles, although variable in lithology. Contours of the upper and lower surfaces as well as an isopach map of the marl in the vicinity of the plant are shown on drawings AX6DD352, AX6DD371, and AX6DD372 of the UFSAR. These drawings indicate the Blue Bluff Marl to be continuous over the entire VEGP site. On the VEGP site, the ESP subsurface investigation (SSAR Appendix 2.5A) determined that the Blue Bluff Marl ranges in thickness from 63 to 95 ft at three locations where the stratum was fully penetrated, with an average thickness of 76 ft and a median thickness of 69 ft.

With respect to data from wells OW-1001/1001A (screened within the Water Table aquifer, but with measured hydraulic head values appearing to be more consistent with the Tertiary aquifer), further review of boring logs, well construction logs, and water levels for both wells indicates that water levels recorded in these wells are invalid. Response to RAI E2.3-3 provides the basis of this conclusion. Given these results and considering that the Blue Bluff Marl was encountered in deeper borings in the vicinity of wells OW-1001/1001A, there is no evidence suggesting that the Blue Bluff Marl is absent or discontinuous at this location.

Isolation of Tertiary and Cretaceous Aquifers

Summerour et al. (1998) and SSAR Section 2.5.1.2.4 of the ESP application present evidence indicating that the Tertiary and Cretaceous aquifers are isolated from the Water Table aquifer. Seismic data acquired at the VEGP site indicate that the fault terminates in the Cretaceous deposits. Therefore, the fault would not affect the Tertiary-age Gordon aquitard (Blue Bluff Marl) isolating the unconfined and confined aquifers. Additional discussion is provided below under "Location and Role of the Pen Branch Fault."

Hydraulic Connection of Hydrologic Units to the Savannah River Through River Alluvium

Clarke and West (1997) have documented the direct hydraulic connection between aquifers and the Savannah River along parts of its reach. This connection occurs due to incision into each aquifer by the paleo Savannah River and the subsequent deposition of permeable alluvium. Additional discussion of this hydraulic connection is given in the conceptual model description provided above. Clarke and West (1997) provide detailed discussion and further analysis.

Location and Role the Pen Branch Fault

SSAR Section 2.5.1.2.4 describes previous investigations of the Pen Branch fault and the site subsurface investigation of the fault that was conducted for the ESP application. Results of this investigation, which included seismic reflection and refraction surveys, clearly document that the Pen Branch fault strikes northeast and dips southeast beneath the VEGP site. SSAR Figure 2.5.1-42 shows the vertical projection of the Pen Branch fault from the top of basement rock in relation to VEGP Units 3 and 4. The plan projection of the intersection of the Pen Branch fault with the top of basement rock is located beneath or slightly southeast of the antiformal hinge at the top of the monocline in the Blue Bluff Marl (SSAR Figure 2.5.1-39). Because of its spatial association with the Pen Branch fault, it is likely that this monocline feature is the result of reverse or reverse-oblique slip on the Pen Branch fault. The seismic survey data further indicate that the fault terminates in the Cretaceous Coastal Plain deposits. Overlying Tertiary deposits, including those comprising the Gordon (Tertiary sand) aquifer, Gordon aquitard (Blue Bluff Marl), and Upper Three Runs (Water Table) aquifer, are therefore not affected by the Pen Branch fault. This result is consistent with that of Summerour et al. (1998), who reported that none of the faults identified in their seismic surveys appear to have disturbed the Gordon aquitard (Blue Bluff Marl), which isolates the unconfined aquifer from underlying confined aquifers.

Based on the results and discussion presented above, the Pen Branch fault has not affected the Tertiary deposits at the VEGP site and would be neither a barrier nor conduit for transport in these deposits. Insufficient data are available to determine if the fault would be a barrier or conduit in the deeper, Cretaceous deposits that have been affected by the fault.

References

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Clarke, J.S., and West, C.T., 1998, Simulation of Ground-Water Flow and Stream-Aquifer Relations in the Vicinity of the Savannah River Site, Georgia and South Carolina: U.S Geological Survey Water-Resources Investigations Report 98-4062, 134 p.

Georgia Department of Natural Resources, 2004, Environmental Radiation Surveillance Report, 2000-2002, Environmental Protection Division, March.

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Summerour, J.H., Lineback, J.A, Huddlestun, P.F., and Hughes, A.C., 1994, An Investigation of Tritium in the Gordon and Other Aquifers in Burke County, Georgia: Georgia Geologic Survey Information Circular 95, 93 p.

Summerour, J.H., Shapiro, E.A., and Huddlestun, P.F., 1998, An Investigation of Tritium in the Gordon and Other Aquifers in Burke County, Georgia, Phase II: Georgia Geologic Survey Information Circular 102, 72 p.

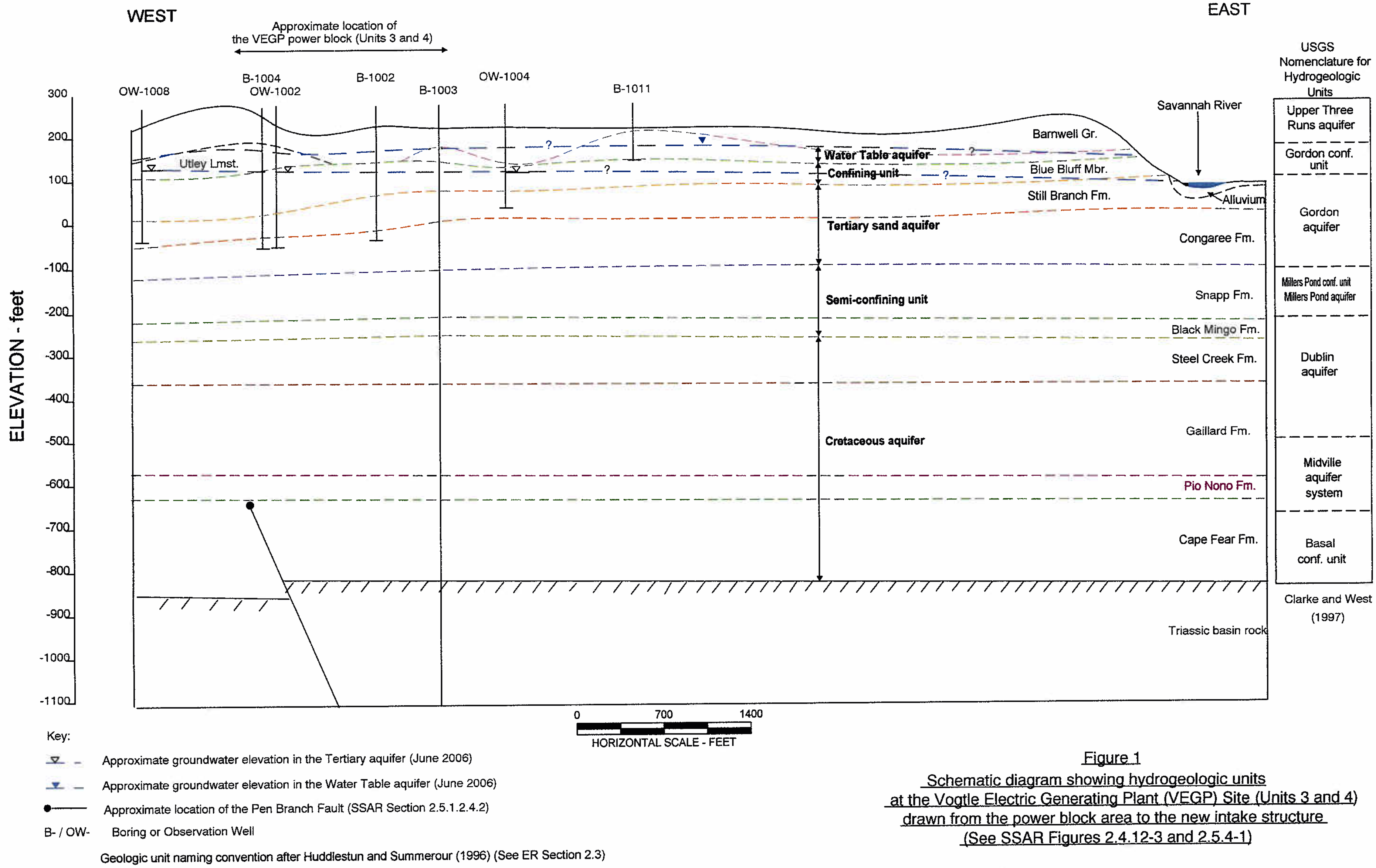


Figure 1

Schematic diagram showing hydrogeologic units at the Vogtle Electric Generating Plant (VEGP) Site (Units 3 and 4) drawn from the power block area to the new intake structure (See SSAR Figures 2.4.12-3 and 2.5.4-1)

**E2.3-3** <u>Section 2.3.1.2.3 Observation Well Data</u> **Resolve conflicting information (i) regarding the status of all "A" wells. For example, see the following sections: Site Safety Analysis Report (SSAR) (Part 2), Appendix 2.4A, Observation Well Installation and Development Report, pages 2.4A-6, 2.4A-14 and 2.4A-123, which state that "abandoned holes are labeled as "A" (for example OW-1002A) and that well OW-1001A was abandoned using grout on June 5, 2005, (ii) ER (Part 3) page 2.3.1-15, which states that the replacement well for OW-1001 was OW-1001A, and (iii) ER Figures 2.3.1-17 through 2.3.1-20, and SSAR figures 2.4.12-8 through 2.4.12-11 which use data from well OW-1001A to compute the piezometric contour maps.**

Response:

The following response is provided in three parts to satisfy parts (i) through (iii) of the request.

<u>Part (i)</u>:

The only new "A" well installed at the site for the ESP application was observation well OW-1001A. The confusion arises because the boring or drill logs contained in SSAR Appendix 2.4A (report Appendix E) are labeled "OW" (for Observation Well) as opposed to "B" (for Boring log) or "D" (for Drill log). A summary of the holes drilled at the site to accommodate installation of the new observation wells is provided in Table 1 of this RAI.

The hydrogeological investigation contractor drilled twenty borings between May 24 and June 14, 2005 as shown in Table 1. Boring logs for all of these wells, with the exception of holes OW-1001A and OW-1003, are contained in SSAR Appendix 2.4A (report Appendix E). Boring logs were not prepared for wells OW-1001A and OW-1003 as no soil samples were retrieved from these holes (Note: Boring log OW-1003 should read OW-1003A, as described in the footnote to Table 1).

Of the twenty borings drilled at the site, six were designated as "A" holes. These were: OW-1001A, OW-1002A, OW-1003A, OW-1005A, OW-1006A and OW-1008A. Four of these borings (OW-1001A, OW-1002A, OW-1003A, and OW-1005A) were abandoned because the inside diameter of the hole was too small to house the observation well. Boring OW-1006A was abandoned because of a shortage in 4.25-in hollow-stem auger to advance the hole. The hole abandonment records for these borings are contained in SSAR Appendix 2.4A (report Appendix F). Boring OW-1008A is the upper portion of boring OW-1008 and was not abandoned. The "A" is designated to show that the upper portion of this boring was drilled using 3.25-in hollow-stem augers while the lower portion was drilled using the rotosonic drilling method.

RAI Response:

Part (ii):

After completion of the hydrogeological investigation drilling, the geotechnical investigation contractor installed a new observation well, labeled OW-1001A, in the Water Table aquifer. This new observation well was installed on October 11, 2005 during the geotechnical investigation performed for the ESP application. The well construction log for OW-1001A is contained in SSAR Appendix 2.5A (report Appendix D). The new well was installed in the vicinity of existing observation well OW-1001 as, following a period of groundwater level monitoring in OW-1001 from June 2005 to September 2005, the groundwater level data from this well was considered invalid. The groundwater levels reported in OW-1001 were not consistent with the groundwater levels reported in the other observation wells open to the Water Table aquifer. Review of the boring log, daily field log, well development log, and the in situ hydraulic conductivity test results for the well indicate that this is likely due to the formation material adjacent to the well having been adversely impacted by well construction such that the well is not in good hydraulic communication with the aquifer. Consequently, water levels measured in the well are considered to be non-representative of the hydraulic head in the aquifer (See also response to RAI E2.3-4).

Part (iii):

ER Figures 2.3.1-17 through 2.3.1-20 and SSAR Figures 2.4.12-8 through 2.4.12-11 are groundwater surface elevation contour maps for the Water Table aquifer. These maps were developed using the groundwater elevation data for the Water Table aquifer and utilized monthly groundwater level measurements from observation well OW-1001A.

The construction log for OW-1001A, contained in SSAR Appendix 2.5A (report Appendix D), indicates that the screened portion of the well ranges in elevation from 146.13 to 136.13 ft msl. Groundwater level elevations in OW-1001A range from 135.91 to 135.9 ft msl, as shown in ER Table 2.3.1-18 and SSAR Table 2.4.12-1. Groundwater levels were measured in OW-1001A for the period extending from October 2005 to June 2006. Following completion of the monitoring program and review of the groundwater level data, it became apparent that groundwater levels in the well are close to or below the bottom of the screened interval, precluding hydraulic communication with the aquifer. As a result, the groundwater level data for observation well OW-1001A is considered invalid.

Piezometric contour maps for the Water Table aquifer will be updated to omit the invalid data from OW 1001A and will be included in the next revision to the ESP application.

RAI Response:

Table 1 Summary of the Holes Drilled at the Site for Installation of the Observation Wells

| Boring / Drill Log No. | Drilling Method | Drill Dates | | Sampled Depth | | Drill Depth Below the GS | Boring "Abandoned" or "Well" Installed |
|---|---|---|---|---|---|---|---|
| | | **Start** | **End** | **From (ft)** | **To (ft)** | **(ft)** | |
| OW-1001A | 3.25" HSA | 25-May | 25-May | No sampling | | 100 | Abandoned |
| OW-1001 | 4.25" HSA | 24-May | 29-May | 113.5 | 140 | 140 | Well |
| OW-1002A | 3.25" HSA | 24-May | 25-May | 0 | 108.5 | 108.5 | Abandoned |
| OW-1002 | Rotosonic | 2-Jun | 6-Jun | 87 | 237 | 237 | Well |
| OW-1003A | 3.25" HSA | 24-May | 24-May | 0 | 90 | 90 | Abandoned |
| OW-1003 | 4.25" HSA | 25-May | 25-May | No sampling | | 90.5 | Well |
| OW-1004 | Rotosonic | 3-Jun | 11-Jun | 87 | 187 | 187 | Well |
| OW-1005A | 3.25" HSA | 31-May | 31-May | 0 | 75 | 75 | Abandoned |
| OW-1005 | 4.25" HSA | 2-Jun | 7-Jun | 68.5 | 170 | 170 | Well |
| OW-1006A | 4.25" HSA | 3-Jun | 4-Jun | 0 | 125 | 125 | Abandoned |
| OW-1006 | 4.25" HSA | 9-Jun | 14-Jun | 118.5 | 135 | 135 | Well |
| OW-1007 | 4.25" HSA | 4-Jun | 7-Jun | 98.5 | 122 | 122 | Well |
| OW-1008A | 3.25" HSA | 26-May | 26-May | 0 | 107.5 | 105 | Well OW-1008 |
| OW-1008 | Rotosonic | 31 Mayl | 1-Jun | 108 | 247 | 247 | Well |
| OW-1009 | 4.25" HSA | 24-May | 27-May | 0 | 100 | 100 | Well |
| OW-1010 | 4.25" HSA | 1-Jun | 1-Jun | 0 | 93.5 | 93.5 | Well |
| OW-1011 | Rotosonic | 11-Jun | 12-Jun | 87 | 217 | 217 | Well |
| OW-1012 | 4.25" HSA | 31-May | 1-Jun | 0 | 93.6 | 93.6 | Well |
| OW-1013 | 4.25" HSA | 9-Jun | 10-Jun | 0 | 103.5 | 103.5 | Well |
| OW-1014 | Rotosonic | 11-Jun | 11-Jun | 97 | 197.4 | 197.4 | Well |
| OW-1015 | 4.25" HSA | 30-May | 3-Jun | 0 | 120 | 120 | Well |

Notes:
Borings OW-1001A, OW-1002A, OW-1003A, and OW-1005A were abandoned due to the use of 3.25-in hollow stem auger.
Boring OW-1006A was abandoned due to the of shortage hollow stem augers.
Boring log OW-1003 contained in SSAR Appendix 2.4A (report Appendix E) should read OW-1003A.
The drilling method for boring OW-1006 is assumed to be 4.25" HSA (not described in SSAR Appendix 2.4A (report Appendix E)).
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**E2.3-4** <u>**Section 2.3.1.2.3 Observation Well Data**</u> **Discuss the implications of the anomalous water levels (116.54 to 118.36 feet between June 2005-June 2006, page 2.3.1-45, Table 2.3.1-18) and seasonal fluctuations recorded by well OW-1001 with respect to the site hydrogeological conceptual model and corresponding ground water flow. The well was installed at or above the Blue Bluff Marl (see SSAR Section 2.4, Appendix A, page 2.4A-10); however it recorded water level elevations consistent with those of the underlying Tertiary aquifer. In addition, explain the reasoning for replacing well OW-1001 (page 2.3.1-15) as the seasonal fluctuation was more than 1.8 feet. This variation is greater than the seasonal average variation (0.62 feet) for all other water table wells (excluding OW-1001A).**

Response:

Prior to responding to this request, it should be noted that some minor typographic and transcription errors were identified in ER Table 2.3.1-18 and SSAR Table 2.4.12 and ER Table 2.3.1-19 and SSAR Table 2.4.12-2. Because the magnitudes of these errors are small the interpretation and conclusions regarding the hydrogeologic site characteristics reported in the ESP application are not affected. The corrected monthly groundwater level elevations in the Water Table and Tertiary aquifers are shown in the attached Tables 1 and 2 of this RAI, respectively. Monthly groundwater elevation data for observation wells OW-1001 and OW-1001A are considered invalid and are omitted from these tables. These corrected tables will be included in the next revision to the ESP application. The validity of the data from these two observation wells and the reasons for omitting these data are discussed below.

Table 1 shows that monthly groundwater level elevations in the Water Table aquifer for the period extending from June 2005 to June 2006 range from 132.53 to 165.48 ft msl with seasonal fluctuations averaging about 0.7 ft. Table 2 shows that for the same monitoring period groundwater level elevations in the Tertiary aquifer range from 82.13 to 127.99 ft msl with seasonal fluctuations averaging about 5.0 ft. ER Table 2.3.1-18 shows groundwater levels measured in observation well OW-1001 (installed in the Water Table aquifer) range from 116.54 to 118.36 ft msl with a seasonal fluctuation of about 1.8 ft. These groundwater levels and seasonal fluctuations are not consistent with the groundwater levels and seasonal fluctuation of groundwater levels in the Water Table aquifer.

The groundwater elevations observed in OW-1001 suggest that the screened interval of the well or a portion of the screened interval is not in hydraulic communication with the Water Table aquifer. Review of the boring log, daily field log, well development log, and the in situ hydraulic conductivity test results for observation well OW-1001 indicate that this is likely due to the formation material adjacent to the well having been adversely impacted by well construction. The construction log for OW-1001, contained in SSAR Appendix 2.4A (report Appendix F), indicates that the screened interval of the well ranges in elevation from 110 to 101 ft msl. The boring log for OW-1001, contained in SSAR Appendix 2.4A (report Appendix E), indicates that the bottom of the screen is about 5 ft above the top of the Blue Bluff Marl (BBM) which was encountered at elevation 96 ft msl. The boring log reports that 1500 gallons of water were lost during cleaning of the hole upon its completion. In addition, the daily field log for June 6, 2005, contained in SSAR Appendix 2.4A (report Appendix A), reports that significant grout loss occurred during backfilling of the well annulus above the screened interval.

RAI Response:

The well development log for OW-1001, contained in SSAR Appendix 2.4A (report Appendix G), indicates that the well was dry after the removal of two well volumes of water and that the recovery of water into the well was very slow (less than 1-ft over a 12-hour period). The log also indicates that the water removed from the well during development was gray in color suggesting that grout may have been within close proximity to the well screen. The results of the in situ hydraulic conductivity test for OW-1001, contained in SSAR Appendix 2.5A (report Appendix D), show almost no measurable water inflow during the test and report a hydraulic conductivity value of $2.7 \times 10^{-7}$ cm/s ($7.6 \times 10^{-4}$ ft/day). This value is about three orders of magnitude less than the hydraulic conductivity values of 0.12 to 2.7 ft/day reported for the Water Table aquifer (ER Table 2.4.12-3). Therefore, the groundwater level data from observation well OW-1001 is considered invalid.

As a result of the fact that the groundwater levels reported in OW-1001 were not consistent with the groundwater levels reported in the other observation wells open to the Water Table aquifer for the period from June to September 2005, a new observation well, OW-1001A, was installed in the Water Table aquifer in the immediate area of OW-1001. The well was installed on October 11, 2005 during the geotechnical investigation performed for the ESP application. The construction log for OW-1001A, contained in SSAR Appendix 2.5A (report Appendix D), indicates that the screened portion of the well ranges in elevation from 146.13 to 136.13 ft msl. Groundwater level elevations in OW-1001A range from 135.91 to 135.9 ft msl, as shown in ER Table 2.3.1-18 and SSAR Table 2.4.12-1. Groundwater levels were measured in OW-1001A for the period extending from October 2005 to June 2006. Following completion of the monitoring program and review of the groundwater level data, it became apparent that groundwater levels in the well are close to or below the bottom of the screened interval, indicating no hydraulic communication with the aquifer. As a result, the groundwater level data for observation well OW-1001A is considered invalid (See also response for RAI E2.3-3).

RAI Response:

Table 1 Monthly Groundwater Level Elevations in the Water Table Aquifer

| Well | Groundwater Level Elevations (ft msl) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jun-05** | **Jul-05** | **Aug-05** | **Sep-05** | **Oct-05** | **Nov-05** | **Dec-05** | **Jan-06** | **Feb-06** | **Mar-06** | **Apr-06** | **May-06** | **Jun-06** |
| 142 | 154.37 | 154.38 | 154.49 | 154.64 | 154.75 | 154.69 | 154.60 | 154.71 | 154.78* | 154.71 | 154.63 | 154.55 | 154.48 |
| 179 | 147.42 | 148.40 | 148.42 | 148.72 | 148.69 | 148.75 | 148.52 | 148.61 | 148.64 | 148.72 | 148.66 | 148.76 | 148.78 |
| 802A | 157.88* | 157.86 | 158.07 | 158.23 | 158.29 | 158.34 | 158.28 | 158.28 | 158.39 | 158.23 | 158.17 | 158.09 | 157.99 |
| 803A | 159.98 | 159.91 | 160.15 | 160.32 | 160.39 | 160.48 | 160.39 | 160.37 | 160.48 | 160.45 | 160.30 | 160.20 | 160.12 |
| 804 | 163.73 | 163.62 | 163.92 | 164.10 | 164.21 | 164.23 | 164.05 | 164.08 | 164.23 | 164.30 | 164.11 | 163.99 | 163.88 |
| 805A | 158.53 | 158.57 | 158.84 | 158.98 | 159.09 | 159.09 | 159.05 | 158.94 | 158.92 | 158.98 | 158.82 | 158.82 | 158.63 |
| 806B | 155.62 | 155.65* | 155.78 | 155.90 | 155.96 | 155.98 | 155.88 | 155.97 | 155.98 | 156.03 | 155.85 | 155.78 | 155.73 |
| 808 | 158.88 | 159.14 | 159.42 | 159.55 | 159.49 | 159.37 | 159.15 | 159.04 | 159.19 | 159.15 | 158.99 | 158.53 | 158.80 |
| 809 | 152.78 | 152.70 | 152.75 | 152.89 | 152.98 | 152.97 | 152.98 | 153.10 | 153.22 | 153.18 | 153.05* | 153.02 | 153.00 |
| LT-1B | 154.92 | 154.82 | 155.01 | 155.16 | 155.18 | 155.22 | 155.06 | 155.18 | 155.52* | 155.28 | 155.18 | 155.15 | 154.95 |
| LT-7A | 154.39 | 154.15 | 154.33 | 154.46 | 154.48 | 154.46 | 154.31 | 154.57 | 154.83 | 154.59 | 154.57 | 154.50 | 154.41 |
| LT-12 | 158.21 | 157.90 | 158.07 | 158.22 | 158.31 | 158.28 | 158.21 | 158.53 | 158.66 | 158.48 | 158.54 | 158.48 | 158.23 |
| LT-13 | 156.10 | 155.92 | 156.13 | 156.30 | 156.32 | 156.37 | 156.23 | 156.36 | 156.66 | 156.35 | 156.32 | 156.32 | 156.23 |
| OW-1003 | 155.94 | 155.89 | 156.06 | 156.29 | 156.24 | 156.36 | 156.26 | 156.34 | 156.37 | 156.43 | 156.32 | 157.24 | 156.16 |
| OW-1005 | 132.95 | 132.73 | 132.88 | 133.01 | 132.67 | 132.65 | 132.53 | 132.74 | 133.04 | 133.12 | 133.14 | 133.20 | 133.12 |
| OW-1006 | 147.66 | 147.48 | 147.57 | 147.60 | 147.49 | 147.20 | 147.18 | 147.41 | 147.40 | 147.37 | 147.35 | 147.12* | 147.05 |
| OW-1007 | 151.82 | 151.72 | 151.78 | 151.63 | 151.45 | 151.15 | 151.05 | 151.41 | 151.49 | 151.45 | 151.22 | 151.11 | 150.99 |
| OW-1009 | 162.38 | 162.40 | 162.71 | 162.90 | 163.01 | 163.03 | 162.87 | 162.93 | 163.01 | 163.01 | 162.89 | 162.79 | 162.65 |
| OW-1010 | 163.06* | 163.26 | 163.59 | 163.77 | 163.81 | 163.78 | 163.62 | 163.60 | 163.63 | 163.57 | 163.44 | 163.29 | 163.09 |
| OW-1012 | 161.83 | 161.93 | 162.07 | 162.06 | 161.98 | 161.80 | 161.71 | 161.82 | 161.86 | 161.80 | 161.68 | 161.53 | 161.37 |
| OW-1013 | 164.95 | 165.00 | 165.29 | 165.47 | 165.48 | 165.42 | 165.21 | 165.29 | 165.46 | 165.31 | 165.23 | 165.11 | 164.96 |
| OW-1015 | 159.63 | 159.58 | 159.78 | 159.90 | 159.96 | 159.96 | 159.82 | 159.81 | 159.79 | 159.89 | 159.75 | 159.66 | 159.58 |

Note: * Corrected groundwater level elevations

RAI Response:

Table 2 Monthly Groundwater Level Elevations in the Tertiary Aquifer

| Well | Groundwater Level Elevations (ft msl) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jun-05 | Jul-05 | Aug-05 | Sep-05 | Oct-05 | Nov-05 | Dec-05 | Jan-06 | Feb-06 | Mar-06 | Apr-06 | May-06 | Jun-06 |
| 27 | 91.50 | 89.96 | 91.63 | 83.96 | 82.13 | 88.24 | 82.57 | 84.62 | 85.77 | 84.49 | 83.42 | 83.08 | 83.03 |
| 29 | 98.88 | 97.80 | 98.33 | 93.17 | 91.86 | 91.89 | 92.59 | 93.97 | 94.19 | 93.63 | 93.05 | 92.16 | 91.76 |
| 850A | 105.27 | 104.68 | 104.76 | 101.04 | 100.03 | 99.91 | 100.70 | 101.86 | 101.69 | 101.48 | 101.14 | 100.07 | 99.63 |
| 851A | 114.54 | 114.40 | 114.02 | 111.59 | 111.38 | 110.60 | 112.34 | 112.32 | 112.43 | 112.42 | 112.23 | 111.08 | 110.36 |
| 852 | 114.71 | 114.49 | 114.00 | 111.88 | 111.09 | 111.21 | 111.88 | 113.06 | 113.51 | 113.14 | 112.82 | 111.74 | 110.38 |
| 853 | 108.60 | 108.17 | 107.98 | 104.51* | 103.64 | 103.45 | 104.18 | 105.32 | 105.14 | 104.97 | 104.65 | 103.58 | 103.15 |
| 854 | 107.06 | 106.88 | 106.65 | 103.37 | 102.38 | 102.23 | 102.38* | 104.13 | 103.85 | 103.73 | 103.45 | 102.31 | 101.86 |
| 855 | 102.63 | 101.74 | 102.00 | 97.22 | 96.08 | 96.21 | 96.85 | 98.43 | 98.48* | 98.15 | 97.53 | 96.75 | 95.93 |
| 856 | 114.07 | 113.94 | 113.49 | 111.37 | 110.57 | 110.63 | 111.31 | 112.52 | 112.46 | 112.39 | 112.07 | 111.21 | 109.94 |
| OW-1002 | 120.76* | 120.61 | 120.04 | 118.65 | 117.81 | 117.71 | 118.44 | 119.36 | 119.63 | 119.64 | 119.43 | 118.37 | 117.65 |
| OW-1004 | 108.27 | 108.14 | 108.01 | 105.06 | 104.05 | 103.75 | 104.51 | 105.56 | 105.38* | 105.28 | 105.12 | 103.88 | 103.54 |
| OW-1008 | 126.06 | 127.99 | 125.09 | 124.24 | 123.49 | 123.51 | 124.19 | 125.10 | 125.46 | 125.54 | 125.21 | 124.33 | 123.42 |
| OW-1011 | 122.50 | 122.38 | 121.49 | 120.37 | 119.59 | 119.73 | 120.46 | 121.41 | 121.64 | 121.70 | 121.48 | 120.47 | 119.37 |
| OW-1014 | 111.18 | 111.00 | 110.74 | 108.34 | 107.34 | 107.11 | 107.81 | 108.87 | 108.73 | 108.75 | 108.66 | 107.41 | 106.94 |

Note: * Corrected groundwater level elevations.

## Section 2.4 Ecology

**E2.4-1a Describe the methods that Southern Nuclear Operating Company (SNC) is using to delineate wetlands that could be impacted by pre-construction and construction activities. Include the process for determining whether an area is considered a wetland – i.e., how has SNC defined a "wetland"?**

Response:

In early December 2006, a contractor (Ecoscience) working for SNC began work to define and delineate wetlands on the Vogtle site. In order to ensure a complete accounting of all wetlands present on the site, SNC requested that the contractor define and map all wetlands. Wetlands that will be impacted by construction of Units 3 and 4, either directly or indirectly will be delineated in accordance with the 1987 "Corps of Engineers Wetlands Delineation Manual, Report Y-87-1, U.S. Army Waterways Experiment Station, Vicksburg, Ms. All site wetlands will be defined and mapped.

The process used for determining whether an area is a wetland is based on the Corps Delineation Manual referenced above, the "National List of Plant Species that Occur in Wetlands USFWS 1988, and the Hydric Soil Definition Criteria and Lists, USDA, Natural Resources Conservation Services, 1992. The Delineation manual defines wetland as "land characterized by the presence of water at a frequency and duration sufficient to support, and that under normal circumstance does support, wetlands vegetation or aquatic life and is commonly referred to as a bog, swamp, or marsh."

There are three provisions in the process of wetland identification:

- Inundated or saturated soil conditions resulting from permanent or periodic inundation by ground water or surface water.
- Prevalence of vegetation typically adapted for life in saturated soil conditions (hydrophytic vegetation).
- Presence of normal circumstances.

**E2.4-1b Provide the results of the wetlands delineation that was conducted in December 2006.**

Response:

Wetland delineations were conducted at the VEGP site by Eco-Sciences of Georgia December 17-19 and December 21-22, 2006. Results of the delineations are discussed in the Jurisdictional Waters report issued by Eco-Sciences in January 2007 and are included in Enclosure 2.

**E2.4-1c Provide a description of the activities that could impact wetlands (including dewatering).**

Response:

The activities associated with construction of the new Vogtle units that have potential to impact wetlands are limited to only a small portion of the site. Only the construction of the intake, barge slip, and discharge structures have the potential to directly impact wetlands. These direct impacts will be addressed by Clean Water Act Section 404 permits and are discussed in detail in response to other RAIs, 3.9-4. In addition to the activities producing direct impacts, there are other activities that have potential for indirect impacts to site wetlands. While these indirect impacts are not likely to require Corps 404 permits, SNC has evaluated them to ensure that all environmental impacts associated with the new Vogtle Units have been evaluated in accordance with the provisions of 10 CFR 52 and the National Environmental Policy Act (NEPA). There are other activities that may result in indirect impacts to wetlands. The construction conducted on the powerblock and cooling towers is in an upland area of the site where no wetlands are present. However, stormwater drainage from these areas is routed to Retention pond 2. Retention pond 2 was constructed in the early stages of construction for Vogtle Units 1 and 2 to provide sediment retention for stormwater prior to discharge to Beaverdam Creek. These ponds were constructed prior to the implementation of most of the Clean Water Act regulations and over the years have development distinct wetland characteristics. Recently, SNC conducted field work in support of wetland delineation and both Retention Ponds 1 and 2 were evaluated. Since these ponds were built as instream sediment ponds, there is some concern that they may now be considered jurisdictional wetlands, based on a recent court decision and supporting case law. SNC is evaluating the proper regulatory status for these ponds. However, even if they are determined to be jurisdictional, SNC does not anticipate any activities that will require a Section 404 permit. The ponds will likely be left as is. If additional stormwater retention volume is required, SNC will construct additional storage in an upland area in accordance with applicable regulatory requirements. This issue will be discussed with the USACE over the next few months as part of the wetland delineation process and the regulatory status of these ponds will be confirmed. Only retention pond 2 will receive drainage from the powerblock and cooling tower area. Retention pond 1 is not expected to receive runoff from areas disturbed by construction.

The proposed new construction will include a Heavy Haul Road from the barge slip to the construction site. This road is not expected to encounter wetlands along its route, but SNC will implement the necessary erosion and sediment controls and best management practices (BMPs) to ensure runoff does not negatively impact wetlands. There will also be a road constructed to the new intake site. Part of this road will be constructed in the Savannah River floodplain. This portion of the road will be managed under the Corps Section 404 permit for the intake.

A significant excavation will be required for the powerblock area. This excavation will remove material down to the blue bluff marl which will serve as the base material for the foundations. This excavation will extend below the normal water table in the Unconfined (Water Table) aquifer. A dewatering system will be put in place to remove groundwater from the excavation during the construction process. A short distance to the north is Mallard Pond, a manmade pond that was on the site prior to construction. This pond is fed by a spring in the south end that is believed to originate in Utley cave, a Karst formation that intercepts groundwater from the unconfined (Water Table) aquifer. The groundwater at VEGP, including this area, is discussed in detail in the response to RAI E2.3-2. The discharge from Mallard pond feeds a small stream that also receives flow from a wetland on the northwest portion of the site and intersects the Savannah River upstream of the new intake location. The flow from mallard pond and the water level in the pond is controlled by a standpipe located near the dam on the north end of the pond. The flow through Mallard Pond was estimated during the licensing of Unit 1 and 2 as approximately 250 gpm. Based on recent evaluation (see RAI 2.3-2 response), there may be a short term reduction in recharge flow to Mallard Pond during the dewatering of the Powerblock excavation. The pond level will not be substantially affected since it is maintained by a standpipe. The stream below the pond may experience a reduction in flow, but it is not expected that this reduction will significantly alter the stream habitat, beyond what might be experienced during a drought period. The stream is, for the most part, heavily incised to a depth of four to eight feet throughout its length. There are at least two beaver ponds located on the stream where water is spread across a large area. As such, no significant impact to this wetland area is anticipated as a result of construction activities.

**E2.4-1d Provide a description of the potential impact for each specific wetland, and an estimate of the number of acres potentially impacted. Include information on activities that would involve access through wetlands.**

Response:

The primary impacts to wetlands at the VEGP site are limited to the construction of the Unit 3 & 4 cooling water intake structure (CWIS) and discharge structure, and will all take place in the 100-year floodplain. Detailed descriptions of construction activities for the CWIS, CWIS access road, and discharge structure can be found in response to RAI E3.9-4.

Approximately 12.5 acres of wetlands will be impacted during construction of the Unit 3 & 4 cooling water intake structure. Impacts will include the removal of native vegetation, grading, and cut and fill activities. The actual intake structure and canal will be located in approximately 3 acres of wetlands. Impacts in the remainder of the construction area will be temporary since all areas beyond those occupied by the CWIS will be allowed to revert/restored back to its native condition. The CWIS access road will run from the bluff ridge down to the CWIS construction site. No wetlands will be directly impacted by the construction of the CWIS access road.

Approximately 10 acres of wetlands will be impacted during construction of the barge slip and discharge structure. Similar to the existing discharge structure, the Units 3 & 4 discharge structure will consist of a buried pipe with a submerged discharge outlet into the Savannah River. Impacts will include the removal of native vegetation, grading, and cut and fill activities. Once the discharge pipe is in place and covered, the disturbed area will be re-vegetated to prevent erosion and allowed to revert/restored back to its native condition. Once installed, the discharge pipe is expected to disturb less than a tenth of an acre.

For all construction activities involving the potential to impact wetlands, Best Management Practices, as discussed in response to RAI E4.3-1a, will be implemented.

**E2.4-1e Provide a map and the accompanying Geographic Information System (GIS) data that includes the delineated wetlands and identify whether the wetlands are jurisdictional. If it has not been determined if the wetlands are jurisdictional, provide a schedule for obtaining this information from the Army Corps of Engineers. Identify the 100-year floodplain on the map.**

Response:

As discussed in RAI E2.4-1b, wetland delineations were conducted at the VEGP site by Eco-Sciences of Georgia in December, 2006. Wetland maps are included in the Jurisdictional Waters report contained in Enclosure 2. PDF maps and a DWG file are included for NRC review in Enclosure 3 and are not formatted for posting to ADAMS. Consultation with the Army Corps of Engineers (ACOE) is ongoing. Beginning in early 2007, SNC will submit the Request for Jurisdictional Determination Form to the ACOE and begin the Section 404 permitting process. While no formal schedule has been determined, SNC expects to have the jurisdictional determination submitted to the USACE by March 2007.

**E2.4-1f Provide information on any best management practices that will be used to minimize impacts to wetlands. This should include information on clearing methods, erosion runoff and siltation control methods (both permanent and temporary), dust suppression methods and other construction practices for control or suppression specific to the site. Tie the best management practices to the activity and/or location that it will support.**

Response:

Refer to response to RAI 4.3-1a.

**E2.4-1g Provide a summary of the unavoidable adverse environmental impacts and the irreversible and irretrievable commitment of resources associated with wetlands that would be filled or removed during construction.**

Response:

The new intake structure construction would affect approximately 12.5 acres. Most of the acreage involved would be in the bottomland hardwood forest wetland within the Savannah River 100-year floodplain; the remainder would affect the bluff above the floodplain (non wetland). The actual intake structure and intake canal would be located in approximately 2 - 3 acres of wetland. The construction area for the new discharge line and barge facility will affect approximately 10 acres. However, the barge facility will be constructed between the old barge facility and the existing intake structure, on fill that was put in place during the initial construction, thus will not affect any existing wetlands. No impacts to the 100-year floodplain will occur as a result of barge facility construction. Installation of the discharge pipe is expected to disturb less than a tenth of an acre of the floodplain. The proposed project requires intake/discharge structures and a barge facility, therefore adverse impacts to the river floodplain are unavoidable. No wetlands are expected to be affected in the upland portions of the project site.

Canopy species in the lower, wetter areas along the Savannah River are primarily bald cypress and tupelo gum, while sycamore, boxelder, sugarberry, and swamp chestnut oak occupy the slightly higher ground in the bottomland hardwoods. The Georgia state-listed threatened bay star-vine was found on the wooded bluffs above the floodplain in the vicinity of the proposed intake structure during the protected species survey. Its habitat preferences are such that it could occur in the floodplain forest as well. The locations of the bay star vine identified in the survey are provided in Exhibit 8 of the T&E Species Report (TRC 2006). SNC will work with the Georgia Department of Natural Resources to ensure that any protected species are indeed protected.

**E2.4-1h Describe cumulative impacts to wetlands.**

Response:

Approximately 22.5 acres of wetlands would be disturbed by the construction project, most in the Savannah River 100-year floodplain. Of the 22.5 acres only a small percentage will be lost permanently. As described in the response to E2.4-1i, SNC would mitigate the disturbance or loss of those wetlands. The middle reach of the Savannah River, downstream of the Augusta Lock and Dam, is largely undeveloped, except for isolated intake structures such as those at VEGP, SRS, and Urqhardt. Therefore, cumulative impacts to the reach of the river would be minimal.

**E2.4-1i Provide information on any planned mitigation associated with wetlands.**

Response:

At this time, no specific mitigation activities have been discussed with USACE, however, the typical mitigation ratio is 3:1. With that in mind, SNC believes there are sufficient wetlands available for onsite mitigation. There are approximately 170 acres of wetlands at the VEGP site. As discussed in RAI E2.4-1d, an estimated 22.5 acres of wetlands will be impacted by Unit 3 & 4 construction activities. Based on current construction impacts estimates and an expected mitigation ratio of 3:1, approximately 67.5 acres of wetlands would be required for mitigation.

**E2.4-1j Provide information on activities that would impact the 100-year floodplain.**

Response:

As described in ESP Environmental Report Section 4.1.1.1, the only construction activities performed in the 100 year floodplain include the new barge slip, discharge structure and intake structure. These impacts are discussed separately in the responses to E3.9-5 and E 3.9-6.

**E2.4-2 <u>Sections 2.4.1 Terrestrial Ecology and 4.3 Terrestrial Ecosystems ESRP</u> Section 2.4.1 directs the staff's review of the terrestrial environment and biota on the site, transmission corridors, and offsite areas likely to be impacted by construction, maintenance or operation. The ESRP identifies the need for information on "important" species and habitats, including threatened and endangered species. ESRP Section 4.3.1 directs the staff to review the description, quantification, and assessment of the impacts of construction on the terrestrial ecosystem. The applicant should provide an assessment that has sufficient detail to predict and evaluate the significance of potential impacts to "important" species, including threatened and endangered species.**

Response:

The details of this RAI are addressed in the responses to RAI E2.4-2a through j.

**E2.4-2a Provide information on suitable habitat for threatened and endangered species, onsite, along the transmission line corridors, and in any other off-site area likely to be impacted by site preparation activities, construction, maintenance or operation. For example, during the site audit, the State of Georgia Department of Natural Resources (GA DNR) informed the staff that although no specimens have been discovered thus far, the bluff above the bottomland hardwood swamp at VEGP that would be affected by construction of the intake is suitable habitat for the Federally-listed relict trillium (Trillium reliquum).**

Response:

In accordance with the ESRP, SNC authorized seasonal threatened and endangered species field surveys of natural areas at the VEGP site and along 340 miles of VEGP-associated transmission lines (TRC 2006). The field surveys were conducted by Third Rock Consultants (TRC) during Spring (April 12-21), Summer (August 22-31) and Fall (October 24-November 2) of 2005. The TRC (2006) report details the methods and results, and Appendices A and B of the TRC report provide details on habitats associated with threatened and endangered species targeted during the surveys. The TRC report was the basis for the evaluation of threatened and endangered species in the ESP Environmental Report.

RAI Response:

As shown in Table 2.4-1 of the ESP Environmental Report, 71 Federally-listed or State-listed species have been recorded in Burke County or in counties crossed by the transmission lines. Although habitat for some species (e.g., whales, sea turtles) shown in Table 2.4.-1 does not exist at VEGP or along transmission corridors, many other species in the table are associated with a variety of habitats or with a general, widespread habitat type. The Federally-threatened eastern indigo snake, for example, occurs in a variety of habitats (pine flatwoods; scrub oak woods, forested sandhills; moist hammocks, swamps, and floodplains). These habitat types are common along the 340 miles of transmission corridor, so providing the many specific locations of suitable habitat for the eastern indigo snake along the transmission corridors would not further identify segments of the corridors likely to support this species.

As noted in the RAI, the forested riverine bluff at VEGP provides suitable habitat for the Federally-endangered relict trillium. Habitat for the relict trillium in the coastal plain (within which VEGP is located) consists of hardwood forests, especially forests with boulders, or ledges of soft limestone (Patrick et al. 1995). Again, it would not be useful to provide locations of all hardwood forests along the transmission corridors. It should be noted, however, that a figure showing hardwood forests at the VEGP site is being provided. Furthermore, the forested riverine bluff at VEGP was surveyed during the seasonal field surveys conducted in 2005 (TRC 2006). The Spring 2005 survey was conducted during the flowering period for the relict trillium, which is the best search time for positive identification of this species (Patrick et al. 1995), and this was a targeted species that received special attention during the surveys. The relict trillium was not observed during the 2005 surveys, and it has not been recorded by USFWS or GDNR in Burke County.

Many endangered and threatened species are associated with a variety of habitats or with a general, widespread habitat type. Detailed seasonal threatened and endangered species field surveys were conducted during 2005. Additional general information on the location of suitable or typical habitat for endangered and threatened species will not significantly enhance the study.

References:

(TRC 2006) Third Rock Consultants LLC, Threatened and Endangered Species Survey Final Report, Vogtle Electric Generating Plant and Associated Transmission Corridors, for Tetra Tech NUS, Aiken, South Carolina, Lexington, Kentucky, January 16.

Patrick, T.S., J.R. Allison, and G.A. Krakow. 1995. Protected Plants of Georgia, an Information Manual on Plants Designated by the State of Georgia as Endangered, Threatened, Rare or Unusual. Georgia Department of Natural Resources, Wildlife Resources Division, Georgia Natural Heritage Program. Available at http://georgiawildlife.dnr.state.ga.us/assets/documents/trilre.pdf

**E2.4-2b Provide a map and the accompanying GIS data with the locations of the threatened and endangered species surveys that were conducted on the VEGP site (only locations for the surveys on the transmission lines were included in the Third Rock 2006 report). If the VEGP on-site surveys were not conducted as part of the Third Rock effort in 2005, provide information on the timing for the surveys and the methods used for the survey. Information regarding the timing of surveys and the methods used to conduct the surveys is necessary because some species, such as the federally-listed relict trillium (Trillium reliquum), are very difficult to identify most of the year.**

Response:

A map of the locations of the on-site endangered species survey and related GIS data is provided in Enclosure 3 to this submittal. As described in the response to RAI 2.4-2a, the VEGP survey was done as part of the Third Rock survey. Dates and methodology are summarized in the response to RAI 2.4-2a.

**E2.4-2c Are there plans to conduct threatened and endangered surveys in areas that would be affected by construction activities and have not been surveyed (such as the borrow area and new transmission corridor)? If not, provide justification.**

Response:

Threatened and endangered species surveys have been conducted for all known areas that will be disturbed by the pre-construction and construction activities for the proposed Units 3 & 4. The Threatened and Endangered Species Survey Final Report (TRC 2006) by TRC included the existing known transmission corridors. The Transmission Line Macro-corridor Study (Photoscience 2007, included in Enclosure 2) performed by Photoscience and GPC included a threatened and endangered species survey for the proposed new 500 kV transmission line.

Reference

(TRC 2006) Third Rock Consultants LLC, Threatened and Endangered Species Survey Final Report, Vogtle Electric Generating Plant and Associated Transmission Corridors, for Tetra Tech NUS, Aiken, South Carolina, Lexington, Kentucky, January 16.

(Photoscience 2007) Photoscience, Thompson – Vogtle 500 kV Transmission Project. Prepared for Georgia Power Company. January.

**2.4-2d Will any additional surveys for threatened and endangered species be conducted prior to construction? Construction activities may not begin for several years, If there is not a plan in place to conduct these surveys, provide justification.**

Response:

Currently there are no additional threatened and endangered species surveys planned on site. If, at a later date, additional undisturbed areas are determined to be included in the construction footprint, threatened and endangered species surveys will be conducted as applicable. Additionally, if during the construction threatened and endangered species and "important" habitats are discovered construction activities in that area will cease until the necessary study is completed.

**2.4-2e During the site audit the staff learned that Georgia Power Company (GPC) biologists survey the area to ensure no threatened and endangered species are present prior to a timber harvest. Provide information on the activities or circumstances that prompt a survey for threatened and endangered species at VEGP. Is there any formal documentation for the results of these surveys? If so, provide a summary of the results of these surveys.**

Response:

The threatened and endangered species surveys associated with timber harvests or thinning are conducted annually, based on the predetermined areas to be harvested or thinned. These surveys are conducted site specific to the timber stands selected for harvesting. The Georgia Power Company (GPC) biologist use available county records maintained by the U. S. Fish and Wildlife Service (USFWS) and the Natural Heritage Program of the Georgia Department of Natural Resources (**GDNR 2004**), with the field surveys used for verification. These activities are prompted by requests from the foresters within the GPC, Land Department. A general information report of findings is generated for each timber harvesting location. Included in the matrix below are the available findings reports for the past five years (2002 – 2005).

RAI Response:

| Date Survey Conducted | Area Survey/Event | Summary Results and Comments |
|---|---|---|
| December 2006 | Vogtle 2007 thinning planned for the benefit of wildlife and Red Cockaded Woodpeckers and the Longleaf Pine improvement. | Vogtle 2007 thinning planned for the benefit of wildlife and Red Cockaded Woodpeckers and the Longleaf Pine improvement. No negative environmental issues have been identified. These thinning will be an improvement to the Longleaf Pine habitat. |
| May 11, 2005 | Boatramp Tract Stand # 553104 | This 85 acre stand will be thinned to remove poor quality longleaf and remove loblolly and shortleaf pine to manage the area for an uneven age longleaf pine stand. Some small openings will be planted with longleaf after thinning has been conducted. No environmental issues were identified in the field survey or through the data base review.<br>The stand will leave buffers along the roadways. |
| May 11, 2005 | Slash Pine Stand # 553101 | This 45 acre site will be thinned to improve the quality of the stand. No environmental issues were identified in the field or through the data base review.<br>The stand will leave buffers along the roadways. |
| May 11, 2005 | Vogtle Training Center Tract Stand #200601 | Twenty eight acres of this stand will be thinned to improve the quality of the stand. Another 26 acres will be clear-cut and replanted in longleaf pine. The clear-cut was marked to leave some large mast producing hardwoods. No environmental issues were identified in the field or through the data base review.<br>The stand will leave buffers along the roadways. |
| July 2003 | River Road Thinning | The River Road thinning is an approximately 75 acre tract of 15 year old trees. The trees are all located on upland areas with no hardwood drains, creeks or wetlands involved. This is a pine plantation with very little other vegetation. No protected species will be impacted by this thinning operation. Wildlife habitat will be improved by the thinning operation by opening up the area. No environmental concerns were identified on this site. |
| July 2003 | Telfair Improvement Thinning | This tinning of older timber is an approximately 80 acre tract. The thinning will remove weak or malformed trees to improve the stand. No hardwood drains, creeks or wetlands are located on the site. No protected species will be impacted by the thinning. No environmental concerns were identified on the proposed thinning. |

RAI Response:

| Date Survey Conducted | Area Survey/Event | Summary Results and Comments |
|---|---|---|
| March 26, 2002 | Timber adjacent to the Boat Ramp Tract #E553102 clear-cut | An 8 acre tract of upland mixed pine hardwood located adjacent to the Boat Ramp Tract #E553102 clear-cut was surveyed in the field. No wetland, stream or protected species issues were identified on the site. |
| January 24, 2002 | River Road Tract | This timber stand was reviewed for wetland, stream buffer and protected species concerns.<br>All areas are on high ground. No streams or wetlands will be impacted. No protected species concerns were identified through the field visit or literature review. |
| January 24, 2002 | Stand # E200102 | This timber stand was reviewed for wetland, stream buffer and protected species concerns.<br>This longleaf stand will be thinned to promote uneven age management. No streams or wetlands are on the site. No protected species were observed on the site through the site visit or through a literature review. Potential protected species habitat will be improved through this type of timber management. |
| January 24, 2002 | DeLaigle Tract | This timber stand was reviewed for wetland, stream buffer and protected species concerns.<br>This stand of planted pine is on a ridge with no streams or wetlands. The stand will be thinned which will improve wildlife habitat. No protected species concerns were identified during the site visit or through a literature review. |
| January 24, 2002 | Boat Ramp Tract Stand # E553102 | This timber stand was reviewed for wetland, stream buffer and protected species concerns.<br>This 50 year old Slash Pine site is located on the bluff near the Savannah River. The stand will be clear cut.<br>A hardwood buffer will be left on the edge of the bluff.<br>No wetland, stream, or protected species issues were identified on the site. |

Reference

**(GDNR 2004)** Georgia Department of Natural Resources, Nongame Animals and Plants, Georgia Rare Species and Natural Community Information, Locations by County, available at: http://georgiawildlife.dnr.state.ga.us/content/displaycontent.asp?txtDocument=89&txtPage=6,

**E2.4-2f Would there be any direct or indirect impacts on threatened and endangered species due to construction and operation of the new units at VEGP? Additionally, provide a discussion on how these impacts were developed.**

Response:

As mentioned in the response to RAI 2.4-2a, seasonal field surveys in search of threatened and endangered species were conducted in 2005 at the VEGP site and along 340 miles of VEGP-associated transmission lines (TRC 2006). No direct or indirect impacts to threatened and endangered species related to construction or operation of the new Vogtle units have been identified. Locations and other details regarding observed species and the 2005 surveys are provided in Section 2.4.1 of the ESP ER and in the TRC (2006) report.

Onsite impacts associated with construction and subsequent operation of the new Vogtle units have been evaluated in Chapters 4 and 5 of the ER. The additional generation from the proposed new units will require the addition of a 500-kV transmission line. The potential for environmental impacts associated with this 500 kV line have been evaluated in the recent Transmission Line Macro-corridor Study performed by Photoscience and GPC and provided in Enclosure 2 to this submittal (Photoscience 2007; provided as part of this submittal). GPC sites new transmission lines in accordance with Georgia Code Title 22, Section 22-3-161 and complies with all applicable laws, regulations, permit requirements, and good engineering and construction practices. Both Georgia Title 22 and the GPC Title 22 Procedure have been previously provided to NRC. No significant direct or indirect impacts to threatened and endangered species are expected from the construction and operation of Units 3 and 4 or the associated transmission lines. Threatened and endangered species impacts are considered SMALL.

References:

(TRC 2006) Third Rock Consultants LLC, Threatened and Endangered Species Survey Final Report, Vogtle Electric Generating Plant and Associated Transmission Corridors, for Tetra Tech NUS, Aiken, South Carolina, Lexington, Kentucky, January 16.

(Photoscience 2007) Photoscience, Thompson – Vogtle 500 kV Transmission Project. Prepared for Georgia Power Company. January.

**E2.4-2g On October 9, 2006, the staff was informed by GPC biologists that GPC had conducted a comprehensive threatened and endangered species survey of the transmission system in 2000. Provide the 2000 survey report that was conducted by GPC on the transmission lines (this is not the 2006 Third rock report). This report specifically addressed sensitive areas and threatened and endangered species occurrences within 0.5 miles of the transmission lines.**

Response:

A copy of the referenced report has been provided directly to PNNL by GPC.

**E2.4-2h Although no red-cockaded woodpeckers have been found at VEGP, the area north of the proposed borrow areas contains longleaf pine more that 100 years old and is suitable habitat for this Federally-listed species. Provide a copy of the red-cockaded woodpecker safe harbor agreement application that has been submitted for the VEGP Site.**

Response:

Safe Harbor Agreements are voluntary arrangements between the U.S. Fish and Wildlife Service (USFWS) and cooperating non-Federal landowners. These agreements are designed to promote voluntary management for listed species on non-Federal property while giving assurances to participating landowners that no additional future regulatory restrictions will be imposed. A Safe Harbor Agreement for the red-cockaded woodpecker is currently being developed for the VEGP site and will be submitted to USFWS in the first quarter of 2007. USFWS approval is expected by the end of the second quarter of 2007. All areas projected to be impacted by construction activities for the proposed VEGP Units 3 & 4 will be excluded from this agreement. SNC is actively working with its construction contractor to limit impacts to the existing onsite stands of long leaf pine.

**E2.4-2i Please provide the Wildlife Habitat Council 2003 Recertification Application and/or certification documentation for VEGP as well as Edwin I. Hatch Nuclear Plant (Plant Hatch) and Joseph M. Farley Nuclear Plant (Plant Farley).**

Response:

The most recent Wildlife Habitat Council (WHC) Recertification Applications for VEGP, Plant Hatch, and Plant Farley are listed below and included in Enclosure 2:

- 2006 WHC Recertification Application for Vogtle Electric Generating Plant
- 2005 WHC Recertification Application for Edwin I. Hatch Nuclear Plant
- 2005 WHC Recertification Application for Joseph M. Farley Nuclear Plant

VEPG was awarded its WHC certification November 14, 2006. Plant Hatch and Plant Farley were awarded their WHC certifications November 15, 2005. Each certification is valid for three years.

**E2.4-2j Provide a copy of the Wildlife Habitat Enhancement Management Plan. This management plan contains information on timber management, hunting, etc.**

Response:

There is no "Wildlife Habitat Enhancement Management Plan" for the VEGP site. Currently, Georgia Power Company manages VEGP wildlife through the Vogtle Land Management Plan and through the Forestry for Wildlife Partnership Program. The Forestry for Wildlife Partnership Program was formed by the Georgia Department of Natural Resources, Wildlife Resources Division and corporate forest landowners to conserve forests for wildlife. The Vogtle Land Management Plan is included in Enclosure 2.

**E2.4-3** **<u>Section 2.4.2 – Aquatic Ecology</u> – The ER provided references to previous analyses of the aquatic communities of the middle Savannah River upstream and downstream of the U.S. Department of Energy Savannah River Site (SRS) (including the VEGP site), which included algae, aquatic vascular plants, aquatic macroinvertebrates and fish which were performed between 1951 and 2005. These studies included one on fish abundance in the Savannah River and mouths of creeks draining into the Savannah River during the years 1983 to 1985. The basis for the information on fish in the ER appeared to come primarily from three documents, The Fishes of the Savannah River Plant (Bennett and McFarlane 1983), the eight volume Comprehensive Coolant Water Study prepared by Du Pont (1987) and Fishes of the Middle Savannah River Basin (Marcy et al.). Section 2.4.2.2.2 of the ER, Ichthyofauna of the Middle Savannah River, states that "Information on the fishes of the Middle Savannah River can be found in hundreds of publications." Provide a bibliography of all other known studies (not referenced in the ER) on the aquatic ecology of the Savannah River in the vicinity of VEGP, including field studies. Highlight the most recent, comprehensive and applicable resources.**

Response:

SNC's ER includes a bibliography that illustrates the kinds of aquatic studies that have been conducted by biologists at the University of Georgia's Savannah River Ecology Laboratory (SREL) and (Westinghouse Savannah River Company's) Savannah River Technology Center (now Savannah River National Laboratory) over the last several decades. While comprehensive, that bibliography does not include, for example, the many master's theses and doctoral dissertations done at SREL that have dealt with the biota of the Savannah River and its tributaries. SREL alone lists 2,996 publications in its reprint file. Not all of these publications are specific to the Savannah River and its tributaries, but the number gives an indication of the amount of ecological research done in the vicinity of VEGP since the 1950s. A good deal of this research has focused on the aquatic communities of the Savannah River and the tributaries that drain the Savannah River Site. Having established that a large number of research projects and monitoring studies over the last 50 years have focused on the Middle Savannah River and its tributaries since the Savannah River Site (formerly known as Savannah River Plant) began operating, the question of usefulness and applicability with respect to the Vogtle impact assessment must be addressed.

With regard to life histories of important Savannah River fish species, Marcy's et al. *Fishes of the Middle Savannah River Basin* (2005) is the best and most comprehensive source of information available. Bennett and McFarlane's *The Fishes of the Savannah River Plant: National Environmental Research Park* (1983), while less recent, also contains a wealth of useful information on habitat preferences, spawning habits, and diet of Savannah River fishes.

With regard to distribution and abundance of fishes, the series of reports prepared by the Academy of Natural Sciences (of Philadelphia) is the best information source. SNC used the 2001 report, which is entitled *2000 Savannah River biological surveys for Westinghouse Savannah River Co*. and cited as "Arnett 2001." This report includes summary results of previous years' sampling (specifically 1989, 1993, and 1997; the Academy does not survey the River annually) and puts the current year in the context of observed trends.

The Comprehensive Cooling Water Study, especially Volume V (Aquatic Ecology), presents the results of a two-year study of the fish communities of the Savannah River and its tributaries in the area of SRS, and includes information on the distribution and abundance of both adult fish and early life stages of fish. This document is also a useful compendium.

RAI Response:

With regard to impacts of cooling water intake structures on fishes of the Middle Savannah River, the best source of information is the document entitled *Impingement and Entrainment at the River Water Intakes of the Savannah River Plant* (DOE 1987). Although the CWIS proposed for Plant Vogtle will only use a fraction (approximately $1/14^{th}$) of the water that was used by the SRS production reactors in the 1980s and will employ closed-cycle cooling (as opposed to SRS's once-through cooling system), this study offers insights into which groups (shad and herring) and which species (spotted sucker, for example) appear to be most vulnerable to entrainment as ichthyoplankton and which species (bluespotted sunfish and threadfin shad, for example) appear to be most vulnerable to impingement as juveniles and adults. This study also indicated that there was a strong seasonal component to impingement, with most impingement occurring in the spring, rather than winter months.

McFarlane, Frietsche, and Miracle's (1978) *Impingement and Entrainment of Fishes at the Savannah River Plant* is based on studies conducted in the 1970s, but nonetheless contains valuable information. As in the 1987 DOE study, shad and herring suffered disproportionate entrainment losses. As in the 1987 study, bluespotted sunfish was the species most often impinged. These results would seem to validate the results of the 1987 study, and to that extent are very useful.

## A List of Publications Relating to Aquatic Communities of Middle Reaches of Savannah River, including Savannah River Site Tributaries

The following is a list of publications relating to aquatic communities of middle reaches of Savannah River, including Savannah River Site tributaries. Many of these can be properly characterized as field studies.

Academy of Natural Sciences of Philadelphia (ANSP). 1953. Savannah River biological survey, South Carolina and Georgia, June 1951-May 1952. Final Report for E. I. du Pont de Nemours and Company Savannah River Plant. Acad. Nat. Sci. Phila.

Academy of Natural Sciences of Philadelphia (ANSP). 1957. Savannah River biological survey, South Carolina and Georgia, August-September 1955, May 1956. Progress Report for E.I. du Pont de Nemours and Company Savannah River Plant. Acad. Nat. Sci. Phila. 210 pp.

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Academy of Natural Sciences of Philadelphia (ANSP). 1991a. 1990 Savannah River biological survey in the vicinity of Georgia Power and Light's Vogtle Nuclear Power Plant site for Westinghouse Savannah River Company. Rept. No. 91-18F. 151 pp.

Academy of Natural Sciences of Philadelphia (ANSP). 1991b. Savannah River biological surveys, June and September 1989 for Westinghouse Savannah River Company. Rept. No. 90-25F. Acad. Nat. Sci. Phila. 221 pp.

Academy of Natural Sciences of Philadelphia (ANSP). 1992c. 1991 Savannah River biological survey in the vicinity of Georgia Power and Light's Vogtle Nuclear Power Plant Site for Westinghouse Savannah River Company. Report No. 92-27F. Acad. Nat. Sci. Phila. 169 pp.

Academy of Natural Sciences of Philadelphia (ANSP). 1993. Savannah River cursory surveys for Westinghouse Savannah River Company 1992. Report No. 93-8F. Acad. Nat. Sci. Phila. 93 pp.

Academy of Natural Sciences of Philadelphia (ANSP). 1993. Spawning and nursery use of the Savannnah River Swamp by fishes and effects of the 1992 K-Reactor power ascension test. Report 93-7F for Westinghouse Savannah River Co.

Academy of Natural Sciences of Philadelphia (ANSP). 1994a. 1993 Savannah River biological survey in the vicinity of Georgia Power and Light's Vogtle Nuclear Power Plant site for Westinghouse Savannah River Company. Rept. No. 94-9F. 188 pp.

Academy of Natural Sciences of Philadelphia (ANSP). 1994b. Savannah River biological surveys 1993 for Westinghouse Savannah River Company. Rept. No. 94-14F. 341 pp.

Academy of Natural Sciences of Philadelphia (ANSP). 1995. 1994 Savannah River biological survey in the vicinity of Georgia Power and Light's Vogtle Nuclear Power Plant site. Rept. No. 95-11F for Westinghouse Savannah River Company.

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**E2.4-4 In late October 2006, the State of Georgia listed the blue-barred sunfish (Elassoma okatie) as an endangered species. The primary habitat of the blue-barred pygmy sunfish (according to Marcy et al. 2005 The Fishes of the Middle Savannah River) is roadside ditches and backwaters of creeks or rivers with brown-stained water and abundant vegetation. According to discussions with the staff at the Georgia DNR office, the blue-barred pygmy sunfish is present in creeks on the Yuchi Wildlife Management Area south of the site. Provide information on the potential occurrence of the blue-barred pygmy sunfish on the VEGP site (especially in the drainage from Mallard Pond and in the adjacent floodplain of the Savannah River at high water levels) including the relative distribution on-site, relative abundance, and potential impacts to these fish from construction and operation of VEGP Units 3 and 4.**

Response:

As noted in the RAI, the status of the bluebarred pygmy sunfish was elevated by Georgia DNR in late 2006. Until the mid-1990s, this species was thought to occur in only a few blackwater streams in South Carolina, but U.S. Army Corps of Engineers (Corps) biologists conducting surveys in 1995-1996 at Fort Gordon (in the upper portion of the Brier Creek drainage) found bluebarred pygmy sunfish in an onsite stream. Over the next several years, as Corps biologists refined their sampling techniques, bluebarred pygmy sunfish were found in several more streams, impoundments, and wetlands at Fort Gordon, suggesting that the species was more widespread and more abundant than previously assumed. Based on the RAI (above), this species has also been found recently in a stream or streams in the Yuchi Wildlife Management Area south of the Vogtle site.

Georgia Power (see Wiltz 1982) conducted surveys in the late 1970s of the resident fishes of Beaverdam Creek, a six-mile long stream that drains much of the area south and west of the Vogtle site. Daniels Branch, a tributary, was also sampled. Wiltz collected no pygmy sunfish (genus Elassoma) and no Lepomis or Enneacanthus species with which it could be easily confused. All sunfish captured were common species (e.g., redbreast, bluegill) or species not likely to be confused with the bluebarred pygmy sunfish. This suggests that few, if any, representatives of the genus Elassoma were in the Beaverdam Creek drainage in the late 1970s when the surveys were conducted. The blackwater streams of the Savannah River Site, across the river from Plant Vogtle, have been sampled since the early 1950s by

Westinghouse and Savannah River Ecology Lab scientists, none of whom (based on Marcy et al. 2005) has ever captured a bluebarred pygmy sunfish. According to the distribution map in Marcy et al. (2005), a population of bluebarred pygmy sunfish has been found in a small stream in Allendale County, SC, south of the Savannah River Site.

Georgia Power has not conducted systematic surveys for the bluebarred pygmy sunfish on the Vogtle site for obvious reasons: it is an obscure species that was first described in 1987 and was only granted legal protection by the state of Georgia in late 2006. The Corps biologists who discovered the bluebarred pygmy sunfish at Fort Gordon used specialized sampling apparatus (floating Plexiglas light traps) normally associated with larval fish studies rather than surveys of adult fish. Based on the fact Wiltz (1982) collected no bluebarred pygmy sunfish in the Beaverdam Creek drainage and the Mallard Pond drainage does not appear to provide suitable habitat (brown stained with abundant vegetation) for the species (outside of some beaver ponds), it appears unlikely that the species is present.

With regard to construction impacts, current plans call for use of Best Management Practices, including sediment basins, to minimize impacts of construction on water quality of Mallard Pond or other site streams. SNC has concluded that dewatering of Mallard Pond will not occur, therefore, impacts to fish in Mallard Pond would be SMALL.

Given that pygmy sunfishes (Elassoma spp.) are creatures of backwaters, bayous, oxbows, and swamps (Marcy et al. [2005] say “sluggish or still waters” and areas “where the current is weak”) rather than river channel habitats, it is unlikely that construction of new intake/discharge structures would affect this group (or the bluebarred sunfish in particular). It is also unlikely that plant operations would affect this group or this species. The only pygmy sunfish that has appeared, irregularly, in Savannah River fish samples collected by the Academy of Natural Sciences of Philadelphia is Elassoma zonatum, the banded pygmy sunfish (see Arnett 2001, 2000 Savannah River Biological Surveys for Westinghouse Savannah River Company).

## Section 2.5 Socioeconomics

**E2.5-1 Provide a justification (e.g., in terms of population density, distance, commuter routes, etc.) in paragraph or tabular form, that explains why each of the 28 counties within the 50-mile radius of the VEGP site were or were not included as part of the socioeconomic analysis.**

Response:

SNC has provided a table on the following page that details the population density, commuting distance from VEGP to the main population centers, and median household incomes for the 28 counties within the 50-mile radius of the VEGP site. SNC believes that, based on those criteria, it is reasonable to assume that new construction and operations, employees would distribute their residences as current employees have. Most of the counties in the 50-mile radius are very rural – only 12 have population centers with a population greater than 5,000. Corporations locate amenities (restaurants, shopping, entertainment) based on population and tend not to put them in areas with low populations. Most people will settle near amenities. The driving distance from the population centers of all but eight of the counties is greater than 50 miles. Finally, the median household income, which can be used as a surrogate for tax-supported services, school district funding, types of housing, and types of amenities, is less than $30,000 in all but 10 counties.

RAI Response:

Three counties have population centers greater than 5,000, a commuting distance of less than 50 miles, and median household incomes greater than $30,000:  Columbia (33.5% of current VEGP workforce), Augusta-Richmond (26%) and Aiken (4.3%).  Three counties meet two of the criterion:  McDuffie (0.3%; driving distance of 61 miles), Lexington (0, driving distance of 107 miles) and Burke (19.7%; driving distance of 17 miles).  Therefore, SNC thinks the reasonable counties to include in the socioeconomic evaluation are Burke, Columbia, and Richmond.  Together these three counties make up 80% of the existing VEGP workforce, and all have at least 20% of the workforce.  The county with the next highest percent of the VEGP workforce is Aiken, with approximately 4% of the workforce.

| NAME | STATE | No of VEGP residents (2005) | Population Density (2000) [a] | Largest Population Center[a] | Population Center Population[a] | Driving Distance from Largest Population Center to VEGP[b] | Median Household Income (1999)[c] |
|---|---|---|---|---|---|---|---|
| Bulloch | Georgia | 10 | 82.1 | Statesboro | 22,698 | 58.8 | $29,499 |
| Burke | Georgia | 170 | 26.8 | Waynesboro | 5,813 | 16.8 | $27,877 |
| Candler | Georgia | 2 | 38.8 | Metter | 3,879 | 64 | $25,022 |
| Columbia | Georgia | 289 | 307.9 | Martinez | 27,749 | 37 | $55,682 |
| Effingham | Georgia | 0 | 78.3 | Rincon | 4,376 | 75.6 | $46,505 |
| Emanuel | Georgia | 12 | 31.8 | Swainsboro | 6,943 | 57.6 | $24,383 |
| Glascock | Georgia | 2 | 17.7 | Gibson | 694 | 60.2 | $29,743 |
| Jefferson | Georgia | 13 | 32.7 | Louisville | 2,712 | 41.2 | $26,120 |
| Jenkins | Georgia | 16 | 24.5 | Millen | 3,492 | 32.9 | $24,025 |
| Johnson | Georgia | 2 | 28.1 | Wrightsville | 2,223 | 70.9 | $23,848 |
| Lincoln | Georgia | 3 | 39.5 | Lincolnton | 1,595 | 85 | $31,952 |
| McDuffie | Georgia | 3 | 81.7 | Thomson | 6,828 | 61.1 | $31,920 |
| Richmond | Georgia | 224 | 616.5 | Augusta-Richmond County | 195,182 | 32.5 | $33,086 |
| Screven | Georgia | 58 | 23.7 | Sylvania | 2,675 | 35.3 | $29,312 |
| Warren | Georgia | 0 | 22.2 | Warrenton | 2,013 | 72.3 | $27,366 |
| Washington | Georgia | 1 | 31.1 | Sandersville | 6,144 | 66.9 | $29,910 |
| Aiken | South Carolina | 37 | 132.9 | Aiken | 25,337 | 47.9 | $37,889 |
| Allendale | South Carolina | 1 | 27.5 | Allendale | 4,052 | 39.9 | $20,898 |
| Bamberg | South Carolina | 2 | 42.4 | Bamberg | 3733 | 66.6 | $24,007 |
| Barnwell | South Carolina | 4 | 42.8 | Barnwell | 5,035 | 57.1 | $28,591 |
| Colleton | South Carolina | 0 | 36.2 | Walterboro | 5,153 | 91.7 | $29,733 |
| Edgefield | South Carolina | 1 | 49 | Edgefield | 4,449 | 64.1 | $35,146 |
| Hampton | South Carolina | 0 | 38.2 | Hampton | 2,837 | 55.1 | $28,771 |
| Jasper | South Carolina | 0 | 31.5 | Ridgeland | 2,518 | 85.6 | $30,727 |
| Lexington | South Carolina | 0 | 308.9 | West Columbia | 13,064 | 106.9 | $44,659 |
| McCormick | South Carolina | 4 | 27.7 | McCormick | 1,489 | 71.1 | $31,577 |
| Orangeburg | South Carolina | 0 | 82.8 | Orangeburg | 12,765 | 84.6 | $29,567 |
| Saluda | South Carolina | 0 | 42.4 | Saluda | 3,066 | 78.6 | $35,774 |

a USCB 2000a
b Microsoft Corporation 2006
c  USCB 2000b

References:

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**E2.5-2 Please provide the revised New South report concerning historic and archaeological resources on the Vogtle site.**

Response:

A copy of the referenced report is provided in Enclosure 2.

**E2.5-3 Please provide the SNC response letter to the Georgia State Historic preservation officer (SHPO) letter of October 4, 2006, committing SNC to address the recommendations in the SHPO letter and committing to protective measures for 9BK416 and 9BK423.**

Response:

This response has been delayed pending resolution of COL related issues which require additional discussions with SHPO. A copy of the SHPO agreement letter will be provided upon resolution of all issues.

**E2.7-1 <u>Section 2.7.6 - Long-Term (Routine) Diffusion Estimates</u> Provide in electronic format, output from the XOQDOQ code used to calculate the $\chi$/Q and D/Q values due to routine releases of gaseous effluents to the atmosphere.**

Response:

An executive summary of the XOQDOQ analysis, including input files and assumptions, was provided to the NRC during the October 17-19, 2006 Environmental Site Audit. The XOQDOQ code is a publicly available code, and the NR C has SNC's electronic data input files and assumptions necessary to run the XOQDOQ code. With this information the NRC can generate confirmatory output files to verify the calculated $\chi$/Q and D/Q values reported in the ESP Application. The results of all pertinent analyses are presented and summarized in the ESP application.

As was communicated to the NRC staff during the site audit, it is SNC's practice not to provide internal design/evaluation calculation packages or analysis output files for posting on the docket.

**E2.7-2 Section 2.7.1.1 (Data Sources) Section 2.7.1.1 of the ER identifies several data sources used to characterize regional climatological conditions for the VEGP site. During the site audit visit in October 2006, the staff asked whether climatological summaries from the nearby SRS could also be consulted to further establish meteorological characterization of the VEGP site. Confirm if climatological data from the SRS was evaluated and, if so, discuss any findings that resulted.**

Response:

Meteorological and climatological information was obtained for the National Climatic Data Center (NCDC) first-order National Weather Service station in Augusta and for other nearby locations in its network of cooperative observer stations in order to characterize the climatological conditions at the VEGP site. The selection of stations to be included was based upon the following criteria:

- Proximity to the site (i.e., within the general site area - less than or equal to 50 kilometers).
- Data is readily obtainable from a reputable and trustworthy source (e.g., NWS)
- Selected stations in all directions surrounding the site, to the extent possible.
- Where there exists more than one station in a general direction around the site, a station is selected if it contributes one or more extreme conditions (e.g., rainfall, snowfall, temperatures) for that general direction.

The stations selected were considered to be reasonably representative of conditions that might be expected to be observed at the VEGP site and adequate for establishing the climatological characterization of the VEGP site. Therefore climatological summaries from additional sources, such as SRS were not consulted.

## Section 3.3 Plant Water Use

**E3.3-1 <u>Sections 3.3.2 Water Treatment and Section 3.6 Non-radioactive Waste</u> Although SSAR Tables 2.2-5 and 2.2-6 have been presented as listing all onsite chemical usage, describe the water treatment process for potable, cooling, and recirculation systems and identification and quantification of the chemicals used, as directed by ESRP Sections 3.3.2, 3.6.1, and 3.6.2 by providing the following:**

Response:

The details of this RAI are addressed in the responses to RAI E3.3-1a through g.

**3.3-1a A tabulation that identifies, quantifies, and lists the points of addition of chemicals and additives to be used by each system.**

Response:

The proposed new units at VEGP will utilize chemicals to support control of biofouling, corrosion, and solids deposition in a number of systems that depend on cooling water from the Savannah River. These systems are supplied by the natural draft cooling towers and some quantity of these chemicals or their decomposition products will be discharged to the environment via cooling tower blowdown. In addition, certain systems that use groundwater for cooling may also contain corrosion inhibitors and other chemicals to protect metallurgy. These systems may also be blown down, but only on a very small scale.

This blowdown is normally routed as makeup to the natural draft cooling towers. The amount of chemical residual in the blowdown from groundwater systems is small and when added to the approximately 5 million gallon volume of the cooling tower system, would essentially be undetectable. The new units will have a sewage treatment system to manage sanitary waste and a potable water system to provide water for drinking and sanitary use. These systems will use biocide to control biological growth and could use other chemicals to protect piping or enhance performance.

At this time, the treatment regimes for all of these systems for the AP-1000 design have not been determined. However, it is anticipated that these systems will be operated in a manner very similar to the comparable systems for Unit 1 and Unit2. In order to provide a meaningful response to the question, SNC will present information associated with Unit 1 and Unit 2 with the understanding that it is representative of the program that will likely be used for the two new units.

**Water Treatment**

**Cooling Towers**

The treatment program for the cooling towers has three elements: biocide, corrosion inhibitor, and dispersant. The fourth element is a reducing agent to remove residual from the oxidizing biocide use. The cooling tower treatment program is administered by NALCO Chemical in conjunction with site personnel. Chemicals are added by metering pumps directly to the cooling tower basin. The cooling tower blowdown from both units is routed to a mixing sump that also receives all of the other discharges from NPDES regulated systems (wastewater basins, liquid radwaste, steam generator blowdown, etc.) Ammonium bisulfite (a reducing agent) is added directly to the mixing sump by metering pump. The ammonium sulfite is added in stoichemetric excess to ensure all oxidizing biocide residuals are removed. The NPDES limits for cooling Tower Blowdown are 0.2 ppm Average Free Available Oxidant (FAO) and 0.5 ppm Maximum FAO. The time of oxidant discharge must not exceed 120 minutes. The chemicals utilized, their rate of application, and residual, where applicable is provided.

Oxidizing biocide is added in one of three forms: liquid sodium hypochlorite, liquid sodium bromide activated with sodium hypochlorite, or stabilized bromine. The biocide is added twice per week to achieve 0.2 -0.75 ppm FAO to ensure control of algae and general biofouling. Biocide is also added continuously for a period of 120 hours at a concentration of 0.5 ppm FAO to control Asiatic clams. The residual is removed by adding ammonium bisulfite directly to the cooling tower mixing box at a rate to ensure no residual oxidant remains. Sampling is conducted to confirm compliance. A polymer-based dispersant is added to keep silt suspended. The material is added in very low concentrations and displays very low toxicity to aquatic organisms. In addition to biocide and dispersant, a polymeric corrosion inhibitor is added to protect mild steel and tolytriazole is added for yellow/red metal protection. Since the system exerts a demand for corrosion inhibitor, only a small residual remains in the cooling tower. The residual is well below any level of environmental concern.

**Sewage Treatment**

Sewage treatment is accomplished using a package type flow through extended aeration unit that provides excellent treatment of sanitary waste. The waste is disinfected using liquid sodium hypochlorite. The effluent is routed to the 325,000 gallon wastewater retention basin prior to discharge such that disinfection is accomplished and no chlorine residual remains in the final effluent. Although not required by the NPDES permit, BOD, TSS, and fecal coliform are periodically monitored. All values indicate a high quality effluent and are trended to provide diagnostic information for the effluent.

**Potable Water**

Potable water is provided by wells onsite. The water is treated with sodium hypochlorite as a biocide. Phosphate may be used in areas where lead solder in pipe has resulted in high lead values. This problem will not occur in the new units and phosphate addition should not be required.

These programs are managed in strict compliance with the Vogtle NPDES Permit. Vogtle Units 1 and 2 have an outstanding compliance record.

**3.3-1b A list of chemicals processed through each system (e.g, corrosion inhibitors, antifouling agents) and total amounts used per year, frequency of use, and concentrations of these chemicals or their byproducts in the waste stream.**

Response:

The list is located in the ER Table 3.6-1. The concentrations and frequency of use for the listed chemicals are unknown at this time for the AP1000.

**3.3-1c The concentration factor on a seasonal basis for evaporative systems.**

Response:

This value is identified in the ER as four (4) cycles of concentration during normal operation. No seasonal adjustments for concentration factor are expected. The ER also identifies a concentration factor of two as an option, primarily to illustrate the changes in water withdrawal required to support such a change.

**3.3-1d The average and maximum concentrations of natural materials in effluent streams.**

Response:

The following analysis of Savannah River water is provided. The new Vogtle cooling towers will be typically operated at four (4) cycles of concentration.

**TABLE II A CW**
**SAVANNAH RIVER**
**TYPICAL WATER ANALYSIS (CATION)**

| CONSTITUENT CATION | as PPM | MAKEUP ANALYSIS | 6 CYCLE CW ANALYSIS |
|---|---|---|---|
| Calcium | Ca | 6.5 | 39.0 |
| Magnesium | Mg | 3.5 | 22.0 |
| Sodium | Na | 7.3 | 43.8 |
| Potassium | K | 1.9 | 11.4 |
| Aluminum | Al | 0.5 | 3.0 |
| Arsenic | As | <0.01 | <0.06 |
| Barium | Ba | <0.01 | <0.06 |
| Cadmium | Cd | <0.01 | <0.06 |
| Chromium | Cr | <0.014 | <0.084 |
| Copper | Cu | <0.01 | <0.06 |
| Iron | Fe | 0.3 | 1.8 |
| Lead | Pb | <0.01 | <0.06 |
| Manganese | Mn | 0.10 | 0.60 |
| Mercury | Hg | <0.001 | <0.006 |
| Nickel | Ni | <0.014 | <0.084 |
| Strontium | Sr | <0.13 | <0.78 |
| Zinc | Zn | 0.031 | <0.216 |

**TABLE II B CW**
**SAVANNAH RIVER**
**TYPICAL WATER ANALYSIS (ANION)**

| CONSTITUENT ANION | as PPM | MAKEUP ANALYSIS | 6 CYCLE CW ANALYSIS |
|---|---|---|---|
| Silica | $SiO_2$ | 7.5 | 45.0 |
| Bicarbonate | $HCO_3$ | 28.8 | 76.9 |
| Sulfate | $SO_4$ | 7.3 | 43.8 |
| Chloride | Cl | 4.8 | 28.8 |
| Fluoride | F | 0.08 | 0.48 |
| Nitrate | N | 0.28 | 1.7 |
| o Phosphate | P | 0.044 | 0.264 |
| t Phosphate | P | 0.353 | 2.12 |
| Ammonia | N | 0.21 | 1.25 |

**TABLE II C CW**
**SAVANNAH RIVER**
**TYPICAL WATER ANALYSIS**

| CHARACTERISTIC | UNITS | MAKE UP ANALYSIS | 6 CYCLE CW ANALYSIS |
|---|---|---|---|
| TDS | ppm | 60 | 480 |
| Total Hardness | ppm $CaCO_3$ | 30.8 | 184 |
| p Alkalinity | ppm $CaCO_3$ | 23.2 | 63.1 |
| m Alkalinity | ppm $CaCO_3$ | 30 | |
| pH, electrometric @ 23$^{o}$C | | 6.8 | 8.0 - 8.9 |
| Free $CO_2$ | ppm | 7.8 | |
| Conductivity | umhos/cm | 62.6 | 700 - 800 |
| Turbidity | NTU's | 21.8 | |
| Color | color units | 31.4 | |
| Ryznar Index @ 125$^{o}$F | | 10.3 | 5.8 - 6.8 |

**3.3-1e The operating cycles for each effluent treatment system for normal modes of plant operation (e.g., full power operation, shutdown/refueling, startup).**

Response:

There are no expected variations in operating cycles for any effluent treatment system associated with the new Vogtle units. With the exception of the sewage treatment plant, there are no systems defined as “effluent treatment systems” for the new Vogtle units. The cooling towers will be taken out of service for a short period during each refueling outage to clean fill material and remove solids from the basin. During startup and shutdown, the cooling towers will be closely monitored until heat load is removed or restored, but no changes to operational cycles are implemented. The sewage plant does experience fluctuations in flow as a result of daily changes in the number of plant employees as shift changes occurs. The day shift has the largest number of employees, so the flow drops shortly after the shift change each afternoon and remains low until day shift begans again the following morning. Based on experience with the existing Unit 1 and 2, the flow change is in the range of 20 percent. In addition to daily variations, the flow changes significantly during refueling or other outage periods as large numbers of contractors come on site for three to four weeks. Some of the wastewater attributed to increase in contractor personnel is offset by the portable toilets such that this wastewater does not enter the Vogtle sewage treatment plant. The increase in flow due to outage contractors can approach 40 percent. However, the duration is normally limited to four weeks or less.

The Vogtle sewage plant will be designed with a surge tank/lift station that provides attenuation of flow surges to ensure a reasonably constant influent flow rate. The extended aeration process is adversely impacted by large variations in flow. The presence of the surge tank alleviates much of this concern.

**3.3-1f The anticipated quantity and characteristics of treated sanitary effluent.**

Response:

Sanitary wastewater will be treated using a flow though activated sludge, extended aeration treatment process very similar to the process used for Unit 1 and Unit 2. The Unit 1 and Unit 2 NPDES Permit do not contain limits for treated sewage except for the emergency overflow point. The permit requires that the plant be operated and maintained at all times in accordance with best professional engineering judgment. The effluent from the Unit 1 and 2 system is pumped to the 325,000 gallon Wastewater Retention basin, where it is discharged along with other low volume plant wastewater. The estimated volume of treatment capacity required for the new units is 60,000 gpd.

**3.3-1g The ultimate disposal (both where and how) of treated effluents and the standards for the proposed sanitary systems.**

Response:

The treated sanitary wastewater will likely be routed to the same outfall as the Unit 1 and 2. Wastewater is pumped to the Wastewater Retention Basin, then to the blowdown mixing box and finally to the Savannah River. The wastewater is chlorinated as it exits the extended aeration unit. This approach provides storage and attenuation of the wastewater, and sufficient contact time for disinfection prior to discharge. Sludge is pumped out of the extended aeration units periodically (normally on an annual basis) and disposed offsite.

## Section 3.4 Cooling System

**E 3.4-1** <u>Section 3.4.1.3.4-Anti-Fouling Treatment</u> **This section of the ER discusses an additional option for treating biofouling in the make-up water obtained from the Savannah River that would be provided at the intake to ensure there is no biological fouling of the intake structure or the make-up water pipeline to the plant. Provide the location and description of the components for the addition of chemicals to the intake system. Provide the types of biofouling treatments that would be considered.**

Response:

This option was provided based on discussion with plant personnel who expressed a concern that the Unit 1 and 2 system did not have this capability to inject biocide at the river intake. The ability to inject biocide at the river intake allows the system operator the flexibility to treat this portion of the system if there is any indication of biofouling. However, VEGP Unit 1 and 2 have never experienced a problem with biofouling in this system.

The proposed VEGP Units 3 and 4 no longer anticipate the need for chemical treatment of the make-up water obtained from the Savannah River intake structure. This assessment is based on the operational experience of the existing Vogtle Units 1&2 intake structure.

SNC does not chemically treat the makeup water of the existing Unit 1 and 2 at the intake location. The bio-fouling control in the make-up pipeline is handled by maintaining an appropriate velocity to prevent the attachment of the bio-fouling species of concern to the piping. By utilizing this approach SNC is able to avoid having to de-chlorinate any make-up intake water that is diverted to the blowdown sump for radwaste dilution. The same approach would apply to VEGP Units 3 and 4.

## Section 3.9 Pre-Construction and Construction Activities

**E3.9-1** <u>Section 3.9-2</u>**, This section of the ER identified activities associated with limited Work Authorization ("pre-construction activities") as well as construction activities. Several of the activities mentioned on Page 3.9-3 are not included in Figure 3.1-3. These activities include the establishment of debris basins, solid waste storage areas, and settling basins and it is not clear whether these activities are included in the 500 acre footprint. It is also unclear if spoil piles for any dredge material are included in this footprint. Provide a comprehensive description of the activities associated with pre-construction or construction activity.**

Response:

RAI 4.3-1b provides a list of activities that result in disturbance and the corresponding acreage that makes up the 500 acre total. Response to E3.9-2 provides the GIS information for disturbed areas identified in Figure 3.1-3 and also includes a location for the river front structure spoil area. E3.9-2 through E3.9-9 provides a detailed description of pre-construction and construction activities associated with the identified 500 acres. Figure 3.1-3 will be updated to include the river front structure spoil area in the next revision to the ESP application.

**E3.9-2** <u>Section 3.9.2</u> **Provide a detailed map that identifies the disturbance footprint and associated pre-construction and construction activities. Also provide the GIS data used to produce the map, including line or polygon shapefile(s) of the area disturbed by each pre-construction or construction activity.**

Response:

Refer to Environmental Report (ER) Figure 3.1-3, ESP Site Utilization Plan, for details on areas disturbed by Vogtle Units 3 and 4 construction and pre-construction activities. Figure 3.1-3 will be updated to include the river front structure spoil area in the next revision to the ESP application. The GIS data files and a Disturbed Area Figure are provided in Enclosure 3.

**E3.9-3 Page 3.9-4 of the ER states that borrow areas will be in the southern and eastern parts of the VEGP site. Page 4.1-1 (Section 4.1.1.1) of the ER states that borrow areas will be in the northern part of the VEGP site. Reconcile the statements.**

Response:

Section 4.1.1.1 is correct. The borrow pits for this project will be in the northern portion of the site. Page 3.9-4 reflects earlier thinking and was not corrected to reflect the final decision. This will be corrected in the next revision of the ESP application.

In addition, the following figure "Disturbed Areas" provides an illustration of the GIS data files superimposed on a drawing of the plant site.

**E3.9-4 Sections 3.9.2.9 Docking and Unloading Facilities Installation and 3.9.2.10 Intake/Discharge Coffer Dams and Piling Installation and other portions of 3.9.2 Provide a description of the construction process that may be used for projects that may require a 404 permit. There is currently insufficient detail to determine whether there would be any dredge and fill activities associated with the pre-construction activities, including building access roads to and from riverfront structures, the new cooling water intake structure, the new discharge structure, modification of existing barge slip, and installation of proposed 500-kV transmission line. Provide information regarding the pre-construction activities that would have a dredge-and-fill component. Provide information on the quantities of material to be dredged and where these spoils will be placed. Discuss any sediment characterization that would be conducted on the dredged material.**

Response:

The following construction activities may require Clean Water Act Section 404 permits to support dredge and fill:

- Intake structure construction, including a portion of the access road
- Barge slip construction
- Discharge structure construction

For the purposes of this response, "Dredge and Fill" is defined as addition of material to or removal of material from a wetland that meets the definition of "jurisdictional wetland" in Section 404 of the Federal Clean Water Act. Dredge and Fill in jurisdictional wetlands requires a Section 404 permit issued by the US Army Corps of Engineers. A permit under Section 10 of the rivers and harbors Act may also be required for activities conducted in or adjacent to navigable waters.

The proposed construction process anticipates there will be excavation associated with the construction of the new Intake Structure, Barge Slip, and Discharge Structure a significant portion of the excavation will be performed in the Savannah River Floodplain in areas that meet the definition of jurisdictional wetlands. A permit under Section 404 of the federal Clean Water Act will be required. This permit will provide the controls necessary to ensure the excavation activities do not significantly impact the adjacent wetlands and the Savannah River. These controls are typically in the form of Best Management Practices (BMPs) to control erosion and sediment, and the discharge of turbidity to the Savannah River. The Section 404 permit will also contain a Water Quality Certification (WQC) issued by the Georgia Department of Natural Resources – Environmental Protection Division (EPD) to control discharge of water from the construction processes to the Savannah River. Due to the size of the project, coverage under the State of Georgia General Stormwater Permit for Construction Activities will also be required. This permit is also issued by Georgia EPD. Areas to be excavated for the new Intake Structure, Barge Slip, and Discharge Structure are shown in the cross-hatched section in Figure 1 of this document. The excavated material (approximately 300 $yd^3$) will be transported and placed in an upland spoils area (Riverfront Structures Spoils Area) located at approximate plant grid coordinates N12600 E9000, immediately adjacent to the intake structure access road between the new Intake Structure and the Power Block. This spoils area will cover approximately one acre and will contain the material to support dewatering. Once dewatered, the material will be useable for soil amendment or fill in upland areas of the site. Fill activity in the areas will primarily be limited to that associated with barge slip construction. The formation of the barge slip will require over excavation approximately 3' in depth to accommodate the placement of a 3' thick gravel bed (approximately 2,600 $yd^3$) at the bottom and within the envelope of the slip. In addition, there will be a small amount of rip-rap material placed in the river at the end of the discharge pipe to "armor" the bottom in the immediate area to minimize scour from the discharge.

There will be excavation, and cut and fill activities, associated with building the heavy haul road to/from the barge slip and the access road to the new intake area. No dredge and fill activities of the bed of the Savannah River are required to support construction of the aforementioned roads. The 7,200 ft long and 40 ft wide heavy haul road to/from the new Barge Slip and the 4,300 ft long and 20 ft wide Access Road to/from the new Intake Structure will consist of compacted in-situ and structural backfill (with crushed stone road base) material and will have a maximum road grade of approximately 6%.

The following provides specific details for the construction of the new Barge Slip, Intake Structure, and Discharge Structure.

**New Barge Slip Design:** As shown on Figure 1 of this RAI, the Barge Slip is located between the existing Units 1 and 2 intake canal, and the existing ring crane foundation. The barge slip would be excavated from the existing west side shoreline landward for a distance of 220'. The width of the barge slip would be 90'. The channel's side slopes and landward slope would be retained by vertical sheet pile walls. The finished depth below water surface would be about 10'. The excavation will be three feet deeper than the finished bottom to allow for placement of a bedding zone of gravel. The transport barges will be maneuvered into the channel with river tugs and either (1) moored to dolphins or bollards or, (2) sunk by ballasting such that the barge is founded on the gravel bedding zone.

Equipment or components will be removed from the barge by one of two methods. The heavier loads, those exceeding about 100 standard tons, will be "driven" off the stabilized barge with special transporters. The barge will be stabilized by adding water for ballast until it rests firmly on the gravel bottom, or by mooring or a combination of the two. Lighter loads will be removed from a moored barge by a gantry crane or ring crane. The gantry crane that may be used to remove loads weighing less than 100 tons will be either supported on rails or rubber tires, depending on final design. The crane rails (or runway for rubber tires) will be supported by either a strip footing or a pile-supported strip footing.

**New Barge Slip Construction:** The following installation sequence is the likely construction scenario. The preference would be to eliminate all wet excavation operations, and plan the installation of the barge slip from land. Working from a barge on the water is not desirable: The sequence and methods will likely include the following:

1. The construction will begin with the installation of a culvert and drainage system across the existing haul road in order to divert the storm water run off from the north side of the existing haul road to the south into the existing concrete lined drainage ditch away from the construction area.

2. The next sequential step is to grade and level the barge slip area to approximately Elevation 90' msl, and re-grade the surrounding area to tie-in with the existing haul road, intake canal and ringer crane foundation. This will require the removal of any existing rip rap along the footprint of the barge slip to allow for the installation of the sheet pile walls and the subsequent excavation. The excavated material will be loaded on trucks and transported to the upland Riverfront Structures Spoil Area. During this time one or two of the existing tie up dolphins at the current barge receiving area will require extraction and removal.

3. The sheet piles would then be driven to form the interior barge slip outline.

4. For the design option using an unloading gantry crane, compression piling would be installed (if required) at the exterior perimeter of the north and south sheet pile walls to accommodate a concrete crane rail pile cap. The piles and crane rail pile cap would be installed on each side of the barge slip from the mouth of the barge slip to the end of a load receiving area approximately 175' beyond the west end of the barge slip. An additional option for barge unloading may include additional piling and foundations at or near the existing ring crane foundation.

5. The barge slip interior soil anchor tie-backs, walers, bumpers, and tie-up bollards and cleats would be installed.

6. The next construction operation will be the installation of a tethered and floating silt curtain stretched across the entrance to the barge slip. The barge slip interior area would be then be excavated to a depth of approximately three feet below final grade of Elevation 70' msl, to approximate elevation of 67' msl. A backhoe, clamshell, or dragline equipment will be used to remove the majority of the material from the excavation. If the excavation remains relatively dry, small equipment may actually be placed in the excavation to complete the material removal and define the final dimensions. Excavation will begin at the west end of the slip and move toward the river, thus minimizing turbidity entering the river. The excavated material will be loaded on trucks and transported to the Riverfront Structures Spoils area. Based on the bathymetry survey conducted in 2006, the need for dredging from the end of the barge slip to connect with the federal navigation channel is not anticipated.

7. The next construction operation will place three feet of stone fill material on the bottom of the slip to provide a level and stable foundation for (stabilizing) barges prior to off loading heavy roll on/roll off loads. This fill operation will likely be performed utilizing a clamshell bucket and lattice boom crane.

8. Upon completion of the excavation and fill, and clean up and stabilization of the work area, the temporary silt curtain will be removed.

9. The final construction activity would be the erection and testing of the optional barge slip gantry crane.

10. After all construction activity is complete, the site will be stabilized and re-vegetated in accordance with permit requirements. Erosion and sediment controls will remain in place as long as necessary and will be removed only after vegetation is well established and controls are no longer necessary.

**Intake Structure and Canal Design:** As shown on ER Figures 3.4-3 and 3.4-4, the new river water intake consists of the intake canal and intake structure. The intake structure houses the river water make-up pumps, traveling screens, screen wash pumps, and associated equipment. From a permit perspective, the portion of the road to the intake located in the flood plain is also considered to be part of the intake.

The intake structure and canal is sized for three (3) AP1000 Units. However, only the mechanical components supporting VEGP Units 3 and 4 will be installed. The ER addresses water use and other operations impacts for only two units at this time.

The resized intake canal will be approximately 240' long x 170' wide (shown as 200' long x 150' wide on Figure 3.4-4 of the ER), with an earthen bottom at Elevation 70' msl, and vertical sheet pile sides extending to Elevation 98' msl. The intake structure, located at the end of the intake canal, will be an approximately 90' long x 125' wide (shown as 80' long x 100' wide on Figure 3.4-3 of the ER) concrete structure, with individual pump bays accommodating three pumps per unit. Figures 3.4-3 and 3.4-4 will be updated in the next revision to the ESP application.

**Intake Structure and Canal Construction:** The following description of the new Intake Structure installation sequence is a likely construction scenario. The intake construction process will employ environmentally-sound methods to minimize impacts to adjacent wetland areas and the Savannah River. The intake construction will be conducted under a Clean Water Act Section 404 permit. A Section 10 permit under the Rivers and Harbors Act will also be required. This project will also require coverage under the Georgia General Stormwater Permit for Construction. The preference would be to perform the excavation of the intake structure primarily from land, as opposed to working on the water, to minimize the dewatering effort and potential for impact to the Savannah River and adjacent wetlands. The sequence and methods proposed for the intake structure excavation and construction are described below:

1. Construction activities will begin with the clearing, grading, and grubbing of the access road and intake area. The trees will be harvested, as appropriate, and removed from site. Tree stumps will be removed and disposed along with tree branches and vegetation. Typical disposal methods include grinding stumps and limbs into mulch followed by land application in appropriate upland areas or removal offsite. Silt fences, and other erosion and sediment controls will be installed in drainage areas and at the perimeters of the disturbed areas, and the cut and fill operations associated with the building of the access road would begin. The access road would be built incorporating erosion and sediment control measures and road drainage systems consistent with the requirements of the Georgia Stormwater permit for the upland portions of the project. Additional controls required by the USACE 404 permit will be applied in wetland areas.

2. The intake canal and intake area will be excavated to just above high river water level and sloped to the shoreline. The excavated material would be managed in an upland area onsite for possible reuse in the canal banks. Erosion and sediment control measures and will be installed and BMPs utilized, as necessary for this storage area.

3. Permanent sheet piles forming the North and South banks of the intake canal would be driven using a vibratory or diesel hammer to form the north and south walls of a cofferdam. These walls will remain in place after construction. Temporary sheet piling would also be driven around the perimeter of the intake structure, and across the East or West face of the intake canal, to complete the cofferdam. All piling installations would be completed from land, as opposed to on the river. The excavation will be conducted in two phases. The intake area material will be excavated first, and the material inside the

canal will be left for later excavation. Material within the intake structure cofferdam will be excavated to elevation 70 feet. To match the bottom of canal elevation." The North and South canal bank interior anchor tie-backs and walers will then be installed and the interior would be backfilled and capped with gravel or concrete. The North and South exterior banks would then be stabilized with riprap material.

4. The interior of the cofferdam at the perimeter of the intake structure would then dewatered down to about 20' below water level, excavated and the material loaded into trucks and transferred to the upland Riverfront Spoils area. Dewatering would be performed using either a well-point system, or locally dewatered with pumps inside the dam. Once dewatered, installation of the intake base slab and forebay (i.e., the top of slab at Elevation 66' msl) would be completed and the walls and pump bays of the structure erected above river water level. The dewatering system could be removed at this point, but will likely be left in place until the entire structure was completed up to Elevation 125' msl, and debris removed from the interior. The excavation process will include controls to manage erosion and sediment and will also include controls, as necessary to ensure runoff from the excavation process, including the transport of material upland for disposal does not create environmental or aesthetic problems in the construction area. The discharge from the dewatering system will be managed in accordance with the provisions of the Clean Water Act Section 401 Water Quality Certification issued by Georgia EPD in support of the USACE Section 404 permit. Typically, this involves control of turbidity to ensure the receiving stream (Savannah River) is not significantly impacted and use of BMPs to prevent spills of oils or hazardous materials associated with the excavation equipment operation.

5. The next construction operation would be the installation of a tethered and floating silt curtain stretched across the entrance to the intake canal, and the excavation of the canal interior. The intake canal interior area would be excavated down to Elevation 70 msl'. This could be accomplished utilizing backhoe, clamshell, or dragline equipment. Excavation will begin at the west end of the canal cofferdam face and proceed towards the river, to minimize the potential for turbidity entering the river. The excavated material will be loaded on trucks and transported to on site spoils areas. The option to utilize a hydraulic dredge to vacuum the excavation to canal bottom grade where the disturbed material and turbidity is captured as a slurry and pumped to an upland area for dewatering and disposal will be retained. The discharge from the hydraulic dredge will be pumped to an upland spoils area with a retention basin where the solids are filtered out, and the water percolates into the ground or evaporates. The option of routing the discharge from this retention basin back to the river will also be retained. This discharge would also be governed by the provisions of the Water Quality Certification issued by Georgia EPD.

6. The final operations would include installation of the inner serrated weir wall, the outer serrated wall and guide vanes at the mouth of the intake canal and removal of the sheet pile cofferdam from the river side of the intake structure. This activity will be conducted from a barge located in the Savannah River. Appropriate environmental controls will be utilized for this phase of the operation to prevent spills and minimize environmental impact to the river and adjacent wetlands.

7. Temporary construction ramps at the canal and intake area will be removed and disturbed areas around the intake structure would then be stabilized and re-vegetated to preclude future erosion. Erosion and sediment controls will remain in place and will be maintained as long as necessary.

**Discharge Structure Design:** As shown in Section A of E3.9 Figure 1, the new Discharge Structure will consist of a 42 inch diameter steel pipe, that is reduced to a 24 inch diameter steel pipe at the point of discharge. The preliminary centerline elevation of the discharge pipe is approximately 3 feet above the Savannah River bottom elevation. Riprap will be placed around the discharge point to resist potential bottom scour due to the discharge jet from the pipe.

**Discharge Structure Construction:** The following description of the new discharge structure installation sequence is a likely construction scenario:

1. The construction installation will begin with the installation of a temporary sheet pile cofferdam driven to top of pile elevation of approximately Elevation 87' msl. A vibratory or diesel hammer would be used for the installation of the piling.

2. The interior of the cofferdam will be excavated to support pipe installation to a grade approximately 3' below the invert elevation of the discharge piping and contoured up the river bank. The excavated material would be transported by truck to the upland Riverfront Structures spoils area. The cofferdam will be dewatered using a well point system or local pumps. The discharge from the dewatering system will be controlled under the provisions of the water Quality certification issued by Georgia EPD in support of the Section 404 permit.

3. The H-piles for the piping supports will be driven to bottom elevation of 50' msl and top elevation of 83' msl. The horizontal pipe supports and pipe saddles will be installed on the H-piles to the required pipe invert elevation.

4. The next sequential activity is the installation of the filter cloth laid in the bottom of the excavation prior to the installation of the 24 inch diameter piping, transition piping, and the 42 inch diameter piping which would rest on the pipe saddles. The 42 inch diameter pipe will be connected to the main pipeline going to the power block. The upper horizontal pipe supports will then be installed.

5. The dewatering system would be removed and the discharge piping would be backfilled and graded to the required river bank slope contours.

6. Protective rip rap will be installed to stabilize the river bank and discharge point. The next operation is the removal of the cofferdam by cutting the sheet piling within one foot of the river bottom for piling below water level, and one foot below finished grade for piling on land. The final one foot of backfill will be installed over the piling and piping on land, and the disturbed area would be stabilized and re-vegetated to preclude future erosion.

**Proposed 500-kV Transmission Line Installation**: Wetland areas will be avoided in the routing of the proposed 500-kV transmission line if possible. In the event that wetlands are encountered, construction will be conducted in accordance with the necessary permits to protect wetlands areas.

**Dredged Material Sediment Characterization:** Sediment characterization of the material dredged in support of the new Barge Slip, construction is not required. Such characterization is sometimes required by the USACE or EPD in areas where a high probability of potential contamination exists from previous activities at the site. This requirement is sometimes placed on harbor work or work in heavily industrialized areas.

**E3.9-5** **<u>Section 3.9.2.9 Docking and Unloading Facilities Installation</u>, The ER states that "The existing barge slip must be enlarged to support unloading the AP1000 components and modules. The downstream sheet pile wall must be removed and the slip must be excavated to the correct dimensions. The downstream sheet pile wall will be reconstructed and the shore line stabilized prior to use." Provide a map of the site and vicinity delineating the areas of construction and indicate where the actual structure would be located. Provide the proposed construction activity schedule. Provide plan and section views of the new/expanded barge slip, If dredging is involved, identify the areal extent of dredging, the depth of dredging, and the volume of dredged material. Describe any fill material and the volume of material to be placed below the ordinary high water (OHW) level line.**

Response:

The ER reflects the information that was known at the time regarding the proposed barge slip. At that time, the plan was to place the barge slip in the end of the stormwater drain on the upstream side of the Unit 1 and 2 discharge structure piping. After further review, this location was determined to be unworkable and the current location between the ring crane foundation and the existing intake was chosen. ER Figure 3.1-3, Conceptual Site Utilization, provides a map of the site, showing existing Units 1 and 2, as well as the proposed Units 3 and 4, and shows the locations of all new facilities supporting the new units.

E3.9 Figure 1 provides a detailed plan the proposed location of the new Barge Slip to support construction of Units 3 and 4. The slip is located southeast of the existing River Intake Structure for Units 1 and 2, and northwest of the existing Barge Unloading Facility. The proposed construction activity schedule for the new Barge Slip would begin upon the issuance of the Early Site Permit (ESP), Limited Work Authorization (LWA), and other necessary permits.

The approximate construction schedule and durations are as follows:

| **Month** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| **Barge Slip Installation Activity** | | | | | | | | | |
| Install Silt Screens | ■ | | | | | | | | |
| Install Drainage System across Existing Haul Road | ■ | | | | | | | | |
| Grade and Level Barge Slip Area & Remove Dolphins | ■ | | | | | | | | |
| Drive Compression Piles for Gantry Crane and Optional Piles at Existing Crane Foundation | | ■ | ■ | | | | | | |
| Drive Sheet Pile to Interior Barge Slip Outline | | | ■ | ■ | | | | | |
| Install Soil Anchor Tie-backs, Walers, Bumpers, Bollards, and Cleats | | | | ■ | ■ | | | | |
| Install Pile Cap for Crane Runway | | | | | ■ | ■ | | | |
| Finish Grade, Install Bank Stabilization and Re-vegetation | | | | | | ■ | | | |
| Install Tethered and Floating Silt Curtain | | | | | | ■ | | | |
| ***Excavate Barge Slip Interior to 3' Below final Grade and Haul to Spoils Area | | | | | | ■ | ■ | | |
| Install 3' of Stone Bedding Material in Bottom of Barge Slip | | | | | | | ■ | | |
| Remove Temporary Silt Curtain | | | | | | | | ■ | |
| Erect and Load Test the Barge Slip Crane | | | | | | | | ■ | ■ |

***The timing of the barge slip excavation would be coordinated with the United States Army Corps of Engineers (USACE).

E3.9 Figures 1 and 2 provide the plan and section views of the new barge slip, providing proposed slip dimensions, required, cut, fill, and dredging quantities, and generic construction material details.

Construction of the new barge slip will require approximately 300 $yd^3$ (the quantity could be different at the time of construction) of soil to be dredged from the bed of the Savannah River as part of the formation of the east end (river interface) barge slip envelope. The depth of the dredging is to approximately Elevation 67'msl, with the boundaries of the area to be dredged shown in E3.9 Figure 1.

Construction of the Barge Slip will require nearly 2,600 $yd^3$ of stone fill within the basin of the slip, to provide a level and stable foundation for "grounding" the loaded barge.

**E3.9-6** **Section 3.9.2.10 – Intake/Discharge Coffer Dams and Piling Installation The ER discusses the construction of the intake and discharge structures. Section 4.3.2.1 of the ER provides a discussion of the potential impacts of construction of the VEGP Units 1 and 2 intakes, discharge and barge slip structures that were presented in the Final Environmental Impact Statement for VEGP Units 1 and 2. With regard to VEGP Units 3 and 4 pre-construction activities, provide the total area of disturbance during construction of the intake and discharge structures (separately) and the proposed construction activity schedule. Provide approximate seasons for the construction activities for these two structures, especially those anticipated to occur on the intake structure in the months when there is standing water on the Savannah River floodplain. Include a list of the best management practices that would be used to minimize impact to the aquatic ecology of the Savannah River from the construction of the intake and discharge structures.**

Response:

The proposed construction activity schedule for the Intake Structure and associated intake canal will begin after the issuance of the Early Site Permit (ESP), Limited Work Authorization (LWA), and other necessary permits. The intake structure pile driving would follow the new Barge Slip and Discharge Structure area pile driving. The best management practices are described in the response to RAI E4.3-1a. The approximate construction schedule and associated task durations are identified below. The schedule represents the sequence and total months required for the intake structure construction activity. The total pre-construction and construction schedule has 66 month duration. Section 404 Permits contain seasonal restrictions for construction activities. The 66 month schedule has the flexibility to accommodate seasonal variation in water level in the floodplains.

| Month | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Intake Installation Activity** | | | | | | | | | | | | | | | | | | |
| Install Silt Screens/Fences at the Perimeter of Area to be Disturbed | ■ | | | | | | | | | | | | | | | | | |
| Clearing, Grading, Grubbing of Access Road and Intake Area (Harvest Trees, Grid Stumps) | ■ | | | | | | | | | | | | | | | | | |
| Build Access Road - Cut and Fill Access Road, Install Road Base, Cap, Install Drainage System | | ■ | ■ | | | | | | | | | | | | | | | |
| Grade and Level Intake Area and Stabilize Work Area, Remove Excess Excavation to Spoils Area | | | | ■ | | | | | | | | | | | | | | |
| Drive Permanent Sheet Pile for North and South "Banks and Install Tie backs and Whalers | | | | | ■ | ■ | ■ | | | | | | | | | | | |
| Drive Temporary Sheet Pile Cofferdam for Intake Structure | | | | | | | ■ | ■ | | | | | | | | | | |
| Backfill and Cap North & South Banks and Stabilize with Rip Rap | | | | | | | | ■ | ■ | | | | | | | | | |
| Excavate Intake Cofferdam Interior to 20' Below Water Level and Haul to Spoils Area | | | | | | | | | ■ | | | | | | | | | |
| Install Dewatering System and Maintain | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | |
| Install Intake Base Slab and Forebay | | | | | | | | | | ■ | | | | | | | | |
| Install Walls, Pump Bays, and Top Slab Concrete to EL 125' | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | | | |
| Install Tethered and Floating Silt Curtain Across Entrance to Intake Canal | | | | | | | | | | | | | | ■ | | | | |
| **Excavate Intake Canal to EL 70', Send Material to Spoils Area (Hydraulic Dredge, Clam Shell, Drag Line or Excavator) | | | | | | | | | | | | | | ■ | ■ | | | |
| Remove Temporary Silt Curtain | | | | | | | | | | | | | | | ■ | | | |
| Install Exterior and Interior Serrated Weir Wall and Guide Vanes | | | | | | | | | | | | | | | | ■ | | |
| Clean Intake Structure and Remove Dewatering System | | | | | | | | | | | | | | | | ■ | ■ | |
| Extract Temporary Sheet Pile Cofferdam | | | | | | | | | | | | | | | | | | ■ |
| Finish Grade, Install Stabilization and Re-vegetation of Intake Area | | | | | | | | | | | | | | | | | | ■ |

**The timing of the intake canal excavation would be coordinated with the USACE.

The proposed construction activity schedule for the Discharge Structure could begin after the issuance of the Early Site Permit (ESP), Limited Work Authorization (LWA), and other necessary permits. The Discharge Structure area pile driving would follow the new Barge Slip pile driving.

The approximate construction schedule and associated task durations are as follows:

RAI Response:

| **Month** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| **Discharge Structure Installation Schedule** | | | | | | | | |
| Install Silt Screens/Fences at the Perimeter of Area to be Disturbed | ■ | | | | | | | |
| Clearing, Grading, Grubbing of Access Road and Discharge Area (Harvest Trees, Grid Stumps) | ■ | | | | | | | |
| Build Access Road - Cut and Fill Access Road, Install Road Base, Cap, Install Drainage System | | ■ | | | | | | |
| Grade and Level Discharge Area and Stabilize Work Area, Remove Excess Excavation to Spoils Area | | | ■ | | | | | |
| Drive Temporary Sheet Pile Cofferdam for Discharge Piping | | | | ■ | | | | |
| Excavate Intake Cofferdam Interior to 3' Below Pipe Invert Elevation and Contour up the River Bank (Haul to Spoils Area) | | | | ■ | | | | |
| Install Dewatering System and Maintain | | | | | ■ | ■ | | |
| Drive H Piling and Install Horizontal Pipe Supports and Saddles | | | | | ■ | | | |
| Install Filter Cloth | | | | | | ■ | | |
| Install 24"Ø, 42"Ø Piping and Upper Horizontal Pipe Support | | | | | | ■ | | |
| Remove Dewatering System | | | | | | | ■ | |
| Install Rip Rap, Backfill & Grade Shoreline Inside Cofferdam | | | | | | | ■ | |
| Cut and Remove Cofferdam | | | | | | | | ■ |
| Finish Grade General Area, Install Stabilization and Re-vegetation of Discharge Area | | | | | | | | ■ |

As shown on ER Figure 3.1-4, the estimated total area of disturbance for construction of the new Intake Structure and the new Barge Slip/Discharge Structure is approximately 12.5 acres and 10.3 acres, respectively. Refer to E3.9 Figure 1 for a breakdown of the areas of disturbance and sizes of specific portions of the structures.

As shown on E3.9 Figure 1, the sloped areas adjoining the Intake Structure will be covered with rip rap for protection during high water.

The best management practices are described in the response to RAI E4.3-1a.

The ordinary high water (OHW) level line is often taken as the elevation of the river bank which is approximately 85' msl at the intake structure site. However, the river reaches a level of approximately 89' msl on an annual basis in the late winter and spring months. Work on the intake structure is in the flood plain and it is anticipated that construction would be done in the summer, fall, and early winter to minimize the potential for unwanted flooding of the construction area.

**E3.9-7** <u>Section 3.9.2.10 - Intake/Discharge Coffer Dams and Piling Installation</u> **In addition to the information provided on Figures 3.4-2 and 3.4-4 for the new intake and discharge structures, provide the following information: 1) Distance from intake structure and discharge structure to Federal navigation channel; 2) Dimensions of all fill to be used in the Savannah River (including backfill and temporary fill for structures such as cofferdams and access roads); 3) Describe fill materials and number of cubic yards to be placed below the OHW level line; and 4) If dredged material is involved, show the extent of dredging, describe the type of material, number of cubic yards, and method of handling.**

Response:

The navigation channel is 90' wide and shown on E3.9 Figure 1. The minimum distance from the westernmost edge of the navigation channel is approximately 138'for the Intake Structure and approximately 105' for the Discharge Structure.

Construction of the new Intake Structure and the Discharge Structure will not require use of barge mounted equipment. Excavation will be performed using clamshell, dragline, backhoe, or other land-based excavation equipment. The possibility of using a hydraulic dredge for the intake canal has been retained and is discussed in the response to E3.9-4.

The access roads to and from the new Barge Slip and the new Intake Structure will not require any fill to be placed in the Savannah River. Construction of the Barge Slip will require an approximately 3' layer (approximately 2,600 $yd^3$) of stone fill within the 90' wide x 220' long basin of the slip, to provide a level and stable foundation for "grounding" the loaded barge.

No fill material will be required to be placed below the OHW level line, in the river or the floodplain, to support of construction of the new Intake Structure and the Discharge Structure. However, fill will be required in the sheet-pile-enclosed North and South banks of the intake structure below the OHW level (elevation 70' to 98' msl) and at the end of the discharge structure pipe to prevent scouring.

Refer to E3.9 Figure 1 for the boundaries of the dredging from the riverbed In support of construction of the Intake Structure and the Discharge Structure.

"Wet excavation" to support construction of the intake canal will be accomplished using backhoe, clamshell, or dragline equipment. Excavation will begin at the west end of the canal cofferdam face and proceed toward the river, to minimize turbidity entering the river. The excavated material will be loaded on trucks and transported to the Riverfront Structures Spoils Area.

A hydraulic dredge could be used to vacuum excavate to canal bottom grade where the disturbed material and turbidity is captured and pumped onto land. In that case the material will be transported to the spoils area and a retention basin will be used to dewater the material prior to disposal. The water will percolate into the ground, evaporate, or be discharged to the river in accordance with a Section 401 Water Quality Certification issued by Georgia EPD.

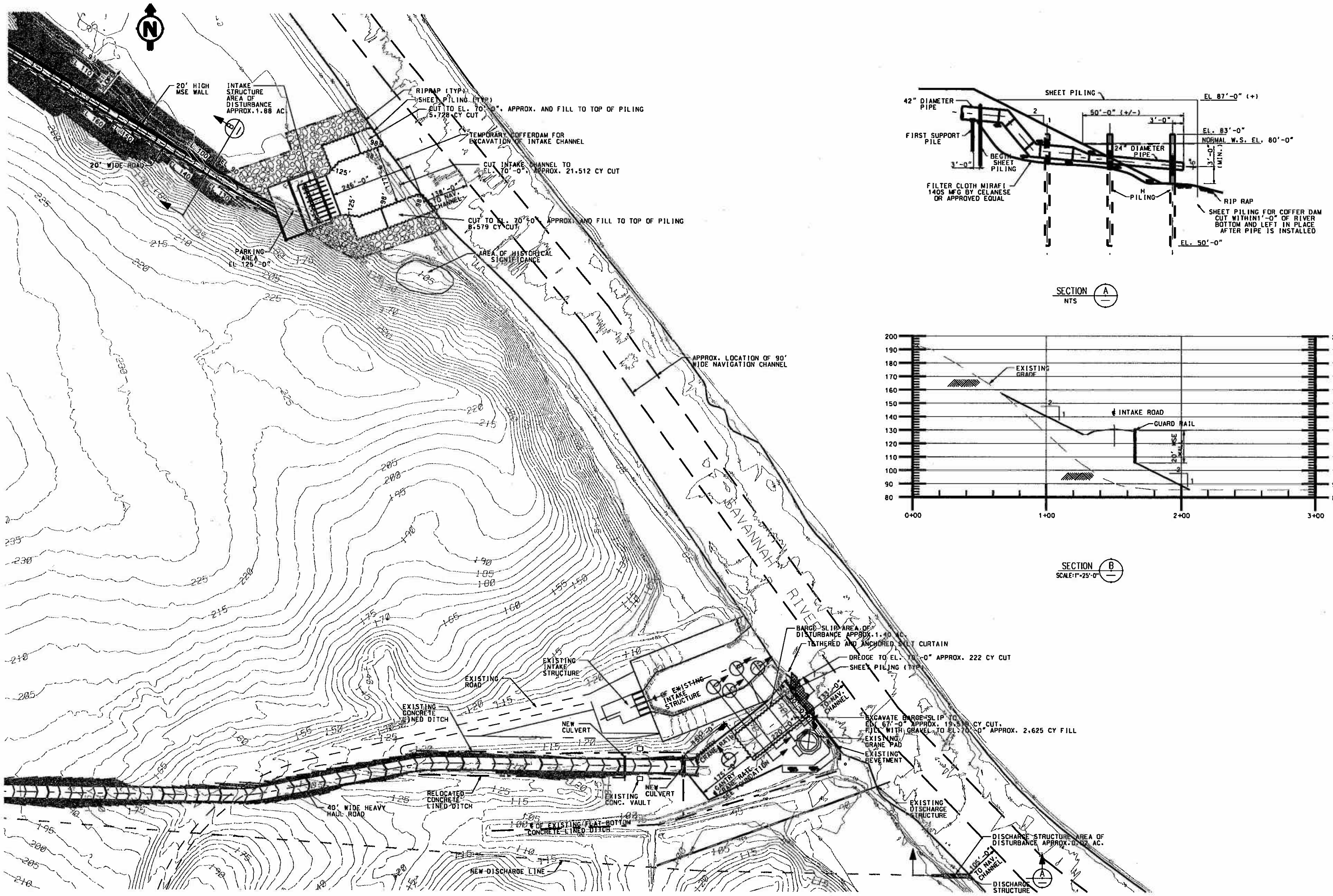



FIGURE 1.0 PLAN-RIVERFRONT STRUCTURES

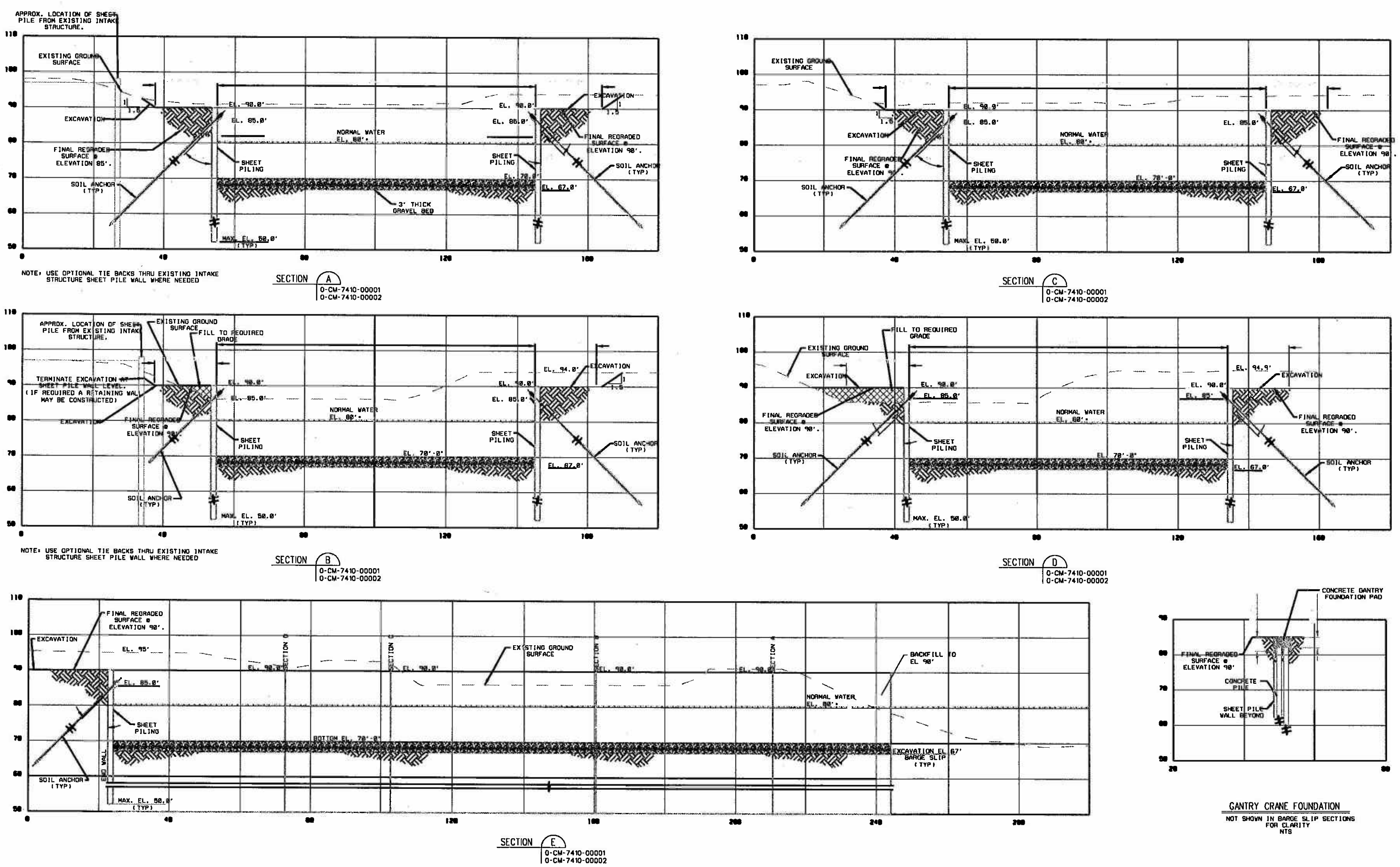



FIGURE 2.0 BARGE SLIP SECTIONS

## Section 4.1 Land Use Impacts

**E4.1-1 Page 4.1-2 of the ER states that an existing onsite landfill would be relocated onsite or the materials would be removed and disposed in an offsite permitted disposal facility. Later on the same page, the ER states that SNC maintains an onsite landfill that is permitted for inert construction and demolition debris. Are the landfills referred to in these two sentences the same landfill?**

Response:

VEGP currently operates two permitted landfills. Landfill 3 has one active trench for inert waste/demolition debris and is in the area of the proposed new 500 kV switchyard. Current plans call for removal of the active trench.

Landfill 2 is located north of the existing switchyard, near the old firing range and is closed with the exception of the asbestos trench, which has remaining capacity and is still being used. SNC is evaluating vertical expansion of the closed portion of this landfill as an option for future disposal of inert waste. The footprint will not change as only a vertical expansion is being considered. This expansion, if performed should not significantly impact the environment and will be evaluated at the time a decision is made

## Section 4.2.2 Water-Related Impacts

**E4.2-1** <u>Section 4.2.2 Water Use Impacts (Construction)</u> **Describe the process and the calculations that support conclusions regarding impacts of construction dewatering on the potentiometric surface at the site property boundary and at Mallard Pond. If a numerical model has been used, describe how data gathered during construction of VEGP Units 1 and 2 were used to calibrate the model. Describe the realistic or conservative aspects of the analysis, the conclusions reached, and the input and output files. If a model has not been employed to quantitatively analyze the potential impact of construction dewatering efforts for VEGP Units 3 and 4, then provide a qualitative assessment addressing the potential impacts of construction dewatering at the VEGP Site boundary and at internal points of interest (e.g., a complete data set from construction of Units 1 and 2 regarding the extent and magnitude of drawdown caused by dewatering the unconfined aquifer).**

Response:

The evaluation of impacts to the Water Table aquifer did not require the production of a numerical model. As discussed in Section 2.3.1 of the ER, including the groundwater elevation maps for the Water Table aquifer (Section 2.3.1), the flow within the Water Table aquifer is to site drainage features. Groundwater elevations range from approximately 130 feet to 160 feet msl. The top of the Blue Bluff Marl in the vicinity of the power blocks is approximately 137 feet msl. The Marl generally slopes downward to the north toward the head of Mallard Pond at an elevation of approximately 100 feet msl before continuing beneath the pond (refer to VEGP ESP SAR Figure 2.5.1-34). The closest distance from the edge of the proposed power block excavation to the property boundary is approximately 2,500 feet west. Because of the distance from the proposed excavation to the property boundary, the generally tight soil properties at the site, the shallowness of the Water Table aquifer above the marl, and the many drainage features between the area to be dewatered and the property boundary, no impacts near the property boundary are anticipated from dewatering activities at the power block.

RAI Response:

Prior to construction of Units 1 and 2, a dewatering contractor designed a drainage system for the excavation of the power block area. The soils in the area had highly variable water carrying capacities: from very low in denser material to extremely high where voids were encountered (**Bush 1974**). Tight soils over the marl made the use of a well point system to remove groundwater ineffective. The contractor instead excavated to the top of water in the power block area. Once groundwater was encountered, the contractor installed a series of trenches across the excavation connected to a trench along the perimeter of the excavation which fed a sump system on the south wall of the excavation. Groundwater was pumped to a settling basin from which it was released to the site's natural drainage systems which eventually flow to the Savannah River.

Dewatering caused a localized horizontal reversal in groundwater flow within the Water Table aquifer in the vicinity of the excavation. Flow originating from the area surrounding the excavation drained into the excavation (**SNC 2005 App. 2B)**. All evidence indicates that this effect was localized and did not have widespread impact.

Mallard Pond is fed by surface and horizontal groundwater flow from the Water Table aquifer that includes flow from a spring believed to be located in Utley Cave, a karst feature in a limestone area at the southwestern end of the pond. During dewatering operations for Units 1 and 2, flow to Mallard Pond was expected to be reduced, but not to cease (**SNC 2005 App. 2B**, **p. 2B-17**). Based on information provided by SNC, the flow to Mallard Pond did not stop during Unit 1 and 2 dewatering activities. However, there is no information as to the magnitude of flow reduction during the dewatering activities. Current flow out of the pond is approximately 250 gpm and is controlled by a standpipe (Section 2.3.1 of ER).

SNC will use a similar method for dewatering the proposed excavation for Units 3 and 4. Water will be removed from the excavation using the trench and sump method or an equivalent method and pumped to a settling pond or group of settling ponds prior to discharge to drainage systems that eventually flow to the Savannah River. The elevation of water in Mallard Pond is approximately 108 feet msl or 2 feet below the top of dam elevation of 110 feet msl. Because the top of the marl is approximately 137 feet msl and the pond elevation is approximately 108 feet msl, dewatering of the proposed excavation would not dewater Mallard Pond. However, dewatering activities could reduce groundwater flow from the excavation towards Mallard Pond. A reduction in recharge to Mallard Pond could reduce the flow rate into the pond. Since the outflow is controlled by a standpipe, the water level in the pond would not fall below the overflow of the standpipe.

Reference:

**(Bush 1974)** Bush, R.Y. 1974, Alvin W. Vogtle Nuclear Plant – Excavation Dewatering, letter form R.Y Bush to J.D. Duff

**(SNC 2005)** Southern Nuclear Company, Updated Final Safety Evaluation Report for VEGP, Revision 13, January 31.

**E4.2-2** **<u>Section 4.2.3 Water Quality Impacts</u> Page 4.2-4 of the ER states "SNC will have a passage dredged from the main channel of the Savannah River to new barge slip to facilitate movement of heavy equipment and components to the site by barge". Although Section 4.3.2, Aquatic Ecosystems, refers to the impacts from construction of the intake and discharge structures and barge facility, there is no reference to the impacts of dredging a passage from the main to the new barge slip. Provide a plan and section view and a map showing the area that would be disturbed, the depth of dredging and an estimate of the amount of habitat that would be destroyed.**

**Indicate how this activity is expected to impact important species. Provide a schedule for the dredging activities and relate how (and if) the timing of the dredging activities would affect the impacts to important aquatic species.**

Response:

SNC performed a bathymetry survey in the fall 2006 to determine the Savannah River cross section information in support of ESP modeling work. Based on review of this information, no dredging will be required to connect the barge slip to the navigation channel. As such, there will be no benthic impact associated with the barge slip. As a practical matter, the bottom material analysis conducted in this area shows the bottom to be largely composed of shifting sands with little habitat value. An estimated construction schedule is included in the response to RAI E3.9-5.

**E4.3-1** **<u>Section 4.3.1 Terrestrial Ecosystems ESRP</u> Section 4.3.1 directs the U.S. Nuclear regulatory Commission (NRC) staff's description, quantification and assessment of impacts of construction on the terrestrial ecosystem. To complete this assessment, the staff needs to have sufficient data on the proposed activities, schedule, footprint, habitats, and best management practices associated with pre-construction and construction activities. Therefore**

Response:

The details of this RAI are addressed in the responses to RAI E4.3-1a through e.

**E4.3-1a** **Provide information on best management practices that will be used to minimize impacts during pre-construction and construction activities. This should include information on clearing methods, erosion, runoff and siltation control methods (both permanent and temporary), dust suppression methods and other construction practices for control or suppression specific to the site. Tie each best management practice to the activity that it would support.**

Response:

Best Management Practices used to minimize impacts during pre construction and construction activities begin with programmatic Construction Environmental Control Plan being put into place.

Construction Environmental Controls Plan Contents

The plan contains descriptions of the environmental management controls that will be used on the site to assist in meeting the overall environmental management objectives for the project.

The processes for achieving these objectives are as follows:

1) Summary Matrix of Environmental Permit Requirements for Construction

While the existing plant procedures address current regulatory requirements and existing permit requirements, a Summary Matrix of Environmental Requirements for Construction will be prepared for all relevant construction-phase environmental requirements as contained in the project's permits. The summary will include a listing of the project-specific permit requirements, the titles of the persons responsible for ensuring compliance with each requirement, and the calendar or scheduled activity start dates by which compliance with each requirement must be completed and the current status of each action item.

2) Environmental Awareness Training

Mandatory environmental awareness training for all construction personnel is part of their regular site orientation. The training is provided before construction personnel, including subcontractor employees, are allowed to work onsite. The training provided is based on the environmental requirements applicable to the project and is project-specific. The following list provides a typical outline for the main topics covered in such a training session:

1. General Site Maintenance (e.g., staying within approved work limits, good housekeeping, no open burning, fire prevention);

2. Erosion and Sediment Control (e.g., assessing site conditions and erosion control requirements, installing and maintaining erosion and sediment control measures while working in area, reporting non-functioning erosion control measures);

3. Sensitive Areas Protection (e.g., working only within approved limits, maintaining buffers zones around sensitive resources, storing hazardous materials away from wetlands and streams, restrictions on dewatering near surface water bodies);

4. Unanticipated Discoveries (e.g., stop work immediately if archeological artifacts, contaminated soils, containers, pipes, and tanks are discovered/uncovered, immediately notify supervisor);

5. Hazardous Material/Waste Handling (e.g., hazard identification, segregation, container management, proper labeling, disposal at approved disposal sites);

6. Spills Prevention and Response (e.g., proper storage of hazardous materials, secondary containment, spill response and notifications).

The training session stresses the importance of maintaining "environmental awareness" in the employee's everyday duties. Environmentally sensitive areas on and adjacent to the site, as well as construction exclusion zones, are described and located on project drawings. The presentation is followed by a question and answer period. Attendance at the training session is mandatory and will be recorded in an appropriate training roster.

3) Environmental Compliance Reviews, Coordination, and Communication

Periodic site environmental compliance reviews and coordination meetings between site project personnel are conducted.

The purpose of these meetings is to discuss current and future construction work activities as they relate to maintaining environmental compliance. Typically, these meetings will be held in tandem with the weekly project status meetings but may be held more frequently as construction activities warrant (e.g., prior to commencement of construction activities in or near an environmentally sensitive resource). The meetings may also provide a forum to discuss and resolve any outstanding environmental corrective actions/issues.

4) Environmental Compliance Inspections and Documentation

Regular environmental compliance inspections of construction activities are performed. The field inspections are conducted and documented to confirm that the site activities remain in compliance with all applicable environmental requirements for the project. Areas/activities onsite covered during the inspections include:

1. Adherence with approved clearing limits, buffers, and exclusion zones;
2. Adequate installation and maintenance of erosion and sediment control measures;
3. Correct implementation of required mitigation measures for work in and around environmentally sensitive resources (e.g., wetlands, rivers and streams, archeological sites);
4. Proper solid waste management activities (e.g., sufficient number trash containers, waste segregation, use of designated storage areas, labeling);
5. Proper hazardous materials management activities (e.g., stored to minimize spills, reduce exposure, prevent fires/explosions); and
6. Implementation of fugitive dust control measures (e.g., watering roads, covering truck loads).

Environmental Inspection Report's are typically used to document the results of each site inspection and to note and describe any areas of concern requiring corrective actions. Identified corrective actions are provided to the appropriate personnel for resolution in a timely manner.

**Environmental Procedures**

Although current site environmental procedures address current regulatory and permit requirements, additional project permit requirements for construction would be incorporated and would address specific measures for mitigation during the construction phase. Sections of the procedures would address any construction activities not currently included. The following topics would be reviewed and sections of the procedures revised to address:

1) Noise and Vibration

Requirements related to mitigating noise and vibration impacts from construction activities may include measures such as restricting noise and vibration generating activities to daylight hours, prohibiting construction activities from specific roads and neighborhoods, use of less vibration producing equipment and/or methods (e.g., dampeners, staggering activities) and verifying that noise control equipment on vehicles and equipment is in proper working order. Notifications to regulatory agencies and nearby residents regarding atypical noise and vibration events (e.g., pile driving, blasting, and steam/air blows) may also be addressed in this section.

2) Air Quality (Fugitive and Vehicular Emissions)

Procedure sections will describe the techniques that will be used to minimize the generation of fugitive dust from construction activities and reduce the release of emissions from construction equipment and vehicles. Fugitive dust control measures such as watering of roads, covering truck loads and material stockpiles, reducing materials handling activities, and limiting vehicle speed are typically required. Visual inspection of emission control equipment is also a common requirement.

3) Erosion and Sedimentation Control

Procedure sections will describe the erosion and sediment control measures to be installed and maintained during the course of construction. These measures will cover temporary and permanent measures and all relevant detailed engineering drawings illustrating the permanent plant design.

Depending on project-specific conditions and permit requirements, the information addressed in this section may include:

1. Clearing limits and maintenance of existing vegetative cover;
2. Site grading;
3. Topsoil stripping and stockpiling;
4. Management of excess rock;
5. Temporary erosion controls (e.g., silt fencing, mulching, erosion control blankets, temporary seeding);
6. Permanent erosion controls (e.g., re-establishing natural drainage patterns, vegetated swales, permanent seeding/plantings);
7. Check dams, rip-rap, retention/detention basins, and sediment barriers;
8. Slope restoration and protection;
9. Roads and equipment crossings; and
10. Maintaining of drainage patterns.

4) Construction Storm Water Management

This section will describe the measures used to manage storm water runoff from construction areas and to prevent and/or minimize contamination of storm water due to project activities (e.g., hazardous material storage, waste management, material stockpiles).

Upon completion of detailed design the temporary and permanent storm water management measures will be addressed in the project-specific Erosion and Sediment Control Plan and Storm water Management Plan. These plans and all relevant detailed design drawings should be referenced there in, and address the erosion and sedimentation control measures to be used to control storm water runoff and to prevent and/or minimize contamination of storm water from project activities.

5) Protection of Sensitive Resources

The procedure section describes the mitigation measures for environmentally sensitive resources within the project site, or in the immediately surrounding area that are, or may be adversely impacted during construction. These areas have been identified during pre-construction surveys of the site area as part of the overall project development and permitting effort. The required mitigation measures are typically addressed in project permits.

The following lists some environmentally sensitive resources that are commonly encountered during construction activities along with the typical mitigation measures required to eliminate and/or reduce impacts on the resources.

1. Wetlands – primary mitigation measure is avoidance based on pre-construction surveys and installation of exclusion fencing. Some project activities may require temporary impacts to wetlands. These impacts will be mitigated by following permit/consent conditions which may include: reduced clearing limits and preservation of existing vegetative cover, maintenance of existing drainage patterns, prohibitions/ restrictions on equipment and vehicular travel, and prohibition of maintenance/refueling near wetland boundaries. The requirements for restoring disturbed areas would also be addressed.

2. Rivers and streams – primary mitigation measure is avoidance through installation of exclusion fencing. Direct impact to a waterway (e.g., crossing of a pipeline, constructing an access road, installation of discharge pipe) in which case specific mitigation measures may be spelled out in permits/consents. Mitigation measures may include: limits on the length of time of the disturbance; seasonal limits and restrictions for in-water work; reduced clearing limits and preservation of existing vegetative cover near the stream banks; installation of only specified crossings (e.g., mat bridges); use of silt curtains and other sediment transport barriers; restrictions on fill activities and materials; and restoration of stream beds, banks, and natural vegetation.

3. Areas of special status wildlife habitats or vegetation – primary mitigation measure is avoidance based on pre-construction surveys, establishment of buffer zones, and installation of exclusion fencing. In rare instances, construction activities may inadvertently encounter special status wildlife species, their habitat, or vegetation (e.g., threatened or endangered species), in which case work in the immediate area would be halted and environmental experts (including possibly agency officials and environmental consultants) would be contacted to determine proper mitigation measures so that work may resume.

4. Archeological/cultural resource areas – primary mitigation measure is avoidance based on pre-construction surveys, establishment of buffer zones, and installation of exclusion fencing. In rare instances, construction activities may inadvertently encounter buried archeological/cultural resources, in which case work in the immediate area would be halted and archeological experts (including possibly agency officials and environmental consultants) would be contacted to determine proper mitigation measures so that work may resume.

6) Unanticipated Discoveries

This section of procedure describes the procedure to be followed, including on and offsite notifications, in the event unanticipated discoveries are made during project construction. Unanticipated discoveries may include: contaminated or suspect soils and groundwater; buried pipes; drums and tanks; building foundations; cultural artifacts; and bones. Construction will be required to immediately stop work in the area of the unanticipated discovery and to immediately report the situation. For unanticipated discoveries that may be immediately hazardous to human health (e.g., broken natural gas line, medical waste, unexploded ordnance), the site safety representative would also be immediately notified. Additional investigations, such as sampling work and analysis, and notifications to appropriate agencies are typically made.

7) Hazardous Materials Management

This procedure section describes the hazardous materials management program that will be implemented and how all petroleum products and chemical substances (termed "hazardous materials") are managed to minimize the potential for threats to human health and the environment. The management program must address the need for Materials Safety Data Sheets (MSDSs) for all hazardous materials brought on site and county and state-specific requirements regarding handling, storage, secondary containment, and disposal.

8) Solid Waste Management (Hazardous/Non-Hazardous Wastes)

This procedure section will describe the solid waste management program for construction wastes generated at the site. The management program typically will address non-hazardous wastes and hazardous wastes through separate procedures. In all cases, the management program must be compliant with all relevant environmental requirements including country and state-specific waste handling and transportation practices and approvals, demonstrated waste minimization activities, and offsite recycling of certain common construction wastes (e.g., used oil, antifreeze, scrap metal, wood).

9) Asbestos and Lead-based Paint

In the event that construction activities may encounter hazardous substances such as asbestos, asbestos-containing material, and lead-based paint, this section will contain the county and state-specific regulatory requirements for containment and/or removal of such materials by trained, authorized personnel Site-specific procedures may also address regulations governing the overall management of the removal and abatement work including:

1. Pre-work notifications;
2. Removal by certified contractors;
3. Handling prior to disposal;
4. Transport to and disposal at licensed facilities; and
5. Post-work closure reports.

10) Spill Prevention and Response:

This section describes the spill prevention and response program and associated procedure. The section will address how to manage all hazardous materials and wastes in such a manner to prevent releases and to minimize the potential for threats to human health and the environment. The management program will address the need for secondary containment, spill response materials, spill thresholds for release to the environment (e.g., reportable quantities), emergency response actions, and notification requirements for project personnel, and appropriate agencies.

11) Cleanup and Restoration

The procedure section describes the requirements related to cleanup and restoration of the site and any other areas used by the project during construction (e.g., offsite laydown yards). Contractors will cleanup and remove all construction materials and debris, restore all surface (e.g., swales, roads, fences, gates, walls) and subsurface (e.g., drainage tiles, wells, utilities) features as per landowners' and permit/consent requirements, and adhere to all requirements regarding permanent stabilization, including re-vegetation of disturbed areas.

**E4.3-1b Provide the total number of acres that would be disturbed onsite.**

Response:

ER Figure 3.1-3, ESP Conceptual Site Utilization provides disturbed (shaded) areas for the permanent facility areas are as follows:

| | |
|---|---|
| Power Block | 75.2 |
| Cooling Tower | 69.3 |
| Switchyard | 68.7 |
| Intake | 12.5 |
| Barge/Discharge Structure | 10.3 |
| New 500KV T-line* | 25.7 |
| Simulator building | 4.0 |
| Onsite Roads* | 41.3 |
| Total | 307 |

(*Value provided is not shown in Figure 3.1-3).

The Figure also provides the temporary areas shown as follows:

| | |
|---|---|
| Parking | 44.5 |
| Batch Plant | 10.2 |
| Warehouse, office & laydown | 63.0 |
| Total | 117.7 |
| Spoils Areas, 2 @ 36 each Total | 72 |

The total disturbed area will be approximately 500 acres.

**E4.3-1c Provide the total number of acres of hardwood, planted pines, native pines, open fields and industrial areas that would be disturbed (this sum should add up to the "total number of acres") and list the activities associated with the disturbance. For example, 25 acres of hardwoods would be removed for the intake, 200 acres of native longleaf would be cleared for the borrow areas.**

Response:

The dominant habitat types were identified in the construction areas and are as follows:

| | |
|---|---|
| Power Block | 75.2 acres previously disturbed / planted loblolly pine |
| Cooling Tower | 69.3 acres previously disturbed / industrial |
| Switchyard | 68.7 acres open fields / planted loblolly pine |
| Intake | 12.5 acres bottomland hardwoods/wetlands |
| Barge Slip/Discharge Structure | 10.3 acres bottomland hardwoods/wetlands |
| New 500KV T-line | 25.7 varies-see PhotoScience Transmission Line Report |
| Simulator building | 4.0 acres mixed hardwoods and pine |
| Onsite Roads | 41.3 acres open fields, planted pine, previously disturbed |
| Parking | 44.5 acres planted longleaf pine |
| Batch Plant | 10.2 acres planted longleaf pine |
| Warehouse, office & laydown | 63.0 acres previously disturbed/mixed planted loblolly/longleaf pine |
| Spoils Areas, 2 @ 36 each Total | 72 acres mixed planted loblolly/longleaf pine |

The total disturbed area will be approximately 500 acres.

The above information is provided as an alternative to Table X-1, submitted in draft form in the Information Needs Request document developed by NRC in support of the October 2006 site audit. The table lists all acreage with the potential to be disturbed. It is unlikely that each activity will disturb the entire area identified and efforts will be made to minimize disturbance, where possible. The total disturbed acreage should be less than the 500 acre total noted above.

**E4.3-1d Provide a habitat map and the accompanying GIS data with hardwoods, planted pines, native pines, open fields and industrial areas in relation to the disturbance footprint.**

Response:

The available GIS information is provided in Enclosure 3.

**E4.3-1e Provide the linear extent of shoreline that would be disturbed by construction activities associated with the new intake and barge slip.**

Response:

The length of disturbance of the shoreline at the Intake Structure and barge slip will be approximately 180 feet and 90 feet, respectively.

## Section 4.4 Socioeconomic Impacts

**E4.4-1** **<u>Section 4.4.2.2.1 (Economic Impacts to the Community)</u> Section 4.4.2.2.1 of the ER states, "the creation of such a large pool of jobs would inject millions of dollars into the regional economy…" Subsequent to the submission of the ER to the NRC, further information was provided to substantiate this claim, based on U.S. Department of Labor Statistics and a "sensitivity analysis" that was referenced. This "sensitivity analysis," however, was not provided. Provide the sensitivity analysis that was performed to further assess the impacts of the construction worker wages on the region. [Note: It appears as though a different table, rather than the sensitivity analysis was mistakenly attached to the December 11, 2006 submittal to the NRC.]**

Response:

SNC has reviewed the previous submittal to the NRC (December 11, 2006) and determined that the sensitivity analysis was included in that submittal. It is the smaller table in the lower left-hand corner of page 3 of 3 of Attachment A-2, #25 to AR-06-2684 and is reproduced here. The sensitivity analysis estimates the dollars that would be infused into the local economy at various level of spending by the construction workforce.

RAI Response:

**Estimated Construction Work Force Wages**

| Month | Workforce Strength | Avg. Monthly Wage[a] ($) | $ Earned by Construction Workforce | Month | Workforce Strength | Avg. Monthly Wage[a] ($) | $ Earned by Construction Workforce | Month | Workforce Strength | Avg. Monthly Wage[a] ($) | $ Earned by Construction Workforce |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Limited Work Authorized Activities | | | | 10 | 3500 | $1,840 | $6,440,000 | 38 | 4350 | $1,840 | $8,004,000 |
| -18 | 80 | $1,840 | $147,200 | 11 | 3600 | $1,840 | $6,624,000 | 39 | 4275 | $1,840 | $7,866,000 |
| -17 | 160 | $1,840 | $294,400 | 12 | 3700 | $1,840 | $6,808,000 | 40 | 4250 | $1,840 | $7,820,000 |
| -16 | 230 | $1,840 | $423,200 | Construciton on Second Unit | | | | 41 | 4225 | $1,840 | $7,774,000 |
| -15 | 300 | $1,840 | $552,000 | 13 | 3800 | $1,840 | $6,992,000 | 42 | 4200 | $1,840 | $7,728,000 |
| -14 | 380 | $1,840 | $699,200 | 14 | 3850 | $1,840 | $7,084,000 | 43 | 4175 | $1,840 | $7,682,000 |
| -13 | 460 | $1,840 | $846,400 | 15 | 3900 | $1,840 | $7,176,000 | 44 | 4150 | $1,840 | $7,636,000 |
| -12 | 530 | $1,840 | $975,200 | 16 | 3950 | $1,840 | $7,268,000 | 45 | 4125 | $1,840 | $7,590,000 |
| -11 | 610 | $1,840 | $1,122,400 | 17 | 4000 | $1,840 | $7,360,000 | 46 | 4100 | $1,840 | $7,544,000 |
| -10 | 700 | $1,840 | $1,288,000 | 18 | 4050 | $1,840 | $7,452,000 | 47 | 4075 | $1,840 | $7,498,000 |
| -9 | 820 | $1,840 | $1,508,800 | 19 | 4100 | $1,840 | $7,544,000 | 48 | 4050 | $1,840 | $7,452,000 |
| -8 | 960 | $1,840 | $1,766,400 | 20 | 4150 | $1,840 | $7,636,000 | 49 | 4025 | $1,840 | $7,406,000 |
| -7 | 1130 | $1,840 | $2,079,200 | 21 | 4175 | $1,840 | $7,682,000 | 50 | 4000 | $1,840 | $7,360,000 |
| -6 | 1310 | $1,840 | $2,410,400 | 22 | 4200 | $1,840 | $7,728,000 | 51 | 3975 | $1,840 | $7,314,000 |
| -5 | 1480 | $1,840 | $2,723,200 | 23 | 4250 | $1,840 | $7,820,000 | 52 | 3950 | $1,840 | $7,268,000 |
| -4 | 1660 | $1,840 | $3,054,400 | 24 | 4275 | $1,840 | $7,866,000 | 53 | 3925 | $1,840 | $7,222,000 |
| -3 | 1830 | $1,840 | $3,367,200 | 25 | 4300 | $1,840 | $7,912,000 | 54 | 3900 | $1,840 | $7,176,000 |
| -2 | 2000 | $1,840 | $3,680,000 | 26 | 4350 | $1,840 | $8,004,000 | 55 | 3875 | $1,840 | $7,130,000 |
| -1 | 2175 | $1,840 | $4,002,000 | 27 | 4375 | $1,840 | $8,050,000 | 56 | 3850 | $1,840 | $7,084,000 |
| Construction on First Unit | | | | 28 | 4400 | $1,840 | $8,096,000 | 57 | 3825 | $1,840 | $7,038,000 |
| 1 | 2350 | $1,840 | $4,324,000 | 29 | 4400 | $1,840 | $8,096,000 | 58 | 3800 | $1,840 | $6,992,000 |
| 2 | 2525 | $1,840 | $4,646,000 | 30 | 4400 | $1,840 | $8,096,000 | 59 | 3700 | $1,840 | $6,808,000 |
| 3 | 2700 | $1,840 | $4,968,000 | 31 | 4400 | $1,840 | $8,096,000 | 60 | 3600 | $1,840 | $6,624,000 |
| 4 | 2870 | $1,840 | $5,280,800 | 32 | 4400 | $1,840 | $8,096,000 | 61 | 3500 | $1,840 | $6,440,000 |
| 5 | 3045 | $1,840 | $5,602,800 | 33 | 4400 | $1,840 | $8,096,000 | 62 | 3000 | $1,840 | $5,520,000 |
| 6 | 3180 | $1,840 | $5,851,200 | 34 | 4400 | $1,840 | $8,096,000 | 63 | 2500 | $1,840 | $4,600,000 |
| 7 | 3250 | $1,840 | $5,980,000 | 35 | 4400 | $1,840 | $8,096,000 | 64 | 2000 | $1,840 | $3,680,000 |
| 8 | 3300 | $1,840 | $6,072,000 | 36 | 4400 | $1,840 | $8,096,000 | 65 | 1000 | $1,840 | $1,840,000 |
| 9 | 3365 | $1,840 | $6,191,600 | 37 | 4350 | $1,840 | $8,004,000 | 66 | 500 | $1,840 | $920,000 |
| | | Subtotal = | $79,856,000 | | | Subtotal = | $214,314,000 | | | Subtotal = | $193,016,000 |

| Total $ earned by construction workforce = | $487,186,000 |
|---|---|

**Sensitivity Analysis**

| % of Total Construction Workforce Wages that could be Spent in Region | $ |
|---|---|
| 10 | $48,718,600 |
| 20 | $97,437,200 |
| 30 | $146,155,800 |
| 40 | $194,874,400 |
| 50 | $243,593,000 |
| 60 | $292,311,600 |
| 70 | $341,030,200 |
| 80 | $389,748,800 |
| 90 | $438,467,400 |
| 100 | $487,186,000 |

a. U.S. Department of Labor Bureau of Labor Statistics. 2005. "May 2005 Metropolitan Area Occupational Employment and Wage Estimates. Augusta-Richmond County, GA-SC." Available online at http://stats.bls.gov/bls/blswage.htm. Accessed October 16, 2006.

**E4.4-2** **<u>Section 4.4.2 (Social and Economic Impacts) and Section 5.8.2 (Social and Economic Impacts</u> With regard to transportation issues during the construction period, Section 4.4.2.2.4 of the ER states, "SNC has assumed that there will be four construction shifts and each shift will include 25 percent of the total construction workforce." In order to thoroughly assess any potential bottlenecks or other transportation issues, please provide further information on construction and operation assumptions. For example, a statement similar to the following (with bold-faced letters and underlined statements filled in) should be provided; (the second paragraph pertains to section 5.8.2.2.4)**

**Based on SNC's past experience constructing power plants, and considering future contracting arrangements, a likely scenario with regard to construction scheduling would involve X construction shifts, where each shift works approximately X days per week, X hours per day. Each day, operations shifts run from X to Y, Y to Z, and Z to X. There would be X construction shifts per day, from X to Y and from Z to A. [Expand this to include all shifts. Inclusion of a Gantt chart to illustrate this schedule would be useful.]**

**Once the plant is fully operational, there would be periodic fluctuations in traffic to and from the plant during outage periods, which would occur, on average, every X months, during non-peak seasons (spring/fall). Outages typically increase on site workforce by X, and the temporary workforce primarily resides in local hotels/apartments, commuting in vehicles/carpools. [Inclusion of a second Gantt chart to illustrate this schedule would be useful.]**

Response:

Shifts were varied during the construction of VEGP Unit 1 and 2, and are varied now during operations, and modified as needs dictate. SNC would continue varied shifts for Units 1 and 2 during the construction of Units 3 and 4, and for all units after Units 3 and 4 began operations. SNC would likely stagger or vary the construction shifts as well. The analysis presented in Section 4.4.2 was a simplified conservative assumption to project a conservative impact. In reality, the impact is likely to be less because SNC will use multiple varied or staggered shifts. The ESP application assumed no staggered or varied shifts for the existing workforce.

**Operations Shifts, non-outage (Winter 2007)**

Approximately 15% of staff: on two -12 hour shifts 7 days a week, 6:00 a.m./6:00 p.m.

Approximately 10% of staff one - 8 hour shift Monday thru Friday, 6:30 a.m. – 3:00 p.m.

Approximately 55% of staff one - 8 hour shift Monday thru Friday, 7:00 a.m. - 3:30 p.m.

Approximately 20% of staff one - 8 hour shift Monday thru Friday, 7:30 a.m. – 4:00 p.m.

**Outage Shifts**

During outages most of the plant staff and the outage workforce are on 12-hour shifts 24/7. The outage shifts are staggered with start/end times between 6-7a.m/6-7p.m. A small percentage of the operations staff remains on an 8 hour shift Monday thru Friday. Once Units 3 and 4 are operational SNC would establish a similar shift routine.

**Construction Shifts**

At the peak of construction of Unit 1 and 2 there were four construction shifts that accounted for approximately 80% of the construction force with 20% working different shift schedules. The construction schedule for 80% of the workforce was two 10- hour shifts Monday thru Thursday and two 12-hour shifts Friday thru Saturday. The construction schedule for the new units would be similar.

For the analysis in the ESP application SNC assumed 25% of construction staffing on each shift. This is fairly close to the expected construction workforce on the Monday thru Thursday day shift and conservative for all other shifts.

One possible construction workforce shift scenario that would minimize impacts to the operation workforce is described below. Under this scenario, most of the construction workforce would not be traveling to/from VEGP at the same time as the existing operations workforce.

Two 10-hour shifts Monday thru Thursday, 6:00 a.m. – 4:00 p.m. and 4:00 p.m. – 2:00 a.m.

Two 12-hour shifts Friday thru Saturday, 6:30 – 630 a.m. – p.m. and p.m. to a.m.

**E4.4-3** <u>**Section 4.4.2 (Social and Economic Impacts)**</u> **Provide the Bechtel report associated with Table 4.4.2-1, which addresses manpower curves, derivation of local skilled craft labor force, and the time period of estimated employment for entire workforce.**

Response:

The Total Peak Workforce associated with Table .4.4.2-1 is an estimate derived based upon three elements and reported in sections 3.10. The three elements of the workforce estimate are:

1. The proposed overall construction schedule for two AP-1000 units.

2. The number of job hours necessary to install and start-up the two units.

3. The estimated net generation output of two AP-1000 units at the Vogtle site used to determine job hours.

The project construction schedule assumes 18 months site preparation and 66 months of construction for a total construction schedule 84 months.

The number of job hours necessary to build and startup two AP-1000 units was estimated based upon Bechtel historical construction data (job hours per net kilowatt installed for closed loop cooled PWR construction, from actual units constructed after 1974 under a 10CFR50 Appendix B program). In that the AP1000 design is highly modularized, where many field job hours are moved from onsite to off site in order to build the modules, the historical number of field job hours had to be reduced to account for the modularization. To account for the modularization, the historical based number of 25 job hours per kilowatt was reduced to 20.5 job hours per kilowatt for the AP-1000.

The estimated net generation output is required in order to utilize the historical workforce data. The net kilowatt output for two AP-1000 units at the Vogtle site is estimated to be 2x1117 MW or 2,234,000 Kw output.

With the above three estimating elements, the total number of job hours to construct the two units was calculated by multiplying the estimated total net kilowatt output times the estimated 20.5 job hours per kilowatt. The total job hours were then converted to equivalent person months by dividing by 173 hours per month to arrive at full time equivalent person months.

The total equivalent person months were then spread over the 84 month project schedule, using a logical ramp-up curve for the manpower.

The net result reflects an estimated 4400 Total Peak Construction and Startup Workforce.

The estimated skilled craft labor force is derived from an assessment made in May 2005 of the known Central Savannah River Area Construction Building Trades members. The time period of estimated employment is a function of scheduled manpower needs as illustrated in Figure 3.10-1.

**E4.4-4** **<u>Section 4.4.2 (Social and Economic Impacts)</u>, Section 4.4.2.2.2 of the ER states that "the assessed value of the plant during construction is estimated to be greater than $0 and less than actual cost." Provide a rough order of magnitude (ROM) estimate of this assessed value (e.g., based on $/kwh or some other generally accepted ROM algorithm). A range would be sufficient; however, it should involve actual numbers on both ends of the range.**

Response:

The estimated cost of each AP1000 installed ranges from $1.23 to $2.57 billion. This is based on a net electrical output of $1,117 MWe.

**E4.4-5** **<u>Section 4,4.2 (Social and Economic Impacts)</u> With regard to various socioeconomic issues addressed in Section 4.4.2 of the ER, provide a comprehensive list of mitigation strategies that are either currently practiced (and would continue to be practiced) and/or planned mitigation measures. Mitigation strategies are proactive and planned activities established by the applicant that will be implemented by the applicant to directly address a negative effect of construction and/or operation of the two new reactors and do not rely upon other stakeholders having to take any action to mitigate the effects. Mitigation could include such things as:**

- **SNC community information and outreach efforts,**
- **Community liaison (e-g., it was mentioned by Burke County staff that a person by the name of Miles Smith acted as the Plant Vogtle community liaison during original construction),**
- **United Way and other charitable/community fund drives,**
- **Working in coordination with school district transportation to carry out evacuation plans (with added benefit of providing school with additional buses for rotation),**
- **Best Management Practices to minimize impacts.**

**During the site audit visit to the region, NRC staff were told of numerous outreach efforts by SNC and yet the ER discusses very few of these.**

Response:

It is very difficult to answer this question without involving a number of people at Vogtle and in the surrounding community. As such, SNC proposes an alternative approach discussed below. SNC and GPC employees at Plant Vogtle and in the surrounding area are very involved in community activities including education and outreach, local service organization and charities, leadership roles in city and county government, and numerous other community service roles both as individuals and as employees. The GPC motto "Be a citizen wherever we serve" does an excellent job of describing the role of SNC and GPC employees in the community. Mr. Ellie Daniel, Communications Specialist at Plant Vogtle has resided in Burke County most of his life and is very familiar with these community support efforts. Mr. Daniel can provide examples of specific involvement of individuals and can arrange for direct discussions with these employees involved in community service. These discussions could then be used to generate a list of examples for use in the EIS, as appropriate. SNC has arranged for Mr. Daniel to be available for a conference call in the immediate future to discuss the matter in detail with NRC and contractor personnel. This call will be arranged as soon as possible after contact from NRC.

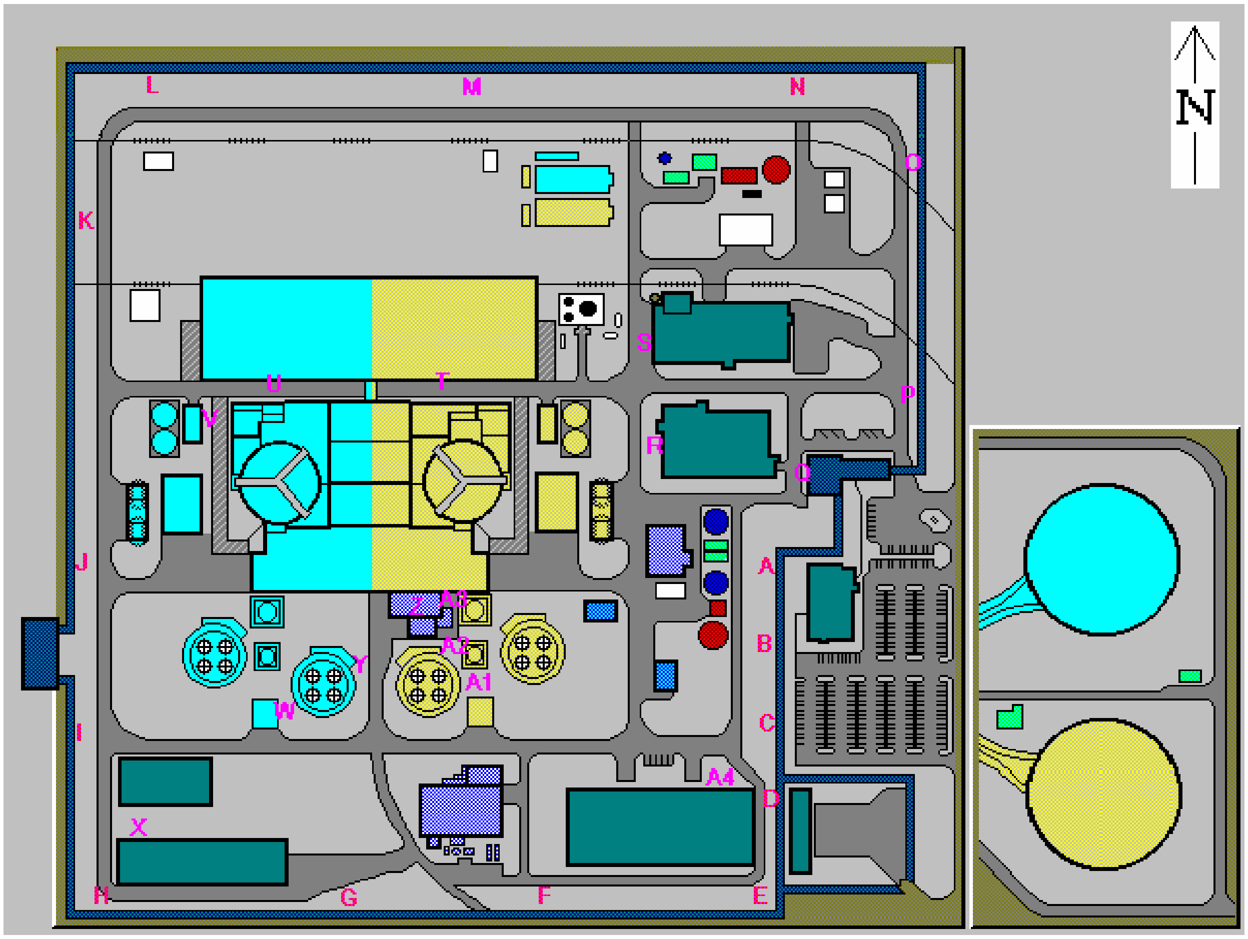
## Section 4.5 Radiation Exposure to Construction Workers

**E4.5-1** <u>Section 4.5 Radiation Exposure to Construction Workers</u> **Provide a site map indicating the location of the internal and general area TLD's used to estimate the annual direct radiation dose to the construction workforce of 50 mrem which is listed in Section 4.5.3.1 of the ER.**

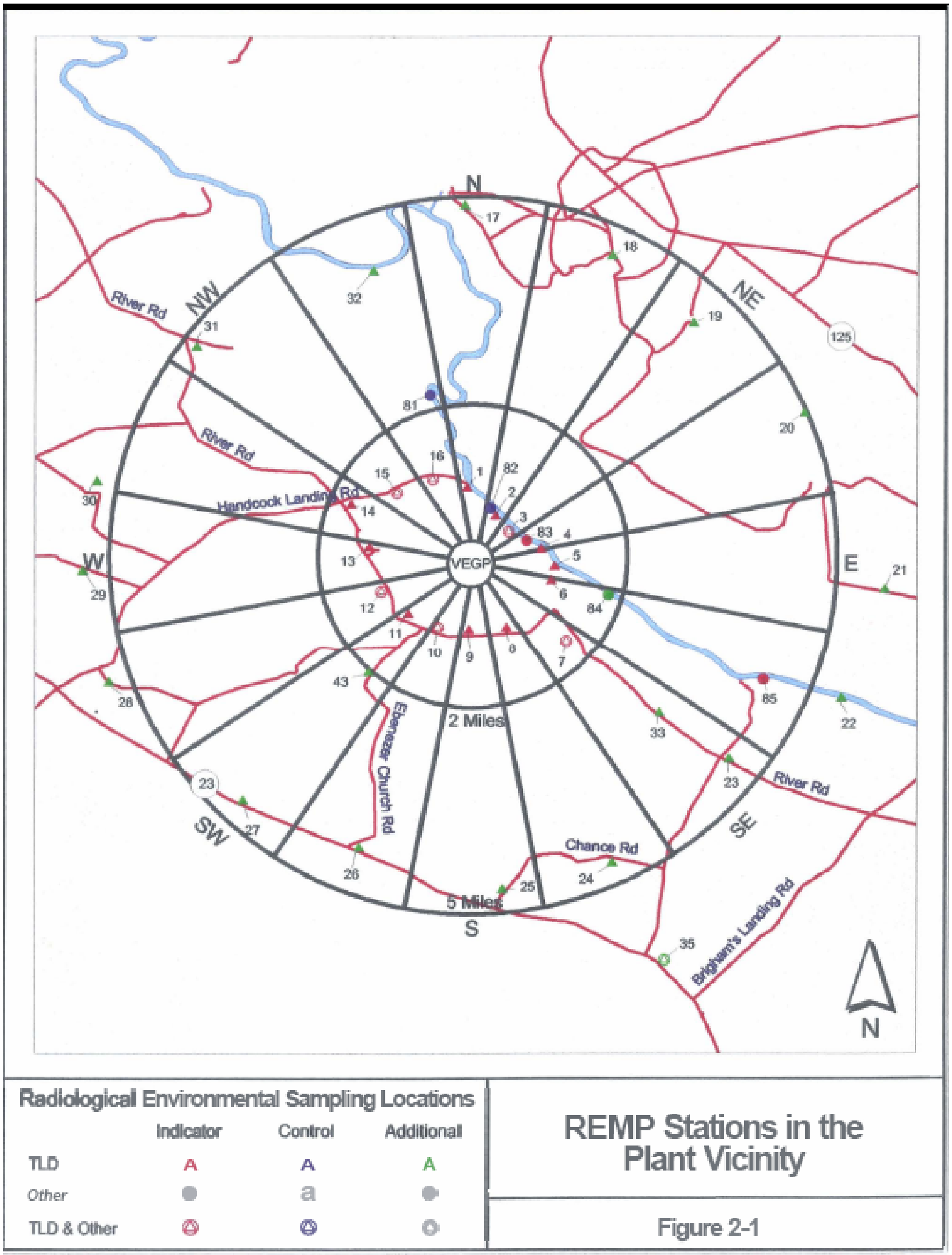
Response:

Following is a site map indicating the location of the TLD's used to determine the dose estimate at the Protected Area Fence closest to the construction site at VEGP Units 1 & 2. The TLD's used to determine this dose estimate are at Stations G, H, I, J, K and L.

RAI Response:



Following is a site map indicating the location of the TLD's used to determine the background dose estimate. The TLD's used to determine the background dose estimate were inner-ring Stations 1-16.




From: Southern Nuclear Operating Company, Vogtle Electric Generating Plant Annual Radiological Environmental Operating Report for 2003.

**E4.5.2-2** **<u>Sections 4.5.2.2 Gaseous Effluents and 4.5.2.3 Liquid Effluents</u> The ER references gaseous releases for 2003 and liquid releases for 2001 as being typical releases for existing units. Provide comparable data for releases for other years to justify use of the release data for years chosen. Explain why the data for typical gaseous and liquid releases were chosen for two different years.**

Response:

In the ER, effluent release data for gaseous and liquid effluents were actually both from year 2003. The reference to 2001 was a typographical error. Section 4.5 has been revised in January 2007 to report annual effluent release values for the year 2002. The annual releases for 2002 were selected because they resulted in the maximum exposure to the public among the years 2001-2004.

The revised Section 4.5 is provided in Attachment 1 of this enclosure and will be incorporated in the next revision of the ESP.

**E4.5.3-1** **<u>Section 4.5.3.1 Direct Radiation Consistent with Environmental Site Audit</u> information request #194, and the SNC response of December 11, 2006, provide a copy of Tetra Tech document RFI# AR-01-ADR-045, "Estimate of ISFSI Dose to Construction Workers, on VEGP 3 & 4," that was used to support the ER analyses.**

Response:

From RFI# ARA-01-ADR-045, Rev. 1, "Estimation of ISFSI Dose to Construction Workers on VEGP 3&4"

This estimate is developed as a realistic, "best estimate" dose to be consistent with the dose from the Unit 1 & 2 units to construction workers. It is not a bounding dose. Bounding dose numbers available for ISFSIs typically use very conservative assumptions such as design basis fuel with maximum burnups and minimum cooling time, and also typically assume that all the casks on the ISFSI pad contain this bounding fuel. These studies are not realistic because it is not physically possible to load maximum burnup, minimum cooled fuel into every cask placed in storage.

This estimate also does not consider the maximum number of casks that could be on the ISFSI pad by the end of the 20 years for which the ESP could be valid. This is considered acceptable for this application because it is not considered likely that the COL will be delayed for 20 years, and because there are a number of factors that could significantly reduce the projected cask dose between the time of this estimate and the actual construction of the Vogtle ISFSI. These include:

- It is very possible that Vogtle will use the underground Holtec cask design that is currently before the NRC for review and approval. The underground design will significantly reduce the already low dose rates from loaded casks in storage.

- In order to reduce construction impacts during the 2013 to 2015 time frame, it is possible that the initial dry storage facility to support Units 1&2 could be constructed within the existing PA in the area directly south of the Aux Bldg rail bay entrance. This would add roughly 1,000 feet of additional distance between the construction workers for Units 3&4 and the ISFSI.

The estimate for the Vogtle ISFSI dose to construction workers is based on the following assumptions and data:

1. Number of fuel assemblies discharged each outage at each existing VEGP unit is 93 assemblies. This discharge rate is assumed to remain valid for the projected period. Note, due to fuel management considerations for zinc addition, Vogtle will be discharging more assemblies than the 93 assemblies over the next 4-5 fuel cycles. It is assumed that the additional discharged assemblies will be accommodated by moving the loading schedule up to 2012. This is a conservative assumption for dose prediction because it results in advancement of the loading schedule.

2. Vogtle is expected to load casks that will hold 32 assemblies. The Holtec MPC-32 was selected for use at Farley, and it is assumed that this cask would also be selected for Vogtle.

3. Vogtle 1&2 will need to load 6 casks every 18 months.

4. The ESP submittal assumed an initial cask loading date in 2014. As a result of fuel management considerations for zinc addition program, additional assembly discharges could advance the initial loading date, possibly as early as 2012. The schedule assumed for ISFSI dose calculations is thus revised as follows:

   2012 – first cask placed in service April 1, six casks in service by July 1

   2013 – six additional casks placed in service by July 1

   2014 – no additional casks placed in service (two outage year)

   2015 - six additional casks placed in service by July 1.

   This is the most aggressive schedule contemplated for Vogtle dry storage start-up. The schedule could be delayed until after Unit 3 is online, in order to eliminate the need for a PA expansion just for the ISFSI.

5. Distance from the ISFSI to the nearest construction worker on Unit 3 is 300 feet. This is based on the proposed layout with the ISFSI located east of the rail spur between units. Current plans are to keep the ISFSI for Unit 1&2 east of the main drainage ditch. The ISFSI for Units 3&4 may be located west of the drainage ditch. This would allow cask transport operations without the need to cross the ditch.

6. Once Unit 3 is complete, the distance from the ISFSI to the nearest construction worker on Unit 4 will be over 1100 feet, based on the projected distance between 3&4 containment centerlines of 800 feet.

7. Data from the Farley ISFSI is used to project dose for the Vogtle ISFSI. Farley and Vogtle both use Westinghouse 17x17 fuel assemblies, and it is projected that the cask design used for Vogtle will be similar to the Holtec MPC-32 HI-STORM 100S design that was selected for Farley.

8. Dose projections were based on TLD data from Farley for the second half of 2005. TLD #72 at Farley was located 300 feet west of the ISFSI, in direct line of site of all three loaded casks. The annual dose corrected for occupational exposure was 14.2 millirem. TLDs #67 and #68 were located over 600 feet away from the ISFSI and were considered to be the free field dose. The annual occupational exposure for both of these TLD locations was 6.7 millirem. Thus, the annual occupational dose at 300 feet from an ISFSI with three loaded casks was projected to be 7.5 millirem.

9. For an ISFSI with six casks, it was assumed that the dose will double to 15 millirem.

10. Since this ISFSI dose assessment was prepared for the ESP, an additional year of TLD data has become available. This additional year of data is presented along with the 2005 data in the table below. Note that the data for 2005 were influenced by the old reactor heads stored within 200 feet of the ISFSI. The old reactor heads were removed in January of 2006. The dose from the ISFSI for the first half of 2006, calculated as described above, is 9.1 millirem (12.9 – 3.8). This is slightly higher than the 7.5 millirem used in the ESP.

    During the second half of 2006, the dose at TLD #72 is representative of six casks in storage. Dose from the ISFSI during this period, calculated as described above and using Jan-June data for TLD #67, is 11.5 millirem. This is lower than the 15 millirem used in the ESP for six casks.

    The additional data for 2006 confirms that the ESP estimates were reasonable for ISFSI dose to construction workers.

| TLD Data Used for ISFSI Dose Estimation (Values presented are annual dose in millirem adjusted for occupancy) | | | | |
|---|---|---|---|---|
| Data Period | TLD #72 | TLD #67 | TLD #68 | Notes |
| July-Dec 2005 | 14.2 | 6.7 | 6.7 | Three casks in storage, old reactor heads stored nearby |
| Jan-June 2006 | 12.9 | 3.8 | 4.5 | Three casks in storage, reactor heads removed January 2006 |
| July-Dec 2006 | 15.3 | TLDs Eliminated | | Six casks in storage |

**E4.5.3-2** **<u>Section 4.5.3.1 Direct Radiation</u> The ER discusses the use of thermoluminescent dosimeter (TLD) data to establish the estimated direct radiation dose to construction workers. This section should provide additional information on the applicant's basis for selecting 50 mrem/year as the average accumulated exposure from VEGP.**

**Provide the following:**

- **The year (or years) over which this data was measured**
- **The number and location of the TLDs used to obtain this dose data**
- **A table listing the TDL readings (net dose in mrem) for each of the TDLs used to obtain the dose estimate of 50 mrem/year**
- **Verification that the TLD values took into account the average plant capacity factor over the measured interval and were corrected for a 100 percent power plant level**
- **Justification for why 50 mrem/year is a representative value to use for the average direct dose value**

**This data may be provided in a table which shows number and location of TLDs used and the net doses (corrected to 100 percent power), measured for each of these TLD locations for each time period used.**

Response:

During review of the dose estimate determination, an error was discovered. This response represents the corrected determination.

TLD data from 2003 was used to establish the estimated direct radiation dose to construction workers. This year was selected because it is the most complete and representative data set. Six Plant TLD stations (Stations G, H, I, J, K and L) along the VEGP Units 1 & 2 Protected Area Fence closest to the proposed construction site were selected to determine the average annual accumulated exposure dose estimate of 115.9 mrem year. Sixteen Environmental TLD stations surrounding the site (Stations 1-16) were used to determine the average annual background dose estimate of 49.0 mrem per year. See Response to RAI E4.5-1 for figure depicting TLD station locations. Construction worker dose was estimated by subtracting the annual accumulated exposure dose estimate by the average annual background dose estimate and applying a conversion factor for a 2,000 hour work year. See values below:

115.9 mrem per year – 49.0 mrem per year = 66.9 mrem per year

66.9 mrem per year * 0.228 = 15.3 mrem per 2,000 hour work year

TLD Measurements Used to Determine Dose Estimate at Protected Area Fence

| | 2003 Data | | |
|---|---|---|---|
| Average Plant Capacity Factor | 1st 6 Mo. 99.95% | 2nd 6 Mo. 90.13% | Annual 95.00% |

| Station Locations | 1st 6 Mo. Net Dose (mrem) | 2nd 6 Mo. Net Dose (mrem) | 2003 Net Dose (mrem) |
|---|---|---|---|
| Protected Area Fence Station G | 61.8 | 58.6 | 120.4 |
| Protected Area Fence Station H | 55.4 | 59.2 | 114.6 |
| Protected Area Fence Station I | 58.1 | 57.3 | 115.4 |
| Protected Area Fence Station J | 55.8 | 57.7 | 113.5 |
| Protected Area Fence Station K | 60.7 | 53.8 | 114.5 |
| Protected Area Fence Station L | 58.3 | 58.7 | 117.0 |
| Average Dose along Protected Area Fence Adjacent to Construction (Stations G,H,I,J,K & L) | | | 115.9 |

| TLD Measurements Used to Determine Background Dose Estimate | | | | | |
|---|---|---|---|---|---|
| | 2003 Data | | | | |
| Average | 1st quarter | 2nd quarter | 3rd quarter | 4th quarter | Annual |
| Plant Capacity Factor | 99.58% | 100.31% | 91.26% | 88.99% | 95.00% |
| | Environmental TLD Data | | | | |
| Environmental TLD Station | 1st quarter | 2nd quarter | 3rd quarter | 4th quarter | 2003 |
| Location | Net Dose (mrem) | Net Dose (mrem) | Net Dose (mrem) | Net Dose (mrem) | Net Dose (mrem) |
| TDL Station 1 | 14.1 | 11.9 | 13.3 | 15.9 | 55.1 |
| TDL Station 2 | 12.1 | 11.8 | 10.8 | 12.8 | 47.4 |
| TDL Station 3 | 13.9 | 12.2 | 13.2 | 15.3 | 54.5 |
| TDL Station 4 | 13.1 | 12.4 | 11.9 | 13.6 | 50.9 |
| TDL Station 5 | 11.9 | 9.1 | 10.3 | 12.5 | 43.8 |
| TDL Station 6 | 10.7 | 11.0 | 9.4 | 10.5 | 41.4 |
| TDL Station 7 | 11.2 | 12.0 | 10.2 | 11.3 | 44.5 |
| TDL Station 8 | 11.5 | 11.8 | 10.5 | 11.1 | 44.8 |
| TDL Station 9 | 12.5 | 13.5 | 12.0 | 12.9 | 50.8 |
| TDL Station 10 | 13.0 | 13.7 | 12.3 | 13.3 | 52.2 |
| TDL Station 11 | 13.4 | 13.5 | 12.0 | 12.9 | 51.7 |
| TDL Station 12 | 12.4 | 13.1 | 11.1 | 12.3 | 48.8 |
| TDL Station 13 | 11.5 | 12.6 | 10.8 | 11.5 | 46.3 |
| TDL Station 14 | 12.5 | 13.8 | 11.5 | 12.6 | 50.3 |
| TDL Station 15 | 13.8 | 14.8 | 12.6 | 13.1 | 54.2 |
| TDL Station 16 | 12.0 | 12.8 | 11.1 | 11.9 | 47.7 |
| Average Background Dose Measurement | | | | | 49.0 |

**E4.5.3-3** **<u>Section 4.5.3.1 Direct Radiation</u> The ER discusses the direct radiation dose contributions that will impact the construction workforce. Provide the following:**

**Verification that, other than the N-16 contribution from the reactor buildings, the Independent Spent Fuel Storage Installation (ISFSI) is the only significant direct radiation source which contributes to the construction worker dose estimate (i.e., there are no other onsite sources, such as outside tanks, that would contribute to the direct radiation source to the construction workers).**

**Discussion of when the ISFSI will be put into use and what percent of loading of the ISFSI the applicant assumed to arrive at the ISFSI contribution of 15 mrem/year to the Unit 3 construction workforce**

**Verification on how the estimated direct radiation dose to construction workers of 51 mrem/year was derived. When the estimate of 15 mrem/year from the planned ISFSI is added to the estimated 37 mrem/year from the reactor buildings, the result is 52 mrem/year.**

Response:

Other than the N-16 contribution from the reactor buildings there are no significant direct radiation sources. Some limited and minor contributions due to radwaste processing and shipments are present but accounted for in the protected area TLDs. No sources of direct radiation are found outside the protected area fence.

See Response to RAI E5.4.3-1 for a discussion of when the ISFSI will be put into use and what percent of loading of the ISFSI SNC utilizes to arrive at the ISFSI contribution of 15 mrem/year to the Unit 3 construction workforce.

As indicated in RAI E4.5.2-2 Section 4.5 has been revised to include additional text on potential sources of direct radiation on the VEGP site, including discussion of the impacts of the planned ISFSI. This section also contains a revised calculation of direct radiation exposure to Units 3 and 4 construction workers, including an estimate of the direct radiation exposure to Unit 4 construction workers from operation of Unit 3.

The revised Section 4.5 is provided in Attachment 1 of this enclosure and will be incorporated in the next revision of the ESP.

**E4.5.4-1** <u>**Section 4.5.4.2 Gaseous Effluents**</u> **In this section of the ER, SNC applies a multiplication factor of ten (10) to the measured annual effluent dose to account for the fact that the workers are located closer to the effluent release point than the maximally exposed member of the public. Provide a description of how this multiplication factor was derived. Since a construction worker and the maximally exposed member of the public would be exposed to the same effluent releases from existing units, one could show that the ratio of the atmospheric dispersion factors, for routine releases, at the construction site closest to the existing units and at the exclusion area boundary does not exceed a factor of ten (10).**

Response:

In the January 2007 revised Section 4.5, SNC eliminated the use of the multiplication factor of 10. Instead, using the GASPAR code, SNC has calculated radiation dose to Units 3 and 4 construction workers from Units 1 and 2 gaseous effluents, and radiation dose to Unit 4 construction workers from Unit 3 gaseous effluents.

The revised Section 4.5 is provided in Attachment 1 of this enclosure and will be incorporated in the next revision of the ESP.

**E.4.5.4-2** <u>**Section 4.5.4.4 Total Doses**</u> **Table 4.5-1 provides the estimated whole body and critical organ doses for construction workers. Provide the estimated TEDE annual dose (sum of whole body and critical organ doses) to construction workers.**

Response:

The January 2007 version of Section 4.5 has been revised to present Total Effective Dose Equivalent (TEDE) for Units 3 and 4 construction workers.

The revised Section 4.5 is provided in Attachment 1 of this enclosure and will be incorporated in the next revision of the ESP.

## Section 5.2.2 Water Related Impacts

**E5.2-1** <u>**Section 5.2.2 Water Related Impacts (Station Operation)**</u> **Section 5.2.2.2 Groundwater Describe the process used to determine the connectivity between the Tertiary and Cretaceous aquifers. Describe the thickness of each geologic formation simulated in each calculation case, and whether partial penetration corrections were applied if only a portion of the combined Tertiary and Cretaceous aquifers were simulated. Discuss the potential impact with regard to integrity of the confining units between and among the Tertiary and Cretaceous aquifers that form the confined aquifer system. Describe the relationship between the unconfined aquifer response and confined aquifer system drawdown, or describe how this aquifer is effectively isolated in terms of temporally variable (e.g., six months, one year, etc.) pumping effects.**

Response:

**Cretaceous Aquifer**

Three wells at VEGP are installed within the Cretaceous aquifer: TW-1, MU-1, and MU-2A (SNC 2005). The general site hydrogeologic description in ER Section 2.3.1 indicates that the bottom of the semi-confining unit (Tertiary in age) between the Cretaceous aquifer and the Tertiary aquifer is approximately -254 feet mean sea level (msl). The FSAR indicates that the thickness of the Cretaceous aquifer beneath Units 1 and 2 is approximately 700 feet. The thickness of the semi-confining unit is approximately 146 feet (ER Section 2.3.1). The bottom of the Cretaceous aquifer is approximately -954 feet msl. Table 1 includes well installation data for wells TW-1, MU-1, and MU-2A. Based on the data in Table 1, it appears the sand/gravel packs for the wells were installed into the Tertiary/Cretaceous semi-confining unit but not into the Tertiary aquifer, which has a bottom elevation of approximately -108 feet msl (ER Section 2.3.1). The screens, however, appear to have been installed in the Cretaceous aquifer.

The static/pumping water level elevations in these wells have remained fairly constant from 2000 through 2004 (See Tables 2, 3, and 4) with the greatest fluctuations occurring in Well MU-2A. The static groundwater elevations in these wells range from approximately 150 to 160 feet msl. The potentiometric maps provided in Section 2.3.1 of the ER indicate the Tertiary head across the proposed site varies from approximately 100 to 125 feet msl. The difference in potentiometric head values between the Tertiary and Cretaceous aquifers suggest that the well materials may not extend into the Tertiary aquifer and that there is a degree of separation between the Cretaceous and the Tertiary aquifers. Current flow potential is upward from the Cretaceous aquifer to the Tertiary aquifer.

**Table 1**
**VEGP Production Wells**

| Well No. | Ground Surface Elevation (Ft msl) | Drilled Depth (feet) | Well Sand/Gravel Depth Interval (feet) | Sand/Gravel Elevation (Ft msl) |
|---|---|---|---|---|
| TW-1 | 218.5 | 860 | 450 - 860 | -231.5 to -641.5 |
| MU-1 | 196.9 | 851 | 435 – 830 | -238.4 to -633.1 |
| MU-2A | 225 | 884 | 435 - 865 | -210 to -640 |

FT msl = Feet mean sea level.
SNC 2005

| Table 2<br>Well TW-1<br>Static/Pumping Groundwater Elevation (Feet)<br>Cretaceous Aquifer | | | | | |
|---|---|---|---|---|---|
| | **2000** | **2001** | **2002** | **2003** | **2004** |
| **January** | -- | -- | -- | -- | -- |
| **February** | -- | 162.1/149.8 | -- | -- | -- |
| **March** | -- | -- | -- | -- | -- |
| **April** | -- | -- | -- | -- | -- |
| **May** | -- | -- | -- | -- | -- |
| **June** | -- | -- | -- | -- | -- |
| **July** | -- | -- | -- | -- | -- |
| **August** | 162.5/148.6 | -- | -- | -- | -- |
| **September** | -- | -- | -- | -- | -- |
| **October** | -- | -- | -- | -- | -- |
| **November** | -- | -- | -- | -- | -- |
| **December** | -- | -- | -- | -- | -- |

| Table 3<br>Well MU-1<br>Static/Pumping Groundwater Elevation (Feet)<br>Cretaceous Aquifer | | | | | |
|---|---|---|---|---|---|
| | **2000** | **2001** | **2002** | **2003** | **2004** |
| **January** | -- | -- | -- | -- | -- |
| **February** | 155.4/147.9 | -- | 154.6/149.3 | -- | -- |
| **March** | -- | -- | -- | -- | -- |
| **April** | -- | -- | -- | -- | -- |
| **May** | -- | -- | -- | -- | -- |
| **June** | -- | -- | 154.6/150.3 | 154.6/150.3 | 155.6/149.1 |
| **July** | -- | -- | -- | -- | -- |
| **August** | 155.8/149.3 | 154.0/147.9 | 150.8/145.8 | -- | -- |
| **September** | -- | -- | -- | -- | -- |
| **October** | -- | -- | -- | -- | -- |
| **November** | -- | -- | -- | -- | -- |
| **December** | -- | -- | 149.7/144.8 | 155.4/150.7 | 154.5/150.3 |

| Table 4<br>Well MU-2A<br>Static/Pumping Groundwater Elevation (Feet)<br>Cretaceous Aquifer | | | | | |
|---|---|---|---|---|---|
| | **2000** | **2001** | **2002** | **2003** | **2004** |
| **January** | 162.2/132.2 | -- | -- | -- | -- |
| **February** | -- | 155.0/120.4 | 150.9/133.3 | -- | -- |
| **March** | -- | -- | -- | -- | -- |
| **April** | -- | -- | -- | -- | -- |
| **May** | -- | -- | -- | -- | -- |
| **June** | -- | -- | -- | -- | -- |
| **July** | -- | -- | -- | -- | -- |
| **August** | -- | 157.1/153.0 | -- | -- | -- |
| **September** | -- | -- | -- | -- | -- |
| **October** | -- | -- | -- | -- | -- |
| **November** | -- | -- | -- | -- | -- |
| **December** | -- | -- | -- | -- | -- |

References: Data for the three wells are included in the following documents already submitted in ER:
SNC 2000a,b; SNC 2001a,b; SNC 2002a,b,c; SNC 2003a,b; SNC 20041,b; SNC 2005

Confined Non-leaky Scenario

The FSAR stated that the aquifer tests in the Cretaceous aquifer had varied results (SNC 2005).

To determine potential offsite impacts of groundwater drawdown, cumulative well yield was used to calculate drawdown as though it had been pumped from a single onsite well. The well MU-2A location was used, because it is the closest production well to an offsite well (5,700 feet) and because the well has been one of the site's primary production wells.

Data used as input (Table 5) to Theis (1937) Non-equilibrium Well Equations (as presented in Calculation Package Summary for Groundwater) was taken from VEGP's Units 1 and 2 FSAR. A mean Transmissivity value of 158,000 gpd/ft (21,123 ft2/day) was used (SNC 2005). The Storativity value (3.1x10-4) is an average of the values calculated for the deeper production wells (FSAR Table 2.4.12-8). Total groundwater use reported to the Georgia Department of Natural Resources by VEGP from 2001 through 2004 averaged 730 gpm. (SNC 2000a,b, 2001a,b, 2002a,b,c, 2003a,b, 2004a,b in Chapter 3 of the Environmental Report) This value is considered the total groundwater use for the existing units. A maximum construction pumping rate of 420 gpm was used (FSAR 2005). The total groundwater use rate for the proposed units is 752 gpm (ER Table 3.3-1).

**Table 5**
**Confined Non-leaky Aquifer Equation**
**Two Unit Operations (Units 1 and 2)**

| Case | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **Distance (FT)** | 5,700 | 5,700 | 5,700 | 5,700 | 5,700 | 5,700 |
| **Storage Coefficient** | 0.00031 | 0.00031 | 0.00031 | 0.00031 | 0.00031 | 0.00031 |
| **Transmissivity ($FT^2$/day)** | 21,123 | 21,123 | 21,123 | 21,123 | 21,123 | 21,123 |
| **Time (Days)** | 3,650 | 7,300 | 10,950 | 14,600 | 18,250 | 21,900 |
| **Flow, Q (gpm)** | 730 | 730 | 730 | 730 | 730 | 730 |
| **Drawdown at property boundary (feet)** | -- | 5.6 | 5.8 | 5.9 | 6.0 | 6.1 |

Therefore, the pumping rate used in the analysis for most of the construction phase is 1,150 gpm (730 + 420 = 1,150 gpm; pumping scenario 1) (See Table 6). There will be a period, after completion of the Unit 3 and before completion of Unit 4, when the pumping rate will include the 730 gpm for the existing units, a construction rate for Unit 4, and an operational rate for Unit 3. For this construction/operational overlap period, the groundwater pumping rate is calculated as the existing rate of 730 gpm, one-half the construction rate or 210 gpm, and one-half the proposed operational rate or 376 gpm (pumping scenario 2_. The total for this period is 1,316 gpm. The estimated pumping rate during the normal operation of all four units is 1,482 gpm (730 gpm + 752 gpm; pumping scenario 3).

**Table 6**
**Confined Non-leaky Aquifer Equation**
**Proposed Two Unit Operations (Units 1 and 2) With Construction Activities and Operations of Units 1 and 2 and Proposed Units 3 and 4**

| Case | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Distance (FT)** | 5,700 | 5,700 | 5,700 | 5,700 | 5,700 |
| **Storage Coefficient** | 0.00031 | 0.00031 | 0.00031 | 0.00031 | 0.00031 |
| **Transmissivity ($FT^2$/day)** | 21,123 | 21,123 | 21,123 | 21,123 | 21,123 |
| **Time (Days)** | 8,760 | 10,950 | 14,600 | 18,250 | 21,900 |
| **Flow, Q (gpm)** | 1,150 | 1,316 | 1,482 | 1,482 | 1,482 |
| **Drawdown at property boundary (feet)** | 8.9 | 10.4 | 12.0 | 12.2 | 12.6 |

Modeling results have the two existing units reducing the potentiometric surface in the Cretaceous aquifer, measured at the VEGP property line, by approximately 5.9 feet by 2025 (Table 5). Two additional units (assuming they become operational in 2015/2016) will increase this drawdown to 12 feet by 2025, using the conservative assumptions in the model (Table 6). By 2045, the potentiometric surface reduction will increase to 12.6 feet (Table 6). For comparison, the two existing units would reduce the potentiometric surface to 6.1 feet by 2045 (Table 5).

The non-leaky aquifer equation (Theis) does not account for the possible semi-confining nature of the Tertiary/Cretaceous confining unit suggested by the results of past pump tests. The equation assumes that the aquifer is homogeneous, isotopic, with negligible recharge and gradient, and that boundary impacts do not occur. The equation was run for each pumping rate scenario described above. The drawdown values calculated are conservative because pumping for each of the simulations was initiated at the start of Unit 1 operations and not adjusted to accommodate changes in pumping rates as described above. Therefore the modeled drawdown at the property boundary is the result of a much longer pumping period for each scenario than will actually occur.

**Confined Leaky Aquifer Scenario**

The issue of connectivity of the Cretaceous and the Tertiary aquifers beneath the site (**SNC 2005**) was not fully supported in the FSAR. However, because the confining unit between the Tertiary and Cretaceous aquifers has been described as semi-confining and from the general description of the unit soils in ER Section 2.3.1, a confined-leaky aquifer is most likely at VEGP. SNC (2005) notes that downstream of the site, the Savannah River cuts through the semi-confining unit separating the Cretaceous and Tertiary aquifers. SNC (2005) does not present hydrologic data for the connectivity of the Cretaceous and Tertiary aquifers beneath the site and no other data on the hydraulic connectivity of the semi-confining unit at VEGP was located. However, data for the Savannah River Site (SRS) just across the Savannah River in South Carolina is available. Aadland et al. (1995) published a study on the SRS groundwater hydrologic units. A vertical hydrologic conductivity value for the corresponding SRS confining unit separating the Cretaceous and the Tertiary aquifers was used for the VEGP analysis.

Prior to construction, pump tests performed in 1977 (**SNC 2005, p. 2.4.12-21 & 22**) indicated the depth from top of casing to water for wells MU-1 and MU-2A was approximately 28 feet and 42 feet, respectively. These depth-to-water values for 1977 and corresponding water elevation data presented in the Groundwater Use Reports submitted to the Georgia Department of Natural Resources (**SNC 2000a,b; SNC 2001a,b; SNC 2002a,b,c; SNC 2003a,b; SNC 2004a,b; SNC 2005**) indicate the preconstruction elevations as approximately 172 feet (MU-1) and 184 feet (MU-2A) for the Cretaceous aquifer at the site and a reduction in the potentiometric surface of the Cretaceous aquifer of approximately 23 feet over the 27-year period from 1977 to 2004.

A leaky scenario (using Hantush-Jacob Non-equilibrium Well Equations; see below) was evaluated to address the characteristics of the likely semi-confined Cretaceous aquifer, The leaky analysis used applicable inputs from the confined non-leaky scenario (Tables 7 and 8). SNC assumed that all of the water pumped from the Cretaceous aquifer was pumped from a fully penetrating single well (MU-2A). The vertical hydraulic conductivity of the Tertiary/Cretaceous confining unit at SRS was used as a surrogate for that at VEGP. The Tertiary/Cretaceous confining unit, known as the Crouch Branch confining unit at SRS, has a vertical hydraulic conductivity for clays to sandy clays of $1.67 \times 10^{-4}$ ft/day and for clayey sands of $8.90 \times 10^{-3}$ feet/day (**Aadland et. al. 1995, p. 73**). An average vertical hydraulic conductivity of $4.5 \times 10^{-3}$ feet/day for the semi-confining unit and unit thickness of 146 feet (from Section 2.3.1 of the Environmental Report) were used. Section 2.3.1 describes the semi-confining unit as consisting of sand, clay, and silt. The results of the leaky scenario model for the drawdown of the Cretaceous potentiometric surface at the property boundary from pumping groundwater for the existing

Units 1 and 2 was 1.9 feet (Table 7) after a period of 40 years (original license period). During the period of current water use by Units 1 and 2 and construction (Table 8) of two new units, the drawdown of the potentiometric surface of the Cretaceous aquifer was estimated to be 2.9 feet (existing and construction of both units) to 3.3 feet (existing and construction of second new unit and operation of first new unit). During the period of operation of all four units the drawdown of the potentiometric surface of the Cretaceous aquifer is estimated to be 3.8 feet.

**Table 7**
**Confined Leaky Aquifer Equation**
**Current Operations**

| Case | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Distance (FT) | 5,700 | 5,700 | 5,700 | 5,700 | 5,700 | 5,700 |
| Storage Coefficient | 0.00031 | 0.00031 | 0.00031 | 0.00031 | 0.00031 | 0.00031 |
| Transmissivity ($FT^2$/day) | 21,123 | 21,123 | 21,123 | 21,123 | 21,123 | 21,123 |
| Time (Days) | 3,650 | 7,300 | 10,950 | 14,600 | 18,250 | 21,900 |
| Flow, Q (gpm) | 730 | 730 | 730 | 730 | 730 | 730 |
| Confining Unit b' (FT) | 146 | 146 | 146 | 146 | 146 | 146 |
| K' Ft/Day | 0.0045 | 0.0045 | 0.0045 | 0.0045 | 0.0045 | 0.0045 |
| Drawdown at property boundary (feet) | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 8.8 |

**Table 8**
**Confined Leaky Aquifer Equation**
**Proposed Two Unit Operations (Units 1 and 2) With Construction Activities and Operations of Units 1 and 2 and Proposed Units 3 and 4**

| Case | 1 | 2 | 3 | 4 | 5 | Maximum Off-normal Operations |
|---|---|---|---|---|---|---|
| Distance (FT) | 5,700 | 5,700 | 5,700 | 5,700 | 5,700 | 5,700 |
| Storage Coefficient | 0.00031 | 0.00031 | 0.00031 | 0.00031 | 0.00031 | 0.00031 |
| Transmissivity ($FT^2$/day) | 21,123 | 21,123 | 21,123 | 21,123 | 21,123 | 21,123 |
| Time (Days) | 8,760 | 10,950 | 14,600 | 18250 | 21,900 | 2 |
| Flow, Q (gpm) | 1,150 | 1,316 | 1,482 | 1,482 | 1,482 | 5,540 |
| Confining Unit b' (FT) | 146 | 146 | 146 | 146 | 146 | 146 |
| K' Ft/Day | 0.0045 | 0.0045 | 0.0045 | 0.0045 | 0.0045 | 0.0045 |
| Drawdown at property boundary (feet) | 2.9 | 3.3 | 3.8 | 3.8 | 3.8 | 8.8 |

Off-normal operation, such as a fire affecting all four units would require the maximum use of groundwater. Although very unlikely, for purpose of analysis SNC assumed groundwater pumping for 2 days at a rate of approximately 5,540 gpm. Using the same leaky aquifer scenario (Table 8), this resulted in a drawdown of the potentiometric surface of 8.8 feet 5,700 feet from Well MU-2A in the direction of the closest off-site well.

Hantush-Jacob Non-equilibrium Well Equations

$$s = [Q/4(3.14)T](Wu,r/B)$$

$$u = r^2S/4tt$$

**Tertiary Aquifer**

Based on water use in 2005, VEGP used approximately 4 gpm of groundwater from its wells in the Tertiary aquifer. Because the current usage from the Tertiary aquifer is only 4 gpm (Section 2.3.2, Table 2.3.2-12) and because SNC plans to use groundwater from the Cretaceous aquifer to support construction and operation of proposed Units 3 and 4, no modeling was performed for the Tertiary aquifer. The top of the Tertiary aquifer is approximately 74 feet msl. The top of the Tertiary/Cretaceous semi-confining unit is approximately -108 feet msl (Section 2.3.1 of the ER). Therefore, the Tertiary aquifer thickness is approximately 182 feet. The Tertiary aquifer potentiometric surface elevations are shown in ER Section 2.3.1. The potentiometric surface elevations across the proposed power block area for Units 3 and 4 ranges from approximately 100 to 125 feet msl. The Tertiary Potentiometric Surface maps in Section 2.3.1 when compared to the Potentiometric Surface of the Confined aquifer map (Figure 2.5-13) from the 1974 Georgia Power ER for Units 1 and 2 (**Georgia Power 1974**) indicate very little change in the Tertiary aquifer beneath the site.

**Water Table Aquifer**

The Units 3 and 4 powerblock would be in an area where multi-directional flow is believed to occur as are Units 1 and 2's powerblock as shown on Figure 2.3.1-16 in Section 2.3.1 of the Environmental Report. The final grade elevation will be approximately 225 feet msl. The top of the marl is at 137 feet msl. Flow through the Water Table aquifer at the Units 3 and 4 location is lateral to drainage features which drain to the Savannah River which in effect eliminates the potential for flow from the Units 3 and 4 locations to off-site. As discussed in Section 2.3.1.2.4 of the Environmental Report, the Blue Bluff Marl, which separates the Water Table aquifer from the Tertiary aquifer, is an effective confining unit. It contained no free groundwater in samples monitored for the construction of Units 1 and 2 (**SNC 2005**). The marl, just north of the powerblock, generally dips downward to the north away from the proposed construction area. The pumping proposed to take place in the Cretaceous aquifer would have no effect on the Water Table aquifer or on Mallard Pond due to the presence of the marl.

The potentiometric surface of the water table is higher than that of the underlying confined Tertiary aquifer (100 to 125 feet msl). This would normally indicate a downward flow of water from the water table to the underlying unit. But because of the confining characteristics of the Blue Bluff marl, this does not occur at the proposed site location. A comparison of the Water Table maps in Section 2.3.1 to the Water Table map (Figure 2.5-14) from the 1974 Georgia Power ER for Units 1 and 2 (**Georgia Power 1974**) indicates no change to the water table elevations within the area of the proposed new units due to pumping within the Cretaceous aquifer over time.

Mallard Pond is situated in a drainage feature north of the proposed new units where the Blue Bluff Marl dips directly beneath the upper portion of the pond and continues to dip to the north. Due to the confining capacity of the Blue Bluff marl, Mallard Pond is isolated from the effects of pumping in the Tertiary or Cretaceous aquifers. Therefore, there would be no impact to the waters of Mallard Pond due to the pumping activities during proposed operations.

References:

(Aadland et. al. 1995) Aadland, Rolf K., Joseph A. Gellici, and Paul A. Thayer, 1995, Hydrogeologic Framework of West-Central South Carolina, State of South Carolina Department of Natural Resources, Water Resources Division, Report 5.

(SNC 2005) Southern Nuclear Company, Updated Final Safety Analysis Report for VEGP, Revision 13, January 31.

(Georgia Power 1974) Georgia Power Company, Environmental Report, Alvin W. Vogtle Nuclear Plant, March 4.

(SNC 2000a) Southern Nuclear Company, Groundwater Use Report – September 1999 to February 2000.

(SNC 2000b) Southern Nuclear Company, Groundwater Use Report – March 2000 to August 2000.

(SNC 2001a) Southern Nuclear Company, Groundwater Use Report – September 2000 to February 2001.

(SNC 2001b) Southern Nuclear Company, Groundwater Use Report – March 2001 to August 2001.

(SNC 2002a) Southern Nuclear Company, Groundwater Use Report – September 2001 to February 2002.

(SNC 2002b) Southern Nuclear Company, Groundwater Use Report – March 2002 to August 2002.

(SNC 2002c) Southern Nuclear Company, Groundwater Use Report – July 2002 to December 2002.

(SNC 2003a) Southern Nuclear Company, Groundwater Use Report – January 2003 to June 2003.

(SNC 2003b) Southern Nuclear Company, Groundwater Use Report – July 2003 to December 2003.

(SNC 2004a) Southern Nuclear Company, Groundwater Use Report – January 2004 to June 2004.

(SNC 2004b) Southern Nuclear Company, Groundwater Use Report – July 2004 to December 2004.

## Section 5.3 Cooling System Impacts

**E5.3-1 State whether the increased water withdrawals associated with the new units would impact vegetation along the shoreline of the Savannah River. If impacts are expected, provide a description of those impacts.**

Response:

Increased water withdrawals associated with the new units would not affect shoreline vegetation. As noted in Section 5.2.2.1 Surface Water SNC evaluated the impact of consumptive water use on river level (river surface elevation). The effect of cooling tower evaporation on river stage from two-unit evaporative losses is predicted to lower the river level by 0.6 inch and 0.8 inch at average annual flow and annual 7Q10 flow, respectively. A water level reduction of this magnitude will not affect shoreline vegetation.

**E5.3-2 <u>Section 5.3.1.2 Aquatic Ecosystems</u> The ER evaluated the potential for entrainment at the intake structure by applying the evaluation of entrainment for VEGP Units 1 and 2 given in the NRC's 1985 FES for operation of the two existing units at VEGP and by a hydrological analysis. In the ER, impingement is assumed not to be an issue based on the design of the intake structure. Because the intake canal and structure for VEGP Units 3 and 4 would be similar in design to the current intake canal and structure for VEGP Units 1 and 2, provide the results of any analyses of actual entrainment or impingement estimates based on the operation of VEGP Units 1 and 2 for the past 20 years. Provide qualitative information if no quantitative data exists. If no information is available for the past 20 years, explain why the previous data remains adequate.**

Response:

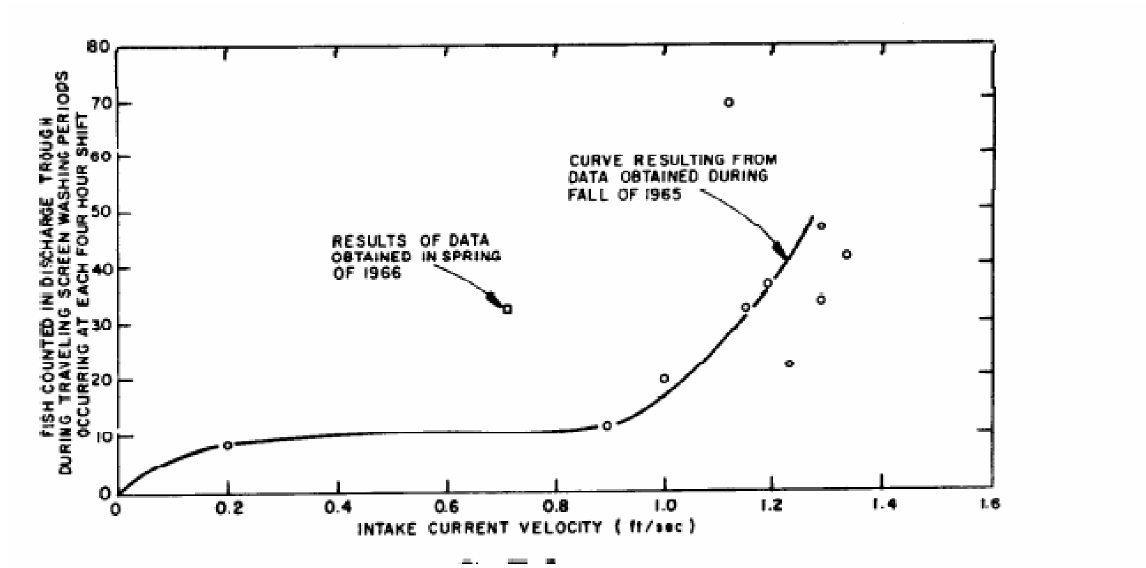
When EPA promulgated Section 316(b) of the Clean Water Act, they established a technology based performance standard "that will help preserve aquatic organisms and the ecosystems they inhabit in waters used by cooling water intake structures (CWIS) at new facilities." 66 Fed Reg. at 65,256 (Dec. 18, 2001).

This technology-based rule is founded around two critical components: (1) a protective intake velocity no greater than 0.5 f/s; and (2) when located on freshwater rivers, that no more than 5% of the mean annual flow pass through the CWIS. EPA spent considerable time and effort determining that these two components were both achievable and effective in reducing impingement and entrainment.

To establish the 0.5 f/s design intake velocity standard, the EPA reviewed available literature, State and Federal guidance, and regulatory requirements. Four of the studies, cited in EPA's 316(b) preamble and listed below, are especially relevant here:

> **Boreman, J**. 1977. Impacts of power plant intake velocities on fish. Power Plant Team, U.S. Fish and Wildlife Service.
>
> **Christianson, A. G., F. H. Rainwater, M.A. Shirazi, and B.A. Tichenor**. 1973. Reviewing environmental impact statements: power plant cooling systems, engineering aspects, U.S. Environmental Protection Agency (EPA), Pacific Northwest Environmental Research Laboratory, Corvallis, Oregon, Technical Series Report EPA–660/2–73–016.
>
> **King, W**. Instructional Memorandum RB–44: Review of NPDES (National Pollutant Discharge Elimination System) permit applications processed by the EPA (Environmental Protection Agency) or by the State with EPA oversight.'' In: U.S. Fish and Wildlife Service Navigable Waters Handbook.
>
> **Sonnichsen, J.C., Bentley, G.F. Bailey, and R.E. Nakatani.** 1973. A review of thermal power plant intake structure designs and related environmental considerations. Hanford Engineering Development Laboratory, Richland, Washington, HEDL–TME 73–24, UC–12.

Based on the documents reviewed, the EPA concluded that appropriate velocity thresholds should be based on the fishes' swimming speeds and endurance. Existing data showed that most species and life stages could endure a velocity of 1.0 ft/s (see figure below). To develop a standard that could be applied nationally and was effective at preventing impingement of most species of fish at their different life stages, EPA applied a safety factor of two to the 1.0 ft/s value to derive a threshold of 0.5 ft/s. EPA determined that 96 percent of fish would be protected at a 0.5 ft/s intake velocity in most instances. 66 Fed Reg. at 65,274.




From USAEC (U.S. Atomic Energy Commission). 1975. Final Environmental Statement related to operation of Indian Point Nuclear Generating Plant Unit No. 3. Consolidated Edison Company of New York, Inc. Docket No. 50-286. Vol. 1. Office of Nuclear Regulation, Washington, DC.

EPA's second component, that no more than 5% of the mean annual flow pass through the CWIS, reflects a conservative assumption by the agency that approximately 5 percent of the river's entrainable organisms can be entrained at an CWIS without significant environmental impact. Even **NUREG 1555, 4.3.2-10** supports a comparable assumption: "If loss of habitat for commercially or recreationally important species occurs, the reviewer should consider the effects on the harvestable crop. It should generally be concluded that loss of up to 5% of such habitat in the site vicinity will have negligible impact on the crop and need no further analysis. Where losses exceed 5%, the reviewers should consider the loss in relation to regional abundance of these species." As was similarly calculated in the ER, EPA assumed a 1:1 relationship between the percentage of water flowing through the cooling water intake and the percentage of organisms entrained. 66 Fed Reg. at 65,300-01. This represents a very conservative estimate since the vast majority of freshwater fish eggs are demersal (i.e., dwell near the bottom of a water body), rather than planktonic, and as a result, those organisms are not susceptible to entrainment to any significant extent **(du Ponte p504).**

The same fundamental logic used by the EPA in establishing the Phase I 316(b) standard was applied by SNC in the 1985 FES related to the operation of VEGP Units 1 and 2. Small amounts of Savannah River water are withdrawn for Units 1 and 2 cooling tower makeup, which minimizes entrainment and impingement impacts. The CWIS was designed and is operated to minimize entrainment and impingement impacts. The existing CWIS incorporates a number of design features that reduce impingement and entrainment of aquatic organisms. These include: (1) the basic orientation of the cooling water intake structure and canal (i.e., perpendicular to the river and its flow); (2) a submerged weir across the intake canal, which reduces the intake of aquatic organisms even further; and (3) extremely low current velocities along the length of the intake canal, and correspondingly low approach velocities at the traveling screens to the makeup water pumps. Based on the modest amount of water withdrawn for cooling tower makeup and the aforementioned design features, the NRC concluded that there would be "no significant adverse impact" **(p. 5-17 of FES)** on Savannah River fish from entrainment and "no significant effects" **(p. 5-18 of the FES)** on the fishes of the Savannah River as the result of impingement.

While no impingement or entrainment sampling has been conducted at the VEGP 1& 2 CWIS, the aquatic ecosystems in the vicinity of the VEGP 1 & 2, and proposed Unit 3 & 4 intake structures, are well researched and documented. However, SNC is able to make use of a wide range of data to make qualitative determinations concerning impingement and entrainment. Numerous studies have been performed in the vicinity of VEGP (see response to RAI 2.4-3) and were reviewed by SNC as an additional step in evaluating the impacts associated with the operation of the CWIS for proposed Units 3 and 4. These documents and their conclusions are summarized below.

In 1977, R.W. McFarlane, et al., completed a detailed assessment of the fish communities and icthyoplankton in the Savannah River, the impacts associated with impingement and entrainment at the SRS intake structures, and the thermal impacts associated with the discharge of cooling water from the SRS reactors. At the time, SRS operated 3 cooling water intake structures with a combined capacity to pump over 951 million gallons of water per day from the Savannah River with an estimated average though screen velocity of 1.25 f/s. Even at those high volumes and screen velocities, the average impingement rate for the combined intake structures averaged 7.3 fish per day. Entrainment was highly seasonal, occurring primarily from March until June with approximately 9.1 to 9.5% of the river's susceptible icthyoplankton entrained at SRS's three intake structures.

In 1983, Georgia Power Company published its pre-operational biological study of the VEGP site, including the Savannah River. Georgia Power characterized numerous aquatic communities including resident and anadromous fish, larval fish and plankton.

From 1983 to 1985, M.H. Paller, et al., performed numerous studies characterizing the fish and icthyoplankton populations on the Savannah River at SRS and in the vicinity of the Plant Vogtle site. His works also focused on impingement and entrainment rates and impacts at the SRS three intake structures.

In 1987, the Comprehensive Cooling Water Study again described resident fish and icthyoplankton populations in the Savannah River in the vicinity of the SRS (and Plant Vogtle). The study further evaluated the impingement and entrainment rates and thermal impacts associated with the three intake and discharge systems at SRS.**(du Ponte p241).** Relying heavily on the previous work of M. H. Paller, et al., data was reviewed from twelve stations on the Savannah River, including three at the VEGP site. Rates of impingement at the three SRS structures averaged 18 fish per day in 1984 and 7.7 fish per day in 1985. **(du Ponte p305)** Entrainment rates were calculated with approximately 8.3% **(du Ponte p506)** and 12.1% **(du Ponte p513)** of the total susceptible icthyoplankton entrained in 1984 and 1985, respectively.

By far the most impressive studies conducted on this section of the Savannah River are those performed by the Academy of Natural Science – Patrick Center for Environmental Research (ANSP). These studies provide significant data for making qualitative determinations concerning aquatic impacts of Vogtle's cooling water systems. Initiated in 1951 and continuing through to present, these studies are designed to assess the potential aquatic impacts of SRS. Covering the Savannah River from river mile 160 to river mile 123 (Vogtle is at river mile 150.5), the ANSP work represents the "longest comprehensive study of a large river in the United States" **(ANSP 2000 p2)**. ANSP conducts four types of studies on the Savannah River; comprehensive, cursory, diatometer, and Plant Vogtle. Each study is designed to look for special patterns of biological disturbance and temporal patterns of change associated with the Savannah River within the boundary of the SRS and include measuring basic water chemistry, diatoms/periphyton, protazoa, aquatic insects, macro-invertebrates and fish. The Plant Vogtle studies, performed from 1985-1997, were conducted to differentiate any potential impacts among the two plants. Two stations, one at River Mile 151.2, the other at river mile 149.8 were established. After 1997, the Vogtle studies were combined with the comprehensive study. Copies of these reports have been difficult to obtain and efforts to do so are ongoing. Review of the 2000 ANSP report, however, indicated no statistically significant impacts associated with the operation of VEGP Units 1 and 2.

The CWIS for proposed Units 3 and 4 will incorporate the best technology available, as established by EPA in its Phase I 316(b) regulations, in order to minimize impacts from impingement and entrainment. Nevertheless, small numbers of adult and juvenile fish may be impinged at the new CWIS and relatively small numbers of fish eggs and larvae may be entrained. From the EPA studies, impingement rates are approximately 25% less at an intake with a velocity of .0.5 ft/s than an intake with a velocity of 1.25 ft/s (see figure above). Based on the data collected from the 1983-85 studies, SNC estimated rates of impingement for VEGP Units 3 & 4 CWIS, as described in the following table:

| **Estimated Daily Impingement Rates for Vogtle Unit 3 & 4 CWIS** | | |
|---|---|---|
| **Measured at SRS CWIS (1983-1985)** | | **Vogtle CWIS** |
| 1G* | 3G* | Unit 3 & 4** |
| 8.56 fish/day | 7.56 fish/day | 1.89-2.14 fish/day |
| 1.25 ft/s intake velocity | 1.25 ft/s intake velocity | <0.5 ft/s design intake velocity |

* Once through cooling system. **Closed-cycle cooling system.

Similarly, rates of entrainment for Vogtle Unit 3 & 4 CWIS can be estimated based on the data collected from the 1983-85 SRS studies multiplied by a correction factor of 0.08 to account for the reduced flow (58,000 gpm vs. 725,000 gpm).

| Estimated Annual Entrainment Rates for Vogtle Unit 3 & 4 CWIS | | |
|---|---|---|
| Measured at SRS CWIS 1G, 3G, & 5G* | | Vogtle CWIS** |
| 1984 | 1985 | Unit 3 & 4 |
| 23.4 million eggs & larvae **or** | 25.9 million eggs & larvae **or** | 1.9-2.1 million eggs & larvae **or** |
| 8.5% of susceptible ichtyoplankton | 8.3% of susceptible ichtyoplankton | 0.66-0.68% of susceptible ichtyoplankton |
| 725,000 gpm flow | 725,000 gpm flow | 58,000 gpm flow |

* Once through cooling system **Closed-cycle cooling system

It is understood that there is always the potential for biological communities to change over time. However, even though the original SRS studies are over twenty years old, those studies offer valuable insight into the Savannah River species that are the most susceptible to impingement and entrainment and, just as importantly, the magnitude of those impacts. And, while no additional impingement and entrainment studies have been conducted, the ANSP studies have continued to monitor the composition of the fish communities of the Savannah River. Those results show that the make-up of fish populations has changed very little over the past twenty years (ANSP 2000). Therefore, SNC submits that it is appropriate to conclude, to the degree consistent with NEPA, that if the dominant fish species remain comparatively unchanged, so too does their relative susceptibility to impingement and entrainment.

In summary, SNC based its determination on the review of over fifty years of extensive, site specific data collected on the habitats and biological assemblages of the Savannah River and the consistent findings of those studies that the intake and discharge of cooling water at SRS and Vogtle has had no significant environmental impact on the Savannah River. Additionally, by 2000, SRS placed the last of its reactors on stand-by reducing the total daily cooling water demand on the Savannah River by over nearly one billion gallons. And finally, because BTA will be installed in order to comply with the Clean Water Act's section 316(b) for VEGP 3 & 4 CWIS, SNC has concluded operation of the CWIS will have only small environmental impacts and will not require mitigation.

References:

Academy of Natural Sciences of Philadelphia (ANSP). 2000. Savannah River biological surveys 1999 for Westinghouse Savannah River Company. Rept. No. 00-14F. Acad. Nat. Sci. Phila.

E. I. du Pont de Nemours & Co, Comprehensive Cooling Water Study, Volume V: Aquatic Ecology DP-1739-5, W. L. Specht, Editor and Compiler, Savannah River Laboratory, Aiken, SC.

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McFarlane, R. W., R. F. Frietsche, and R. D. Miracle, 1978. Impingement and Entrainment of Fishes at the Savannah River Plant: An NPDES 316(b) Demonstration. U.S. Department of Energy. Report DP-1494. E. I. du Pont de Nemours and Company, Aiken, South Carolina.

**E5.3-3** **Section 5.3.3 Heat Dissipation Systems Pursuant to the guidance set forth in ESRP Section 5.3, the NRC staff has a confirmatory role in evaluating impacts, such as fogging, shadowing, and drift deposition, from cooling tower plumes. Electronic input and output files for the SACTl code are needed by the staff to assess the results of the applicant's calculations. Provide, in electronic format, input and output files for the SACTI code used to calculate plume impacts from cooling towers.**

Response:

An executive summary of the SACTI analysis and the electronic input files were provided to the NRC at the October, 2006 Environmental Site Audit. In addition, the output files were made available during the site audit for the NRC's review and evaluation. The information provided during the audit can be used by the NRC to perform a confirmatory analysis. It is SNC's practice not to provide internal design/evaluation calculation packages or computer output files for posting on the docket. Upon request SNC provides an executive summary describing the calculation, calculation methodology, formulas, computer models used and lists or includes all input data. The results of the SACTI analysis are summarized in the ESP application. SNC's practice was communicated to the NRC Staff during the site audit. Electronic copies of the output files are not necessary to perform confirmatory analysis.

**E5.3-4 Section 5.3.3 of the ER presents results from the SACTI model using onsite VEGP meteorological tower data for the year 1999. SACTI model results, such as predominate plume direction (Section 5.3.3.1.1) and plume direction frequency (Section 5.8.1.3), change from Rev 0 to Rev 1 even though stated input meteorological data (1999) remains the same. Provide and explanation for the change in SACTI model output between Rev 0 to Rev 1 of the ER, especially as it relates to plume direction.**

Response:

The meteorological data acquired on site includes many of the parameters used by the SACTI code, such as the dry bulb temperature, wind direction, and wind speed, but does not include the wet bulb temperature, dew point temperature, ceiling height, mixing height, and relative humidity. For the Rev 1 modeling, these additional meteorological parameters were reacquired and were different than those used in the Rev 0 modeling. These additional meteorological parameters determine when a cooling tower plume would become visible. Although the wind direction and frequency did not change between the Rev 0 and Rev 1 modeling, the time that a plume would be visible did, which ultimately resulted in the changes in the predominate plume direction and frequency reported between the Rev 0 and Rev 1 modeling.

## Section 5.4 Radiological Impacts of Normal Operation

**E5.4-1 Sections 5.4.3 Impacts to Members of the Public and 5.4.4 Impacts to Biota Other than Members of the Public Consistent with Environmental Site Audit information request #186, and the SNC response of December 11, 2006, the NRC has determined that the SNC approach of reusing results from previous VEGP GASPAR and VEGP LADTAP analyses performed for VEGP Units 1 and 2, combined with the new AP1000 source term, is not appropriate for calculating radiological impacts of normal operation to members of the public and biota for proposed VEGP Units 3 and 4. Note that the meteorology, release conditions, and site boundaries, used to calculate X/Q values may not be consistent with present conditions.**

Response:

During the recent Meteorological audit at the Vogtle site, discrepancies were identified with the five year met data that require correction. Some of the corrections affect calculated values such as X/Q used in the XOQ/DOQ, GASPAR, and possible LADTAP models. This corrected data will be available to SNC within the next two weeks. SNC will rerun these models and provide a revised response. Based on review of the changes, it is not anticipated that any of the results will be changed appreciably. A revised response will be provided as soon as the information is available.

## Section 5.8 Socioeconomic Impacts

**E5.8-1 Section 5.8.1.3 of the ER states, "…the towers and tops of containment domes likely will be glimpsed from some locations on the river. However, the viewscape will be similar to the existing viewscape." With the AP1000 design, the natural draft cooling towers will be approximately 50 feet taller than the existing towers (Section 5.3.3.2.5) and they will be placed at a different point of the site (possibly at a higher elevation). Will this added height and different location change the viewscape, such that the towers can be seen from a further distance and from different angles than the existing towers. If so, describe the differences in viewscape.**

Response:

The new towers will be at approximately elevation 240' – 245'. The existing towers are at approximately elevation 210' so the apparent height of the new towers will be approximately 80' higher than the existing towers. From most locations where the towers are visible, several hundred feet of tower rises above the tree line, so, while the new towers will be taller than the existing ones, the difference in height has little impact on the aesthetic impact associated with the towers. The difference in height will not appreciably alter the viewscape because most of all four towers will be visible. Sight lines from the river may be such that the new towers will be visible from locations that the existing towers are not, depending on land clearing on and off VEGP property, and tree height. River Road crosses the Goshen-Augusta Newsprint corridor and the Scherer corridor. The Hancock Landing Road crosses the Goshen-Augusta Newsprint corridor. At those crossings, the existing towers are at the ends of the sight lines looking toward VEGP. The new towers will not be within those sight lines, though they will be visible above the distant tree line, just as the existing towers are now if one looks across open fields towards the site. The new towers will be within the sight line of the Thallman corridor as it crosses the Yuchi WMA, and so will be visible to hunters or campers crossing that corridor on the WMA. The new towers will be seen from angles different that those of the existing towers close to the site, and at far distances the change will be four towers in the distance, rather than two. Practically speaking, the two additional towers do not appreciably alter the appearance of VEGP as viewed from offsite areas from what has been viewed for many years. The possibility that the new towers may be viewed from area where towers were not visible has little impact in the rural area surrounding VEGP.

**E6.2-1 <u>Section 6.2.2 Existing Radiological Environmental Monitoring Program Contents</u>**
**Provide a discussion of the monitoring program for tritium in the vadose zone, unconfined aquifer, and confined aquifers at the site. Include a description of the objectives and elements of the program, if any, related to distinguishing releases from VEGP Units 1 and 2 and those from the neighboring SRS. Include a table stating the monitored values in all aquifers. Also, provide a complete statement of potential water use impacts to enable staff to evaluate the groundwater analysis relative to publications of the Tritium Project (Summerour et al. 1998) and the Trans-River Flow Project (Clarke and West 1997, 1998; Cherry 1996). This information is needed to evaluate the adequacy of the monitoring program and associated measurement techniques, as discussed in ESRP Sections 6.2 and 6.3. This information will be used by staff to determine whether reasonable assurance exists that tritium levels in all aquifers (unconfined, Tertiary and Cretaceous) will not exceed the 20,000 pCi/l drinking water standard under future pumping scenarios.**

Response:

All SNC plants will participate in the Nuclear Energy Institute (NEI) Groundwater Protection Initiative which includes developing a monitoring plan and reporting mechanism for communicating radiological releases (leaks and spills). The draft Southern Nuclear Groundwater Protection Initiative Action Plan (monitoring plan) includes monitoring for tritium, gamma isotopic and gross alpha/beta activity in the direct vicinity of the underground structures with the potential to release radiological materials (rad waste building, discharge piping, etc.). This plan will focus on sampling in the unconfined aquifer (Water Table aquifer) and confined tertiary aquifers. As part of the monitoring plan, samples may be collected from the on site existing plant makeup wells (MU-1, MU-2A, & TW-1) installed in the cretaceous aquifer. This monitoring program will not specifically attempt to differentiate a release from Units 1&2 and SRS. In the event tritium, as well as the remaining radioisotopes analyzed, is detected at levels greater than background, the extent and source of the release will be delineated. As mentioned above, the monitoring plan is currently being developed, including an evaluation of the site hydrology to determine if new monitoring wells are needed to satisfy the groundwater monitoring initiative. The groundwater monitoring evaluation is expected to be completed in June 2007 and SNC intends to implement the groundwater program in December 2007.

SNC believes tritium migrating to Vogtle from SRS is unlikely to occur. Vogtle and SRS are hydraulically separated in the water table aquifer and tertiary aquifer by the Savannah River. Further, the gradient of the cretaceous aquifer from Vogtle flowing towards SRS would not support a theory that the pumping conducted by Vogtle could reverse the gradient and cause transport from offsite sources, primarily SRS, to the Vogtle site.

**E 6.2-2** **<u>Section 6.2.2 Existing Radiological Environmental Monitoring Program Contents Consistent with Environmental Site Audit</u> information request #160 and the SNC response of December 11, 2006, provide a description of the future environmental monitoring program for tritium in the vadose zone, unconfined aquifer, and confined aquifers at the VEGP Site. Include a description of the objectives and elements of the program, if any, related to distinguishing VEGP Units 3 and 4 releases from those of VEGP Units 1 and 2, and those from the neighboring Savannah River Site.**

Response:

The draft Southern Nuclear Groundwater Protection Initiative Action Plan for Units 3 and 4 will be consistent with the monitoring plan for Units 1&2. SNC will delineate source(s) of impacts in the event elevated radionuclides (e.g., tritium) are discovered. The primary evaluation will be for onsite sources. As mentioned in E 6.2-1, SNC believes that tritium migration between Vogtle and SRS is unlikely to occur for the reason discussed above.

## Section 6.3 Hydrological Monitoring

**E6.3-1** <u>Section 6.3.2 Construction and Pre-operational Monitoring</u> **Describe the process and field observations that would be used during construction and the pre-operational period to discover and monitor anticipated and unanticipated impacts to the aquifers at the site. How would an unanticipated impact be reflected in revised estimates of future impacts?**

Response:

SNC installed a network of monitoring wells to support collection of groundwater data for preparation of the ER. These wells have been monitored since June 2005 and the data used to develop Section 2.3 of the ER and supporting sections in the SSAR. Monitoring of these wells will continue during the pre-construction and construction process and data will be evaluated and trended. In addition, SNC monitors the three water supply wells monthly and reports groundwater use data to EPD on a semi-annual basis. This data will also be examined during construction to determine if changes are occurring in the aquifer. If anomalies are noted during data review, an investigation will be conducted to determine the cause. In addition, SNC will visually monitor Mallard Pond and other site water sources to determine if activities produce changes in pond level, flow reductions in the drainage below the pond or other visual evidence of changes in aquifer behavior.

SNC will use best management practices to protect the aquifer from impact during the construction process, such as controls for wellhead protection, cross connection, etc.

In the event a significant impact to the groundwater resource is discovered by monitoring or other means, this information will be evaluated as potentially new and significant information and provided to the NRC for review, as appropriate.

## Section 6.5 Ecological Monitoring

**E6.5-1** <u>Section 6.5.1.2 Ecological Monitoring – Aquatic Resources</u> **The ER states that the current VEGP national Pollutant Discharge Elimination System permit does not require monitoring of aquatic ecological resources. The basis for this statement is that no protected species spawn in the vicinity of VEGP and no protected species including mussels, occur in the vicinity of VEGP. The ER also states that the impacts to aquatic communities from construction would be small, localized and temporary and would not warrant formal monitoring. Although formal monitoring has not been conducted, provide additional information (published or unpublished) from any sampling or surveys performed by SNC or its contractors, related to the aquatic ecology of the Savannah River in the near vicinity of VEGP during the period of operation of VEGP Units 1 and 2 that would support the conclusion of the ER.**

Response:

Neither SNC nor its' contractors have conducted any sampling or surveys during the period of operation of Vogtle Unit 1 and 2 related to the aquatic ecology of the Savannah River near VEGP to support the conclusions of the ER. In fact, the Georgia Department of Natural Resources – Environmental Protection Division (EPD) did not require any sampling or surveys in support of the Vogtle NPDES Permit to support impingement and entrainment or the thermal plume mixing zone. This is largely because the information presented in support of the licensing of the facility by NRC clearly demonstrates that the impacts for the intake and discharge are so minor that confirmatory studies were not required. During the licensing of the existing Vogtle units, GPC relied on a large, comprehensive, and current set of data and information developed for the Savannah River site. This information collection began in 1951 and has continued until the present (2006). This data includes sampling stations located at the Vogtle site and covers the types of scientific information necessary to characterize the health, abundance and diversity of the aquatic community. These studies were used along with data collected before operation began to support the NRC Final Environmental Statement (FES). In summary, the studies confirm that the environmental impacts associated with withdrawal of over 750,000 gpd of cooling water at SRS does not significantly impact the aquatic community relative to impingement and entrainment. In addition, studies conducted by GPC confirm that the operation of the intake and discharge at VEGP do not significantly impact the aquatic community.

## Section 7.1 Design Basis Accidents

**E7.1-1** <u>Section 7.1.2 Evaluation Methodology</u> **Consistent with ESRP 7.1, the NRC staff has a confirmatory role in reviewing the applicant's design basis accident calculations. Output from the PAVAN code is needed by the staff to assess the results of the applicant's χ/Q calculations. Therefore, provide, in electronic format, output from the PAVAN code used to calculate the χ/Q values for the evaluation of design basis accidents.**

Response:

An executive summary of the PAVAN analysis, including input files and assumptions, was provided to the NRC during the October 17-19, 2006 Environmental Site Audit. The PAVAN code is a publicly available code, and the NRC has SNC's electronic data input files and assumptions necessary to run the PAVAN code. With this information the NRC can generate confirmatory output files to verify the calculated χ/Q values for the evaluation of design basis accidents reported in the ESP Application. The results of all pertinent analyses are presented and summarized in the ESP application.

As was communicated to the NRC staff during the site audit, it is SNC's practice not to provide internal design/evaluation calculation packages or analysis output files for posting on the docket.

## Section 7.1.3 Source Terms

**E7.1-2** **Provide a copy of the Westinghouse Document LTRCRA-06-21, cited as Westinghouse 2006b.**

Response:

Document is provided in Enclosure 2.

## Section 7.2 Severe Accidents

**E7.2-1** <u>Section 7.2.2 SNC Methodology</u> **The ER includes an evaluation of the risks of severe accidents based on Mellcor Accident Consequence Code System 2 (MACCS2) estimates of severe accident consequences. The NRC staff has a confirmatory role in reviewing the applicant's severe accident calculations. Output from the MACCS2 code is needed by the staff to assess the results of the applicant's calculations. Therefore, provide in electronic format, input to and output from the MACCS2 code used to evaluate the consequences of severe accidents.**

Response:

An executive summary of the MACCS2 analysis, including input files and assumptions, was provided to the NRC during the October 17-19, 2006 Environmental Site Audit. The MACCS2 code is a publicly available code, and the NRC has SNC's electronic data input files and assumptions necessary to run the MACCS2 code. With this information the NRC can generate confirmatory output files to verify the calculated values for the evaluation of severe accidents reported in the ESP Application. The results of all pertinent analyses are presented and summarized in the ESP application.

As was communicated to the NRC staff during the site audit, it is SNC's practice not to provide internal design/evaluation calculation packages or analysis output files for posting on the docket.

**E7.2-2** <u>Section 7.3.2 Surface Water Pathways</u> **The ER includes an evaluation of the risks of severe accidents based on the MACCS2 estimates of severe accident consequences. This evaluation includes the surface water pathway. A complete list of users is needed to determine if the applicants analysis is adequate. Tables 2.3.2 and 2.3.2-3 do not cover the full area within 50 miles of the Vogtle site. Provide complete lists of surface water users within 50 miles of the Vogtle site. The list should include locations and withdrawal rates.**

Response:

NUREG 1555, the Environmental Standard Review Plan, Section 2.3.2 – Water Use, requires that quantitative descriptions of present and known future surface-water uses that are within the hydrological system in which the site is located and that may affect or be affected by the plant be provided. Tables 2.3.2-2 and 2.3.2-3 in Section 2.3.2 provide surface water use data for the entire length of the river within the Savannah River Basin and include water users beyond 50 miles of the site. The surface water withdrawal locations within 50 miles of the VEGP site and within the Savannah River basin are presented in Figure 2.3.2-4. The remaining surface water uses within 50 miles of the VEGP site are located outside the Savannah River Basin watershed and outside the hydrologic system which could be impacted by the construction and operation of VEGP Units 3 and 4. Thus, these uses are not included in the surface water use lists.

The river basin watersheds which have portions located within 50 miles of the VEGP site are the Altamaha River and Ogeechee River basins southwest of the Savannah River basin in Georgia and the Santee River and Edisto River basins northeast of the Savannah River basin in South Carolina. There is no available evidence indicating that any inter-basin transfer of surface water from the Savannah River basin to any of the river basins within 50 miles of the VEGP site has occurred or will occur.

**E-7.2-3** **<u>Section 7.2.3 Consequences to Population Groups Section 7.2.4 Conclusions, Section 10.5 Cumulative Impacts</u> The ER includes an evaluation of the risks of severe accidents for the AP1000 at the VEGP site but does not include sufficient information on the risks associated with the existing plants to make quantitative statements about the cumulative impacts of the existing units plus the proposed new units. Provide a more detailed discussion of the severe accident risks associated with the existing VEGP Units 1 and 2 and a discussion of the cumulative risks of the existing plant and the two new units.**

Response:

When the ESP ER was prepared, the license renewal SAMA analysis was not sufficiently complete to make this comparison. However, the draft SAMA results for Units 1 or 2 were just completed with the following results, shown with comparison to the Units 3 or 4 (single-unit analyses).

| Units | Pop Dose-Risk (person-rem/Ryr) | Cost-Risk ($/Ryr) | Early Fatalities (/Ryr) | Water Ingestion Dose-Risk (person-rem/Ryr) | Decontamination Area (acres/Ryr) |
|---|---|---|---|---|---|
| Units 1 or 2 (SAMA) | 1.87 | 1,340 | 5.0E-7 | 0.22 | 1.8E-2 |
| Units 3 or 4 (AP1000) | 0.0282 | 44.9 | 3.5E-10 | 0.0020 | 6.4E-4 |

The AP1000 risk values are somewhat different than those in the ESP ER for the following reasons:

1) A new evacuation time study was released after the ESP severe accident analysis was performed. This new study was used to develop evacuation speed for both the license renewal SAMA analysis and the current reanalysis.

2) The ESP ER analysis was originally performed in 2005. Certain economic parameters were escalated to 2006 to be consistent with the license renewal SAMA analysis.

3) The original ESP ER analysis was based on nine population rings expressed in kilometers. The new analysis was performed based on 10 rings expressed in miles to be consistent with the license renewal SAMA analysis. The differences in the modeling approaches produced small but noticeable differences in results.

SNC does not believe it is appropriate to add the annual, single-unit risks in the table above to determine a cumulative risk. However, the data indicate that addition of Units 3 and 4 do not appreciably add to the severe accident risk from the existing units.

## Section 9.2 Energy Alternatives

**E9.2-1** **Section 9.2.1.3, Page 9.2-4 of the ER states that "State projections indicate that the available energy savings from [Demand Side Management] DSM programs are insufficient to meet future demand." Please provide a reference for this statement.**

Response:

The Assessment of Energy Efficiency Potential in Georgia Final Report, prepared by ICF Consulting for The Georgia Environmental Facilities Authority (Identified as ICF 2005 in Chapter 9 of the ER) evaluates the energy savings that can be realistically achieved through program and policy interventions in Georgia. According to this report the achievable energy savings by the year 2015 in the Southern Power Region ranges from 679 MW under a minimally aggressive DSM program to 1,425 MW under a very aggressive program. The potential energy savings, even under a very aggressive DSM program, is a small percentage of the additional generating capacity needed by the co-owners by the year 2015 (See Chapter 8 of the ER for generating capacity projections).

**E9.2-2 Section 9.2.3.1.1, Page 9.2-19 of the ER indicates that the emission estimates for NOx and CO from a coal fired plant are both 1815 tons/yr. Is this correct?**

Response:

Section 9.2.3.1.1 is correct. An Excel spreadsheet was used to estimate emissions using AP1000 emission factors developed by the U.S. Environmental Protection Agency (EPA). Due to differences in how spreadsheets and calculators truncate fractional values, the same equation will yield slightly (within 1-2 percent) different results depending on what method (calculator or spreadsheet) was used to perform the calculation. The basic equation for estimating emissions when using an emission factor is:

E=A×EF×(1-C)

Where:

| | | |
|---|---|---|
| E | = | emission estimate |
| A | = | activity level, such as throughput |
| EF | = | emission factor |
| C | = | control efficiency (expressed in percent); C equals zero if no control device is in place |

The coal-fired alternative is defined in Table 9.2-1. The equations for estimating $NO_x$ and CO emissions using the emission factors and $NO_x$ control efficiency provided in Table 9.2-1 are provided below.

Annual Coal Consumption:

$$4\text{ Units} \times \frac{562\text{ MW}}{\text{Unit}} \times \frac{1{,}000\text{ kW}}{\text{MW}} \times \frac{10{,}200\text{ Btu}}{\text{kWh}} \times \frac{1\text{ lbcoal}}{11{,}754\text{ Btu}} \times \frac{1\text{ ton}}{2000\text{ lbs}} \times \frac{8{,}760\text{ hours}}{\text{year}} \times 0.85 = 7{,}260{,}211\text{ tons coal per year}$$

Annual $NO_x$ Emissions:

$$\frac{7{,}260{,}211\text{ tons coal}}{\text{year}} \times \frac{10\text{ lb NO}_x}{1\text{ ton coal}} \times \frac{1\text{ ton}}{2000\text{ lb}} \times (1-0.95) = 1{,}815\text{ tons NO}_x\text{ per year}$$

Annual CO Emissions:

$$\frac{7{,}260{,}211\text{ tons coal}}{\text{year}} \times \frac{0.5\text{ lb CO}}{1\text{ ton coal}} \times \frac{1\text{ ton}}{2000\text{ lb}} \times (1-0) = 1{,}815\text{ tons CO per year}$$

The calculations for NOx and CO coincidentally produced the same result, although the AP 42 emission factors are different. Although this seems unusual, the calculation are correct.

**E9.2-3** **<u>Section 9.2.3</u> Provide the approximate height of the exhaust stacks and power block for the alternative coal and natural gas fired plants discussed in the ER.**

Response:

For the coal-fired alternative, the power block is estimated to be 250-feet to 270-feet tall, and the exhaust stacks are estimated to be 500-feet to 550-feet tall. For the gas-fired alternative, the height of the power block is estimated to be in the range of 40-feet to 50-feet, and the exhaust stacks are estimated to be 150-feet to 200-feet tall.

## Section 9.3 Alternative Sites

**E9.3-1** **<u>Section 9.3-1 Alternative Site Review</u> ESRP Sections 9.3 and 9.4.3 use information regarding Federal- and state-listed species that could occur on or in the vicinity of each of the alternate sites and transmission line corridors as well as information regarding the presence of these specie's habitats including wetlands. Provide a comparison of the alternate sites with the Vogtle site that evaluates the potential impacts to federal-and state-listed species and potential impacts to their habitats (including wetlands and floodplains).**

**With the objective of showing whether any of the alternative sites are obviously superior to the VEGP site. This requires identification of an RSP facility's footprint at each alternative site and whether any new transmission system upgrades would be needed for each site.**

Response:

During the alternate site visits conducted in November 2006, the location of the footprint for the proposed two AP-1000 units was discussed in detail, illustrated on drawings and in aerial photographs, and the personnel participating in the visit were actually taken to the footprint area and shown where the proposed units would be located. At Hatch, the units would be located south of the existing units and east of the Visitors Center in a previously disturbed area of the site. At Farley, the proposed units will be located south of the existing units in an area impacted by the original construction. This area now contains the ISFSI and the old steam generator storage building. The waste settling pond also lies in the footprint area. These existing features would be removed or relocated to support the new unit construction. At Barton, which is a greenfield site, the new units are shown on the handout provided during the site visit. The location of the new facility at each of these sites does not introduce any issues which would significantly favor one site over the other.

With regard to transmission lines, the ER indicates that a 500 KV line will have to be constructed to support the Vogtle site and that a similar line will be required for each alternate site. The length of the line has not been determined for the alternate sites but it is believed that the line will be at least the 50 mile length determined for the Vogtle site. No other lines will be required for any of the sites. As such, the transmission line Vogtle bounds the information for the other sites on the low side making the new transmission line issue essentially moot.

**E9.3-2** **<u>Section 9.3.1.4</u> <u>Evaluation of the Joseph M. Farley Nuclear Plant Site -Terrestrial Resources</u> states that "wildlife would be temporarily displaced from 550 acres and permanently displaced from 300 acres dedicated to the proposed project, their supporting facilities, and construction facilities." Provide information on the composition of the 300 acres (is it mostly wetlands or forested, hardwoods?) Provide information on mitigation that would be required for the wildlife preserve.**

Response:

The area proposed for the two unit footprint at Farley is located within area disturbed by the construction of the existing two units. Most of the new facilities will be located immediately to the south of the existing powerblock in an area that now includes the ISFSI and old steam generator storage building as well as parking and laydown area. The cooling towers for the new units will be located in a previously disturbed area of floodplain. The majority of the impacted area (~90 %) has been developed and has no value to the wildlife preserve. A small amount of revegetated land may be impacted, but it has little habitat value.

**E9.3-3** **<u>Section 9.3.3.1.4 Evaluation of the Joseph M. Farley Nuclear plant Site – Terrestrial Resources</u> Provide a copy of the Tetra-Tech reference – 2002 Final report, Threatened and Endangered Species surveys: Joseph M. Farley Nuclear Plant and Associated Transmission Line Corridors (2001-2002).**

Response:

A PDF file of the referenced report is provided as Enclosure 3. This is a "For Information ONLY" copy and has been already submitted to ADAMS through the Farley License Renewal process.

**E9.3-4** **<u>Section 9.3.3.1.1 Evaluation of the Edwin I. Hatch Nuclear Plant Site Land Use Including Site and Transmission Lines Rights-of-Way</u> How many transmission corridors (as opposed to the number of transmission lines) connect Plant Farley to the transmission system? Would a new transmission line to connect new units sited at Plant Farley to the Webb Substation necessitate a new corridor or expansion of an existing corridor?**

Response:

The 500 kV transmission line supporting proposed new units at Plant Farley would be constructed on a new transmission corridor. This transmission line may be constructed parallel to an existing transmission corridor but would not share a corridor with and existing transmission line. Please note that while the body of the question refers to Plant Farley the title of the question refers to Plant Hatch.

**E9.3-5** **<u>Section 9.3.3.2.4 Evaluation of the Edwin I. Hatch Nuclear Plant Site- Terrestrial Resources</u> Provide information on the number of acres that would be disturbed in order to upgrade the transmission system at Plant Hatch.**

Response:

This information has not been determined at this time. Please see the response to E3.9-4 above.

**E9.3-6** **<u>Section 9.3.3.2.4 Evaluation of the Edwin I. Hatch Nuclear Plant Site- Terrestrial Resources</u> Provide information on whether the upgrades to the transmission system at Plant Hatch would include an additional transmission line via expansion of an existing right of way or the addition of a new right of way.**

Response:

This information has not been determined at this time. However, the 500 Kv line required for expansion to support new units at Hatch will be routed on a new corridor. It may parallel an existing corridor, but will not share a corridor with an existing line. See the response to E3.9-4 above.

**E9.3-7** **<u>Section 9.3.3.2.4 Evaluation of the Edwin I. Hatch Nuclear Plant Site – Terrestrial Resources</u> Provide information on the connection point to the grid for the transmission system at Plant Hatch.**

Response:

This information has not been determined at this time. See the response for E3.9-4 above.

**E9.3-8** **<u>Section 9.3.3.2.4 Evaluation of the Edwin I. Hatch Nuclear Plant Site – Terrestrial Resources</u> Provide a copy of the Tetra-Tech reference – 1999 Final Report Threatened and Endangered Species Surveys: E. I. Hatch Nuclear Plant Units 1 and 2.**

Response:

A PSD file of the referenced report is provided as Enclosure 3. This is a "For Information ONLY" copy and has been already submitted to ADAMS through the Hatch License Renewal process.

**E9.3-9** **<u>Section 9.3.3.3.1 Evaluation of the Barton Site – Land use Including Site and Transmission Line Rights-of-Way</u> The three page Barton Site Summary handout, which was distributed at the NRC staff visit to the site, states that the CSX rail line is 6 miles southwest of the site. The ER (p. 9.3-34) states that the Louisville & Nashville Railroad passes 5.5 miles southwest of the site. Also, the handout refers to the Southern Electric System, including a 115 KV line onsite, while the ER (p. 9.3-5) refers to a connection to the Alabama Power Company transmission system. Please reconcile any inconsistencies between the ER and the handout.**

Response:

The Louisville and Nashville (L& N) Railroad began operation of this line to Montgomery Alabama over 120 years ago. For a long time, Seaboard Coastline Railroad owned 35 % of L & N and in 1971, they purchased the balance of the stock. In 1982, L & N was officially merged into Seaboard Coastline Railroad. In 1986, Seaboard Coastline merged with the Chessie System to become CSX Transportation. The difference between 6 miles and 5.5 miles is explained as a rounding discrepancy.

Southern Company is a Holding Company for four operating companies; Alabama Power Company, Georgia Power Company, Mississippi Power Company, and Gulf Power Company. Southern Nuclear operates the nuclear power plants owned by Alabama Power Company and Georgia Power Company and co-owners, Oglethorpe Power Corporation, the Municipal Electric Authority of Georgia (MEAG), and the City of Dalton, Georgia. Southern Company also holds Southern Nuclear, Southern Company Services, Southern Power, and a number of smaller companies. Transmission lines are owned for the most part by the operating companies and are operated as a system known as the Southern Electric System. Both the reference to the Alabama Power 115 KV line at the Barton site or the Southern Electric System 115 KV line at Barton are correct descriptions of the same line.

## Section 10.4 Benefit-Cost Balance

**E10.4-1** <u>**Section 10.4.1, Benefits**</u> **Please provide a table using Table 10.4.1-1 in NUREG 1555 as guidance, that displays all of the benefit categories attributable to the proposed site and all alternative sites and the expected magnitude of those benefits (in monetary terms whenever possible).**

Response:

| Benefits of the Proposed Project | | | | |
|---|---|---|---|---|
| **Benefit Category** | **Project as Proposed** | **With Option 1** | **With Option 2** | **With Option 3** |
| Description of Project | As Proposed | Proposed Project at Joseph M. Farley Nuclear Plant (FNP) | Proposed Project at Edwin I. Hatch Nuclear Plant (HNP) | Proposed Project at Barton Site (Greenfield site in Alabama) |
| Monetary Benefits | | | | |
| Net Electrical Generating Benefits | | | | |
| Electricity Generated | 16,000,000 to 18,000,000 megawatt-hours per year | 16,000,000 to 18,000,000 megawatt-hours per year | 16,000,000 to 18,000,000 megawatt-hours per year | 16,000,000 to 18,000,000 megawatt-hours per year |
| Generating Capacity | 2,234 megawatts | 2,234 megawatts | 2,234 megawatts | 2,234 megawatts |
| State and Local tax Payments | | | | |
| During Construction | Georgia assesses property at 40% of its value. New units would be assessed at some negotiated valuation greater than $0 and less than actual cost. While the exact amount of tax revenue cannot be known, it could be fairly large, in absolute terms, over the 7-year construction period. | Alabama assesses property at 30% of its value. New units would be assessed at some negotiated valuation greater than $0 and less than actual cost. While the exact amount of tax revenue cannot be known, it could be fairly large, in absolute terms, over the 7-year construction period. | Georgia assesses property at 40% of its value. New units would be assessed at some negotiated valuation greater than $0 and less than actual cost. While the exact amount of tax revenue cannot be known, it could be fairly large, in absolute terms, over the 7-year construction period. | Alabama assesses property at 30% of its value. New units would be assessed at some negotiated valuation greater than $0 and less than actual cost. While the exact amount of tax revenue cannot be known, it could be fairly large, in absolute terms, over the 7-year construction period. |
| During Operations | $29,000,000 to $3,500,000 annually over the life of the units | $21,500,000 to $3,000,000 annually over the life of the units | $29,000,000 to $3,500,000 annually over the life of the units | $21,500,000 to $3,000,000 annually over the life of the units |

| Benefits of the Proposed Project | | | | |
|---|---|---|---|---|
| **Benefit Category** | **Project as Proposed** | **With Option 1** | **With Option 2** | **With Option 3** |
| Effects on regional productivity | | | | |
| During Construction | 3,400 direct jobs and 2,400 indirect jobs (permanent and temporary) added to local economy | 3,400 direct jobs and an incremental increase in indirect jobs (permanent and temporary) added to local economy | 3,400 direct jobs and an incremental increase in indirect jobs (permanent and temporary) added to local economy | 3,400 direct jobs and an incremental increase in indirect jobs (permanent and temporary) added to local economy |
| During Operations | Add 1,600 jobs to local economy | 660 direct jobs and an incremental increase in indirect jobs added to local economy | 660 direct jobs and an incremental increase in indirect jobs added to local economy | 800 direct jobs and an incremental increase in indirect jobs added to local economy |
| Technical and Other Non-monetary Benefits | | | | |
| Advanced Light Water Reactor Development | Maintaining domestic nuclear technology capability as hedge against possible need to control global warming | Maintaining domestic nuclear technology capability as hedge against possible need to control global warming | Maintaining domestic nuclear technology capability as hedge against possible need to control global warming | Maintaining domestic nuclear technology capability as hedge against possible need to control global warming |
| Improvements to Local Facilities | Minor road repairs and improvements in the vicinity of VEGP | Minor road repairs and improvements in the vicinity of FNP | Minor road repairs and improvements in the vicinity of HNP | Minor road repairs and improvements in the vicinity of the Barton Site |
| Fuel Diversity | Nuclear option to coal- and gas-fired baseload generation | Nuclear option to coal- and gas-fired baseload generation | Nuclear option to coal- and gas-fired baseload generation | Nuclear option to coal- and gas-fired baseload generation |
| Licensing certainty | Early resolution of environmental issues, reliance on nuclear as generation option | Early resolution of environmental issues, reliance on nuclear as generation option | Early resolution of environmental issues, reliance on nuclear as generation option | Early resolution of environmental issues, reliance on nuclear as generation option |
| Emissions Reduction | Avoidance of 169 to 5587 tons per year (tpy) sulfur dioxide;540 to 1815 tpy nitrogen oxides; 112 to 1815 tpy carbon monoxide; 94 to 91 tpy particulates | Avoidance of 169 to 5587 tpy sulfur dioxide;540 to 1815 tpy nitrogen oxides; 112 to 1815 tpy carbon monoxide; 94 to 91 tpy particulates | Avoidance of 169 to 5587 tpy sulfur dioxide;540 to 1815 tpy nitrogen oxides; 112 to 1815 tpy carbon monoxide; 94 to 91 tpy particulates | Avoidance of 169 to 5587 tpy sulfur dioxide;540 to 1815 tpy nitrogen oxides; 112 to 1815 tpy carbon monoxide; 94 to 91 tpy particulates |
| Cultural Resources | Mitigative work adding to local historic and pre-historic knowledge base | Mitigative work adding to local historic and pre-historic knowledge base | Mitigative work adding to local historic and pre-historic knowledge base | Mitigative work adding to local historic and pre-historic knowledge base |

**E10.4-2** <u>Section 10.4 Costs</u> **Provide a discussion of the unavoidable and adverse effects of construction and operation at alternative sites (including human health effects), including the expected pre- and post-mitigation levels of those impact categories and, if possible, the expected cost of mitigation. Provide a table that displays all of the adverse environmental impacts of construction and operations at alternative sites; a description of each impact; all mitigation strategies to be undertaken by the applicant for that impact; the cost of mitigation; and the expected value of the unavoidable portion of that impact (Attachment A-3 that was provided as part of SNC's December 11, 2006 submittal is an example of the type and depth of information requested here).**

Response:

In Section 9.3.3 Alternative Site Review, SNC evaluated environmental impacts of construction and operation of the proposed project at three alternative sites (i.e., Farley Nuclear Plant, Hatch Nuclear Plant and the Barton greenfield site). The following table describes the impacts of construction and operation of the proposed project at the three alternative sites, and provides details regarding potential mitigation, and the unavoidable adverse impacts after mitigation has been considered.

Consistent with Regulatory Guide 4.2, each site was evaluated using preliminary reconnaissance level information. Consequently, the costs of mitigation are not easy to determine at this time. Many would be built into the project design (e.g., scheduling to ensure that construction is completed in the shortest possible time; using construction best management practices to limit erosion, fugitive dust, runoff, spills and air emissions; providing first aid stations at the construction site, etc.). Others would rely on a communication plan of early/frequent communication between SNC and the affected communities to minimize cost and insure effective management.

| **Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites** | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| **Construction-Related** | | | |

| Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| **Land Use** | Adverse Impact – Up to 550 acres of land would be cleared during construction, with the potential for erosion. Land would not be available for other uses.<br>Mitigation Measure - Comply with requirements of applicable federal, state and local construction permits/approvals and local ordinances. Clear only areas necessary for installation of the power plant/infrastructure. Restrict construction activities to the construction footprint. Use adequate erosion controls and stabilization measures, such as those provided in the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management. Restrict activities to actual construction site and access ways. Locate soil stockpiles near the construction site. Revegetate all affected temporary-use areas after completion of construction.<br>Unavoidable Adverse Environmental Impacts - 310 acres of land occupied on a long-term basis by nuclear plant and associated infrastructure. | Adverse Impact - Approximately 550 acres of land would be cleared during construction, with the potential for erosion. Land would not be available for other uses.<br>Mitigation Measure - Comply with requirements of applicable federal, state and local construction permits/approvals and local ordinances. Clear only areas necessary for installation of the power plant/infrastructure. Restrict construction activities to the construction footprint.<br>Use adequate erosion controls and stabilization measures, such as those provided in the Georgia Stormwater Manual. Restrict activities to actual construction site and access ways. Locate soil stockpiles near the construction site. Revegetate all affected temporary-use areas after completion of construction.<br>Unavoidable Adverse Environmental Impacts - 310 acres of land occupied on a long-term basis by nuclear plant and associated infrastructure. | Adverse Impact - Potential for erosion from clearing approximately 550 acres of land for construction of the new plant and temporary facilities and from clearing additional acreage for construction of roads, parking lots, and switchyard. Land would not be available for other uses.<br>Mitigation Measure - Comply with requirements of applicable federal, state and local construction permits/approvals and local ordinances. Clear only areas necessary for installation of the power plant/infrastructure. Restrict construction activities to the construction footprint. Use adequate erosion controls and stabilization measures, such as those provided in the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management. Restrict activities to actual construction site and access ways. Locate soil stockpiles near the construction site. Revegetate all affected temporary-use areas after completion of construction.<br>Unavoidable Adverse Environmental Impacts - 310 acres of land occupied on a long-term basis by nuclear plant and associated infrastructure. 2,800 acres would be excluded from future agricultural and recreational use. |

| Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| | Adverse Impact - Construction of transmission corridor across approximately 10 linear miles of eastern Alabama.<br>Mitigation Measure - Minimize potential impacts through compliance with permitting requirements and best management practices, including sediment basins. Restrict sites of access to corridor for construction equipment. Limit maintenance access roads. Revegetate, with attention to wildlife structure or food plots.<br>Unavoidable Adverse Environmental Impacts - Land use on some land would change from woodland or agriculture to open scrub or grassland. | Adverse Impact - Construction of new transmission lines in new corridors in eastern Georgia.<br>Mitigation Measure - Minimize potential impacts through compliance with permitting requirements and best management practices, including sediment basins. Restrict sites of access to corridor for construction equipment. Limit maintenance access roads. Revegetate, with attention to wildlife structure or food plots.<br>Unavoidable Adverse Environmental Impacts - Land use on some land would change from woodland or agriculture to open scrub or grassland. | Adverse Impact - Construction of transmission corridor across approximately 35 linear miles of central Alabama.<br>Mitigation Measure - Minimize potential impacts through compliance with permitting requirements and best management practices, including sediment basins. Restrict sites of access to corridor for construction equipment. Limit maintenance access roads. Revegetate, with attention to wildlife structure or food plots.<br>Unavoidable Adverse Environmental Impacts - Land use on some land would change from woodland or agriculture to open scrub or grassland. |
| | Adverse Impact - Potential to disturb buried historic, archaeological, or paleontological resources.<br>Mitigation Measure - Conduct sub-surface testing prior to start of any onsite work to identify buried historic, cultural, or paeleontological resources. Follow established procedures to stop work and contact appropriate regulatory agencies if potential unanticipated historic, cultural, or paleontological resources are discovered.<br>Unavoidable Adverse Environmental Impacts - Potential for destruction of unanticipated historic, cultural, or paleontological resources. | Adverse Impact - Potential to disturb buried historic, archaeological, or paleontological resources.<br>Mitigation Measure - Conduct sub-surface testing prior to start of any onsite work to identify buried historic, cultural, or paeleontological resources. Follow established procedures to stop work and contact appropriate regulatory agencies if potential unanticipated historic, cultural, or paleontological resources are discovered.<br>Unavoidable Adverse Environmental Impacts - Potential for destruction of unanticipated historic, cultural, or paleontological resources. | Adverse Impact - Potential to disturb buried historic, archaeological, or paleontological resources.<br>Mitigation Measure - Conduct sub-surface testing prior to start of any onsite work to identify buried historic, cultural, or paeleontological resources. Follow established procedures to stop work and contact appropriate regulatory agencies if potential unanticipated historic, cultural, or paleontological resources are discovered.<br>Unavoidable Adverse Environmental Impacts - Potential for destruction of unanticipated historic, cultural, or paleontological resources. |
| | Adverse Impact - Construction debris would be disposed in on-site or off-site landfills.<br>Mitigation Measure - Use waste minimization to reduce volume of debris.<br>Unavoidable Adverse Environmental Impacts - Some land would be dedicated to disposal of construction debris and not available for other uses. | Adverse Impact - Construction debris would be disposed in on-site or off-site landfills.<br>Mitigation Measure - Use waste minimization to reduce volume of debris.<br>Unavoidable Adverse Environmental Impacts - Some land would be dedicated to disposal of construction debris and not available for other uses. | Adverse Impact - Construction debris would be disposed in on-site or off-site landfills.<br>Mitigation Measure - Use waste minimization to reduce volume of debris.<br>Unavoidable Adverse Environmental Impacts - Some land would be dedicated to disposal of construction debris and not available for other uses. |

| Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| **Hydrological and Water Use** | Adverse Impact - Construction has potential to erode sediments into water resources and would dewater the shallow aquifer. Potential public concern with respect to groundwater availability in Nanafalia aquifer. Mitigation Measure - Adhere to applicable regulations, permits, and plans. Use best Management practices as found in the Georgia Stormwater Manual. Install drainage controls to direct dewatering runoff. Manage concerns from members of the public on a case-by-case basis. Unavoidable Adverse Environmental Impacts - Dewatering of shallow aquifer to surface water during construction. | Adverse Impact - Construction has potential to erode sediments into water resources and would dewater the shallow aquifer. Potential public concern with respect to groundwater availability in Floridan aquifer. Mitigation Measure - Adhere to applicable regulations, permits, and plans. Use best Management practices as found in the Georgia Stormwater Manual. Install drainage controls to direct dewatering runoff. Manage concerns from members of the public on a case-by-case basis. Unavoidable Adverse Environmental Impacts - Dewatering of shallow aquifer to surface water during construction. | Adverse Impact - Construction has potential to erode sediments into water resources. Mitigation Measure - Adhere to applicable regulations, permits, and plans. Use best Management practices as found in the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| | Adverse Impact - Construction would require approximately 460 gpm of groundwater. Mitigation Measure - Practice water conservation as practical. No other measures or controls would be necessary because withdrawals would be less than allowed by current permits. Unavoidable Adverse Environmental Impacts - Use of groundwater as source for all water used for construction. | Adverse Impact - Construction would require approximately 460 gpm of groundwater. Mitigation Measure - Practice water conservation as practical. No other measures or controls would be necessary because withdrawals would be less than allowed by current permits. Unavoidable Adverse Environmental Impacts - Use of groundwater as source for all water used for construction. | Adverse Impact - Construction would require approximately 460 gpm of surface water. Mitigation Measure - Practice water conservation as practical. Withdrawals would be less than allowed by permits. No other measures or controls would be necessary. Unavoidable Adverse Environmental Impacts - Use of water from Jordan Reservoir as source for all water used for construction. |
| | Adverse Impact - Construction along river banks or stream banks (in the case of the transmission line) could introduce sediments into the river or stream. Mitigation Measure - Adhere to best management practices. Install drainage controls. Revegetate as soon as possible after clearing. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Construction along river banks or stream banks (in the case of the transmission line) could introduce sediments into the river or stream. Mitigation Measure - Adhere to best management practices. Install drainage controls. Revegetate as soon as possible after clearing. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Construction along Jordan Reservoir shoreline or stream banks (in the case of the transmission line) could introduce sediments into the reservoir or stream. Mitigation Measure - Adhere to best management practices. Install drainage controls. Revegetate as soon as possible after clearing. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |

| Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| | Adverse Impact - Use of heavy equipment introduces the possibility of petroleum spills that could enter surface water.<br>Mitigation Measure - Use good maintenance practices to maintain equipment, and prevent spills and leaks. Invoke FNP's existing Spill Prevention Countermeasures and Control (SPCC) plan for construction activities.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Use of heavy equipment introduces the possibility of petroleum spills that could enter surface water.<br>Mitigation Measure - Use good maintenance practices to maintain equipment, and prevent spills and leaks. Invoke HNP's existing SPCC plan for construction activities.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Use of heavy equipment introduces the possibility of petroleum spills that could enter surface water.<br>Mitigation Measure - Use good maintenance practices to maintain equipment, and prevent spills and leaks. Develop and implement a SPCC plan for construction activities.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| **Aquatic Ecology** | Adverse Impact - Construction at river's edge would cause the loss of some organisms, and temporary degradation of habitat. Transmission line construction across streams would cause the loss of some organisms and temporary degradation of habitat.<br>Mitigation Measure - Install coffer dams or similar engineering protective measures around the construction site. Use best management practices to minimize erosion and sedimentation. Install storm water drainage system at large construction sites and stabilize disturbed soils.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts, including effects of construction noise on fish, for which there is no known mitigation. | Adverse Impact - Construction at river's edge would cause the loss of some organisms, and temporary degradation of habitat. Transmission line construction across streams would cause the loss of some organisms and temporary degradation of habitat.<br>Mitigation Measure - Install coffer dams or similar engineering protective measures around the construction site. Use best management practices to minimize erosion and sedimentation. Install storm water drainage system at large construction sites and stabilize disturbed soils.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts, including effects of construction noise on fish, for which there is no known mitigation. | Adverse Impact - Construction on Jordan Reservoir shoreline would cause the loss of some organisms, and temporary degradation of habitat. Transmission line construction across streams would cause the loss of some organisms and temporary degradation of habitat.<br>Mitigation Measure - Install coffer dams or similar engineering protective measures around the construction site. Use best management practices to minimize erosion and sedimentation. Install storm water drainage system at large construction sites and stabilize disturbed soils.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts, including effects of construction noise on fish, for which there is no known mitigation. |

| Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| **Terrestrial Ecology** | Adverse Impact - Habitat loss would kill or displace animals. Clearing and grading would kill or displace animals. Construction noises could startle or scare animals.<br>Mitigation Measure - Site plant footprint and transmission corridor to avoid critical or sensitive habitats/ species as much as possible per Alabama regulations and Alabama Power Company (APC) practices. Limit vegetation removal and construction activities to construction site or corridor and access roads.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Habitat loss would kill or displace animals. Clearing and grading would kill or displace animals. Construction noises could startle or scare animals.<br>Mitigation Measure - Site plant footprint and transmission corridor to avoid critical or sensitive habitats/ species as much as possible per Georgia regulations and Georgia Power Company (GPC) practices. Limit vegetation removal and construction activities to construction site or corridor and access roads.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Habitat loss would kill or displace animals. Clearing and grading would kill or displace animals. Construction noises could startle or scare animals.<br>Mitigation Measure - Site plant footprint and transmission corridor to avoid critical or sensitive habitats/ species as much as possible per Alabama regulations and APC practices. Limit vegetation removal and construction activities to construction site or corridor and access roads.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| | Adverse Impact - Birds may collide with tall construction equipment.<br>Mitigation Measure - No measures or controls would be necessary because impacts would be small.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Birds may collide with tall construction equipment.<br>Mitigation Measure - No measures or controls would be necessary because impacts would be small.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Birds may collide with tall construction equipment.<br>Mitigation Measure - No measures or controls would be necessary because impacts would be small.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| **Socioeconomic** | Adverse Impact - Construction workers, employees at the existing units, and local residents would be exposed to elevated levels of dust, noise and exhaust emissions from vehicles.<br>Mitigation Measure - Train and appropriately protect FNP employees and construction workers to reduce the risk of potential exposure to noise, dust and exhaust emissions. Make public announcements or prior notification of atypically loud construction activities. Use dust control measures (such as watering, stabilizing disturbed areas, covering trucks). Ensure construction equipment is maintained. Manage concerns from adjacent residents or visitors on a case-by-case basis.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Construction workers, employees at the existing units, and local residents would be exposed to elevated levels of dust, noise and exhaust emissions from vehicles.<br>Mitigation Measure - Train and appropriately protect HNP employees and construction workers to reduce the risk of potential exposure to noise, dust and exhaust emissions. Make public announcements or prior notification of atypically loud construction activities. Use dust control measures (such as watering, stabilizing disturbed areas, covering trucks). Ensure construction equipment is maintained. Manage concerns from adjacent residents or visitors on a case-by-case basis.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Construction workers and local residents would be exposed to elevated levels of dust, noise and exhaust emissions from vehicles.<br>Mitigation Measure - Train and appropriately protect the construction workers to reduce the risk of potential exposure to noise, dust and exhaust emissions. Make public announcements or prior notification of atypically loud construction activities. Use dust control measures (such as watering, stabilizing disturbed areas, covering trucks). Ensure construction equipment is maintained. Manage concerns from adjacent residents or visitors on a case-by-case basis.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |

| Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| | Adverse Impact - Construction workers, employees at the existing units, outage employees, and local residents would be exposed to elevated levels of traffic.<br>Mitigation Measure - Post signs near construction entrances and exits to make the public aware of potentially high construction traffic areas. Add turn lanes at construction entrance. Consider buses, vans, carpools, or staggered shifts.<br>Unavoidable Adverse Environmental Impacts - Level of service on State Road 95, State Road 52, and U.S. Route 84 would be reduced during shift change. | Adverse Impact - Construction workers, employees at the existing units, outage employees, and local residents would be exposed to elevated levels of traffic.<br>Mitigation Measure - Post signs near construction entrances and exits to make the public aware of potentially high construction traffic areas. Add turn lanes at construction entrance. Consider buses, vans, carpools, or staggered shifts.<br>Unavoidable Adverse Environmental Impacts - Level of service on U.S. Highway 1 would be reduced during shift change. | Adverse Impact - Construction workers and local residents would be exposed to elevated levels of traffic.<br>Mitigation Measure - Post signs near construction entrances and exits to make the public aware of potentially high construction traffic areas. Add turn lanes at construction entrance. Consider buses, vans, carpools, or staggered shifts.<br>Unavoidable Adverse Environmental Impacts - Level of service on State Road 22 would be reduced during shift change. |
| | Adverse Impact - Construction workers could be injured.<br>Mitigation Measure - Provide on-site services for emergency first aid, arrange with local hospital emergency room to accept trauma victims, and conduct regular health and safety monitoring. Provide appropriate job-training to construction workers.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Construction workers could be injured.<br>Mitigation Measure - Provide on-site services for emergency first aid, arrange with local hospital emergency room to accept trauma victims, and conduct regular health and safety monitoring. Provide appropriate job-training to construction workers.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Construction workers could be injured.<br>Mitigation Measure - Provide on-site services for emergency first aid, arrange with local hospital emergency room to accept trauma victims, and conduct regular health and safety monitoring. Provide appropriate job-training to construction workers.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |

| Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| | Adverse Impact – Increase in demand for housing could increase rental rates and housing prices which may make housing unaffordable for some low income populations.<br>Mitigation Measure - Discuss construction plans and anticipated influx of workers with community leaders. Builders and developers would meet the demand for additional housing, and because the project has a long lead time, and the construction workforce would build gradually, it is likely that if the community anticipates the increase in population, adequate affordable housing would always be available.<br>Unavoidable Adverse Environmental Impacts - Potential short-term shortage of affordable housing in Houston County. | Adverse Impact – Initially sufficient housing to support the influx of construction workforce may be unavailable in Appling and Toombs counties. Increased demand for housing could make housing unaffordable for some low income populations.<br>Mitigation Measure - Discuss construction plans and anticipated influx of workers with community leaders. Builders and developers would meet the demand for additional housing, and because the project has a long lead time, and the construction workforce would build gradually, it is likely that if the community anticipates the increase in population, adequate affordable housing would always be available.<br>Unavoidable Adverse Environmental Impacts - Potential short-term shortage of affordable housing in Appling and Toombs counties. | Adverse Impact – Small increase in demand for housing in Chilton, Elmore, and Autauga counties.<br>Mitigation Measure - Discuss construction plans and anticipated influx of workers with community leaders. Builders and developers would meet the demand for additional housing, and because the project has a long lead time, and the construction workforce would build gradually, it is likely that if the community anticipates the increase in population, adequate housing would always be available.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |

| Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| | Adverse Impact - Initially there may be insufficient classroom space for the influx of construction workers families.<br>Mitigation Measure - Discuss construction plans and anticipated influx of workers with community leaders. Increased tax revenues as a result of the large construction project would fund additional school resources. Because the project has a long lead time, and the construction workforce would build gradually, it is likely that if the community anticipates the increase in population, adequate classroom space would always be available.<br>Unavoidable Adverse Environmental Impacts - In the short-term there could be school crowding in Houston County. | Adverse Impact - Small increase in demand for classroom space from in-migration of construction workers families.<br>Mitigation Measure - Discuss construction plans and anticipated influx of workers with community leaders. Increased tax revenues as a result of the large construction project would fund additional school resources. Because the project has a long lead time, and the construction workforce would build gradually, it is likely that if the community anticipates the increase in population, adequate classroom space would always be available.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact – Small increase in demand for classroom space from in-migration of construction workers families.<br>Mitigation Measure - Discuss construction plans and anticipated influx of workers with community leaders. Increased tax revenues as a result of the large construction project would fund additional school resources. Because the project has a long lead time, and the construction workforce would build gradually, it is likely that if the community anticipates the increase in population, adequate classroom space would always be available.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| | Adverse Impact - Small increase in demand for public services in Houston County.<br>Mitigation Measure Discuss construction plans and anticipated influx of workers with community leaders. Increased tax revenues after construction begins could be used to purchase additional facilities/equipment and hire/train additional staff, if necessary.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Small increase in demand for public services in Appling and Toombs counties.<br>Mitigation Measure Discuss construction plans and anticipated influx of workers with community leaders. Increased tax revenues after construction begins could be used to purchase additional facilities/equipment and hire/train additional staff, if necessary.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Small increase in demand for public services in Chilton, Elmore, and Autauga counties.<br>Mitigation Measure Discuss construction plans and anticipated influx of workers with community leaders. Increased tax revenues after construction begins could be used to purchase additional facilities/equipment and hire/train additional staff, if necessary.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| **Radiological** | Adverse Impact - Construction workers would be exposed to small doses of radiation from the existing units.<br>Mitigation Measure - None required. All doses would be well within regulatory limits.<br>Unavoidable Adverse Environmental Impacts - Small radiation exposure to construction workers. | Adverse Impact - Construction workers would be exposed to small doses of radiation from the existing units.<br>Mitigation Measure - None required. All doses would be well within regulatory limits.<br>Unavoidable Adverse Environmental Impacts - Small radiation exposure to construction workers. | Adverse Impact - None. Because the site is undeveloped construction workers would not be exposed radiation.<br>Mitigation Measure - No mitigation required.<br>Unavoidable Adverse Environmental Impacts - None. |

| Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| **Atmospheric and Meteorological** | Adverse Impact - Construction would cause increased air emissions from traffic and construction equipment, and fugitive dust.<br>Mitigation Measure - Use dust control measures (such as watering, stabilizing disturbed areas, covering trucks). Ensure that construction equipment is well maintained.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Construction would cause increased air emissions from traffic and construction equipment, and fugitive dust.<br>Mitigation Measure - Use dust control measures (such as watering, stabilizing disturbed areas, covering trucks). Ensure that construction equipment is well maintained.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Construction would cause increased air emissions from traffic and construction equipment, and fugitive dust.<br>Mitigation Measure - Use dust control measures (such as watering, stabilizing disturbed areas, covering trucks). Ensure that construction equipment is well maintained.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| **Environmental Justice** | Adverse Impact - No disproportionately high or adverse impacts to minority or low-income populations were identified.<br>Mitigation Measure - No mitigation required.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - No disproportionately high or adverse impacts to minority or low-income populations were identified.<br>Mitigation Measure - No mitigation required.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - No disproportionately high or adverse impacts to minority or low-income populations were identified.<br>Mitigation Measure - No mitigation required.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| **Operations-Related** | | | |
| **Land Use** | Adverse Impact - Operating the new units would generate radioactive and non-radioactive wastes that are required to be disposed in permitted disposal facilities or permitted landfills.<br>Mitigation Measure - Practice waste minimization to minimize the volume of wastes.<br>Unavoidable Adverse Environmental Impacts - Some land would be dedicated to permitted landfills or licensed disposal facilities and would not be available for other uses. | Adverse Impact - Operating the new units would generate radioactive and non-radioactive wastes that are required to be disposed in permitted disposal facilities or permitted landfills.<br>Mitigation Measure - Practice waste minimization to minimize the volume of wastes.<br>Unavoidable Adverse Environmental Impacts - Some land would be dedicated to permitted landfills or licensed disposal facilities and would not be available for other uses. | Adverse Impact - Operating the new units would generate radioactive and non-radioactive wastes that are required to be disposed in permitted disposal facilities or permitted landfills.<br>Mitigation Measure - Practice waste minimization to minimize the volume of wastes.<br>Unavoidable Adverse Environmental Impacts - Some land would be dedicated to permitted landfills or licensed disposal facilities and would not be available for other uses. |

| Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| **Hydrological and Water Use** | Adverse Impact - Operations would result in discharge of small amounts of chemicals to the Chattahoochee River.<br>Mitigation Measure - All discharges would comply with Alabama NPDES permit and applicable water quality standards. Revise the existing FNP Storm Water Pollution Prevention (SWPP) plan or prepare and implement a new one to avoid/minimize releases of contaminated storm water. Revise the existing FNP SPCC plan or prepare and implement a new one to avoid/minimize contamination from spills.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Operations would result in discharge of small amounts of chemicals to the Altamaha River.<br>Mitigation Measure - All discharges would comply with Georgia NPDES permit and applicable water quality standards. Revise the existing HNP SWPP plan or prepare and implement a new one to avoid/minimize releases of contaminated storm water. Revise the existing HNP SPCC plan or prepare and implement a new one to avoid/minimize contamination from spills.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Operations would result in discharge of small amounts of chemicals to the Jordan Reservoir.<br>Mitigation Measure - All discharges would comply with Alabama NPDES permit and applicable water quality standards. Prepare and implement a SWPP plan to avoid/ minimize releases of contaminated storm water. Prepare and implement a SPCC plan to avoid/minimize contamination from spills.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| | Adverse Impact - Water for some systems would be provided by groundwater.<br>Mitigation Measure - Maximum normal groundwater use would be within existing permit limits.<br>Unavoidable Adverse Environmental Impacts - Water withdrawn from groundwater would not be available for other uses. In the unlikely event of off-normal pumping by more than one unit, the groundwater withdrawal limits could be exceeded and the aquifer drawdown could be accelerated. | Adverse Impact - Water for some systems would be provided by groundwater.<br>Mitigation Measure - Maximum normal groundwater use would be within existing permit limits.<br>Unavoidable Adverse Environmental Impacts - Water withdrawn from groundwater would not be available for other uses. In the unlikely event of off-normal pumping by more than one unit, the groundwater withdrawal limits could be exceeded and the aquifer drawdown could be accelerated. | Adverse Impact – None. Aquifer underlying the site has low permeability and groundwater would not be used at the site.<br>Mitigation Measure - No mitigation required.<br>Unavoidable Adverse Environmental Impacts - None. |
| | Adverse Impact - Maintenance activities at the site and along the transmission line could result in small petroleum spills.<br>Mitigation Measure - Revise the existing FNP SPCC plan or prepare and implement a new one to avoid/minimize contamination from spills. Adhere to the APC SPCC plan when working on transmission lines.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Maintenance activities at the site and along the transmission line could result in small petroleum spills.<br>Mitigation Measure - Revise the existing HNP SPCC plan or prepare and implement a new one to avoid/minimize contamination from spills. Adhere to the GPC SPCC plan when working on transmission lines.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Maintenance activities at the site and along the transmission line could result in small petroleum spills.<br>Mitigation Measure - Prepare and implement a SPCC plan to avoid/minimize contamination from spills. Adhere to the APC SPCC plan when working on transmission lines.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |

| Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| | Adverse Impact - Maximum surface water consumptive use would be less that 2 percent of the lowest annual mean flow.<br>Mitigation Measure - No mitigation required.<br>Unavoidable Adverse Environmental Impacts - Water lost through evaporation would not be available for other uses. | Adverse Impact - Maximum surface water consumptive use would be less that 3 percent of the lowest annual mean flow.<br>Mitigation Measure - No mitigation required.<br>Unavoidable Adverse Environmental Impacts - Water lost through evaporation would not be available for other uses. | Adverse Impact - Maximum surface water consumptive use would be less that 2 percent the lowest annual mean flow.<br>Mitigation Measure - No mitigation required.<br>Unavoidable Adverse Environmental Impacts - Water lost through evaporation would not be available for other uses. |

| Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| | Adverse Impact - Operations would result in a small thermal plume discharged to the Chattahoochee River.<br>Mitigation Measure - The differences between plume temperature and ambient water temperature would be maintained within limits set in the NPDES permit.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Operations would result in a small thermal plume discharged to the Altamaha River.<br>Mitigation Measure - The differences between plume temperature and ambient water temperature would be maintained within limits set in the NPDES permit.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Operations would result in a small thermal plume discharged to the Jordan Reservoir.<br>Mitigation Measure - The differences between plume temperature and ambient water temperature would be maintained within limits set in the NPDES permit.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| **Aquatic Ecology** | Adverse Impact - Operations would result in discharge of small amounts of chemicals to the Chattahoochee River.<br>Mitigation Measure - The NPDES permit limits are set to ensure that discharges do not significantly affect aquatic populations or water quality.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Operations would result in discharge of small amounts of chemicals to the Altamaha River.<br>Mitigation Measure - The NPDES permit limits are set to ensure that discharges do not significantly affect aquatic populations or water quality.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Operations would result in discharge of small amounts of chemicals to the Jordan Reservoir.<br>Mitigation Measure - The NPDES permit limits are set to ensure that discharges do not significantly affect aquatic populations or water quality.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| | Adverse Impact - Routine maintenance activities could result in petroleum spills near water.<br>Mitigation Measure - Revise the existing FNP SPCC plan or prepare and implement a new one to avoid/minimize contamination from spills.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Routine maintenance activities could result in petroleum spills near water.<br>Mitigation Measure - Revise the existing HNP SPCC Plan or prepare and implement a new one to avoid/minimize contamination from spills.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Routine maintenance activities could result in petroleum spills near water.<br>Mitigation Measure - Prepare and implement a SPCC Plan to avoid/minimize contamination from spills.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| | Adverse Impact - Impingement, entrainment and thermal discharges.<br>Mitigation Measure - Cooling towers.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Impingement, entrainment and thermal discharges.<br>Mitigation Measure - Cooling towers.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Impingement, entrainment and thermal discharges.<br>Mitigation Measure - Cooling towers.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |

| Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| **Terrestrial Ecology** | Adverse Impact - Some birds would collide with the cooling towers or the transmission lines. Mitigation Measure - This is not a problem with the existing cooling towers and would not be expected to be a problem with the new towers. Bird collisions with transmission lines are rare. No mitigation is necessary. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Some birds would collide with the cooling towers or the transmission lines. Mitigation Measure - This is not a problem with the existing cooling towers and would not be expected to be a problem with the new towers. Bird collisions with transmission lines are rare. No mitigation is necessary. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Some birds would collide with the cooling towers or the transmission lines. Mitigation Measure – APC has not experienced problems with existing cooling towers at similar sites and bird collisions with cooling towers would not be expected to be a problem at the Barton site. Bird collisions with transmission lines are rare. No mitigation is necessary. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| | Adverse Impact - Salt drift would be distributed around each tower. Mitigation Measure – Design cooling towers to ensure the rate of deposition would be less than that expected to cause leaf damage. No other mitigation is necessary. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Salt drift would be distributed around each tower. Mitigation Measure - Design cooling towers to ensure the rate of deposition would be less than that expected to cause leaf damage. No other mitigation is necessary. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Salt drift would be distributed around each tower. Mitigation Measure - Design cooling towers to ensure the rate of deposition would be less than that expected to cause leaf damage. No other mitigation is necessary. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| | Adverse Impact - Episodic loud noises at the site or along transmission line could frighten animals. Mitigation Measure - None necessary. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Episodic loud noises at the site or along transmission line could frighten animals. Mitigation Measure - None necessary. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Episodic loud noises at the site or along transmission line could frighten animals. Mitigation Measure - None necessary. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| **Socioeconomic** | Adverse Impact - The plants emit low noise. Mitigation Measure - Noise levels would normally not be above background at the site boundary. No mitigation is necessary. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - The plants emit low noise. Mitigation Measure - Noise levels would normally not be above background at the site boundary. No mitigation is necessary. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - The plants emit low noise. Mitigation Measure - Noise levels would normally not be above background at the site boundary. No mitigation is necessary. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| | Adverse Impact - Episodic loud noises could annoy nearby residents. Mitigation Measure - Handle incidents on a case-by-case basis. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Episodic loud noises could annoy nearby residents. Mitigation Measure - Handle incidents on a case-by-case basis. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Episodic loud noises could annoy nearby residents. Mitigation Measure - Handle incidents on a case-by-case basis. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |

| Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| | Adverse Impact - New transmission line has potential to induce electric shock in people standing near the line. Mitigation Measure - Build transmission line to NESC code to minimize noise and electric shock. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - New transmission line has potential to induce electric shock in people standing near the line. Mitigation Measure - Build transmission line to NESC code to minimize noise and electric shock. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - New transmission line has potential to induce electric shock in people standing near the line. Mitigation Measure - Build transmission line to NESC code to minimize noise and electric shock. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| | Adverse Impact - Additional cooling towers and plumes would impact existing viewscape. Mitigation Measure - Consider landscaping to hide towers from boaters on the river. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Additional cooling towers and plumes would impact existing viewscape. Mitigation Measure - Consider landscaping to hide towers from boaters on the river. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Cooling towers and plumes would impact existing viewscape. Mitigation Measure - Consider landscaping to hide towers from boaters on the river. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| | Adverse Impact - Two additional units would increase the traffic on local roads during shift change. More frequent outages at FNP would increase traffic even further. Mitigation Measure - Consider staggering outage shifts to reduce plant-associated traffic on local roads during shift changes. Unavoidable Adverse Environmental Impacts - Level of service on State Road 95, State Road 52, and U.S. Route 84 could be reduced during shift change.. | Adverse Impact - Two additional units would increase the traffic on local roads during shift change. More frequent outages at HNP would increase traffic even further. Mitigation Measure - Consider staggering outage shifts to reduce plant-associated traffic on local roads during shift changes. Unavoidable Adverse Environmental Impacts - Level of service on U.S. Highway 1 could be reduced during shift change. | Adverse Impact – Operation of two units would increase the traffic on local roads during shift change. Outages at the Barton site would increase traffic even further. Mitigation Measure - Consider staggering outage shifts to reduce plant-associated traffic on local roads during shift changes. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| | Adverse Impact - Emissions from diesel generators and the auxiliary boilers. Mitigation Measure - No mitigation needed. Emission would be within limits established in certificates of operation. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Emissions from diesel generators and the auxiliary boilers. Mitigation Measure - No mitigation needed. Emission would be within limits established in certificates of operation. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Emissions from diesel generators and the auxiliary boilers. Mitigation Measure - No mitigation needed. Emission would be within limits established in certificates of operation. Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |

| Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| | Adverse Impact - Population in the region may increase by 1,750 people.<br>Mitigation Measure - No mitigation required. The increased tax revenues from construction would support upgrades to additional infrastructure. Housing availability is adequate in the region.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Population in the region may increase by 1,750 people.<br>Mitigation Measure - No mitigation required. The increased tax revenues from construction would support upgrades to additional infrastructure. Housing availability is adequate in the region.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Population in the region may increase by 2,120 people.<br>Mitigation Measure - No mitigation required. The increased tax revenues from construction would support upgrades to additional infrastructure. Housing availability is adequate in the region.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| **Radiological** | Adverse Impact - Potential doses to members of the public from releases to air and surface water.<br>Mitigation Measure - All releases would be well below regulatory limits. No mitigation required.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Potential doses to members of the public from releases to air and surface water.<br>Mitigation Measure - All releases would be well below regulatory limits. No mitigation required.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Potential doses to members of the public from releases to air and surface water.<br>Mitigation Measure - All releases would be well below regulatory limits. No mitigation required.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| **Atmospheric and Meteorological** | Adverse Impact – Entrained particles in plume from cooling towers would contribute to particulate emissions.<br>Mitigation Measure – Cooling towers would be designed to minimize plume. No mitigation required.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Entrained particles in plume from cooling towers would contribute to particulate emissions.<br>Mitigation Measure - Cooling towers would be designed to minimize plume. No mitigation required.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Entrained particles in plume from cooling towers would contribute to particulate emissions.<br>Mitigation Measure - Cooling towers would be designed to minimize plume. No mitigation required.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |
| | Adverse Impact - Diesels and the auxiliary boiler would contribute to air emissions.<br>Mitigation Measure - Comply with permit limits and regulations for installing and operating air emission sources.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Diesels and the auxiliary boiler would contribute to air emissions.<br>Mitigation Measure - Comply with permit limits and regulations for installing and operating air emission sources.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - Diesels and the auxiliary boiler would contribute to air emissions.<br>Mitigation Measure - Comply with permit limits and regulations for installing and operating air emission sources.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |

| Unavoidable Adverse Environmental Impacts of Proposed Project at Alternative Sites | | | |
|---|---|---|---|
| **Category** | **Proposed Project at Joseph M. Farley Nuclear Plant (FNP)** | **Proposed Project at Edwin I. Hatch Nuclear Plant (HNP)** | **Proposed Project at Barton Site (Greenfield site in Alabama)** |
| **Environmental Justice** | Adverse Impact - No disproportionately high or adverse impacts on minority or low-income populations resulting from operation of the proposed new units have been identified.<br>Mitigation Measure - None required.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - No disproportionately high or adverse impacts on minority or low-income populations resulting from operation of the proposed new units have been identified.<br>Mitigation Measure - None required.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. | Adverse Impact - No disproportionately high or adverse impacts on minority or low-income populations resulting from operation of the proposed new units have been identified.<br>Mitigation Measure - None required.<br>Unavoidable Adverse Environmental Impacts - Small unavoidable adverse impacts. |

**E10.4-3** **Section 10.4 (Benefit-Cost Balance) For each dollar value provided in the ER, provide the year for which that was determined. This is not the same as the year of the report from which the value was taken. Below are some examples of such dollar amounts:**

- **Section 10.4.1.7, the Southern States Energy Board-sourced numbers: $350 million in output, $60 million in total labor income.**
- **Section 10.4.2.1, provides the year of the study, but it is not clear what year the dollar estimates are taken from, including the overnight capital cost range from $1,100/kW to $2,300/kW. If all studies use the same base year (e.g. 2000), then a simple statement can be provided to this effect.**
- **Table 10.4-2, construction cost estimates of $4.5 billion and operating cost of 6.5 cents per kilowatt-hour.**

Response:

The Southern States Energy Board reference (SSEB 2004) does not provide specific years for the $350 and $60 million figures, nor does it specifically identify the studies done by the NEI to support this statement. However, the Southern States Energy Board is considered a reliable source of data. SNC believes that the Southern States Energy Board's interpretation of NEI's data is correct, somewhat current (within the late 1990s to early 2000s), and useful for this analysis, even if the exact years of the data cannot be determined.

The overnight capital costs, $1,100/kW to $2,300/kW, and the levelized costs of electricity, $36 to $83 per megawatt hour, have both been extracted from the University of Chicago study (UC 2004). The levelized costs of electricity are drawn from Table 1-1 on page 1-8 of that report. According to Table 1-1, they are in 2003 US dollars. The overnight capital cost range was also extracted from Table 1-1 and from page 3-5 of that report, and are stated in 2003 US dollars.

In Table 10.4-2, the $4.5 billion and 6.5 cents per kilowatt-hour numbers were based on the 2003 levelized costs of electricity and 2003 overnight capital costs identified above. Therefore, these numbers are also in 2003 US dollars.

All socioeconomic sections were reviewed to identify dollar values that may not have been assigned a year. Only one table had dollar values that had not been assigned a year; Table 5.8.2-1 Estimated Property Taxes Generated by VEGP Units 3 and 4. SNC has verified that these dollars are reported as 2006 dollars. These data are also included in Table 10.4-2.

## Section 10.5 Cumulative Impacts

**E10.5-1** <u>Section 10.5 Cumulative Impacts</u> **The ER discusses cumulative impacts of VEGP Units 3 and 4 added to the existing Units 1 and 2. Provide information on impacts to important species in the Savannah River as a result of water withdrawal or heat discharged to the river from facilities other than proposed Units 3 and 4 and existing units 1 and 2.**

Response:

Section 2.3.2 of the Environmental Report lists major users of the Savannah River water up- and downstream of the Vogtle Plant. With regard to cumulative impacts of water withdrawal and thermal discharges, three surface water users are noteworthy: the Savannah River Site, the D-Area Powerhouse (produces steam for SRS facilities), and South Carolina Electric & Gas Company's (SCE&G's) Urquhart Station. The Savannah River Site, exclusive of D-Area Powerhouse, uses less than three million gallons per day (MGD). The SRS D-Area Powerhouse uses an average of 36.2 to 60.8 MGD. Urquhart Station uses from 70 to 103 MGD, on average.

The U.S. Department of Energy funded a study of impingement and entrainment at the SRS River Water Intakes conducted in 1984-1985. Three intakes and pumping stations (1G, 3G, and 5G) were evaluated. Two intakes (1G and 3G) supplied water to three production reactors, which were shut down in the early 1990s, dramatically reduced cooling water withdrawals at the SRS intakes (by as much as 90 percent), and assumed to have reduced impingement and entrainment commensurately. Currently SRS withdraws about 2.9 MGD, mostly to maintain the water levels in two large reservoirs.

Because D-Area produces only steam and puts no electricity on the regional grid, it does not appear to be subject to the requirements of the EPA's Final Rule on cooling water intake structures (CWIS), and will probably not be required by the state of South Carolina to assess impingement and entrainment. Intake 5G supplies water to the D-Area Powerhouse. Impingement and entrainment data for the D-Area Powerhouse are analyzed in the report *Impingement and Entrainment at the River Water Intakes of the Savannah River Plant* (DOE 1987).

Urquhart Station, a 250 MW fossil-fueled plant, lies well upstream of Plant Vogtle on the South Carolina side of the river. SCE&G has decided to achieve compliance with the EPA regulation for Cooling Water Intake Structures at Phase II facilities (Federal Register/Volume 69/No. 131/July 9, 2004) at Urquhart Station by installing new hardware (wedgewire screens), probably in 2009-2010, and will not be conducting impingement and entrainment studies. This hardware change should substantially reduce entrainment and impingement at Urquhart Station, and could have the effect of reducing cumulative impacts of CWIS in this reach of the river.

The area affected by the thermal discharge would be very small, extending approximately 37 feet across the river and approximately 33 feet downstream of the discharge structure (see Section 5.3.2). Since the Savannah River Site's production reactors shut down in the early 1990s, the nearest discharger of heated effluent is SRS's D-Area Powerhouse, which discharges to Beaverdam Creek (S.C.) approximately 2 miles upstream of its confluence with the Savannah River which, in turn is approximately 1.5 miles upstream of Plant Vogtle. There is no potential for cumulative thermal impacts to important aquatic species.

**E10.5-2** **<u>Section 10.5.2 (Cumulative Impacts)</u> of the ER states that the maximum salt deposition rate is 2.5 pounds per acre per month at a distance of 1,600 feet for a single cooling tower. Section 5.3.3.1.3 states that the maximum salt deposition rate is 3.6 pounds per month at a distance of 3,300 feet for a single cooling tower. Reconcile these conflicting statements as well as the discussion of cumulative salt deposition impacts in Section 10.5.2.**

Response:

The analysis provided in Section 5.3.3.1.3 of Revision 1 is correct. Changes in the location of cooling towers 3 and 4 resulted in a change between the distances from the two sets of towers. The impacts of heat dissipation were revised to reflect this distance change (approximately 200 feet further apart) for the new locations of the towers. The resulting change in the deposition analysis was not reflected in Section 10.5.2 Revision 1. The paragraph discussing the cumulative impacts of salt deposition from Section 10.5.2 will be included in the next revision and should read as follows:

The distance between the additional pair of cooling towers and the existing pair of towers will be approximately 4,000 feet. A single cooling tower's plume is estimated to have a maximum salt deposition rate of 3.6 pounds per acre per month, and that maximum deposition will occur 1,600 feet from the tower. Salt deposition was not estimated for Units 1 and 2. Even assuming that all four towers deposited the maximum of 3.6 pounds per acre per month, SNC does not believe that salt deposition from all four units warrants mitigation for several reasons. The deposition rate is a calculated maximum rate, and so the actual rate will likely be less. The maximum salt deposition from all four towers will not overlap and combine since the distance between the two sets of towers (approximately 4,000 feet) is greater than twice the distance to the maximum deposition of 1,600 feet. The salt deposition from the Units 3 and 4 towers would overlap since the towers are only 1,100 feet apart. The maximum estimated cumulative salt deposition rate is 7.2 pounds per acre per month at 1,600 feet north of the towers (3.6 pounds per acre per tower; well within the NUREG-1555 significant level of 8.9 pounds per acre per month) and will not constitute an adverse impact.

# Attachment 1

Revision to Environmental Report 4.5

4.5 Radiation Exposure to Construction Workers

## 4.5.1 Site Layout

The physical location of the new units relative to the existing VEGP units is depicted on Figure 3.1-3. As shown, the new units will be immediately west of the existing units. Construction activity will take place outside the existing protected area, but inside the restricted area boundary.

## 4.5.2 Radiation Sources

During the construction of the new units, the construction workers could be exposed to radiation sources from the routine operation of the existing units. Furthermore, Unit 4 construction workers could be exposed to radiation from Unit 3 operation.

### 4.5.2.1 Direct Radiation

The existing units' principal sources contributing to direct radiation exposure at the construction site include the reactor buildings and the planned Independent Spent Fuel Storage Installation (ISFSI), which will be located west of the existing Unit 2 (See Figure 3.1-3). In addition, workers constructing Unit 4 could be exposed to direct radiation from the Unit 3 reactor building. Because the primary sources of gamma-emitting radioactivity associated with the existing units are contained within heavily shielded areas or containers, external radiation doses from these facilities are expected to be indistinguishable from background.

### 4.5.2.2 Gaseous Effluents

Sources of gaseous releases for the existing units are currently confined to six paths: plant vents (Unit 1 and Unit 2), the condenser air ejector, the steam packing exhauster systems (Unit 1 and Unit 2), Radwaste Processing Facility and the DAW (Dry Active Waste Building). Waste gas decay tanks are batch released through the Unit 1 plant vent. The containment purges are released through their respective plant vents. **(SNC 2004a)**

The annual releases for 2002 were reported as 26.3 curies of fission and activation products, 0.0207 curies of I-131, $1.67 \times 10^{-5}$ curies of particulates with half-lives greater than eight days, and 105 curies of tritium **(SNC 2003)**. The annual releases for 2002 were selected because they resulted in the maximum exposure to the public among the years 2001-2004.

Unit 4 construction workers could also be exposed to radioactivity in gaseous effluents from Unit 3. Section 3.5 presents the projected gaseous effluent releases for Unit 3.

### 4.5.2.3 Liquid Effluents

Effluents from the liquid waste disposal system result in small amounts of radioactivity in the Savannah River. The annual liquid radioactivity releases for 2001 were reported as 0.220 curies of fission and activation products, 1,490 curies of tritium, and 0.000423 curies of dissolved and entrained gases **(SNC 2002)**. The annual releases for 2001 were selected because they were reported as the maximum exposure to the public among the years 2001-2004.

Unit 4 construction workers could be exposed to radioactivity in liquid effluents from Unit 3, but that is unlikely given that drinking water is derived from sources other than the Savannah River. Section 3.5 presents the projected liquid effluent releases for Unit 3. Applying the Units 1, 2, and 3 liquid effluent doses to Unit 4 construction workers is conservative in that it assumes these construction workers engage in the same activities that lead to the calculated liquid effluent doses (i.e., consuming fish and drinking surface water).

## 4.5.3 Measured and Calculated Dose Rates

The measured or calculated dose rates used to estimate worker dose are presented below.

### 4.5.3.1 Direct Radiation

Existing External Radiation Exposure

The average accumulated exposure from VEGP Protected Area internal and general area thermoluminscent dosimeters (TLDs) over a 365 day period is 50 mrem. The average Environmental Plant Site Boundary TLD exposure over a 365 day period is 13 mrem. The measured radiation dose from the internal and general area TLDs minus the Environmental Plant Site Boundary TLDs, is:

50 mrem per year – 13 mrem per year = 37 mrem per year

Independent Spent Fuel Storage Installation (ISFSI)

The estimated dose to construction workers from the planned ISFSI is estimated to be 15 mrem per year for the Unit 3 construction workforce and negligible for the Unit 4 construction workforce**.** SNC will put the ISFSI in service during the final months of Unit 3 construction, therefore doses to construction workers from the ISFSI will be for only a short time, and less than that estimated for a year of exposure. For conservatism, it is assumed that the Unit 3 construction workers would be exposed to an entire year's dose (15 mrem) from the ISFSI.

Unit 3 Direct Radiation Exposure to Unit 4 Construction Workers

Conservatively assuming that the 37 mrem per year value presented above for Units 1 and 2 is attributable only to direct radiation from these units, and assuming this would be representative of the direct radiation dose from Unit 3 to Unit 4 construction workers gives a direct radiation dose to Unit 4 construction workers from Unit 3 operations of:

37 mrem per year / 2 units = 18.5 mrem per year (for one unit)

Summary of External Radiation

From all of the sources discussed above, the highest direct radiation dose to construction workers will be during Unit 4 construction and is estimated to be 55.5 mrem per year. The highest direct radiation exposure during Unit 3 construction would be 52 mrem per year (37 mrem + 15 mrem from the ISFSI). Therefore the Unit 4 construction workers doses would be bounding and are discussed in the remainder of this section.

### 4.5.3.2 Gaseous Effluents

Units 1 and 2

The XOQDOQ and GASPAR codes were used to calculate the dose to Unit 4 workers from Units 1 and 2 gaseous effluents. The calculation is analogous to that for the new units as described in Section 5.4. Unit 4 construction workers would receive a total body radiation dose of 0.077 millirem per year and a maximum organ (lung) dose of 0.16 millirem per year from Units 1 and 2 normal radiological releases.

Unit 3 Gaseous Effluent Exposure to Unit 4 Construction Workers

Using the XOQDOQ and GASPAR codes, as described in Section 5.4, Unit 4 construction workers would receive a total body radiation dose of 0.71 millirem per year and a maximum organ (skin) dose of 2.44 millirem per year from Unit 3 normal radiological releases.

### 4.5.3.3 Liquid Effluents

Units 1 and 2

The Annual Radioactive Effluent Release Report for 2001 **(SNC 2002)** reports a total body dose of 0.0907 millirem and a critical organ dose (GI-LLI) of 0.153 millirem to the maximally exposed member of the public due to the release of liquid effluents from the existing units, calculated in accordance with the existing units' Offsite Dose Calculation Manual **(SNC 2004b)**. SNC assumes this dose rate represents the rate for construction workers from Units 1 and 2 releases.

Unit 3 Liquid Effluent Exposure to Unit 4 Construction Workers

Using the LADTAP code, as described in Section 5.4, the maximally exposed member of the public would receive a total body radiation dose of 0.017 millirem per year and a maximum organ (liver) dose of 0.021 millirem per year from normal Unit 3 liquid radiological releases.

## 4.5.4 Construction Worker Doses

Construction worker doses were conservatively estimated using the following information (see Section 4.4.2):

- The estimated maximum dose rate for each pathway
- An exposure time of 2000 hours per year
- All gaseous releases assumed at ground level
- A peak loading of 4,400 construction workers per year total for two AP1000 units

The estimated maximum annual dose for each pathway as well as the total dose is shown in Table 4.5-1.

### 4.5.4.1 Direct Radiation

Section 4.5.3 indicates an average annual direct radiation dose of 55.5 millirem based on TLD measurements and estimates for the Unit 3 dose to Unit 4 construction workers. These TLD measurements and calculated doses reflect continuous exposures for long periods of time. The average measured dose rate of 55.5 millirem/yr is based on continuous exposure.

Adjusting for an exposure time of 2000 hours/year yields an annual worker whole body or total effective dose equivalent (TEDE) dose of 12.7 millirem.

### 4.5.4.2 Gaseous Effluents

The annual gaseous effluent doses to a Unit 4 construction worker after Unit 3 is operating (Section 4.5.3.2), which accounts for an exposure time of 2,080 hours per year, are 0.077 millirem for the total body, and 0.16 millirem for the critical organ (lung) from Units 1 and 2 gaseous effluent releases and 0.71 millirem for the total body, and 2.44 millirem (skin) for the critical organ from Unit 3 gaseous effluent releases. The total dose is 0.79 millirem total body and 2.53 millirem to the critical organ (skin). .

### 4.5.4.3 Liquid Effluents

As the annual liquid effluent doses to the maximally exposed member of the public in Section 4.5.3 are based on continuous occupancy, they were adjusted for an exposure time of 2000 hr/yr. Although it is unlikely that the construction workers will be exposed to liquid effluent pathways, it is assumed that the liquid effluent dose rates to which the workers will be exposed are the same as those for the maximally exposed member of the public.

The resulting doses are 0.021 millirem for the total body and 0.035 millirem for the critical organ (GI-LLI) from Units 1 and 2 liquid effluent releases and 0.0039 millirem for the total body, and 0.0048 millirem for the critical organ (liver) from Unit 3 liquid effluent releases. The total annual dose is 0.025 millirem total body and 0.037 millirem to the critical organ (GI-LLI).

### 4.5.4.4 Total Doses

The annual doses from all three pathways are summarized in Table 4.5-1 and compared to the public dose criteria in 10 CFR 20.1301 and 40 CFR 190 in Table 4.5-2 and Table 4.5-3, respectively. The unrestricted area dose rate in Table 4.5-2 was estimated from the annual TLD doses. Since the calculated doses (12.7 mrem per year and 0.006 mrem per hour) meet the public dose criteria of 10 CFR 20.1301 and 40 CFR 190, the workers will not need to be classified as radiation workers. Table 4.5-4 shows that the doses also meet the design objectives of 10 CFR 50, Appendix I, for gaseous and liquid effluents.

The maximum annual collective dose to the AP1000 construction work force (4,400 workers) is estimated to be 56 person-rem. The calculated doses are based on available dose rate measurements and calculations. It is possible that these dose rates will increase in the future as site conditions change. However, the VEGP site will be continually monitored during the construction period and appropriate actions will be taken as necessary to ensure that the construction workers are protected from radiation.

**Table 4.5-1 Annual Construction Worker Doses**

| | Annual Dose (mrem) | |
|---|---|---|
| | **Total Body** | **Critical Organ** |
| Direct irradiation | 12.7 | NA |
| Gaseous effluents | 0.79 | 2.5 (skin) |
| Liquid effluents | 0.025 | 0.037 (GI-LLI) |
| Total | 13.5 | 2.5 (skin) |

### Table 4.5-2 Comparison with 10 CFR 20.1301 Criteria for Doses to Members of the Public

| Criterion | Dose Limit | Estimated Dose |
|---|---|---|
| Annual dose (millirem) | 100 | 13.5 |
| Unrestricted area dose rate (millirem/hour) | 2 | 0.006 |

### Table 4.5-3 Comparison with 40 CFR 190 criteria for doses to members of the public

| | Annual Dose (mrem) | |
|---|---|---|
| Organ | Limit | Estimated |
| Total body | 25 | 13.5 |
| Thyroid | 75 | 1.4 |
| Other organ | 25 | 2.5 (skin) |

### Table 4.5-4 Comparison with 10 CFR 50, Appendix I criteria for effluent doses

| | Annual dose (mrem) | |
|---|---|---|
| | Limit | Estimated |
| Total body dose from liquid effluents | 3 | 0.025 |
| Organ dose from liquid effluents | 10 | 0.037 (GI-LLI) |
| Total body dose from gaseous effluents | 5 | 0.79 |
| Organ dose from radioactive iodine and radioactive particulates in gaseous effluents | 15 | 0.78 (thyroid) |

### Section 4.5 References

**(SNC 2002)** Southern Nuclear Company, Vogtle Electric Generating Plant – Units 1 And 2, NRC Docket Nos. 50-424 and 50-425, Facility Operating License Nos. NPF-68 and NPF-81, Annual Radioactive Effluent Release Report for January 1 2001 To December 31, 2001

**(SNC 2003)** Southern Nuclear Company, Vogtle Electric Generating Plant – Units 1 And 2, NRC Docket Nos. 50-424 and 50-425, Facility Operating License Nos. NPF-68 and NPF-81, Annual Radioactive Effluent Release Report for January 1 2002 To December 31, 2002

**(SNC 2004a)** Southern Nuclear Company, Vogtle Electric Generating Plant – Units 1 And 2, NRC Docket Nos. 50-424 and 50-425, Facility Operating License Nos. NPF-68 and NPF-81, Annual Radioactive Effluent Release Report for January 1 2003 To December 31, 2003

**(SNC 2004b)** Southern Nuclear Company, Offsite Dose Calculation Manual for Southern Nuclear Operating Company Vogtle Electric Generating Plant, Version 22, June 25.

**Southern Nuclear Operating Company**

**AR-07-0061**

**Enclosure 2**

**Reports and Documents**

**Provided in Support of**

**RAI Responses**

**Southern Nuclear Operating Company**

**AR-07-0061**

**Enclosure 3**

**Electronic Files on CDs**

**Providing Data and Information**

**Requested by RAIs**