South Carolina Electric & Gas (SCE&G)
Nuclear Power Plant
Siting Study

1.0 Background & Introduction

SCE&G commissioned a study to determine if there are suitable sites within its service territory to locate new nuclear units. This study included an evaluation of sites previously evaluated in earlier SCE&G nuclear power plant site studies, including those for the original location of the Virgil C. Summer Nuclear Station (VCSNS), and added one additional site, the Savannah River Site (SRS). SRS was identified as a potential site since it is within the SCE&G service territory, it has been evaluated as a potential nuclear site in other recent studies (including NUSTART), and it is being encouraged by local officials for consideration.

A total of 18 potential nuclear power plant sites, located across the SCE&G service territory, were evaluated in previous siting studies reviewed (Appendix A). Results of this review, including consideration of current conditions and experience with operations at VCSNS, indicate that none of the previously evaluated sites would be "obviously superior" to VCSNS as the site for a new nuclear power plant. Accordingly, the balance of this study focused on comparison of VCSNS and SRS as candidate sites for the SCE&G COL.

This report describes processes, criteria and results of the evaluation and comparison of SRS and VCSNS as the geographic location for a COL application for a potential new nuclear power plant. Actual site evaluations were based on the following assumed plant locations for a new plant at the two sites:

- VCSNS – Land south of the existing plant and on the topographic plateau at about the same elevation as existing plant grade (Figure 1-1).

- SRS – The site location identified in Figure 1-6 of the report *Study of Potential Sites for the Deployment of New Nuclear Plants in the United States, prepared by Dominion Energy Inc. and Bechtel Power Corporation*, September 27, 2002 (Figure 1-2).

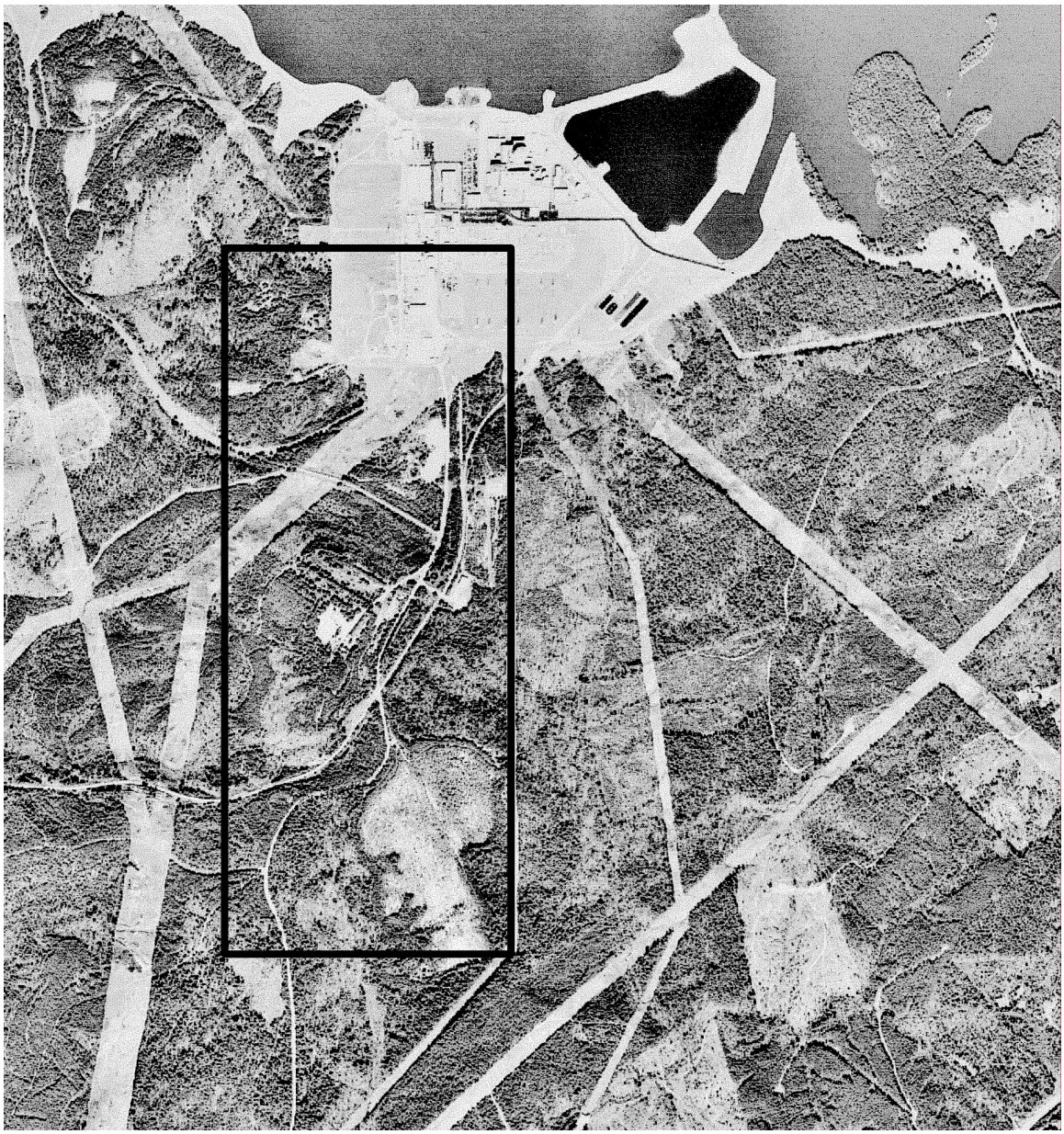

Figure 1-1 – Potential Location for New Plant at VCSNS

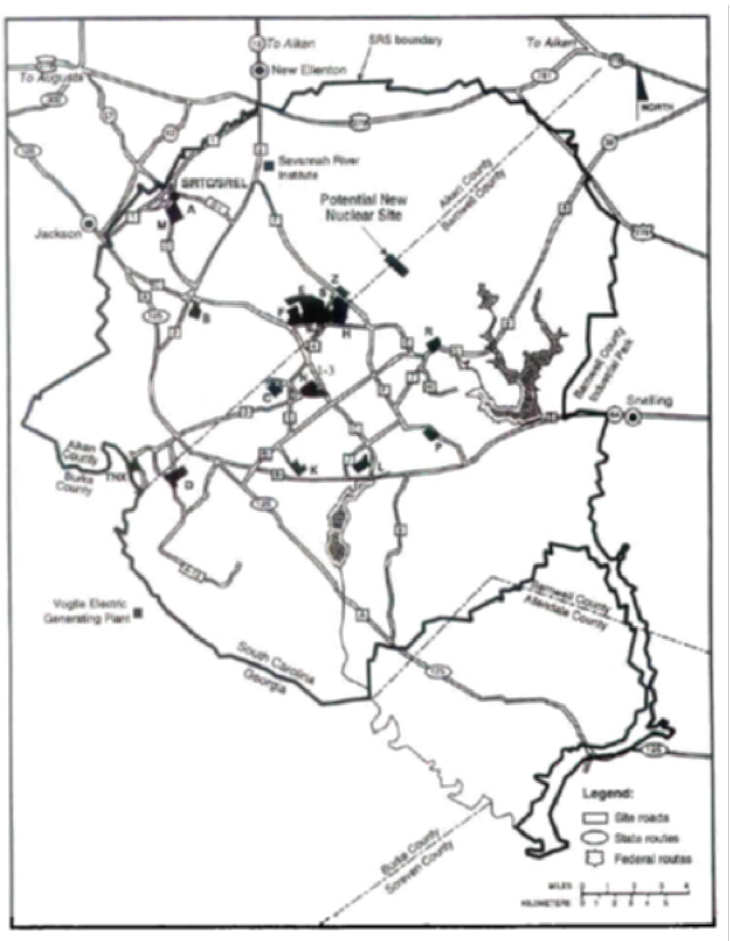

Figure 1-2 – Potential Location for New Plant at SRS

2.0 Siting Process Overview

Site selection was conducted in accordance with the overall process outlined in the EPRI *Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application* (Siting Guide), March 2002. This process, as adapted for the SCE&G site selection study, is depicted in Figure 2-1.

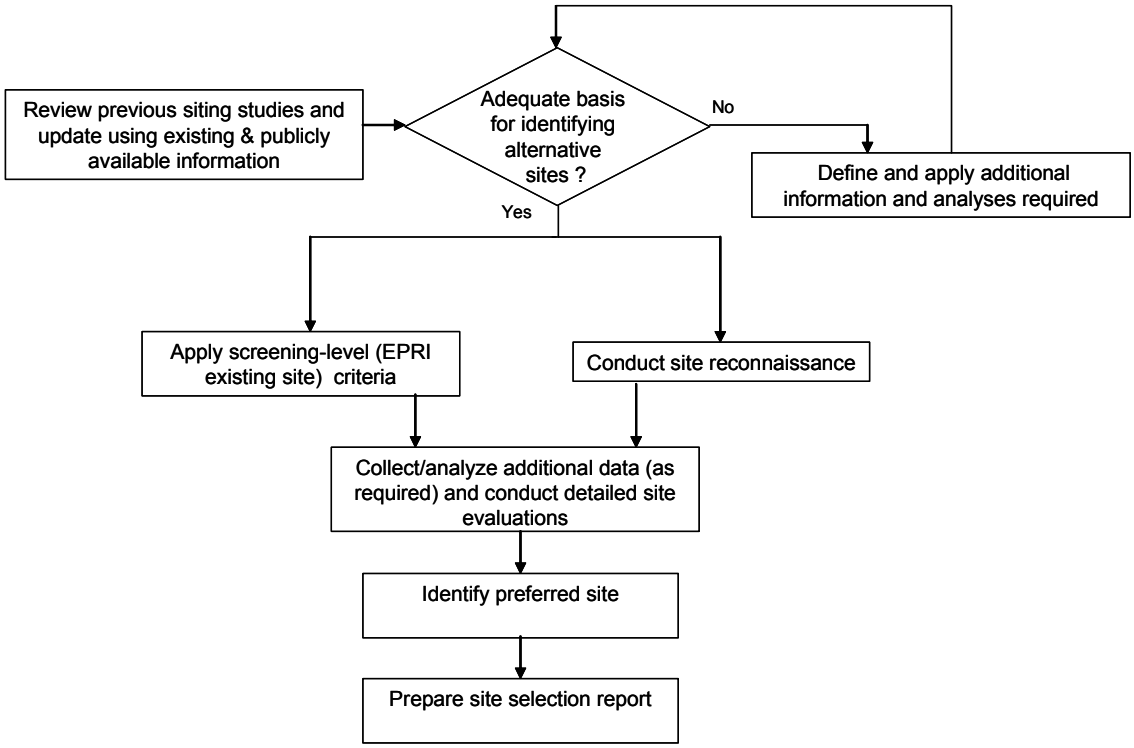

Figure 2-1 Site Selection Process Overview

This process began with evaluation and update of the basis for selecting VCSNS and SRS as the primary alternatives for consideration. This analysis was based on a review of previous site selection studies conducted for SCE&G, updated, as applicable, with publicly available data. Because this analysis indicated that no other sites in the SCE&G service area are likely to be obviously superior to VCSNS, no additional analysis to identify potential sites was required.

Data collection and analysis to provide detailed evaluation of these two sites was initiated in parallel with the effort described in the previous paragraph. Screening-level criteria developed from the EPRI Existing Site Criteria (Table 4.2 of the EPRI *Siting Guide*) were applied to evaluation of the two sites. Once these initial screening-level evaluations were developed (Section 3.0), reconnaissance-level on-site visits were conducted to support the site selection analysis.

Using all available data (including reconnaissance data, if applicable) and criteria developed based on the EPRI general site criteria (Section 3.0 of the EPRI *Siting Guide*), detailed site suitability evaluations of the two alternative sites were conducted (Section 4.0). Overall composite site suitability ratings were developed for the two alternative sites. A preferred site for the SCE&G COL application was selected based on these composite ratings and other applicable considerations that relate to the SCE&G business plans.

3.0 Screening-Level Evaluation of Candidate Sites

The overall process for screening-level site evaluation was comprised of the following elements, each of which is described in the following paragraphs; results from applying the process are described in Appendix B.

- Develop criterion ratings for each site
- Develop weight factors reflecting the relative importance of each criterion
- Develop composite site suitability ratings

Criterion Ratings – Each site was assigned a rating of 1 to 5 (1 = least suitable, 5 = most suitable) for each of the potential site evaluation criteria, using the rationale listed in Table 3-2. Information sources for these evaluations included publicly available data, information available from SCE&G files and personnel, site visits, and large scale satellite photographs.

Weight Factors - Weight factors reflecting the relative importance of these criteria were synthesized from those developed for previous nuclear power plant siting studies. The weight factors were originally derived using methodology consistent with the modified Delphi process specified in the Siting Guide. Weight factors used (1 = least important, 10 = most important) are listed in the table below.

Criterion Number	Criterion	Weight Factor
P1	Cooling Water Supply	9.8
P2	Flooding	4.4
P3	Population	8.6
P4	Hazardous Land Uses	5.9
P5	Ecology	5.6
P6	Wetlands	5.6
P7	Railroad Access	6.7
P8	Transmission Access	7.4
P9	Geology/Seismic	9.8
P10	Land Acquisition	6.3

Composite Suitability Ratings – Ratings reflecting the overall suitability of each site were developed by multiplying criterion ratings by the criterion weight factors and summing over all criteria for each site.

Screening Criteria

Criteria presented in Table 3-2, were derived from the existing site criteria listed in Section 4.2 of the EPRI *Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application* (Siting Guide), March 2002. They are intended to provide insights into the overall site suitability trade-offs between the two sites and to take advantage of data available at this stage of the site selection process.

Screening Results

Results of the screening evaluation are presented in the Table 3-1 and Figure 3-1; technical bases for individual criterion ratings are provided in Appendix B.

The VCSNS site was found to rate higher in the railroad access, transmission access, and seismic criteria; the two sites were rated essentially equal in the remaining criteria. Overall, based on the screening-level evaluation, VCSNS was found to be a superior location for the SCE&G COL application.

	Criterion										
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	**Composite Site Rating**
	Cooling Water Supply	Flooding	Popula-tion	Hazard-ous Land Uses	Ecology	Wetlands	Railroad Access	Transmis-sion Access	Geology & Seismic	Land Acquisi-tion	
	Weight Factor										
Potential Site Name	**9.8**	**4.4**	**8.6**	**5.9**	**5.6**	**5.6**	**6.7**	**7.4**	**9.8**	**6.3**	
	Site Ratings										
SRS	3.5	5	4	4	4	4	4.79	1.00	2	4.5	**246.6**
VCSNS	4	5	4	4	4	4	4.96	4.94	3	5	**294.7**

Table 3-1 Screening Evaluation Ratings

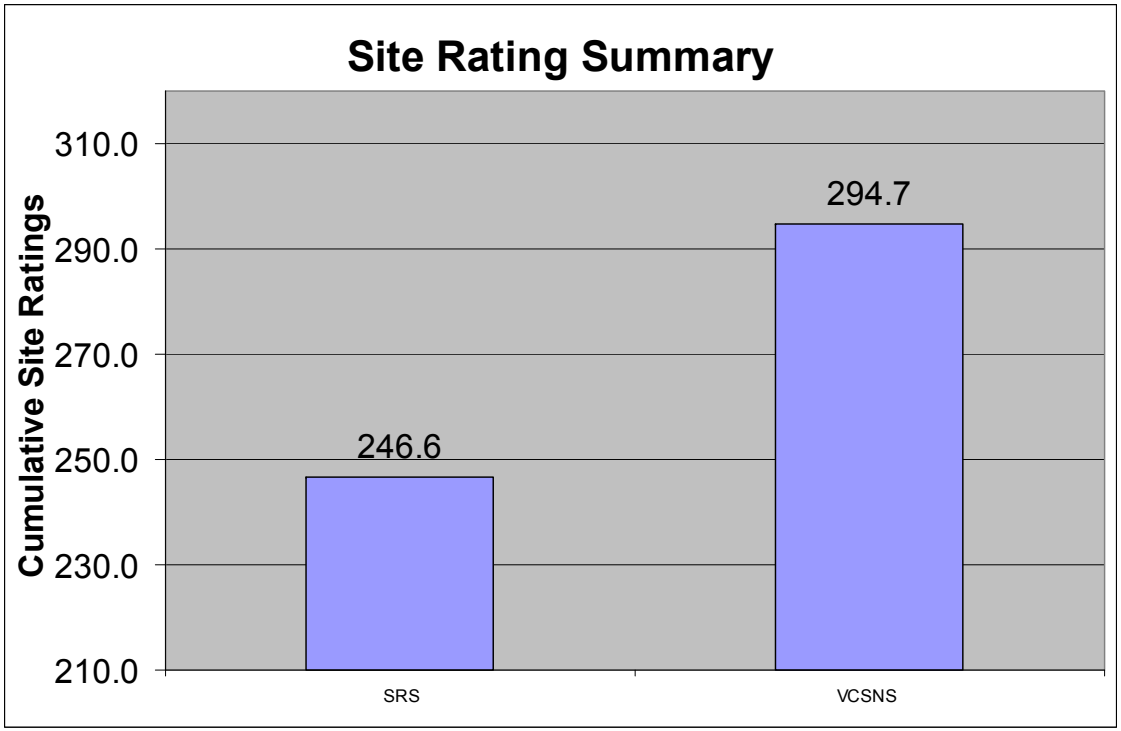

Figure 3-1 Screening Evaluation Composite Site Suitability Ratings

Table 3-2 - SCE&G Site Selection Study- Screening Evaluation Criteria

Criterion Number	Criterion	Measure of Suitability		Data, Analysis & Comments
		Metric	Rating Rationale	
P1	Cooling Water Supply	7Q10 in cfs	> 800 = 5 550 to 799 = 4 400 to 549 = 3 200 to 399 = 2 < 200 = 1	Comments and Discussion Data from existing reports; to fill any data gaps, data from typical streams in the Carolinas was plotted on a graph from 0 to 900 cfs (range based on the data received). The graph was inspected for inherent divisions. These divisions were used to define the rating numbers.
		7-Day Minimum Flow for the Water Year 2002 in cfs (drought year)	> 350 = 5 250 to 349 = 4 150 to 249 = 3 75 to 149 = 2 < 75 = 1	Data from typical streams in the Carolinas was plotted on a graph from 0 to 450 cfs (range based on the data received). The graph was inspected for inherent divisions. These divisions were used to define the rating numbers.
		Lake or River	4 – Site is located on an existing lake or reservoir 3 – Site includes both a Lake/Reservoir and River 2 – Site is located on a river	
		Average Flow or Reservoir Volume	> 10,000 cfs or > 7500 acre reservoir = 5 > 5000 cfs or > 5000 acre reservoir = 4 > 1300 cfs (minimum) or > 2500 acre reservoir = 3 [whichever is greater for site that have both river and reservoir]	Lakes plus river reaches for which the average flow >10 times the plant makeup water requirement. Based on twin-unit AP1000 plant makeup water requirement is 60,000 gpm, which equates to a "10x" water source flow requirement of about 1300 cfs. Used this as starting point (along with rating of 3) since both sites readily meet this requirement.
			Site rating is numerical average of sub-criterion ratings, rounded to a whole number	
P2	Flooding	Difference between mean site elevation and mean water elevation from USGS maps	1 – Difference less than 50 feet 3 – Difference between 50-100 feet 5 – Difference more than 100 feet	Ratings are based on actual flood elevations (PMF) for SRS and VCSNS from existing documents.
P3	Population	Distance to high-density population density; distance to population centers (cities and towns)	Ratings were assigned as follows based on distance in miles to nearest large population center (more than 25,000 persons) and with population density > 300 persons/mi^2. > 30 miles – 5 < 30 miles - 4 < 20 miles - 3 < 10 miles - 2 < 5 miles – 1	Sources were existing reports and US Census Bureau

Criterion Number	Criterion	Measure of Suitability		Data, Analysis & Comments
		Metric	Rating Rationale	
P4	Hazardous Land Uses	Number of airports, pipelines, and other known hazardous industrial facilities , as determined from publicly available data	1 – Any large municipal/commercial airport less than 5 miles, or more than 5 county or private airports within 5 miles 2 – Three to four small airports or pipelines within 5 miles 3 – Any large municipal/commercial airport within 10 miles, or 3-5 airports (county or private) or pipelines within 10 miles 4 – One to two small airports or pipelines within 10 miles 5 – No hazardous land uses within 10 miles	Identification of nearby hazardous land uses from existing site documents and USGS topo maps.
P5	Ecology	Number of protected species within the 400 acres	0 species = 5 1-2 species = 4 3-4 species = 3 4-5 species = 2 >5 species = 1	The data is for 400-acre circular sites at each location. DOE, 1997; NRC, 2004; SCDNR, 2003.
		Habitat: Professional judgment of the amount and quality of habitat available for species, based on poor quality aerial photographs.	5 = excellent 4 = good 3 = adequate 2 = fair 1 = poor	Judgment based on low resolution aerial photographs and written descriptions (DOE, 1997; NRC, 2004).
		Flexibility: Professional judgment of the amount of space within the site circle to avoid known locations of protected species during construction of the facility:	5 = No species present 4 = plenty of room 3 = adequate room 2 = site is somewhat constricting 1 = insufficient room	Judgment based on low resolution aerial photographs and written descriptions (DOE, 1997; NRC, 2004). Ranking was based on professional judgment of the comparison of sites.
		Site rating is numerical average of sub-criterion ratings, rounded to a whole number		

Criterion Number	Criterion	Measure of Suitability		Data, Analysis & Comments
		Metric	Rating Rationale	
P6	Wetlands	Total acreage of wetland within the 400 acres, not including the lake or reservoir that would be the primary source of cooling water.	< 1 acres = 5 1 to 2.5 acres = 4 2.6 to 5.0 acres = 3 5.1 to 10 acres = 2 > 10 acres = 1	Data directly from National Wetlands Inventory. (FWS, 2005) and existing site environmental reports
		Acreage of higher quality wetlands, i.e. forested wetland, within the 6000 acres.	<1 acres = 5 1 to 2.5 acres = 4 2.6 to 5.0 acres = 3 5.1 to 10 acres = 2 > 10 acres = 1	Data directly from National Wetlands Inventory. (FWS, 2005) and existing site environmental reports.
		Flexibility: Professional judgment of the amount of space within the 6000 acre site to be able to avoid wetlands during construction of the facility:	5 = No or very few wetlands, easily avoided 4 = Few wetlands, easily avoided. 3 = numerous wetlands, moderately difficult to avoid 2 = Numerous wetlands difficult to avoid 1 = Too many wetland or insufficient space to avoid.	Professional judgment. Based on inspection of a map of wetlands within the 6000-acre sites. (FWS, 2005)
P7	Railroad Access	Estimated cost of constructing rail spur to the site, based on distance in miles to the nearest rail line and a linear cost of $3M/mile.	Ratings computed by scaling costs from lowest (rating = 5) to highest (rating = 1)	Data from existing reports and USGS topo maps.
P8	Transmission Access	Estimated cost of constructing transmission connection from the site to nearest point on the existing grid, based on twice the distance in miles (redundant connections) to the nearest point on the existing grid and a linear cost of $2M/mile	Ratings computed by scaling costs from lowest (rating = 5) to highest (rating = 1)	Data from existing reports and USGS topo maps; topo maps show transmission lines but do not distinguish between 100 and 230 kV lines or higher.

<table>
<tr><th>Criterion Number</th><th>Criterion</th><th colspan="2">Measure of Suitability</th><th>Data, Analysis & Comments</th></tr>
<tr><th></th><th></th><th>Metric</th><th>Rating Rationale</th><th></th></tr>
<tr><td>P9</td><td>Geology/Seismic</td><td colspan="3">A numerical system of weights and ratings, based upon suitability criteria, are assigned to the following five sub-categories: vibratory ground motion, capable tectonic sources, surface faulting and deformation, geologic hazards, and soil stability. These data are used to compute (i.e., rate times weight) a suitability index number for each category; methods for deriving individual sub-category indexes are discussed below. Index numbers are summed across all five sub-categories to obtain an overall suitability index for each site. The index numbers are then mapped to criterion ratings of 1 to 5 according to the following algorithm:

<table>
<tr><th>Index Range</th><th>Criterion Rating</th></tr>
<tr><td>5 - 21</td><td>5</td></tr>
<tr><td>22 - 37</td><td>4</td></tr>
<tr><td>38 - 53</td><td>3</td></tr>
<tr><td>54 - 69</td><td>2</td></tr>
<tr><td>70 - 85</td><td>1</td></tr>
</table></td></tr>
<tr><td></td><td></td><td colspan="2">Vibratory Ground Motion
(Weight = 5; Index Range = 0 – 50)
<table>
<tr><th>PGA Range
PGA (%g)</th><th>Sub-Rating</th></tr>
<tr><td>0 - 3</td><td>1</td></tr>
<tr><td>3 - 6</td><td>2</td></tr>
<tr><td>6 - 9</td><td>3</td></tr>
<tr><td>9 - 12</td><td>4</td></tr>
<tr><td>12 - 15</td><td>5</td></tr>
<tr><td>15 - 18</td><td>6</td></tr>
<tr><td>18 - 21</td><td>7</td></tr>
<tr><td>21 - 24</td><td>8</td></tr>
<tr><td>24 - 27</td><td>9</td></tr>
<tr><td>27 – 30</td><td>10</td></tr>
</table></td><td>Peak ground acceleration (PGA) is a measure of the maximum force experienced by a small mass located at the surface of the ground during an earthquake and it is an index of hazard for some structures. The units for PGA are in percent of gravity (%g); i.e. an acceleration of 0.30g is expressed as 30%g. PGA used for these evaluations is for a probability of exceedance (PE) of 2% in 50 years (once in 2500 years). The latest available PGA data, obtained from the U.S. Geological Survey (USGS) Earthquakes Hazards Program, National Seismic Hazard Mapping Project (see References, Appendix A), are used for all sites.</td></tr>
<tr><td></td><td></td><td colspan="2">Capable Tectonic Structure
Class A Features (Weight = 2; Index Range = 0-10)
Class B Features (Weight = 1; Index Range = 0-5)
<table>
<tr><th>Feature Range (miles)</th><th>Sub-Rating</th></tr>
<tr><td>none within 200 mi radius</td><td>0</td></tr>
<tr><td>greater than 100 to 200 mi</td><td>2</td></tr>
<tr><td>greater than 50 to 100 mi</td><td>3</td></tr>
<tr><td>greater than 25 to 50 mi</td><td>4</td></tr>
<tr><td>0 to 25 mi</td><td>5</td></tr>
</table></td><td>Capable tectonic structures are addressed as avoidance criteria. No absolute exclusionary criteria have been identified. The objective is to identify the existence of capable or potentially capable tectonic structures within 200 miles of sites. The latest data available from USGS are utilized to identify capable and potentially capable tectonic sources within 200 miles of sites.

It is assumed that capable and potential capable tectonic sources, which are Quaternary features that may generate strong ground motion, fall into two categories as defined by Crone and Wheeler (2000, p5 – see References, Appendix A):</td></tr>
</table>

<table>
<tr><th>Criterion Number</th><th>Criterion</th><th colspan="2">Measure of Suitability</th><th>Data, Analysis & Comments</th></tr>
<tr><th></th><th></th><th>Metric</th><th>Rating Rationale</th><th></th></tr>
<tr><td>P9
Continued</td><td></td><td colspan="2"></td><td>Class A features have good geologic evidence of tectonic origin and are potentially seismogenic; and

Class B features have geologic evidence that supports the existence of a seismogenic fault or suggests Quaternary deformation, but the currently available geologic evidence for Quaternary tectonic activity is less compelling than for a Class A feature.

The existence of capable tectonic sources can impact the determination of the SSE, especially those near a site. Thorough and detailed investigation of the latest fault and seismic information will be required for new permitting.</td></tr>
<tr><td></td><td></td><td colspan="2">Surface Faulting and Deformation
Within 5 miles (Weight=2; Index Range = 0-10)
Five miles to with 25 miles (Weight = 1; Index Range = 0-5)
Feature/Range — Sub-Rating
Within 25 miles
No structures — 0
Potential non-capable structures — 1
Potential capable structures — 5
Within 5 miles
No structures — 0
Potential non-capable structures — 2
Potential capable structures — 3
Fault exceeds 1,000 ft. in length — 4
Capable fault exceeds 1,000 ft. in length — 5</td><td>No absolute exclusionary criteria have been identified with regard to surface faulting and deformation. Suitability criteria have been established based on the occurrence of surface and near-surface faulting and tectonic and non-tectonic structures within a 25-mile and 5-mile radius of sites, as follows (EPRI Siting Guide, p.3-7).

Within 25 miles
Lacking any such structures altogether (Best)
Potential non-capable structures
Potential capable structures (Least)

Within 5 miles
Lacking any such structures altogether (Best)
Potential non-capable structures
Potential capable structures
Fault exceeding 1,000 feet in length
Capable fault exceeding 1000 feet in length (Least)

The potential for surface or near-surface faulting or deformation primarily concerns plant design. Therefore, features identified within 5 miles of candidate sites receive a higher weight.</td></tr>
</table>

Criterion Number	Criterion	Measure of Suitability		Data, Analysis & Comments
		Metric	Rating Rationale	
P9 Continued		**Geologic Hazard** (Weight = 1; Index Range = 0-1) **Feature** — **Sub-Rating** No geologic hazard present — 0 Geologic hazard present — 1		Based on guidance in the EPRI Siting Guide sites having the following geologic and man-made conditions should be avoided: ➢ Areas of active (and dormant) volcanic activity. ➢ Subsidence areas caused by withdrawal of subsurface fluids such as oil or groundwater, including areas that may be affected by future withdrawals. ➢ Potential unstable slope areas, including areas demonstrating paleolandslide characteristics. ➢ Areas of potential collapse (e.g. karst areas, salt, or other soluble formations). ➢ Mined areas, such as near-surface coal mined-out areas, as well as areas where resources are present and may be exploited in the future. ➢ Areas subject to seismic and other induced water waves and floods. Sites furthest away from these features are considered the most suitable sites.
		Soil Stability (Weight = 2; Index Range = 0-4) **Feature** — **Sub-Rating** Rock Site — 0 Deep soil site, no known deleterious soil conditions — 1 Deep soil site, potential stability issues or inadequate information to assign a sub-rating of 1 — 2		No absolute exclusionary criteria have been identified with respect to soil stability. Soil stability is addressed as an avoidance criterion. Certain soil properties have unfavorable characteristics in association with vibratory ground motion. These soil properties include poor mineralogy, low-density soil (lack of compaction), and high water content (or high water table). Sites with the highest values of PGA in combination with deleterious site soils receive a relatively lower rating. Sites having rock foundations or more suitable soil conditions are considered to be better sites.
P10	Land Acquisition	Cost to acquire land	Ratings based on cost to acquire site property 0 - no or negligible cost 3 – over $5 million 5 – over $10 million	

4.0 Detailed Evaluation of Candidate Sites and Selection of Preferred Site

The objective of this component of the site selection process was to further evaluate the two candidate sites and select a preferred site for the SCE&G COL. Section 4.1 outlines the process for evaluating candidate sites, while Section 4.2 describes process results and the selection of alternate sites.

4.1 Process for Detailed Evaluation Candidate Sites

General siting criteria used to evaluate the sites were derived from those presented in Chapter 3.0 of the *Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application*, EPRI, Palo Alto, CA: 2002 (Siting Guide). Criteria from the siting guide were tailored to reflect issues applicable to, and data available for, the SCE&G candidate sites. A list of the criteria appears in Table 4-1.

The overall process for applying the general site criteria was analogous to that described in Section 3.0 and was comprised of the following elements. Results from applying the process are described in Section 4.2.

Criterion Ratings – Each site was assigned a rating of 1 to 5 (1 = least suitable, 5 = most suitable) for each of the potential site evaluation criteria, using the rationale described in Appendix C. Information sources for these evaluations included publicly available data, information available from SCE&G files and personnel, USGS topographic maps and information derived from site visits.

Weight Factors - Weight factors reflecting the relative importance of these criteria were synthesized from those developed for previous nuclear power plant siting studies. The weight factors were originally derived using methodology consistent with the modified Delphi process specified in the Siting Guide. Weight factors used (1 = least important, 10 = most important) are listed Table 4-2.

Composite Suitability Ratings – Ratings reflecting the overall suitability of each site were developed by multiplying criterion ratings by the criterion weight factors and summing over all criteria for each site, as summarized in Table 4-2.

4.2 Evaluation of Candidate Sites

Summary results of applying the evaluation process described in Section 4.1 to VCSNS and SRS are provided in Table 4-2 and Figure 4-1. Detailed discussions of the basis for site ratings for each of the criteria are provided in Table 3-2 and Appendix C.

Based on these results and on other considerations described below, VCSNS was selected as the preferred site for the SCE&G COL. In addition to its advantages as an existing nuclear power plant site, it ranked higher in 14 of the general site criteria (versus rating lower in only two) and was rated as being more suitable in the overall composite ratings.

Siting Criteria	Siting Criteria
Health and Safety Criteria: Accident Cause-Related Criteria	**Environmental Criteria: Operational-Related Effects on Aquatic Ecology, cont'd.**
Geology and Seismology	Entrainment/Impingement effects
Cooling System Requirements: Cooling Water Supply	Dredging/Disposal Effects
Cooling Water System: Ambient Temperature Requirements	**Environmental Criteria: Operational-Related Effects on Terrestrial Ecology**
Flooding	Drift Effects on Surrounding Areas
Nearby Hazardous Land Uses	**Socioeconomic Criteria**
Health and Safety Criteria: Accident Effects-Related	Socioeconomic – Construction Related Effects
Extreme Weather Conditions	Socioeconomics – Operation
Population	Environmental Justice
Emergency Planning	Land Use
Atmospheric Dispersion	**Engineering and Cost Related Criteria: Health and Safety Related Criteria**
Health and Safety Criteria: Operational Effects-Related	Water Supply
Surface Water- Radionuclide Pathway	Pumping Distance
Groundwater Radionuclide Pathway	Flooding
Air Radionuclide Pathway	Civil Works
Air-Food ingestion pathway	Brownfield Site Remediation (if applicable)
Surface Water – food radionuclide pathway	Water Supply
Transportation Safety	**Engineering and Cost: Transportation or Transmission Related Criteria**
Environmental Criteria: Construction-Related Effects on Aquatic Ecology	Railroad Access
Disruption of Important Species/Habitats	Highway Access
Bottom Sediment Disruption Effects	Barge Access
Environmental Criteria: Construction-Related Effects on Terrestrial	Transmission Cost and Market Price Differentials
Disruption of Important Species/Habitats and Wetlands	**Engineering and Cost- Related Criteria: Related to Socioeconomic & Land Use**
Dewatering Effects on Adjacent Wetlands	Topography
Environmental Criteria: Operational-Related Effects on Aquatic Ecology	Land Rights
Thermal Discharge Effects	Labor Rates

Table 4-1 General Site Criteria

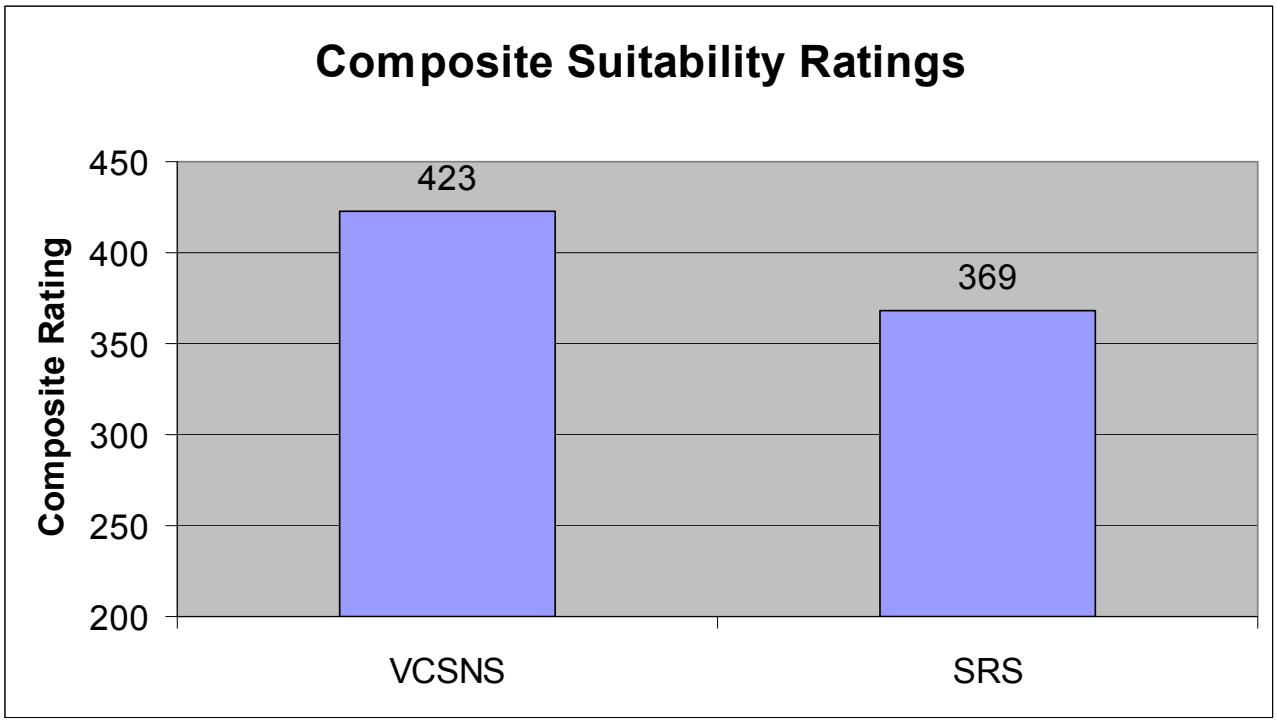

Figure 4-1 Composite Suitability Ratings

Table 4-2 General Site Criterion Ratings

Criterion		Weight Factor	SRS		VCSNS	
			Rating	Score	Rating	Score
1.1.1	Geology/Seismology	**3.77**	2	7.54	3	11.31
1.1.2	Cooling System Requirements	**3.27**	3.5	11.45	4	13.08
1.1.3	Flooding	**2.4**	5	12	5	12
1.1.4	Nearby Hazardous Land Uses	**3.35**	3	10.05	3	10.05
1.1.5	Extreme Weather Conditions	**2.36**	4	9.44	4	9.44
1.2	Accident Effect Related	**4.09**	4	16.36	5	20.45
1.3.1	Surface Water – Radionuclide Pathway	**2.5**	5	12.5	4	10
1.3.2	Groundwater Radionuclide Pathway **	**2.55**	4	10.2	4.5	11.475
1.3.3	Air Radionuclide Pathway	**2.5**	5	12.5	5	12.5
1.3.4	Air-Food Ingestion Pathway	**2.5**	3	7.5	4	10
1.3.5	Surface Water-Food Radionuclide Pathway	**2.41**	5	12.05	5	12.05
1.3.6	Transportation Safety	**2.14**	5	10.7	5	10.7
2.1.1	Disruption of Important Species/Habitats	**2.64**	4	10.56	4	10.56
2.1.2	Bottom Sediment Disruption Effects	**2.14**	3	6.42	4	8.56
2.2.1	Disruption of Important Species/Habitats and Wetlands	**3.18**	4	12.72	4	12.72
2.2.2	Dewatering Effects on Adjacent Wetlands	**2.77**	4	11.08	4	11.08
2.3.1	Thermal Discharge Effects	**3.64**	4	14.56	4	14.56
2.3.2	Entrainment/Impingement Effects	**3.23**	4	12.92	5	16.15
2.3.3	Dredging/Disposal Effects	**2.36**	3	7.08	3.5	8.26

Criterion		Weight Factor	SRS		VCSNS	
			Rating	Score	Rating	Score
2.4.1	Drift Effects on Surrounding Areas	**2.36**	4	9.44	4	9.44
3.1.1	Socioeconomics – Construction – Related Effects	**2**	5	10	5	10
3.3.1	Environmental Justice	**1.95**	5	9.75	5	9.75
3.4.1	Land Use	**3.8**	5	19	5	19
4.1.1	Water Supply	**3.7**	3	11.1	5	18.5
4.1.2	Pumping Distance	**3.05**	3	9.15	5	15.25
4.1.3	Flooding	**2.9**	5	14.5	5	14.5
4.1.5	Civil Works	**3.4**	3	10.2	3	10.2
4.2.1	Railroad Access	**2.6**	4	10.4	5	13
4.2.2	Highway Access	**2.8**	3	8.4	5	14
4.2.3	Barge Access	**2.85**	5	14.25	1	2.85
4.2.4	Transmission Access	**4.8**	1	4.8	5	24
4.3.1	Topography	**2.55**	3	7.65	4	10.2
4.3.2	Land Rights	**2.75**	4.5	12.38	5	13.75
4.3.3	Labor Rates	**3.3**	3	9.9	4	13.2
	Composite Site Rating			**369**		**423**

APPENDIX A

Survey of Previous Siting Studies

As discussed in Section 1.0 of this report, an analysis of previous siting studies evaluated by SCE&G was conducted as part of the current study. This included a review of the studies leading up to the original selection and licensing approval of VCSNS and a survey of siting studies evaluated conducted for SCE&G since selection of the VCSNS site was conducted. Results of these reviews are provided in Sections A.1 and A.2, respectively.

A.1 Licensing Approval of the VCSNS Site

The VCSNS site was originally approved by the Nuclear Regulatory Commission (NRC) as a nuclear power plant site in conjunction with issuance of a Construction Permit in 1973. Suitability of the site was confirmed with issuance of an Operating License by NRC in 1982.

In its Environmental Report – Construction Permit Stage, SCE&G reported that three alternative sites had been identified in areas near load centers where electrical generation facilities would be required in the near future.

The Parr site (which became the site for VCSNS) was selected over two other alternative sites (Bushy Park and Wateree) based on the following considerations:

- Bushy Park (near Charleston) was found to pose special problems with regard to meeting seismic design criteria due to its proximity to the Charleston earthquake.

- Wateree was found to be especially suitable for near-term fossil plant development.

The Parr site was found to combine suitable nuclear power plant site characteristics with a history of nuclear generation (Carolinas-Virginia Tube Reactor). Specifically,

- The site was in a remote location such that its utilization would have minimal environmental impacts in terms of population relocation, land use, and ecological considerations.
- It was convenient to existing railroads and highways and adjacent to existing and planned transmission facilities.
- The integrated power complex (i.e., VCSNS plus the Fairfield Pumped Storage Project) provided for maximum utilization of water resources, both for cooling requirements and for power generation.
- The site was found to have superior site economics as compared to the other two alternative sites.

In addition to opportunities for co-location of VCSNS and the pumped storage facility, the Parr site also offered the potential for supporting additional nuclear units, with the concomitant reductions in environmental impacts (e.g., confining environmental and population disruption to a single area, reduction in the number of roads and transmission lines).

For these reasons, the Parr site was selected as the preferred site for VCSNS. Additional use of the site for the SCE&G COL – as part of planning for new units at the site – is consistent with the basis on which it was originally selected and approved.

A.2 Survey of Additional Site Selection Studies

Since selection of VCSNS, and as part of its overall system planning activities, SCE&G conducted several studies of potential power plant sites within the service territory. These studies included a nuclear plant site selection study and two fossil plant studies conducted in the 1970s and 1980s. Each of these studies examined sites at or near the VCSNS site and provided updated perspectives on the environmental and other considerations for the site.

A 1974 study (Dames & Moore, 1974) examined 18 potential locations with the specific objective of identifying a separate location for a second SCE&G nuclear plant. Findings of this study indicated that there are several potential locations for such a plant within the service territory. However, evaluation of the reported characteristics of these sites indicates that none of them are "obviously superior" to VCSNS for a new nuclear plant, especially considering its:

- Status as an existing nuclear power plant site,
- Availability of adequate land and water for new units,
- Availability of existing transportation and transmission infrastructure, and
- Favorable location with respect to SCE&G loads.

Additional site selection studies were conducted in the 1980s (Dames & Moore 1982, 1988), focused on identifying sites for potential future fossil-fueled power plants. Although not all criteria used in the fossil plant site siting studies are directly applicable to nuclear plants, these studies consistently identified sites at VCSNS as being among the most environmentally preferable sites considered.

Thus, these studies examined a wide variety of alternative sites across the service territory, and, from an overall perspective, the results provide additional confidence that no sites are "obviously superior" to VCSNS for the SCE&G COL.

References

Gilbert Associates, Inc., SCE&G Company Nuclear Site Evaluation, Parr, Wateree and Bushy Park Sites Report No. 1644, April 20, 1967

Dames and Moore, 1974. Draft Final Report, Site Selection Study, Proposed Nuclear Power Plant for SCE&G Company, October 4.

Dames and Moore, 1982. Final Report Confidential Site Selection Study for SCE&G Company, July 8.

Dames and Moore, 1988. Final Report, Confidential Site Selection Study Update, 120MW Coal-fired Power Plant for SCE&G, March.

APPENDIX B

Technical Basis for Screening Criterion Ratings

Criterion P1 – Water Supply						
Site	Rating					Comments and Discussion
	7Q10	7-Day Minimum (2002)	Lake / River	Average Flow/Vol	Average	
Savannah River						
SRS	5	5	2	5	4	The 7Q10 at the gauging station at Augusta, upstream of SRS, is 3,746 cfs. The 7-day minimum flow (2002) is 3,840 cfs, also at the Augusta gauging station upstream of SRS. The average flow in the Savannah River at Augusta, GA is 10,027 cfs. Total consumptive water use at SRS was 120 cfs in 2002, much less than the historic highs of 1350 cfs. The SRS impoundment closest to the site is Par Pond with a surface area of approximately 2700 acres, although Par Pond is supposedly highly contaminated and so would not be a viable cooling water source. The site already has an existing intake structure on the Savannah River, and a cooling water pipeline to Par Pond. However, the condition of the existing system is suspect, and may require substantive upgrades. There is also the major issue about who would have control of the cooling water circuit at SRS. Because the cooling water loop at SRS (from which makeup water would be taken) is owned and operated by SRS, the average rating of 4 was modified to a 3.5 to account for the additional logistical and operational difficulties of addressing this water supply interface that does not apply at VCSNS.

Broad River/Monticello Reservoir						
VCSNS	4	3	3	5	4	Monticello Reservoir, a 6,500 acre impoundment, was built to supply cooling water to the station and to provide an upper reservoir for the Fairfield Pumped Storage Facility (FPSF). Cooling water is withdrawn for the existing station at a rate of 1,143 cfs, passed through the condensers, and ultimately returned to Monticello Reservoir. Monticello Reservoir has no net recharge, so loss from evaporation is made up from water pumped from the Broad River. Previous studies indicate that Monticello Reservoir can provide 970,000 gpm for the cooling of two once thru plants even though only one was constructed; actual VCSNS cooling flow is 513,000 gpm. Closed cycle cooling systems for two new units at VCSNS would have a net consumptive use of about 67 cfs. Monticello Reservoir storage capacity is about 380,000 acre-feet. This volume of stored water, combined with the ability to provide makeup water from the Broad River in Parr Reservoir (average river flow is in excess of 4,000 cfs) provides abundant water supply for new nuclear units. The Broad River was impounded in 1914 for a small run-of-river hydroelectric plant (Parr Hydro). The impoundment, Parr Reservoir, currently has a surface area of 4400 acres. The daily cycle of operation at FPSF transfers up to 14,700 cfs of water from Parr Reservoir to Monticello Reservoir and back. Low Flow data for Broad River currently based on 7Q10 flow at the Carlisle gage (02156500) equals 730 cfs for the period 1938-1991, and 620 cfs if flows through 2003 are taken into account. The annual 7-day low flow (2002) is 220 cfs.

Criterion P2 – Flooding		
Site	Rating	Comments and Discussion
Savannah River		
SRS	5	The average site elevation is 310 feet, resulting in a difference of over 100 feet elevation between the site and the elevation for Upper Three Runs Creek, which is at 136 feet. The site is sufficiently far from Savannah River and at sufficient elevation such that the river poses no flooding concerns at the site. Major flooding sources for the site are from Upper Three Runs Creek (about 1.2 miles west of site), Tinker Creek (tributary of Upper Three Runs Creek and about 1 mile northwest of site) and Mill Creek (tributary to Tinker Creek and about 0.7 miles northeast of site). The proposed site elevation is more than 120 feet above all of these existing streams. Regarding onsite tributaries nearest the site, the PMF for Upper Three Runs is estimated to be 173.5 ft. Although PMF water levels on Tinker and Mill Creeks would likely be higher than the elevation determined for Upper Three Runs Creek, they would not pose a threat to the proposed site given it's location at more than 120 feet above the existing streambeds, especially given the small drainage areas for these two creeks. A cascading failure of upstream dams is estimated to result in flood elevation of 141 ft., still well below site elevation.
Broad River		
VCSNS	5	The average site elevation is more than 100 feet above the PMF for Parr Reservoir. VCSNS is a flood-dry site. The major water body that could affect flooding at site is the Parr Reservoir/Broad River. A maximum PMF water elevation of 290.5 feet was calculated at Parr Reservoir. This is about 150 feet below site grade elevation of 435 feet. This forms the basis for the VCSNS rating of 5. Considering coincidental dam breaching, the maximum water surface elevation is conservatively estimated at 390 feet, which is still 45 feet below plant grade. Seismically induced floods also pose no threat. Another source of flooding is Monticello Reservoir on Frees Creek. A PMF analysis resulted in a maximum water elevation of 436.6 feet from wave run-up and wind set-up based on maximum wind velocity of 50 mph coinciding with the 48 hour PMP. This value is below the 438-foot crest elevation of the site protection berm and service water pond dams. In addition, because the Monticello Reservoir is an upper reservoir that supplies water to the FPSF, its elevation can be further adjusted (i.e., lowered), as needed, to accommodate PMP events, so flooding from the reservoir is not a concern at VCSNS.

Criterion P3 – Population		
Site	Rating	Comments and Discussion
SRS	4	Large population centers nearest the site include: Aiken, SC - 25,337 Augusta, GA – 43,459 (1994); 199,775 in 2000 (in 1996 the governments of the City of Augusta and Richmond County combined to form a single governing body known as Augusta-Richmond County) Distance to these centers is: 19.5 miles to Aiken (over 25,000) 25 miles to Augusta (199,775 – Augusta-Richmond County balance) Population densities are highest in the Cities of Aiken, Augusta and North Augusta at approximately 1,000 persons/mi^2 Smaller towns within 15 miles include: New Ellenton (2250) Jackson (1625), Barnwell (5035), Snelling (246) and Williston, SC (3307). No permanent residents reside at SRS, but 13,000 employees work onsite (41.9 persons/mi^2) County population and population densities are as follows (site is in Aiken and Barnwell Counties): Aiken - 142,552 (132.9 persons/mi^2) Barnwell - 23,478 (42.8 persons/mi^2) Allendale - 11,211 (27.2 persons/mi^2) Bamberg - 16,658 (42.4 persons/mi^2) Columbia, GA – 89,288 (307.9 persons/mi^2) Richmond, GA - 199,775 (616.5 persons/mi^2).
VCSNS	4	Large population centers nearest the site include: Columbia – 116,278 (928.6 persons/mi^2) West Columbia – 13,064 (132.6 persons/mi^2) Distance to these centers is approximately 21 miles to Columbia and West Columbia Smaller towns within 15 miles include: Jenkinsville (724), Salem (126), Winnsboro (3599), Winnsboro Mills (2263), Peak (61), Chapin (628); Newberry (10,580) is 16 miles away. [Jenkinsville is closest at 2 miles.] County population and population densities are as follows (VCSNS is in Fairfield County): Fairfield County – 23,454 (34.2 persons/mi^2) Richland County – 320,677 (423.9 persons/mi^2) [Columbia in Richland Co.] Lexington County – 216,104 (308.9 persons/mi^2) [West Columbia in Lexington Co.] Newberry County – 36,108 (57.2 persons/mi^2)

Criterion P4 – Hazardous Land Uses		
Site	Rating	Comments and Discussion
SRS	4	No airports, pipelines, rail, or hazardous chemical storage, handling or manufacturing facilities are found within 5 miles of SRS. There is a gas pipeline within 10 miles of the site. In addition, several industrial and manufacturing facilities are found nearby. The closest airports are Barnwell County Airport about 14 miles to the east of the site, and Bush Field near Augusta, GA about 18 miles west-northwest of the site. No military facilities are found within 10 miles of site (site is about 6 miles from the nearest SRS boundary, however). The nearest gas pipeline is 10 miles northwest of SRS near Beech Island. CSX railway is about 11 miles from the site (closest point). It is 15 miles to the Vogtle nuclear plant (southwest of site). No large hazardous chemical storage, handling or manufacturing facilities exist within 5 miles of the site. However, Carolina Metals, Inc is about 13.5 miles southeast of the proposed site and produces depleted uranium and uranium tetrafluoride*. Potentially hazardous industrial activities are also found within SRS.**
VCSNS	4	A main rail line and one small airport (landing strip) are found within 5 miles of the site. No pipelines or known hazardous chemical industrial or manufacturing facilities are located nearby. The VCSNS spur railroad line connects with the main railroad line approximately 2 miles to the southwest. A small landing strip is found north of Winnsboro (14 miles from the site). The large metropolitan airport at Columbia is more than 25 miles away (southeast of site). There is an airport at Newberry (about 18 miles west of site). VCSNS site is adjacent to the proposed site. One gas pipe line supplies gas turbines at the Parr Hydro facility about 2 miles south-southwest of VCSNS. Two other hydroelectric power plants are located nearby [Parr Hydro at Parr Dam, and FPSF, which is co-located with VCSNS].

*There are no airports, military facilities, or large hazardous chemical storage, handling or manufacturing facilities within 5 miles of the SRS boundary. However, there are several industrial and manufacturing areas nearby, including:

- Starmet CMI, Inc. (formerly Carolina Metals, Inc.), located 13.5 miles away in Barnwell County – processes uranium contaminated metals;
- Chem-Nuclear Systems, Inc., located approximately 8 miles away in Barnwell, SC - commercial low-level waste disposal and waste transportation activities;
- Transnuclear, Inc. - waste transportation activities in Aiken County;
- a fossil-fired electric generating plant 20 miles north of SRS; and
- Fort Gordon Army Post southwest of Augusta, GA.

Other major industrial and manufacturing facilities in the area include textile mills, plants producing polystyrene foam and paper products, and chemical processing plants.

**While there appear to be no existing off-site man-made hazards within five miles of SRS, and no projected hazards have been identified, SRS does contain a number of potentially hazardous industrial activities (beyond 5 miles), as well as some within SRS (e.g., fuel and plutonium storage facilities and target fabrication facilities, nuclear material production reactors, chemical separation plants, a uranium fuel processing area, liquid HLW tank farms, a waste vitrification facility, etc.). While on-site activities would be conducted within the highest government safety standards, there are still some associated risks.

Criterion P5 – Ecology (Terrestrial and Aquatic Ecology combined)					
Site	Rating				Comments and Discussion
	No. of Species	Habitat	Flexibility	Average Score	
Savannah River					
SRS	5	3	5	4	There are no federal or state listed species on-site. There are federal and state listed rare, threatened, and endangered species that have been seen within the SRS, including the bald eagle, wood stork, and red-cockaded woodpecker. However, none have been recorded in the immediate vicinity of the proposed site nor have any nests been observed in the general area of the sites. The smooth purple coneflower is the only federally listed endangered plant species that occurs within the SRS, but this is not found in the immediate vicinity of the site. The nearest sightings of bald eagles and bale eagle nests have been around the Par Pond system. Par Pond is about 3 miles south of the proposed site. The closest area of endangered plant species is on the other side of Tinker Creek about a mile from the sites, where some smooth purple coneflower plants have been identified. There are no known important regional aquatic organisms, threatened or endangered aquatic species, spawning areas or migrating routes for aquatic species, nor commercially or recreationally valuable aquatic species in the immediate vicinity of the proposed site.
Broad River					
VCSNS	5	3	5	4	There are no federal or state listed species on-site. Six bald eagle nesting sites occur within a 5-mile radius of the site; four of these sites are believed to be active nesting sites and the status of the other two is unknown. Four of the sites are on Parr Reservoir, one is on Monticello Reservoir; and one is two miles east of Monticello Reservoir. No areas are designated by the USFWS as critical habitat for endangered species exist at the site. No aquatic federally listed endangered or threatened species are known to occur in Monticello Reservoir or Parr Reservoir in the vicinity of site. Two federal listed and 12 state listed aquatic species have been reported from the counties of the site and transmission lines. One plant (frasera caroliniensis), listed as a species of "regional concern" by the State of South Carolina, is found near Parr Reservoir.

Criterion P6 – Wetlands					
Site	Rating				Comments and Discussion
	Total Acres	Acres of Forested	Flexibility	Average Score	
SRS	5	1	5	4	No wetlands are found in the immediate area of the site, although there are significant wetlands 2 to 4 miles from the site. In general, wetlands cover about 49,000 acres of the approximately 198,000 acres occupied by the SRS. The proposed site is within the approximately 250 acres of the site, which consists of mostly wooded land, predominantly loblolly and slash pine that have been planted since the late 1950s.
VCSNS	5	1	5	4	Some minor, small wetlands may be encountered on previously undisturbed portions of the site, south of VCSNS.

Criterion P7 – Railroad Access		
Site	Rating (See rating summary below)	Comments and Discussion
SRS	4	The assigned rating is based on a distance of 2.4 miles as measured to the nearest rail line on the USGS topographic maps. In general, SRS is served by the CSX railroad. There are approximately 80 miles of onsite rail lines, with approximately 60 miles being maintained by DOE. Currently no rail spur exists at the preferred site. To avoid security issues associated with transportation through the SRS site, a preferred approach for a commercial nuclear plant may be to install a spur line from the main CSX line to the proposed site [estimated distance for this spur is at least 10 miles]. If this option were to be used in the evaluation, the rating would be lowered to a 1.
VCSNS	5	On-site railroad access is already provided to VCSNS with a spur from the Norfolk Southern line; so no new rail spur would be required at the site. The spur runs along the east side of the Broad River (NUREG 1437, Supplement 15).

Criterion P8 – Transmission Access		
Site	Rating (See rating summary below)	Comments and Discussion
SRS	1	The transmission system on the SRS site consists of multiple 115 kV transmission lines forming a ring of network around the site. Three switching stations for the 115 kV transmission lines exist around the sites to feed the different area loads. The 115 kV system for the SRS is fed from SCE&G. A single 115 kV transmission line runs along the edge of the proposed site. A 230 kV line from Graniteville runs parallel to the 115 kV line at the edge of the proposed site. SRS studies have estimated transmission capital and upgrade costs ranging from about $140 million to more than $240 million. The lower value was assumed for this analysis; based on this data, a rating of 1 has been assigned.
VCSNS	5	SCE&G has built eight transmission lines for the specific purpose of connecting VCSNS to the transmission system. Two additional transmission lines were built by Santee Cooper, co-owner of VCSNS, to connect the station to the regional grid. A total of 10 transmission lines connect VCSNS to the transmission system. While some additional upgrading/modification is expected to tie in the new site, a rating of 5 is assigned since transmission lines already exist at VCSNS.

Rating Summary

Criterion P7 – Rail Access; Criterion P8 – Transmission Access

Rail and transmission access costs were estimated by measuring the straight-line distance from each site to the nearest approach to existing transmission and rail facilities. Costs were based on a linear construction cost of $2 million per mile for transmission and $3 million per mile for rail. It was assumed that double-circuit connections would be required for transmission, so that the costs equal $ 4 million x distance to existing lines. Ratings were developed by normalizing rating for individual cost criteria across the full range of cost differentials across all sites.

A summary of the distances, costs and ratings for the rail and transmission access criteria is provided in the following table.

Site	Distance to Transmission (mi)	Transmission Cost ($M)	Trans-mission Rating	Distance to Railroad (mi)	Railroad Cost ($M)	Railroad Rating
SRS	N/A	140.0	1.00	2.4	7.2	4.79
VCSNS	0.5	2.0	4.94	0.5	1.5	4.96

Criterion P9 – Geology/Seismology Summary Rating			
Site	Index	Rating	Comments and Discussion
SRS	54	2	See following back-up tables
VCSNS	48	3	See following back-up tables

Table P9-01 Ratings for SRS

Feature	Source	Weight	Rating	Index No.
Vibratory Ground Motion	PGA 18 - 24 %g with 2% PE in 50 years (USGS National Seismic Hazards Mapping Project, 2002).	5	8	40
Capable Tectonic Source (Class A)	The Bluffton and Charleston Class A liquefaction features occur within 50 to 100 miles of SRS. The Georgetown Class A liquefaction features occur within 100 to 200 miles (USGS Fault and Fold Database, 2003. Crone & Wheeler, 2000).	2	3	6
Capable Tectonic Source (Class B)	No Class B features were identified within a 200 mile radius of SRS (Crone & Wheeler, 2000, p.8).	1	0	0
Surface Faulting & Deformation within 25 miles	No surface faulting or deformation has been identified at the site. Subsurface faulting occurs as described for the 5-mile radius (below).	1	0	0
Surface Faulting & Deformation within 5 miles	The Pen Branch Fault (Class C) occurs through the approximate center of the site. (USGS Fault and Fold Database, 2003; Crone & Wheeler, 2000). Other faults (unclassed and non-Quaternary) also occur at the site.	2	2	4
Geologic Hazards	No areas of volcanic activity, subsidence due to withdrawal of subsurface fluids, potential unstable slope, potential collapse, mined areas, or areas subject to seismic or other induced water waves or floods occur at the site (Dominion Energy, Inc. and Bechtel Power Corp. 2002).	1	0	0
Soil Stability	SRS is a deep soil site. The Santee Formation occurs beneath the site as a discontinuous layer of varying thickness. At SRS the formation consists of relatively soft silty and clayey sands with low penetration resistance at depths of 100 to 150 feet. Development of sensitive facilities will require thorough investigation of any soft underlying materials.	2	2	4
			Total Index	**54**

Table P9-02 Ratings for VCSNS

Feature	Source	Weight	Rating	Index No.
Vibratory Ground Motion	PGA 23.57 %g with 2% PE in 50 years (USGS National Seismic Hazards Mapping Project, 2002).	5	8	40
Capable Tectonic Source (Class A)	The Charleston, Bluffton, and Georgetown Class A liquefaction features all occur within 100 to 200 miles of VCSNS (USGS Fault and Fold Database, 2003. Crone & Wheeler, 2000).	2	2	4
Capable Tectonic Source (Class B)	No Class B features were identified within a 200 mile radius of VCSNS (USGS Fault and Fold Database, 2003. Crone & Wheeler, 2000).	1	0	0
Surface Faulting & Deformation within 25 miles	No surface faulting or deformation has been identified at the site. Near surface faulting occurs as described for the 5-mile radius (below).	1	0	0
Surface Faulting & Deformation within 5 miles	Unnamed non-capable faults in the crystalline bedrock were found at VCSNS during construction (VCSNS FSAR).	2	2	4
Geologic Hazards	No areas of volcanic activity, subsidence due to withdrawal of subsurface fluids, potential unstable slope, potential collapse, mined areas, or areas subject to seismic or other induced water waves or floods occur at the site (VCSNS FSAR).	1	0	0
Soil Stability	VCSNS is a rock site	2	0	0
			Total Index	**48**

Criterion P10 – Land Acquisition		
Site	Rating	Comments and Discussion
SRS	4.5	The site and SRS on which site is located are currently owned by the Federal Government, it is assumed that the site property would be transferred to SCE&G for a nominal fee such that there would be no associated land acquisition costs. However, there may be additional hidden costs or schedule issues associated with negotiating lease agreements and access controls. Accordingly the site is given a slightly lower than "most suitable" rating of 4.5.
VCSNS	5	The site property is already owned by SCE&G.

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USGS Topographic Maps (1:100,000 scale) for Newberry, South Carolina, US Geological Survey (1986) and Barnwell, South Carolina (1982).

USGS Topographic Maps (1:24,000 scale) for New Ellenton SE (1963), New Ellenton SW (1965), and Jenkinsville (1969), South Carolina.

APPENDIX C

Technical Basis for General Site Criteria Ratings

General siting criteria used in the SCE&G nuclear power plant siting study were derived from those presented in Chapter 3.0 of the *Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application*, EPRI, Palo Alto, CA: 2002 (Siting Guide).

The following information is provided in this appendix for each criterion:

- Objective – what aspect of site suitability is being measured
- Evaluation approach – technical basis/methodology used to develop site ratings from available data
- Discussion – Data and information available for the two sites under consideration
- Results – Ratings results and rationale

The following two candidate sites were evaluated as candidates for SCE&G's Combined Operating License (COL) application: Savannah River Site (SRS) and the Virgil C. Summer Nuclear Station (VCSNS). Locations of these sites are described in Section 1.0 of this report.

Note that the two sites were evaluated with respect to the following siting criteria during the initial screening phase: cooling water supply, flooding, population, hazardous land uses, ecology, wetlands, railroad access, transmission access, geology/seismic, and land acquisition; the evaluation and results of this phase are presented in Appendix B. Appendix C provides a more detailed discussion of the full EPRI general site criteria, including those initially addressed in Appendix B. For several of these criteria (e.g., cooling water), the original evaluation did not change and reference is made to the criterion discussion in Appendix B, with a brief summary and the final ratings presented in Appendix C for completeness. For other screening criteria (i.e., population, ecology and geology/seismic), additional data were evaluated or additional detail provided in Appendix C, as appropriate, to provide a more comprehensive analysis of the full suite of EPRI siting criteria and sub-criteria.

Technical bases for site ratings developed for each of the general site criteria are provided in the following sections. Criterion/section numbering is designed to reflect section numbers in Chapter 3 of the EPRI Siting Guide where the criteria is discussed, e.g., Criterion 1.1.1 - Geology/ Seismology appears in Section 3.1.1.1 of the Siting Guide.

1. HEALTH AND SAFETY CRITERIA

1.1 ACCIDENT CAUSE-RELATED

1.1.1 Geology/Seismology

This criterion was evaluated as part of the initial screening process (Criterion P9, Appendix B). The data, the evaluation and the results have not changed from the initial screening. Accordingly, the complete evaluation and results, including detail on each of the sub-criteria evaluations in support of the final site ratings, are included here.

Objective - The objective of this criterion is to rank the suitability of SRS and VCSNS with respect to the geologic and seismic setting, using to the extent possible the same or similar criteria previously utilized to rank other potential sites.

Evaluation approach - A numerical system of weights and ratings based upon suitability criteria were assigned to each geologic/seismic category, including vibratory ground motion, capable tectonic sources, surface faulting and deformation, geologic hazards, and soil stability (Sections 1.1.1.1 through 1.1.1.5) and used to compute (i.e., rate times weight) an index number for each category. (To enable the comparative evaluation of sites, the weights and rating schemes adopted herein for SRS are the same as used for VCSNS). The index numbers for each site were summed to compute a GEOL Index (Tables 1.1-1 through 1.1-4). The range of GEOL indexes was then used to develop a ranking system for candidate sites (Section 1.1.1.6). The sites were ranked on a scale of 1 to 5, based on the GEOL scale, with the most suitable sites receiving a rank of 5. Weights and the basis for deriving correlating site ratings from the GEOL scale are discussed with respect to each of the sub-criteria below.

Discussion – Site data are presented for each of the sub-criteria in Sections 1.1.1.1 through 1.1.1.5, below.

Results – A discussion of the roll-up of individual criteria to develop overall site ratings for the Geology/Seismology criterion appears in Section 1.1.1.6.

1.1.1.1 Vibratory Ground Motion

Objective – The purpose of this sub-criterion is to rate sites according to the magnitude of ground motion that may be expected. As long as expected peak ground accelerations do not exceed that for the certified designs under consideration there are no exclusionary or avoidance components to this sub-criterion.

Evaluation approach – Peak ground acceleration (PGA) is a measure of the maximum force experienced by a small mass located at the surface of the ground during an earthquake and it is an index of hazard for some structures. The units for PGA are in percent of gravity (%g); i.e. an acceleration of 0.30g is expressed as 30%g. PGA provided herein, as for other sites, is for a probability of exceedance (PE) of 2% in 50 years (once in 2500 years). PGA data for SRS and VCSNS were obtained from the USGS National Seismic Hazards Mapping Project, 2002 (http://eqint.cr.usgs.gov/eq/html/lookup-2002-interp.html).

Discussion/Results – The location evaluated for SCE&G at SRS and VCSNS have PGA values as shown in the table below.

Probabilistic ground motion values in %g

Site	PGA (%g) with 2% PE in 50 years
SRS	22.25
VCSNS	23.57

The following table shows the assigned weight and rating scheme for vibratory ground motion.

Weight	Range	Rating	Index Range
5	PGA (%g)		0 - 50
	0 - 3	1	
	3 - 6	2	
	6 - 9	3	
	9 - 12	4	
	12 - 15	5	
	15 - 18	6	
	18 - 21	7	
	21 - 24	8	
	24 - 27	9	
	27 – 30	10	

Based upon the information provided in Table 1.1-1 (at the end of Section 1.1.1), SRS and VCSNS receive the following ratings and computed index numbers for vibratory ground motion.

Site	Rating	Index No.
SRS	8	40
VCSNS	8	40

1.1.1.2 Capable Tectonic Structure or Source

Objective – No absolute exclusionary criteria have been identified. Capable tectonic structures are addressed as avoidance criteria, therefore, the objective of this criterion is to identify the existence of capable or potentially capable tectonic structures within 200 miles of the site. Candidate sites that are furthest from capable or potentially capable tectonic structures are considered more suitable.

Evaluation approach – A database compiled by USGS (Quaternary Fault and Fold Database, 2003; http://qfaults.cr.usgs.gov/) and Crone and Wheeler (2000) were utilized to identify capable and potentially capable tectonic sources within 200 miles of SRS. It was assumed that capable and potential capable tectonic sources, which are Quaternary features that may generate strong ground motion, fall into two categories as defined by Crone and Wheeler (2000, p5):

Class A features have good geologic evidence of tectonic origin and are potentially seismogenic; and
Class B features have geologic evidence that supports the existence of a seismogenic fault or suggests Quaternary deformation, but the currently available geologic evidence for Quaternary tectonic activity is less compelling than for a Class A feature.

Discussion/Results – The table below shows a list of Class A and Class B features within a 200 mile radius of each candidate site. There are no known Class B features within 200 miles of SRS or VCSNS.

Feature	Class	Site	Distance from site (mi)
Bluffton liquefaction features	A	SRS	Greater than 50 to 100
Charleston liquefaction features	A	SRS	Greater than 50 to 100
Georgetown liquefaction features	A	SRS	Greater then 100 to 200
Bluffton liquefaction features	A	VCSNS	Greater than 100 to 200
Charleston liquefaction features	A	VCSNS	Greater than 100 to 200
Georgetown liquefaction features	A	VCSNS	Greater than 100 to 200

The existence of capable tectonic sources can impact the determination of the SSE, especially those near a site. The defining seismic event for the SRS and VCSNS areas is the Charleston earthquake of 1886. Despite thorough investigation and numerous studies, the causative fault(s) for this earthquake has not been identified. Geophysical studies have indicated the occurrence of faults near the epicenter of the Charleston 1886 earthquake. These studies are continuing, and may affect the determination of capable structures near SRS and VCSNS. Regardless, thorough and detailed investigation of the latest fault and seismic information will be required for new permitting.

The following table shows the assigned weight and the rating scheme for capable tectonic sources. Class B is included to show the rating scheme for this Class used at other sites.

Weight	**Range** (miles)	**Rating**	**Index Range**
Class A 2	none within 200 mi radius greater than 100 to 200 mi greater than 50 to 100 mi greater than 25 to 50 mi 0 to 25 mi	0 2 3 4 5	0 - 10
Class B 1	none within 200 mi radius greater than 100 to 200 mi greater than 50 to 100 mi greater than 25 to 50 mi 0 to 25 mi	0 2 3 4 5	0 - 5

Based on the information provided in Table 1.1-1, SRS and VCSNS receive the following ratings and computed index numbers.

Class A

Site	Rating	Index No.
SRS	3	6
VCSNS	2	4

Class B

Site	Rating	Index No.
SRS	0	0
VCSNS	0	0

SRS and VCSNS Locations – Class A Features

There are two Class A features within 50 to 100 miles of SRS, and one within 100 to 200 miles. All are Quaternary liquefaction features of the type associated with vibratory ground motion, and are believed to be caused by movement along unknown faults.

Charleston Liquefaction Features (SC) (Class A) – Soil liquefaction-formed sand fissures, blows and craters. Located approximately 95 miles south-southeast from SRS in the central coast region of South Carolina. Quaternary faulting indicated by direct observations of liquefaction during the Charleston 1886 earthquake. Middle to late Holocene liquefaction features produced by prehistoric earthquakes have also been identified. Source faulting has not been identified (Crone and Wheeler, 2000).

Bluffton Liquefaction Features (SC) (Class A) – Prehistoric sandblow craters. Located approximately 80 miles southeast from SRS in the southern coast region of South Carolina. Quaternary faulting indicated by late Holocene liquefaction features. Source faulting has not been identified (Crone and Wheeler, 2000).

Georgetown Liquefaction Features (SC) (Class A) – Prehistoric sandblow craters. Located approximately 135 miles east from SRS in the central coast region of South Carolina. Quaternary faulting indicated by late Holocene liquefaction features (and possibly a few liquefaction features due to the Charleston 1886 earthquake). Source faulting has not been identified (Crone and Wheeler, 2000).

These same Class A features also are located within 100 to 200 miles of VCSNS (see above discussion which is relevant to both sites).

Charleston Liquefaction Features (SC) (Class A) – Located approximately 120 miles southeast from VCSNS in the central coast region of South Carolina.

Bluffton Liquefaction Features (SC) (Class A) – Located approximately 140 miles south of VCSNS in the southern coast region of South Carolina.

Georgetown Liquefaction Features (SC) (Class A) – Located approximately 130 miles southeast from VCSNS in the central coast region of South Carolina.

Crone and Wheeler (2000) and the USGS Fault Database (2003) also identify Class C features. Class C features are defined by Crone and Wheeler (2000) as features where:

> Geologic evidence is insufficient to demonstrate (1) the existence of a tectonic fault, or (2) Quaternary slip or deformation associated with the feature.

Several Class C features occur within 200 miles of SRS and VCSNS. They are discussed because the occurrence of such features is considered in the ranking scheme adopted in Section 1.1.1.3. These features would require thorough investigation and evaluation for the permitting of new nuclear facilities at SRS or VCSNS. No Class D features have been identified within 200 miles of SRS or VCSNS. Additional information is provided below with respect to Class C features within 200 miles of SRS and VCSNS.

SRS and VCSNS Locations - Class C Features

The following Class C faults are considered non-capable.

Belair Fault Zone (GA) (Class C) – The Belair Fault Zone is located approximately 30 miles northwest of the center of SRS, and approximately 70 miles southwest of VCSNS. Latest movement along the Belair Fault has not been demonstrated to be of Quaternary age. However, the available evidence does not definitely preclude Quaternary activity (USGS Fault Database, 2003; Crone and Wheeler, 2000).

Cooke Fault (SC) (Class C) – The Cooke Fault is located approximately 80 miles south-southeast of SRS, and approximately 110 miles southeast of VCSNS. Latest activity (buried deformation) is Eocene in age. There is no evidence of post-Eocene activity (USGS Fault Database, 2003; Crone and Wheeler, 2000).

Cape Fear Arch (NC) (Class C) – A broad northwest trending arch in southeast North Carolina, formed by uplifting of the crystalline basement rocks. This feature is located approximately 160 miles east-northeast from VCSNS. Faults have been suggested, but none have been identified. Some suggested faults have been discounted (USGS Fault Database, 2003; Crone and Wheeler, 2000).

Hares Crossroads Fault (NC) (Class C) – The Hares Crossroads Fault is located in eastern North Carolina approximately 180 miles northeast of VCSNS. This fault offsets coastal plain sediment of unknown age. The fault may not be tectonic in origin, and is not demonstrably of Quaternary age (USGS Fault Database, 2003; Crone and Wheeler, 2000).

Helena Banks Fault Zone (SC) (Class C) – The Helena Banks Fault Zone is located in the Atlantic Ocean offshore of South Carolina, approximately 110 miles east-southeast of SRS, and 150 miles southeast of VCSNS. There is no evidence of activity for this feature since Miocene time (USGS Fault Database, 2003; Crone and Wheeler, 2000).

Pen Branch Fault (SC) (Class C) – The Pen Branch Fault passes through the approximate center of SRS, approximately 80 miles south-southwest from VCSNS. The occurrence, orientation and age of this fault are well documented by numerous site geologic and seismic investigations. Other unclassified and non-Quaternary faults also occur at

VCSNS. These faults are considered as non-capable and non-Quaternary due to the absence of evidence of activity since Eocene time (USGS Fault Database, 2003).

Stanleytown – Villa Heights Faults (VA) (Class C) – The Stanleytown – Villa Heights Faults are located in south-central Virginia, approximately 170 miles north-northeast of VCSNS. They consist of two small north-striking faults situated near Martinsville, Virginia. Both faults may be landslides rather than tectonic faults. The available evidence does not demonstrate a Quaternary age for these features (USGS Fault Database, 2003; Crone and Wheeler, 2000).

1.1.1.3 Surface Faulting and Deformation

Objective – Develop site ratings for site suitability relative to surface faulting and deformation in the site vicinity.

Evaluation approach – No absolute exclusionary criteria have been identified with regard to surface faulting and deformation. Suitability criteria have been established based on the occurrence of surface faulting and tectonic and non-tectonic structures within a 25-mi and 5-mi radius of candidate sites, as follows (EPRI 2000, p.3-7):

Within 25 miles
- Any such structures altogether (Best)
- Potential non-capable structures
- Potential capable structures (Worst)

Within 5 miles
- Any such structures altogether (Best)
- Potential non-capable structures
- Potential capable structures
- Fault exceeding 1,000 feet in length

The potential for surface faulting or deformation primarily concerns plant design, therefore features identified within 5 miles of a candidate site receive a higher weight. Following are the assigned weights and ratings for surface faulting and deformation.

Weight	Range	Rating	GEOL Index Range
within 25 mi–1	No structures Potential non-capable structures Potential capable structures	0 1 5	0–5
within 5 mi–2	No structures Potential non-capable structures Potential capable structures Fault exceeding 1,000 feet in length Capable fault exceeding 1,000 feet in length	0 2 3 4 5	0–10

Discussion/Results

Based upon the information presented in Table 1.1-1, SRS and VCSNS receive the following ratings and computed index numbers for surface faulting and deformation.

Within 25 miles

Site	Rating	Index No.
SRS	0	0
VCSNS	0	0

Within 5 miles

Site	Rating	Index No.
SRS	2	4
VCSNS	2	4

1.1.1.4 Geologic Hazards

Objective – Based on EPRI guidance (2000, p. 3-7) sites having the following geologic and man-made conditions should be avoided:

- Areas of active (and dormant) volcanic activity,
- Subsidence areas caused by withdrawal of subsurface fluids such as oil or groundwater, including areas which may be affected by future withdrawals,
- Potential unstable slope areas, including areas demonstrating paleolandslide characteristics,
- Areas of potential collapse (e.g. karst areas, salt, or other soluble formations),
- Mined areas, such as near-surface coal mined-out areas, as well as areas where resources are present and may be exploited in the future,
- Areas subject to seismic and other induced water waves and floods.

Evaluation approach – Sites furthest away from these features would be considered the most suitable sites; sites were rated in accordance with the presence of and distance from these features. Following are the assigned weight and rating used for geologic hazards:

Weight	Range	Rating	GEOL Index Range
1	Geologic hazard(s) present	1	0–1

Discussion/Results

None of the listed geologic hazards are known to exist at SRS or VCSNS, as shown on Table 1.1-1.

1.1.1.5 Soil Stability

Objective – Evaluate the sites with respect to the difficulty of soil conditions expected at each site.

Evaluation approach – No absolute exclusionary criteria have been identified with respect to soil stability. Soil stability is addressed as an avoidance criterion. Certain soil properties have unfavorable characteristics in association with vibratory ground motion. These soil properties include poor mineralogy, low density soil (lack of compaction), and high water content (or high

water table). Sites with the highest values of PGA in combination with deleterious site soils would receive a relatively lower rating. Sites having rock foundations or more suitable soil conditions are considered to be better sites. VCSNS is a rock site.

Following are the assigned weights and ratings for soil stability:

Weight	Range	Rating	Index Range
2	Rock site	0	0 - 4
	Deep soil site, no known deleterious soil conditions	1	
	Deep soil site with potential stability issues, or insufficient information available to assign a rating of 1	2	

Discussion/Results – Detailed investigations at SRS have identified relatively soft subsurface soils beneath portions of the site. These soils (Santee Formation) are characterized as silty and clayey sands with low penetration resistance that occurs beneath the site as a layer that is discontinuous with varying thickness. These soils are found at depths of 100 to 150 feet. Both grouted (earlier) and ungrouted (later) facilities have been constructed at SRS. Because of the possibility for soil liquefaction and/or settlement, any location for new nuclear facilities at SRS would require thorough investigation to determine the presence of any problematic soils (Dominion Energy, Inc. and Bechtel Power Corp., 2002).

Based upon the information presented in Table 1.1-1 and 1.1-2, SRS and VCSNS receive the following ratings and computed index numbers for soil stability.

Site	Rating	Index No.
SRS	2	4
VCSNS	0	0

1.1.1.6 Summary Rating for Geology/Seismology

The index numbers for this ranking scheme range from 5 to 85. This range of indexes was used to develop a ranking system to compare the suitability of sites as follows.

Index Range	Rating
5 - 21	5
22 - 37	4
38 - 53	3
54 - 69	2
70 - 85	1

The index numbers for the SRS and VCSNS locations were summed. The resulting index was compared to the index ranges in the above table to determine the rank for SRS and VCSNS. Based upon this evaluation, SRS and VCSNS are ranked as follows.

Site	Index Number	Summary Rating
SRS	54	2
VCSNS	48	3

Table 1.1-1 Ratings for Savannah River Site (SRS) Location

Feature	Source	Weight	Rating	Index No.
Vibratory Ground Motion	PGA 18 - 24 %g with 2% PE in 50 years (USGS National Seismic Hazards Mapping Project, 2002).	5	8	40
Capable Tectonic Source (Class A)	The Bluffton and Charleston Class A liquefaction features occur within 50 to 100 miles of SRS. The Georgetown Class A liquefaction features occur within 100 to 200 miles (USGS Fault and Fold Database, 2003. Crone & Wheeler, 2000).	2	3	6
Capable Tectonic Source (Class B)	No Class B features were identified within a 200 mile radius of SRS (Crone & Wheeler, 2000, p.8).	1	0	0
Surface Faulting & Deformation within 25 miles	No surface faulting or deformation have been identified at the site. Subsurface faulting occurs as described for the 5-mile radius (below).	1	0	0
Surface Faulting & Deformation within 5 miles	The Pen Branch Fault (Class C) occurs through the approximate center of the site. (USGS Fault and Fold Database, 2003; Crone & Wheeler, 2000). Other faults (unclassified and non-Quaternary) also occur at the site.	2	2	4

Table 1.1-1 Ratings for Savannah River Site (SRS) Location

Feature	Source	Weight	Rating	Index No.
Geologic Hazards	No areas of volcanic activity, subsidence due to withdrawal of subsurface fluids, potential unstable slope, potential collapse, mined areas, or areas subject to seismic or other induced water waves or floods occur at the site (Dominion Energy, Inc. and Bechtel Power Corp. 2002).	1	0	0
Soil Stability	SRS is a deep soil site. The Santee Formation occurs beneath the site as a discontinuous layer of varying thickness. At SRS the formation consists of relatively soft silty and clayey sands with low penetration resistance at depths of 100 to 150 feet. Development of sensitive facilities will require thorough investigation of any soft underlying materials.	2	2	4
			Total Index	**54**

Table 1.1-2 Ratings for Virgil C. Summer Nuclear Station Site (VCSNS)

Feature	Source	Weight	Rating	Index No.
Vibratory Ground Motion	PGA 23.57 %g with 2% PE in 50 years (USGS National Seismic Hazards Mapping Project, 2002).	5	8	40
Capable Tectonic Source (Class A)	The Charleston, Bluffton, and Georgetown Class A liquefaction features all occur within 100 to 200 miles of VCSNS (USGS Fault and Fold Database, 2003. Crone & Wheeler, 2000).	2	2	4
Capable Tectonic Source (Class B)	No Class B features were identified within a 200 mile radius of VCSNS (USGS Fault and Fold Database, 2003. Crone & Wheeler, 2000).	1	0	0
Surface Faulting & Deformation within 25 miles	No surface faulting or deformation have been identified at the site. Near surface faulting occurs as described for the 5-mile radius (below).	1	0	0
Surface Faulting & Deformation within 5 miles	An unnamed non-capable fault in the crystalline bedrock was found at VCSNS during construction (VCSNS FSAR).	2	2	4
Geologic Hazards	No areas of volcanic activity, subsidence due to withdrawal of subsurface fluids, potential unstable slope, potential collapse, mined areas, or areas subject to seismic or other induced water waves or floods occur at the site (VCSNS FSAR).	1	0	0
Soil Stability	VCSNS is a rock site	2	0	0
			Total Index	**48**

References

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Stephenson, D. and Stieve, A. 1992. Structural Model of the Basement in the Central Savannah River Area, South Carolina and Georgia.

USGS Earthquakes Hazards Program. National Seismic Hazard Mapping Project. Interpolated Probabilistic Ground Motion for the Conterminous 48 States by Latitude Longitude, 2002 data.

USGS Earthquakes Hazards Program. National Seismic Hazard Mapping Project. Quaternary Fault and Fold Database for the United States, 2005.

1.1.2 Cooling System Requirements

Objective - Cooling system requirements are important siting considerations for new power generating facilities. The objective of this criterion is to rate the candidate sites with respect to specific cooling system requirements, using to the extent possible the same or similar criteria previously utilized to evaluate other potential nuclear power plant sites.

Evaluation approach - The principle requirements of interest are the quantity of cooling water available and the ambient air temperature (EPRI Siting Guide, Section 3.1.1.2.1). Exclusionary and avoidance conditions apply to the evaluation of candidate sites with respect to these cooling system requirements. AP1000 cooling water supply requirements for units with closed-cycle cooling systems are summarized below.

Cooling System Type	AP1000 Two-Unit Requirement
Closed-cycle	Make up flow rate (gpm) – 42,000
Closed-cycle	Maximum Water Consumption (gpm) – 60,000
Closed-cycle	Monthly Average Water Consumption (gpm) – 42,000

Ambient air temperature characteristics of a potential site affect the design of heat removal systems. The candidate sites were compared to determine which site has the most suitable ambient air characteristics with respect to the PPE values outlined in the EPRI Siting Guide, Section 3.1.1.2.2. With the exception of extreme low temperature values, sites with the lowest temperatures are considered to be the most suitable.

Discussion/Results – Site data and results are presented for each of the sub-criteria in Sections 1.1.2.1 and 1.1.2.2, below. Overall ratings for the Cooling System Requirements criterion are provided in Section 1.1.2.3.

1.1.2.1 Cooling Water

The two sites were evaluated with respect to the cooling water criterion during the initial screening phase (Appendix B, P1 criterion) and both were found to have an adequate flow or

reservoir volume to support the requirements of a closed cycle cooling water system. The rating approach used in this evaluation was described previously in Table 3-2 and site data are presented in Appendix B of this report (Criterion P1).

To summarize, the Savannah River at SRS can easily meet the required closed-cycle cooling water flows, with closed-cycle makeup requirements comprising only a small fraction of the average Savannah River flow. The SRS impoundment closest to the site is Par Pond with a surface area of approximately 2700 acres, although Par Pond is reported to be highly contaminated and so would not be a viable cooling water source. The site already has an existing intake structure on the Savannah River, and a cooling water pipeline to Par Pond. However, the condition of the existing system is suspect, and may require substantive upgrades. There is also the major issue about who would have control of the cooling water on a DOE site.

Previous studies indicate that Monticello Reservoir can provide 970,000 gpm for the cooling of two once thru plants even though only one was constructed; actual VCSNS cooling flow is 513,000 gpm. Closed cycle cooling systems for two new units at VCSNS would have a net consumptive use of about 67 cfs. Monticello Reservoir storage capacity is about 380,000 acre-feet. This volume of stored water, combined with the ability to provide makeup water from the Broad River in Parr Reservoir (average river flow is in excess of 4,000 cfs) provides abundant water supply for new nuclear units.

No additional cooling water data have been identified for either site since the initial screening evaluation. Therefore, the previous results and ratings apply; (see Appendix B and table below).

Cooling Water	7Q10	7-Day Minimum	Lake/River	Average Annual Flow/Vol.	Average/ Composite
SRS	5	5	2	5	**4/3.5[1]**
VCSNS	4	3	3	5	**4/4**

1 – As discussed in Appendix B, because the cooling water loop at SRS (from which makeup water would be taken) is owned and operated by SRS, the average rating of 4 was modified to a 3.5 to account for the additional logistical and operational difficulties of addressing this water supply interface that does not apply at VCSNS.

References

Environmental Report for VC Summer Nuclear Station, SCE&G, Docket No. 50/395, License No. NPF-12.

Virgil C. Summer Nuclear Station Unit 1, Environmental Report, SCE&G, Section 2.3.3: Heat Dissipation.

Parr Hydroelectric Project, Progress Report 2, June 1973, Alden Research Laboratories (98-73/M260P)

DEIS, Accelerator Production of Tritium at the Savannah River Site, USDOE, December 1997

Study of Potential Sites for the Deployment of New Nuclear Plants in the United States, Dominion Energy, September 2002

1.1.2.2 Ambient Temperature Requirements

The candidate sites were compared to one another to assess their relative suitability with respect to selected temperature extremes and frequency values.

Temperature data were obtained from local weather stations as compiled by the Southeast Regional Climate Center – historical climate summaries and normals – which is part of the National Oceanic and Atmospheric Administration's National Climate Data Center. Closest daily weather stations with a reasonable period of record (e.g., more than 20 years) were selected for each site. Data indicate that each site meets the ambient temperature exclusionary and avoidance criteria addressed in the EPRI Siting Guide (Section 3.1.1.2.2). Maximum and minimum annual temperature values (dry bulb), as well as the highest and lowest average monthly temperatures values were compared between sites. Actual meteorological conditions at the two sites, however, may vary from the data collected and evaluated for the closest reporting (representative) weather stations: Aiken, SC, for SRS (period of record 1948-2004), and Winnsboro, SC, for VCSNS (period of record 1930-2004).

Ambient Temperatures (degrees F)	Highest temperature of record	Highest monthly average	Lowest temperature of record	Lowest monthly average	Rating
SRS	109 (8/22/83)	90.8 (August)	-4 (1/21/85)	34.4 (January)	**4**
VCSNS	107 (6/28/54)	90.8 (July)	-1 (1/21/85)	32.4 (January)	**4**

Source: www.dnr.sc.gov/climate/sercc/climateinfo/historical/historical.html
NOAA National Climatic Data Center, Ashville, NC: 2004 Local Climatological Data, Annual Summary with Comparative Data for Columbia, SC.
NOAA National Climatic Data Center, Ashville, NC: 2004 Local Climatological Data, Annual Summary with Comparative Data for Augusta, GA.

With the exception of extreme low temperature values, sites with the lowest dry bulb temperatures are considered to be the most suitable. Based only on a comparison of highest temperature and average high temperature records, and consideration of general climate conditions at the sites and their close proximity to one another, no significant differences in temperature were noted between the two sites; therefore both sites were assigned an equal ranking. Because the maximum temperature for all sites was in excess of 100 F, a ranking of 4 was given for both sites.

1.1.2.3 Cooling System Summary Rating

The sites were assigned overall cooling system ratings taking into account the cooling water supply and the ambient air temperature characteristics. Sites with the largest supply of cooling water and the optimal ambient air temperature values were assigned a rating of 5.

Criteria	Cooling Water Supply	Ambient Temperature	Composite Rating
SRS	4	4	4
VCSNS	4	4	4

1.1.3 Flooding

Objective – The objective of this criterion is to evaluate the suitability of the two candidate sites with respect to potential flooding. Potential sites appear to meet the exclusionary and avoidance siting criteria outlined in the EPRI Siting Guide (Section 3.1.1.3). These criteria exclude potential sites within major wetlands, areas less than one foot above the maximum flood elevation.

Evaluation approach – The relative suitability of SRS and VCSNS with respect to probable maximum flood (PMF) elevations was evaluated for SRS and VCSNS during the initial screening phase (Appendix B, Criterion P2). The evaluation relied on existing documents and recommended plant layout locations. Primary emphasis during the initial evaluation was on PMF elevations for the main water bodies (rivers and reservoirs) and their major tributaries where flood elevations were identified.

Other potential flooding sources (e.g., upstream dam failure concerns) were considered during the detailed evaluation phase. The full discussion is included in the table below.

Discussion/Results – A summary of site data presented previously, as well as additional data on other flooding sources, is summarized in the table below; site ratings with respect to flooding are also included.

Summary of Pertinent Flood Related Information – SRS, VCSNS

Criteria	SRS	VCSNS
Site grade elevation	Average site grade elevation is at 310 feet.	Average site grade elevation is 435 feet. VCSNS is a flood-dry site.
Maximum flood elevation (from main water body)	PMF for Savannah River at SRS is estimated to be 224.5 ft. The site is sufficiently far from Savannah River and at sufficient elevation such that the river poses no flooding concerns at the site.	The major water body that could affect flooding at site is the Parr Reservoir/Broad River. A maximum PMF water elevation of 290. 5 feet was calculated at Parr Reservoir. This is about 150 feet below site grade elevation of 435 feet. This forms the basis for the VCSNS rating of 5.

Criteria	SRS	VCSNS
Maximum flood elevation (from onsite drainage, local streams, etc.)	Major flooding sources for the site are from Upper Three Runs Creek (about 1.2 miles west of site), Tinker Creek (tributary of Upper Three Runs Creek and about 1 mile northwest of site) and Mill Creek (tributary to Tinker Creek and about 0.7 miles northeast of site). The proposed site elevation is more than 120 feet above all of these existing streams. Regarding onsite tributaries nearest the site, the PMF for Upper Three Runs is estimated to be 173.5 ft. Although PMF water levels on Tinker and Mill Creeks would likely be higher than the elevation determined for Upper Three Runs Creek, they would not pose a threat to the proposed site given it's location at more than 120 feet above the existing streambeds, especially given the small drainage areas for these two creeks.	Another source of flooding is Monticello Reservoir on Frees Creek. A PMF analysis resulted in a maximum water elevation of 436.6 feet from wave run-up and wind set-up based on maximum wind velocity of 50 mph coinciding with 48 hour PMP. This value is below the 438-foot crest elevation of the site protection berm and service water pond dams. In addition, because the Monticello Reservoir is an upper reservoir that supplies water to the FPSF, it's elevation can be further adjusted (i.e., lowered), as needed, to accommodate PMP events.
Freeboard	Over 100 feet based on PMF of on-site drainages which pose greatest threat	Over 100 feet based on PMF for Parr Reservoir/Broad River.
Downstream ice jam flooding concerns	No ice conditions experienced at SRS facilities; ice on Savannah River is rare and resulted in no flooding	Ice on Monticello Reservoir and Broad River is rare and has resulted in no flooding
Storm-related flooding concerns	PMP stormwater ponding should be addressed in maximum flood elevation above.	PMP stormwater ponding should be addressed in maximum flood elevation above.
Seismically induced flooding concerns	No concerns with seismic induced Tsunami flooding.	Seismically induced floods also pose no threat.
Upstream dam failure concerns	Cascading failure of upstream dams estimated to result in flood elevation of 141 ft., still well below site elevation.	Considering coincidental dam breaching (on Broad River), the maximum water surface elevation is conservatively estimated at 390 feet, which is still 45 feet below plant grade.
Rating	**5**	**5**

1.1.4 Nearby Hazardous Land Uses

1.1.4.1 Existing Facilities

1.1.4.2 Projected Facilities

Objective – The objective of this criterion is to include NRC guidance on considerations regarding the nature and proximity of man-related hazards (dams, airports, transportation routes, and military and chemical manufacturing and storage facilities).

Evaluation approach –For the purpose of this evaluation, it was assumed that both sites can be developed to meet the exclusionary criteria outlined in 10 CFR 100. The suitability of the candidate sites was, therefore, evaluated based on the relative number and distance of the following off-site man-made hazards that could be identified on USGS topographic maps, supplemented by information found in existing environmental reports for each site. The evaluation was limited to only existing hazards within a 5- to 10-mile radius of the sites, to the

extent such information was available. This included primarily airports, pipelines, and rail. Note that information relating to projected man-made hazardous facilities could not be identified from available sources.

The relative suitability of SRS and VCSNS with respect to nearby hazardous land uses was evaluated during the initial screening phase (Appendix B, Criterion P4). However, after further review of the data, the rating scale was modified as follows to better reflect site conditions:

1 = Large metropolitan airport less than 5 miles, or multiple county or small metropolitan airports within 5 miles
2 = Large metropolitan airport less than 10 miles or multiple county or small metropolitan airports within 10 miles
3 = Three to four small airports or at least one pipeline or railroad within 5 miles
4 = Three to four small airports, or at least one pipeline or railroad within 10 miles
5 = No hazardous land uses within 10 miles.

Discussion - To summarize, no significant hazards from off-site sources have been identified at either site - based on reviews of USGS topographic maps (100,000 scale) and existing documents – that demonstrate undue risks exist for the design of those facilities. However, there is a private DOE rail line within 5 miles of the SRS site and a gas pipeline within 10 miles of the site. The Vogtle nuclear plant is 15 miles southwest of the site. In addition, SRS does contain a number of potentially hazardous industrial activities within the reservation itself (e.g., fuel and plutonium storage facilities and target fabrication facilities, nuclear material production reactors, chemical separation plants, a uranium fuel processing area, liquid HLW tank farms, a waste vitrification facility, etc.).

A main rail line and one small airport (landing strip) are found within 5 miles of VCSNS.

Results – While both sites received a rating of 4 in the screening evaluation for hazardous land use (Appendix B) , the ratings have been refined to reflect the revised rating scale noted above. Both sites have at least one potentially hazardous land use less than 5 miles from the site and received a rating of 3.

Nearby Hazardous Land Uses	Rating
SRS	3
VCSNS	3

1.1.5 Extreme Weather Conditions

1.1.5.1 Winds
1.1.5.2 Precipitation

Objective – The objective of this criterion is to rate the suitability of the two candidate sites with respect to extreme weather conditions. Extreme weather conditions of interest are related to specific PPE criteria regarding tornado design, wind and precipitation (EPRI Siting Guide, Section 3.1.1.5).

Evaluation approach – During the review of available meteorological information on the sites, no information was found that indicated either site could not meet the exclusionary and avoidance criteria specified for the PPE values.

Extreme weather data readily available for both sites included fastest-mile wind speed or peak wind gusts (Augusta, GA, for SRS and Columbia, SC, for VCSNS) includes the number of tornadoes per 10,000 square miles (state average), and maximum 24-hour precipitation values. Available extreme weather data were obtained from government sources (National Climate Data Center and Southeast Regional Climate Center), and from existing DOE SRS environmental documents. Available VCSNS reports (ER and FSAR for license renewal) did not contain extreme weather information. NCDC Climatic Wind Data for US are found at ncdc.noaa.gov/documentlibrary.pdf/wind1996.pdf. Finally, precipitation data came from the same weather stations and periods of record as identified for ambient temperature.

Discussion/Results

The strongest winds in the SRS and VCSNS areas occur in tornadoes, which can have wind speeds as high as 116 meters per second (260 miles per hour [mph]). The next strongest surface winds occur during hurricanes. Winter storms with winds as high as 32 meters per second (72 mph) have been recorded occasionally. The fastest 2-minute wind speeds recorded (since 1996) at Augusta, GA and Columbia, SC are 49 mph (May 2004) and 48 mph (August 2002), respectively. The fastest 1-minute wind speed recorded at Augusta, GA between 1951 and 1980 is 28 meters per second (63 mph); and the fastest mile at a 100-year return is 37.1 meters per second (83 mph) (DOE 1984). Based on historic tornado occurrences (1950-1995), the NOAA forecast value for the annual average number of tornadoes per10,000 square miles in South Carolina is 3.4 (NOAA undated).

In terms of extreme wind, where data are available for both sites, the results are nearly identical; this is expected given their close proximity to one another. With respect to precipitation, the maximum values are slightly higher for SRS. This difference is not considered significant, however. While neither site is near the coast, both have the potential for severe weather – primarily in the form of hurricanes and tornadoes – and so each site is given a rating of 4.

Site data, to the extent available, and rating results are summarized in the tables below.

Site	Fastest Mile (mph) 1951-1980	Fastest Mile (mph) (at 100-yr return) 1951-1980	Peak Gusts (5 sec) (mph) 1930-2004	Tornado Frequency	Maximum 24-hr precipitation.
SRS	63	83	74*	3.4	9.68 in
VCSNS	NA	NA	78**	3.4	7.77 in

* For Augusta, GA
** For Columbia, SC

Extreme Weather Conditions	SRS	VCSNS
Rating	4	4

1.2 ACCIDENT EFFECTS-RELATED

Objective – The overall objective of this criterion is to evaluate sites with respect to the evaluation of design-related accident evaluations and potential effects of accidents.

Evaluation approach – Site ratings for this criterion are developed as a composite of three sub-criteria that address site characteristics relevant to consideration of accidents: Population, Emergency Planning Considerations, and Atmospheric Dispersion.

Discussion/Results – A discussion of each of the sub-criteria appears in the following paragraphs 1.2.1, 1.2.2, and 1.2.3. A discussion of the roll-up of the sub-criterion ratings into a single rating for the Accident-Effects-Related criterion appears in Section 1.2.4.

1.2.1 Population

Objective - The objective of this criterion is to evaluate the relative suitability of the candidate sites with respect to the population density in the vicinity of the sites. For the purposes of this evaluation, it was assumed that both sites meet the population conditions codified in 10CFR100.21. These conditions are:

- the sites have exclusion area authority,
- a low population zone exists beyond the exclusion area, and
- sufficient distance exists to high population centers.

Evaluation approach - As outlined in Regulatory Guide 4.7, low population areas are preferred and low population zones should have densities less than 500 people per square mile (EPRI 2001).

Available census data regarding total population, population densities, and population-center distances were reviewed for the candidate sites. Data were obtained in Section 2.1 of the respective site Final Safety Analysis Reports (for MOX facility in case of SRS) and on-line data from the US Census Bureau.

The two candidate sites were rated according to the overall population totals within 20 and 50 mile radius areas around the sites, population densities, and distances to nearby population centers. Areas with the lowest population totals, densities, and longer distances to population centers were given a rating value of 5.

The relative suitability of SRS and VCSNS with respect to general population features was evaluated during the initial screening phase (Appendix B, Criterion P3); the focus in this

criterion is on site proximity to high population centers, and population projections and population densities within a 20- and 50-mile radius of each site.

Discussion/Results - Total resident populations and population densities projected for the year 2020 at radii of 20 and 50 miles are summarized for each site below. Population projections were obtained from the candidate site FSAR's and population projections available through state agencies. These values include only resident population totals. A population center is a densely populated area with a resident population over 25,000. Distances to the nearest population center for the two candidate sites are shown below. Population center estimates were obtained from the US Census Bureau.

Site	Nearest Population Center	Population	Approximate Distance (miles)
SRS	Aiken, SC	25,337	19.5
SRS	Augusta, GA/Richmond County balance	195,182	25
VCSNS	Columbia, SC	116,278 (2004)	21
VCSNS	West Columbia	13,064	21

http:/www.census.gov/population/estimates/metro-city/placebyst/*

Distance (miles)	Site	Total Population (2020 Projection)	Population Density (population/mile^2)
0-20	SRS	91,640	73
	VCSNS	136,842	109
0-50	SRS	906,169	115
	VCSNS	1,027,842	131

Population densities are relatively low at both sites, although nearby cities of Augusta and Columbia have local population densities of approximately 1,000 persons/mi^2. As such, both sites were given a rating of 4.

Population	SRS	VCSNS
Rating	4	4

1.2.2 Emergency Planning

Objective – The objective of this criterion is to evaluate the relative suitability of the two candidate sites with respect to emergency planning characteristics of the general area around each site. (No exclusionary or avoidance criteria apply to this issue.) In particular, this evaluation relied on information pertaining to general population in surrounding area, road conditions near site, access to major traffic networks, terrain features, and climatic conditions.

Evaluation approach – Sites with the least constrained evacuation planning issues (low population, good access from site to major traffic networks and no terrain or climate limitations) were considered the most suitable and were assigned a score of 5.

Discussion/Results – A summary of relative information for each site is provided below. Neither site had any significant limitations with respect to climate or terrain conditions.

SRS - Established transportation corridors surrounding the site include rail line and several major US highways and interstates. No significant egress constraints have been identified although the Savannah River prevents direct egress to the west. SRS is served by more than 200 miles of primary roads and more than 1000 miles of unpaved roads. Two interstate highways serve the SRS area: I-20 provides a primary east-west corridor in the region and I-520 links I-20 with Augusta. US 1 and US 25/SR 121 are principal north-south routes in the region and US 78 provides an east-west connection. Although three routes passing through the site (US 278, SR 19 and SR 125) are open to the public, access to SRS is controlled. A site-wide emergency plan is in place to protect the health and safety of the public and workers at SRS. There are no physical characteristics or significant surrounding population that would present impediments to any emergency response. There are no schools, prisons, hospitals, and cities with population density over 50 persons per square mile, although the site includes a workforce of 13,000.
Because direct access/egress is controlled by DOE, the site is given a rating of 4.

VCSNS - The proposed site is located very near major roads. State Highway 215 borders the Monticello Reservoir to the east, and Site Highway 213 borders the area to the south. U.S. Highway 176 and Interstate 26 are located to the southwest of the proposed site. All roads serve the greater Columbia, SC area, and multiple egress routes are available in all directions. The Monticello Reservoir prevents direct egress to the north. Population density is low in the immediate site area. No other limiting climate or terrain conditions were identified. The site is given a rating of 5.

Emergency Planning	SRS	VCSNS
Rating	4	5

1.2.3 Atmospheric Dispersion

Objective – The objective of this criterion is to evaluate the suitability of the two candidate sites with respect to short-term atmospheric dispersion characteristics, as a measure of the relative level of concentrations that could occur during accident conditions at the sites.

Evaluation approach – The efficiency of atmospheric diffusion is primarily dependent on wind speed, wind direction, and the change in air temperature with height which affects atmospheric stability. These factors are used to calculate an atmospheric dispersion function referred to X/Q. The best way to calculate this function is using on-site meteorological data.

Discussion and results

SRS - Winds at the Savannah River Site average approximately 8.5 miles per hour and are typically in either a southwest or northeast direction (not out of the southeast towards Augusta, GA). The meteorology at the site is classified as *unstable* approximately 56 percent of the time – unstable conditions lead to rapid dispersion and lower ground-level concentrations.

VCSNS - Winds in the Columbia, SC area average approximately 7 miles per hour and are typically in either a southwest or northeast direction. General climatology is not anticipated to differ significantly from that of the Savannah River Site.

Both proposed sites are anticipated to have similar climatology, and thus, similar atmospheric dispersion conditions; because X/Qs at both sites are expected to meet site parameters as established in certified plant designs, both sites are given ratings of 5.

Atmospheric Dispersion	**SRS**	**VCSNS**
Rating	**5**	**5**

1.2.4 Composite Accident-Effects Related Ratings

Finally, composite ratings for this criterion (Accident Effects) are a composite of those for sub-criteria 1.2.1, 1.2.2, and 1.2.3; the ratings for these sub-criteria, along with the summary rating for this criterion, are provided in the following table.

Sub-criterion	**SRS**	**VCSNS**
Population	4	4
Emergency Planning	4	5
Atmospheric Dispersion	5	5
Overall Rating	**4**	**5**

1.3 OPERATIONAL EFFECTS-RELATED

1.3.1 Surface Water – Radionuclide Pathway

1.3.1.1 Dilution Capacity

1.3.1.2 Baseline Loadings

1.3.1.3 Proximity to Consumptive Users

Objective – The purpose of this criterion is to evaluate candidate sites with respect to potential liquid pathway dose consequences. (No site exclusionary or avoidance criteria apply to this issue.) Besides potential source terms, dilution in the receiving surface water body is of primary importance. Three factors considered in evaluating the potential dilution for a receiving water body are dilution capacity, baseline loadings, and proximity to consumptive users.

Evaluation approach – Site ratings for this criterion are developed as a composite of three sub-criteria that address site characteristics relevant to consideration of operation: Dilution Capacity, Baseline Loadings, and Proximity to consumptive users.

- Dilution Capacity - The purpose of this sub-criterion is to rate sites based on the overall capacity of the receiving water body to dilute effluents from a nuclear power plant. Information on the radioactive source term dilution at a new power plant will be site specific. For siting consideration where such information is not available, however, surrogate parameters, representing the dilution capacity of a stream, can be used. The greater the dilution capacity of the receiving water body, the shorter will be the mixing length downstream defined as the zone within which complete mixing of a discharge contaminant occurs. Sites with higher dilution capacity are rated higher.

- Baseline Loadings – The capacity of a stream to impact health and safety of downstream consumers is related to the existing, or baseline loadings of, radionuclides that are present in the system or can be anticipated in the future. The purpose of this sub-criterion is to characterize sites in accordance with existing levels of radioactive contamination in the receiving water body. Sites are given a rating of 5 for no baseline loadings; proportionally lower ratings are assigned as higher existing levels of radionuclide contamination are identified.

- Proximity to consumptive users - The purpose of this sub-criterion is to rate sites in accordance with the proximity of plant effluent release point to the location(s) public water supply withdrawal(s). More proximal withdrawals present higher potential for dose impacts from the surface water ingestion pathway and can require additional design and licensing efforts. Downstream locations of public water supply withdrawals and recreational contact were identified for each site. Sites with greater pathway lengths to users were more suitable and were assigned a score of 5.

Discussion/Results

A summary of the sub-criterion and overall ratings for the surface water-radionuclide pathway criterion is presented in the following table.

Site	Dilution Capacity	Baseline Loadings	Proximity to D/S public water supply	Composite Rating
SRS	5	4	5	**5**
VCSNS	4	4	3	**4**

Ratings for dilution capacity are directly related to average annual river flow.

Dilution Capacity

- The receiving body of water for SRS, the Savannah River, is large enough to efficiently dilute effects from a nuclear power plant. (Sub-rating = 5)
- Monticello Reservoir and the ultimate receiving body of water for VCSNS, the Broad River, will efficiently dilute effects from a nuclear power plant. However, because the Broad River is not as large as the Savannah River, a rating of 4 is given to VCSNS.

Baseline Loadings

- Both SRS and VCSNS are located near existing radiological operations. As such, baseline loadings of radiological contamination are not expected to significantly differ between the two sites. A conservative rating of 4 is given to each site.

Proximity to Consumptive Users

Ratings are based on the distance to the closest downstream public water supply intake structure from each site (based on gross approximations from site to location on water closest to nearest city deriving its water supply from the river); the closer the water intake, the lower the rating. Water intake distances in river miles (downstream from sites) are projected as follows:

- Savannah River Site – Savannah River / Millett (18 miles) (Sub-rating = 5)
- VC Summer Site – Broad River / Parr (2.3 miles) (Sub-rating = 3).

Overall, SRS is preferred with respect to radionuclide exposure via water releases, as reflected in the following ratings.

Sub-criterion	SRS	VCSNS
Dilution Capacity	5	4
Baseline Loadings	4	4
Proximity to Consumptive Users	5	3
Overall Rating	**5**	**4**

1.3.2 Groundwater Radionuclide Pathway

Objective – The objective of this criterion is to evaluate the candidate sites with respect to the relative vulnerability of shallow groundwater resources to potential contamination.

Evaluation approach – All candidate sites overlie aquifers that have not been designated by EPA's (1986) classification scheme. EPA guidelines were, however, used to assign a designation to candidate site aquifers. In addition, the relative vulnerability of these aquifers to groundwater pollution was evaluated using a standard numerical ranking system called DRASTIC (Aller et al. 1987). Sites considered most suitable are those that are least vulnerable to groundwater contamination within a 2-mile radius of a site.

Discussion/Results – Class I groundwater is addressed as an avoidance criteria (EPRI Siting Guide). This classification includes groundwater resources of unusually high value. They are highly vulnerable to contamination and are irreplaceable sources of drinking water and or ecologically vital. Groundwater resources underlying the candidate sites are either currently used or are potential sources of drinking water, hence, they would be considered Class II aquifers according to the EPA classification guidelines. There are no sole source aquifers at the SRS or VCSNS locations.

The DRASTIC evaluation was completed using site-specific data, where available, or data from published sources. The most important variables that control the groundwater pollution potential are:

- D–Depth to water,
- R–Recharge (net),
- A–Aquifer media,
- S–Soil media,
- T–Topography (slope),
- I–Impact of the vadose zone,
- C–Conductivity (hydraulic) of the groundwater flow system.

DRASTIC assigns a weighted numeric value to each characteristic, depending on its relative contribution to risk of groundwater contamination. This results in a numeric ranking for each site, allowing the sites to then be ranked in order of suitability. The higher an area scores on the DRASTIC index, the more susceptible a site is to groundwater contamination. Following is a summary of the DRASTIC evaluations.

SRS

DRASTIC Variable	Range and Source of Information	Weight	Rating	Number
Depth to water	40' to 60' (Dominion Energy, Inc. and Bechtel Power Corp., 2002. Evaluation of INEEL, Portsmouth and Savannah River Sites).	5	3 - 5	15 – 25
Net Recharge	6" to 8" per year (DRASTIC EPA Manual, 1987)	4	6 - 8	24 - 32
Aquifer Media	Sand and some clay (Dominion Energy, Inc. and Bechtel Power Corp., 2002. Evaluation of INEEL, Portsmouth and Savannah River Sites. USGS Project Workplan to Evaluate Ground-Water Flow in the Vicinity of the Savannah River Site, 2002.	3	4 - 6	12 - 18

DRASTIC Variable	Range and Source of Information	Weight	Rating	Number
	Summerour, J. H., et. al., 1994).			
Soil Media	Sandy loam (Soil Conservation Service Report, Burke County, GA.).	2	6	12
Topography	2.5% to 5.5% (USGS Topographic maps)	1	9	9
Impact Vadose Zone	Sand with some clay (Dominion Energy, Inc. and Bechtel Power Corp., 2002. Evaluation of INEEL, Portsmouth and Savannah River Sites. USGS Project Workplan to Evaluate Ground-Water Flow in the Vicinity of the Savannah River Site, 2002. Summerour, J.H., et. al. 1994).	5	6	30
Hydraulic Conductivity	53 to 318 gpd/ft^2 (Dominion Energy, Inc. and Bechtel Power Corp., 2002. Evaluation of INEEL, Portsmouth and Savannah River Sites. Driscoll, 1986)	3	2	6
			INDEX	**108-132**

VCSNS

DRASTIC Variable	Range and Source of Information	Weight	Rating	Number
Depth to water	20' to 90' (VCSNS Application for Renewed Operating License, Appendix E – Environmental Report).	5	2 - 7	10 - 35
Net Recharge	4" to 7" per year (DRASTIC EPA Manual, 1987)	4	6	24
Aquifer Media	Metamorphic / igneous rock and weathered metamorphic / igneous rock (VCSNS Application for Renewed Operating License, Appendix E – Environmental Report. VCSNS FSAR).	3	3 - 4	9 - 12
Soil Media	Clay loam (DRASTIC EPA Manual, 1987. Gage Group, Inc., Ground Water Modeling, Settlement Analysis, and Dewatering Well Locations, 2005. VCSNS FSAR).	2	3	6
Topography	8% to 14% (USGS Topographic maps)	1	3 - 5	3 - 5
Impact Vadose Zone	Metamorphic igneous (DRASTIC EPA Manual, 1987. VCSNS FSAR).	5	4	20
Hydraulic Conductivity	9 to 19 gpd/ft^2 (Gage Group, Inc., Ground Water Modeling, Settlement Analysis, and Dewatering Well Locations, 2005)	3	1	3
			INDEX	**75-105**

DRASTIC indexes for all typical hydrogeologic settings range from 65 to 223 (Aller et al. 1987, p. 82). This range of indexes was used to develop a ranking system to compare vulnerability of the candidate sites, as follows:

DRASTIC Index Range	Relative Vulnerability	Rank
65–98	Low	5
98–132	Low to Moderate	4
132–166	Moderate	3
166–199	High	2
199–233	Very High	1

Based on these DRASTIC Index Ranges for qualitative vulnerability, the candidate site was ranked as follows:

Candidate Site	DRASTIC Rating	Site Rating
SRS	108 – 132	4
VCSNS	75 – 105	4 - 5

References

Aller, L., Bennett, T., Lehr, J., Petty, R. and G. Hackett. 1987. DRASTIC: A Standardized System for Evaluating Ground Water Pollution Potential Using Hydrogeologic Settings. EPA/600/2-87/035, June 1987.

Dominion Energy, Inc. and Bechtel Power Corp., 2002. Evaluation of INEEL, Portsmouth and Savannah River Sites.

DRASTIC: A Standardized System for Evaluating Ground Water Pollution Potential Using Hydrogeologic Settings; EPA Manual, 1987.

Driscoll, Fletcher G., Groundwater and Wells, 1986.

EPA. 1986. Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy, Office of Groundwater Protection.

Natural Resources Conservation Service Soil Survey for Burke Co. GA.

Summerour, J. H., et. al., An Investigation of Tritium in the Gordon and Other Aquifers of Burke Co., Georgia, 1994.

USGS Project Workplan to Evaluate Ground-Water Flow in the Vicinity of the Savannah River Site, 2002.

GAGE Group, Inc., Ground Water Modeling, Settlement Analysis, and Dewatering Locations, 2005.

SCE&G FSAR, VCSNS, Application for Renewed Operating License, Appendix E – Environmental Report.

1.3.3 Air Radionuclide Pathway

1.3.3.1 Topographic Effects

1.3.3.2 Atmospheric Dispersion

Objective – The purpose of this criterion is to address the relative suitability of sites with respect to the potential for exposure to the public from routine airborne releases from a nuclear power plant.

Evaluation approach – The criterion is comprised of two suitability characteristics:

> Topographic Effects – Site ratings are based on whether there are any significant topographic features that would materially affect dispersion of the plume from plant releases (e.g., channeling of releases from a site located low in a high-banked river valley).
>
> Atmospheric Dispersion – Measured in terms of long term (e.g., annual average X/Q) dispersion characteristics. Sites with lower X/Q values are rated higher than those with less favorable dispersion conditions.

Discussion/Results – Neither of the sites is believed to have significant potential for negative topographic effects on long-term dispersion. Additionally, as noted above, atmospheric dispersion conditions at the proposed sites are not anticipated to differ significantly. Therefore, the proposed sites are equally sufficient with respect to radionuclide exposure via airborne releases.

Air Radionuclide Pathway	SRS	VCSNS
Rating	5	5

1.3.4 Air-Food Ingestion Pathway

Objective – The objective of this criterion is to rate candidate sites in terms of the relative potential for exposure of humans to radioactive emissions through deposition of radioactive materials on food crops with subsequent consumption of foodstuffs by exposed individuals.

Evaluation approach – A potential exposure pathway for nuclear power plants is the emission of radionuclides into the food chain on local crops and pastures. Radiological doses and dose commitments resulting from a nuclear plant are well known and documented. While the operational impacts on the public through food pathway exposures are negligible, sites with lower amounts of crop and pasture land uses are considered to be more suitable. No exclusionary or avoidance criteria apply to this issue. Sites with less crop production nearby are rated higher than those with less nearby agriculture.

Discussion/Results – General information regarding crop lands and pastures near the sites is summarized below. Data is from the National Agricultural Statistics Service (2002 Census of Agriculture – http://151.121.3.33:8080/Census/Create_Census_US_CNTY.jsp).

SRS (Aiken/Barnwell County) - In Aiken County, agriculture (farmland) represents 143,942 acres out of 686,720 total acres (1,073 square miles) (21%). Out of the total farmland, 56,872 acres are planted in crop (39.5%). Other farmland is used for cattle (10,634 head), hogs and pigs (2,112), sheep/lambs (532), and 21 million poultry (sold in 2002). In Barnwell County, agriculture (farmland) represents 85,114 acres out of 350,720 total acres (54 square miles) (24%). Out of the total farmland, 35,458 acres are planted in crop (41.7%). Other farmland is used for cattle (4,186 head), hogs and pigs (727), and sheep/lambs (22).

VCSNS (Fairfield County) - In Fairfield County, agriculture (farmland) represents 56,375 acres out of 439,680 total acres (687 square miles) (13%). Out of the total farmland, 16,750 acres are planted in crop (29.7%). Other farmland is used for cattle (6,009 head) and hogs and pigs (45). Based on the in percentages of acreage occupied by farmland in the vicinity of the sites, VCSNS is assigned a rating of 4 and SRS a rating of 3.

Air-Food Ingestion Pathway	SRS	VCSNS
Rating	3	4

1.3.5 Surface Water – Food Radionuclide Pathway

Objective – The purpose of this criterion is to evaluate the relative suitability of sites in terms of the specific use of irrigation water by downstream locations as a potential pathway for potential exposure.

Evaluation approach – Sites with the fewest number of downstream irrigation uses are more suitable and are rated higher than sites with a large number of downstream irrigation withdrawals. No exclusionary or avoidance criteria apply to this issue (EPRI 2001).

Discussion/Results – Based on data from the National Agricultural Statistics Service (2002 Census of Agriculture – http://151.121.3.33:8080/Census/Create_Census_US_CNTY.jsp), a very small percentage of cropland is irrigated.

- SRS – Aiken County – 1,799 acres (1.2%).
- SRS – Barnwell County – 1,313 acres (1.5%)
- VCSNS – Fairfield County – 250 acres (0.4%).

With such small amounts of farmland being irrigated, both sites are favorable with respect to radionuclide pathways by irrigation of cropland and are assigned ratings of 5.

Surface Water-Food Radionuclide Pathway	SRS	VCSNS
Rating	5	5

1.3.6 Transportation Safety

Objective - The objective of this criterion is to evaluate the suitability of the two candidate sites with respect to potential to create fog and ice hazards to local transportation. No exclusionary or avoidance criteria apply to this issue.

Evaluation approach – Potential impacts from plant operations on transportation safety could occur as a result of increased hazards from cooling towers. Both natural draft and mechanical cooling towers can increase area fogging conditions and ice formation on local roads and highways. Sites with high frequencies of naturally-occurring fog and ice events will likely be more adversely affected by cooling tower operations.

Discussion/Results – Relative information regarding existing fog and ice conditions at the sites is summarized in the table below. Given the incidence of fog and ice along with the relative isolation of each of the sites, a rating of 5 was assigned to each.

	Fog Conditions	Ice Conditions	Rating
VCSNS	Mean number of days with heavy fog is 25.9 for the past 56 years. No off-site fogging conditions from cooling tower are likely.	Very low probability of cooling tower fogging or icing effects on off-site locations.	**5**
SRS	Mean number of days with heavy fog is 35.1 for the past 54 years. No off-site fogging conditions from cooling tower are likely.	Very low probability of cooling tower fogging or icing effects on off-site locations.	**5**

References

NOAA National Climatic Data Center, Ashville, NC: 2004 Local Climatological Data, Annual Summary with Comparative Data for Columbia, SC.

NOAA National Climatic Data Center, Ashville, NC: 2004 Local Climatological Data, Annual Summary with Comparative Data for Augusta, GA.

2. ENVIRONMENTAL CRITERIA

2.1 CONSTRUCTION-RELATED EFFECTS ON AQUATIC ECOLOGY

2.1.1 Disruption of Important Species/Habitats

Objective – The objective of this criterion is to evaluate the candidate sites with respect to potential construction related impacts on aquatic or marine ecology. Regulatory Guide 4.7 defines plant and animal species as important if one or more of the following conditions apply:

- the species is commercially or recreationally valuable,
- the species is officially listed as endangered or threatened,
- the species effects the well being of another species within (1) or (2) above,
- the species is a critical component of the structure and function of a valuable ecosystem, or
- the species is a biological indicator of radionuclides in the environment.

Of particular concern are potential impacts to habitat areas used by important species. These areas include those used for:

- breeding and nursery,
- nesting and spawning,
- wintering, and
- feeding.

Evaluation approach – The following siting criteria were used to evaluate the two candidate sites.

- Exclusionary – Designated critical habitat of endangered species.
- Avoidance – Areas where threatened and endangered species are known to occur.
- Suitability – Areas where limited potential impact to important species is expected.

No information was obtained which would indicate that a given location would exceed the exclusionary or discretionary criteria relative to ecology. Therefore, the evaluation focused on the relative suitability of the site based on the number of areas where limited potential impact is expected. The number of potential impact areas was directly correlated to the number of important aquatic resources that may occur at the Site (within 400 acres), their habitat (based on existing reports and professional judgment of the amount and quality of habitat available for species), and flexibility (professional judgment of the amount of space within the site circle to avoid known locations of protected species during construction of the facility).

The relative suitability of SRS and VCSNS with respect to ecology (rare, threatened and endangered aquatic and terrestrial species, and critical habitat) was evaluated during the initial screening phase (Appendix B, Criterion P5). Additional site ecological information specific to aquatic resources at each site is included in the full discussion below.

Discussion/Results

SRS – There are no known important regional aquatic organisms, threatened or endangered aquatic species, spawning areas or migrating routes for aquatic species, nor commercially or recreationally valuable aquatic species in the immediate vicinity of the proposed site. The aquatic resources of SRS have been the subject of intensive study for more than 30 years, and the important aquatic species at SRS have been well documented. The Upper Three Runs has one of

the richest aquatic insect fauna of any stream in North America. At least 551 species of aquatic insects, including at least 52 species and 2 genera new to science, have been identified (Wike et al 1994). A recent study identified 93 species of caddisflies, including 3 species that had not been previously found in South Carolina and 2 species that are new to science. Other insect species found in the creek are considered endemic, rare, or of limited distribution. The American sandburrowing mayfly, a relatively common mayfly in Upper Three Runs, is listed by the Federal government as a candidate species for protection under the Endangered Species Act (the species is sensitive to siltation, organic loading and toxic releases); and a 1993 study identified an extremely rare clam species *(Elliptio hepatica)* in the Upper Three Runs drainage. SRS would not allow activities that result in contamination of this stream or its tributaries (e.g., Tinker Creek).

There is one endangered fish species, the shortnose sturgeon, which occurs in the Savannah River near the site. No critical habitat for threatened or endangered aquatic species exists on SRS. There are also several commercial fish species found in the Savannah River. Important commercial species are the American shad, hickory shad, and striped bass, all of which are anadromous. The most important warm water game fish are bass, pickerel, crappie, bream, and catfish.

VCSNS - No aquatic federal or state listed endangered or threatened species are known to occur in Monticello Reservoir or Parr Reservoir in the vicinity of site. Two federal listed and 12 state listed aquatic species have been reported from the counties where VCSNS is located.

Disruption of Impt. Species and Habitat (Aquatic)	SRS	VCSNS
No. Species	4	5
Habitat	3	3
Flexibility	4	4
Composite rating	**4**	**4**

2.1.2 Bottom Sediment Disruption Effects

2.1.2.1 Contamination

2.1.2.2 Grain Size

Objective – The objective of the criterion is to evaluate the potential short-term impacts to aquatic/marine resources resulting from construction related dredging activities at the candidate sites.

Evaluation approach – The evaluation sought available data on the amount of contaminated sediments near the candidate sites and the grain size of sediments in the area. In general, sites with the lowest concentration of heavy metals and toxic organic compounds and the highest sediment grain size are considered to be the most suitable.

Little information exists regarding the site specific level of sediment contamination that exists in water bodies near the candidate sites. The majority of the available information was obtained from the EPA's National Sediment Quality Survey (2001 and 2004). Information in the EPA report addresses sediment contamination levels as Tier I (adverse impacts to aquatic life are probable) and Tier II (adverse impacts to aquatic life are possible but infrequent). Using best professional judgment, the following evaluation considered the results of the EPA's Tier I/Tier II study results to determine the relative contamination potential for the candidate sites.

No information regarding sediment grain size was obtained for this evaluation. Because sediment grain size is highly variable, even within a small area of coastline or river reach, the following evaluation of potential bottom sediment disruption effects was limited to available information regarding sediment contamination levels in principle water bodies at the two sites.

Discussion/Results

SRS – An updated EPA study (EPA 2004) evaluated 2,874 sampling stations in the Southeast, and identified 12 waterbodies, including the Lower Savannah River, as having the most significant sediment contamination in EPA Region 4. With respect to on-site water bodies, previous releases from R-Reactor (before it shut down in 1964) contaminated Par Pond with low levels of radioactive material, primarily Cesium-137. Most of the Cesiuim-137 lies in the upper 1 foot of fine sediment, primarily in the area of the original stream corridor. An estimated 43 curies of Cesium-137 remain (APT EIS).

VCSNS - The Broad River, on which VCSNS is located, was not identified in the EPA study as having significant sediment contamination levels. No other information on contaminated sediment in the Broad River was readily available. In general, no significant water quality problems have been identified in Broad River, Monticello River and Parr Reservoir. Storm water and waste water discharges to Monticello Reservoir are regulated under a NPDES permit. The range of parameters monitored include flow, temperature, various metals, pH, total suspended solids, oil and grease, biochemical oxygen demand, fecal coliform, residual chlorine and ammonia. Two minor violations identified in the reservoir by SCDHEC in past 5 years – one for oil and grease and one for residual chlorine were addressed immediately and corrective actions taken. A 1998 South Carolina Department of Health and Environmental Control (DHEC) report notes that water quality in the Broad River from the Tyger River to the Parr Shoals Dam is suitable for a range of aquatic life, but is experiencing a significantly increasing trend in total phosphorus concentrations from upstream agricultural and municipal sources. In addition, fecal coliform bacteria levels are occasionally elevated in this stretch of the river.

The presence of contaminated sediments in the immediate vicinity of the candidate sites including any onsite streams cannot be confirmed. However, based on the EPA survey results and other site-specific water quality information, contaminated sediments at levels of regulatory concern may exist at SRS, but are less likely to exist in Monticello Reservoir or the Broad River. It is understand that the degree of impact at a specific site will also vary with grain size, which is one of the sub-criteria, and the extent of dredging that may be required at a given site. Because dredging is not one of the parameters considered for this particular evaluation, and information on grain size was not readily available for most of the sites, the estimated potential for contaminated sediments to affect the cost and schedule of any construction related dredging operations was based on the limited information available and professional judgment.

Based on the available information and given the evidence of contamination of onsite water bodies at SRS from past operations, VCSNS is given a slightly higher rating than SRS as noted below.

Bottom Sediment Disruption Effects	SRS	VCSNS
Rating	3	4

References

EPA 1997. The Incidence and Severity of Sediment Contamination in Surface Waters of the United States.Volume 1: National Sediment Quality Survey. Office of Science and Technology. EPA 823-R-97-006, September 1997.

EPA 1997. The Incidence and Severity of Sediment Contamination in Surface Waters of the United States. Volume 2: Data Summaries for Areas of Probable Concern. Office of Science and Technology. EPA 823-R-97-007, September 1997.

EPA 2004. The Incidence and Severity of Sediment Contamination in Surface Waters of the United States. National Sediment Quality Survey. Office of Science and Technology. EPA 823-R-04-007. November.

NUREG 1437, Supplement 15.

2.2 CONSTRUCTION-RELATED EFFECTS ON TERRESTRIAL ECOLOGY

2.2.1 Disruption of Important Species/Habitats and Wetlands

2.2.1.1 Important Species/Habitats
2.2.1.2 Groundcover/Habitat
2.2.1.3 Wetlands

Objective – The objective of this criterion is to evaluate the candidate sites with respect to potential construction related impacts on important species and terrestrial ecology. Regulatory Guide 4.7 defines important plant and animal species if one or more of the following conditions apply.

- the species is commercially or recreationally valuable,
- the species is officially listed as endangered or threatened,
- the species effects the well being of another species within (1) or (2) above,
- the species is a critical component of the structure and function of a valuable ecosystem, or
- the species is a biological indicator of radionuclides in the environment.

Of particular concern are potential impacts to habitat areas used by important species. These areas include those used for:

- breeding and nursery,

- nesting and spawning,
- wintering, and
- feeding.

Evaluation approach – The following siting criteria were used to evaluate the two candidate sites.
- Exclusionary – Designated critical habitat of endangered species.
- Avoidance – Areas where threatened and endangered species are known to occur.
- Suitability – Areas where limited potential impact is expected.

The candidate sites were evaluated with respect to information available on important species/habitats, groundcover, and mapped wetlands within a 4-mile radius.

During this evaluation, no information was obtained which would indicate any of the sites exceeded the exclusionary and avoidance criteria outlined above. This following evaluation was, therefore, focused on the relative suitability of each site where limited potential impact is expected. The number of potential impact areas was directly correlated to the number of important aquatic resources that may occur at the Site (within 400 acres), their habitat (based on existing reports and professional judgment of the amount and quality of habitat available for species), and flexibility (professional judgment of the amount of space within the site circle to avoid known locations of protected species during construction of the facility.

Another sub-criteria evaluated was the total acreage of wetland within 6000 acres, not including the lake or reservoir that would be the primary source of cooling water. This was also broken out into three components: total wetlands (acres), total acreage of higher quality wetlands, and flexibility, or the ability to avoid wetlands during construction.

The relative suitability of SRS and VCSNS with respect to ecology (rare, threatened and endangered aquatic and terrestrial species, and critical habitat) and wetlands was evaluated during the initial screening phase (Appendix B, Criterion P5 and P6). Additional site ecological information specific to terrestrial and wetland resources at each site is included in the full discussion below.

Discussion/Results – Consolidating the data for both sensitive terrestrial species and wetlands (analyzed previously), the site evaluations can be summarized as follows:

SRS – There are no federal or state listed species on-site. There are federal and state listed rare, threatened, and endangered species that have been seen within the SRS, including the bald eagle, wood stork, and red-cockaded woodpecker. However, none have been recorded in the immediate vicinity of the proposed site nor have any nests been observed in the general area of the sites. The smooth purple coneflower is the only federally listed endangered plant species that occurs within the SRS, but this is not found in the immediate vicinity of the site. The nearest sightings of bald eagles and bale eagle nests have been around the Par Pond system. Par Pond is about 3 miles south of the proposed site. The closest area of endangered plant species is on the other side of Tinker Creek about a mile from the site, where some smooth purple coneflower plants have been identified.

No wetlands are found in the immediate area of the site, although there are significant wetlands 2 to 4 miles from the site. In general, wetlands cover about 49,000 acres of the approximately

198,000 acres occupied by the SRS. The proposed site is within the approximately 250 acres of the preferred APT site, which consists of mostly wooded land, predominantly loblolly and slash pine that have been planted since the late 1950s.

VCSNS - There are no federal or state listed species on-site. Six bald eagle nesting sites occur within a 5-mile radius of the site; four of these sites are believed to be active nesting sites and the status of the other two is unknown. Four of the sites are on Parr Reservoir, one is on Monticello Reservoir; and one is two miles east of Monticello Reservoir. No areas are designated by the USFWS as critical habitat for endangered species exist at the site. No wetlands are found on the site. However, forested wetlands are found within the site vicinity (6,000 acres). Although not listed, a candidate species, the robust redhorse, has been stocked in the Broad River as part of a species re-introduction program.

Site ratings based on Important Terrestrial Species/Habitat

Site	T&E species (terrestrial)	Habitat	Flexibility	Overall rating
SRS	5	3	5	4
VCSNS	5	3	5	4

Site ratings based on Wetlands

Site	Total wetland acreage within site (400 acres)	Acreage of Higher Quality wetlands around site (6000 acres)	Flexibility	Overall rating
SRS	5	1	5	4
VCSNS	5	1	5	4

Taking into account the above terrestrial species and wetland ratings, each site was given the following composite rating:

Site Composite Rating

Site	Terrestrial	Wetlands	Composite Rating
SRS	4	4	4
VCSNS	4	4	4

2.2.2 Dewatering Effects on Adjacent Wetlands

2.2.2.1 Depth to Water Table

2.2.2.2 Proximal Wetlands

Objective – The objective of this criterion is to evaluate the sites with respect to potential impacts from construction related dewatering activities on area wetlands.

Evaluation approach – The evaluation included a review of information related to the depth of the water table and the distance to nearby wetlands. A determination of the extent of wetland acreage within the study area was limited. National Wetland Inventory maps were used for some sites as the basis for determining wetland acreage. Those maps include numerous areas that do not represent jurisdictional wetlands under Section 404 of the Clean Water Act, which contributed to the difficulty in making an estimate of wetland acreage. Moreover, those maps were based primarily on interpretation of aerial photography, and the amount of field validation that was performed varies according to region of the country and local terrain. Site Environmental Reports and other documents developed during the early stages of site licensing were also reviewed. These documents may not necessarily reflect existing wetland conditions at the sites.

Discussion/Results

SRS – Depth to the groundwater table is shallow to moderate (between 10 and 100 feet below ground surface). The depth to the top of the water table (Upper Three Runs Aquifer) averages 40 feet below the surface at the south end of the preferred site and drops to around 60 feet at the north end. In 1993 SRS withdrew 3,500 million gallons per year of groundwater in support of site operations.

The SRS contains approximately 49,000 acres of wetlands (25% of total site area), most of which are associated with floodplains, streams, and impoundments. Wetlands on the reservation may be divided into the following categories: bottomland hardwoods, cypress-tupelo, scrub-shrub, emergent, and open water. The most extensive wetland type on SRS is swamp forest associated with the Savannah River floodplain. Approximately 9,390 acres of these wetlands are found on SRS. Carolina bays, a type of wetland unique to the southeastern U.S., are also found on SRS. These natural shallow depressions occur on interstream areas of SRS and range from lakes to shallow marshes, herbaceous bogs, shrub bogs, or swamp forests.

VCSNS – The groundwater table at VCSNS generally follows the land surface. The depth to water table is governed by topography and the direction of movement is therefore toward streams located in the lower elevations. Within 20 miles of the site, groundwater wells range from 62 to 365 feet deep but commonly are less than 200 feet deep. The depth to groundwater in the vicinity of the site is typically from 20 to 90 feet, generally in jointed bedrock.

There are two groundwater removal (dewatering) wells on the site that are used to lower the water table and alleviate problems with water seepage into below grade portions of buildings. This is the only withdrawal of groundwater associated with VCSNS. It is estimated that both wells withdraw less than 26 gallons per minute and both wells discharge to the site storm water system.

Sites with the lowest potential for adverse impacts on area wetlands from on-site construction related dewatering activities were assigned a rating value of 5. Both sites have a similar depth to groundwater, no wetlands on the immediate site but high quality wetlands surrounding the site. As such, both are given a rating of 4.

Dewatering Effects on Adjacent Wetlands	SRS	VCSNS
Rating	4	4

2.3 OPERATIONAL-RELATED EFFECTS ON AQUATIC ECOLOGY

2.3.1 Thermal Discharge Effects

2.3.1.1 Migratory Species Effects
2.3.1.2 Disruption of Important Species/Habitats
2.3.1.3 Water Quality

Objective – No exclusionary or avoidance criteria apply to condenser cooling water system thermal discharges on receiving water bodies (EPRI Siting Guide, Section 3.2.3.1). The objective of this criterion is to address the relative suitability of the two candidate sites with respect to potential thermal impacts. Two specific thermal impact issues were considered:

- disruption of important species and habitats, and
- impact on water quality of the receiving water body.

Information on migratory species (also identified in EPRI criteria) was not available for the site and therefore was not evaluated as part of this criterion.

Evaluation approach – In December 2001, the EPA published a final regulation, which affects the location, design, construction, and capacity of intake structures for new power plants. The EPA rule will strongly encourage the use of closed-cycle designs to reduce adverse cooling water system impacts, and it is assumed that new nuclear reactors at both SRS and VCSNS would include closed cooling water systems.

In addition, an important consideration in evaluating the suitability of the sites was the design of condenser cooling system used by the existing unit at each site.

Discussion – Both candidate sites are located on large bodies of water, the Savannah River and Monticello Reservoir for SRS and VCSNS, respectively. Information on existing cooling systems is summarized in the table below.

SRS - Makeup water would be taken from the Savannah River with blowdown to control chemistry returned directly to the river or through Par Pond which discharges into Lower Three Runs Creek. Impacts to onsite surface water bodies and the Savannah River should be minimal if thermal increases are held to less than 1 degree Centigrade. In addition, an evaluation of impacts associated with the restart of the L Reactor indicated no adverse impacts to anadromous fish in the Savannah River. The EIS predicted that the thermal plume would be restricted to only one side of the river and allow a zone of passage on the other side for anadromous species upstream and downstream (DOE 1996). No reactors are currently operating at SRS.

VCSNS – A once through cooling water system is currently in operation at VCSNS. In the late 1980s fish kills were observed in the VCSNS discharge bay in the late summer and early fall. Monitoring by SCE&G identified high discharge temperatures combined with Monticello Reservoir drawdowns (for pumped storage operations) as the probable cause of the fish kills. At lower reservoir levels, the flow of cooler water along the bottom of the discharge canal into the discharge bay was restricted, and temperatures rose to lethal levels for fish. From 1991 to 1993 SCE&G undertook several measures to resolve this problem, including removing an elevated area in the discharge canal, limiting drawdown of Monticello Reservoir, and dredging the entire length of the canal. Monitoring in 1994 and 1995 verified that fish kills in the discharge channel had ceased.

In Monticello Reservoir, the major factor of plant operations affecting heat-related deaths of fish is the temperature of water in the discharge bay and the discharge canal. The current NPDES permit limits the daily maximum discharge temperatures to 45^{o} C (113^{o} F) and monthly average plume temperature to 32^{o} C (90^{o} F). To limit the heat load rejected to Monticello Reservoir, in 1996 SCE&G installed the turbine building closed cooling water system to provide cooling for certain station loads that were previously handled by circulating water systems.

After leaving the condensers, the circulating water moves from the plant to a discharge basin (via pipe). From the basin, the heated effluent moves through a 1000-foot-long discharge canal to Monticello Reservoir. Discharge canal directs the heated effluent to the northeast. A 2600-foot-long jetty prevents the recirculation of the heated water. To mitigate the effects of excessively warm water in the discharge canal on the fishery, the entire length of the discharge canal was dredged during July and August 1993. The dredging increased the amount of cool water that flows into the canal during low reservoir levels. Dredging altered the circulation patterns in the canal and increased the cool water flow such that the temperature at the bottom of the discharge bay in summer remained 10 to 15 degrees cooler than "end-of-pipe' discharge temperatures. Between 1995 and 2000 the maximum water temperatures measured in Monticello Reservoir at a sampling station just outside the mouth of the discharge canal ranged between 35.1^{o} C and 39.8^{o} C (95.2^{o} F and 103.7^{o} F). The maximum discharge temperature established by NPDES permit and measured at the point at which the flow from the cooling system enters the discharge embayment is 45^{o} C (113^{o} F). The maximum plume temperature measured at the intake of the Fairfield Pumped Storage Facility is 32^{o} C (90^{o} F). This discharge canal conveys the water from the discharge embayment toward the main body of the reservoir and toward the FPSF.

During relicensing of VCSNS, NRC staff concluded that the potential impacts of discharging heated water from VCSNS to Monticello Reservoir are small. Current thermal discharges may have localized effects on, but are not expected to affect, the larger geographical distribution of aquatic organisms. The staff expects that the measures in place at VCSNS will provide mitigation for all impacts related to heat shock, and no new mitigation measures are warranted.

Results – Both candidate sites are located on or near large bodies of water which would likely provide sufficient heat rejection capacity for a new unit, appropriately located, using a closed cooling water system without having significant thermal impacts to aquatic/marine ecology and water quality. No information was discovered during the evaluation which revealed any concerns with significant thermal impacts from the existing units.

Rating of the two sites with respect to the potential thermal discharge impacts on important species/habitats and water quality is summarized below. The sites were rated equally suitable with respect to thermal discharges from closed-cycle cooling systems – with each given a conservative rating of 4 based on past thermal issues at VCSNS and water quality concerns at Par Pond and the presence of important aquatic species at SRS.

Thermal Discharge Effects	SRS	VCSNS
Presence of important aquatic species	4	5
Water quality	4	4
Overall rating	**4**	**4**

2.3.2 Entrainment/Impingement Effects

2.3.2.1 Entrainable Organisms

2.3.2.2 Impingable Organisms

Objective – No exclusionary or avoidance criteria apply to entrainment and impingement impacts from the operation of condenser cooling water systems (EPRI Siting Guide, Section 3.2.3.1). The objective of this criterion is to address the relative suitability of the candidate sites with respect to potential entrainment and impingement impacts.

When cooling water is pumped from water bodies, several environmental impacts can occur. Entrainment refers to the removal of small, drifting organisms with the cooling water. Small fish, fish eggs, phytoplankton, zooplankton, and other aquatic/marine organisms experience high mortality rates as they pass through cooling water pumps and heat exchangers. Impingement refers to larger organisms that are screened out of the cooling water at the intake structure. Impinged organisms can include large fish, crustaceans, turtles, and other aquatic/marine organisms that can not avoid high intake velocities near the intake structure and are trapped on the intake screens.

Evaluation approach – Concerns about entrainment and impingement losses are resource dependent and vary on a site-to-site basis. Typically, power plants with once-through cooling water systems have higher entrainment and impingement impacts than power plants with closed-cycle cooling water systems. The EPA issued a final rule in December 2001 affecting the design of intake structures for new power plants. These rules encourage the use of close-cycle systems, although for purposes of this evaluation, both types of cooling systems are being evaluated. Developers of new power plants who choose certainty and faster permitting over greater design flexibility, will be encouraged to limit intake water capacities and velocities and incorporate specific intake screen designs to reduce entrainment and impingement losses.

The two candidate sites were evaluated with respect to relative potential for entrainment and impingement impacts for closed-cycle cooling water systems.

Discussion

SRS – Several reactors have operated in the past at SRS and resulted in a high number of losses due to entrainment (10%) and impingement (7,500 fish per year). They have since shut down for many years and it is not clear whether past entrainment and impingement losses are considered significant, can be avoided in the future, and/or would be an issue in future licensing. It should be noted that a 1990 DOE report [Entrainment sampling at the Savannah Rive Site Savannah River water intakes, November 1990, WSRC-TR-90-497) indicated that there was growing concern, at that time, surrounding striped bass and American shad stocks in the Savannah River. Presumably entrainment and impingement losses could remain an issue at SRS in the future with existing or new reactor start up, although it is believed that these such could be adequately addressed through improvements in intake design.

VCSNS – Based on information in the NUREG 1437, entrainment of phytoplankton and zooplankton has not been found to be a problem at operating nuclear power plants. VCSNS has a once-through cooling system, but a new unit would likely include a closed cooling water system.

Entrainment of fish and shellfish in early life stages at VCSNS has been investigated as part of the 316(b) demonstration for the SCDHEC NPDES permit. Entrainment sampling of VCSNS intake waters for icthyoplankton (fish eggs and larvae) took place between October 1983 and September 1984. No other specific entrainment studies have been conducted at the site.
Entrainment studies conducted in 1983-1984 were conducted prior to the introduction of white perch to the reservoir. Gizzard shad larvae were the most abundant organisms collected.

Even with large volumes of surface water pumped by both facilities (VCSNS and FPSF), and related potential fish entrainment, Monticello Reservoir maintains sustainable populations of a variety of fish, and a sustainable fishery. Changes in fish communities since 1985 have coincided with the introduction of a new species, including the white perch and blue catfish, which are effective predators and competitors with other species. While entrainment of fish and shellfish in early life stages from VCSNS operations would continue, potential impacts on fish populations in Monticello Reservoir are expected to be small.

The current NPDES permit for VCSNS states that the VCSNS cooling water intake structure(s) reflect the best technology available for minimizing adverse environmental impact. Thus no further sampling has been required. The staff expects that the measures in place at VCSNS (e.g., placement of intake structure) provide mitigation for all impacts related to entrainment, and no new mitigation measures are warranted.

Impingement of fish and shellfish on debris screens of cooling water system at VCSNS was monitored and evaluated from October 1983 to September 1984 as part of VCSNS's 316(b) demonstration. The current NPDES permit for VCSNS states that VCSNS cooling water intake structure(s) reflect the best technology available for minimizing adverse environmental impact. Thus no further sampling has been required.

No mollusks or crustaceans of economic importance as fisheries resources are present in Monticello Reservoir.

Results – A summary of the rating scores for the sites is shown in the table below. Sites with the lowest potential impact were assigned a value of 5.

Proposed facilities at each site will include cooling towers that will reduce the amount of cooling water withdrawal required for plant operation. In addition, proper design of the water intake structure would minimize the potential adverse impacts. In NUREG 1437, NRC concludes that, with cooling towers and appropriate intake design, potential adverse impacts due to entrainment or impingement of aquatic organism are minor and do not significantly disrupt existing populations. While this information indicates entrainment and impingement would not be a significant problem at either site, SRS is given a slightly lower rating given its past history and the presence of important aquatic resources at the site. VCSNS is given a rating of 4 to account for potential cumulative impacts associated with the existing unit that includes a once-through cooling system.

Potential Impact	**SRS**	**VCSNS**
Entrainment	4	5
Impingement	4	5
Composite Rating	**4**	**5**

2.3.3 Dredging/Disposal Effects

2.3.3.1 Upstream Contamination Sources

2.3.3.2 Sedimentation Rates

Objective – The objective of the criterion is to evaluate the sites for potential environmental impacts related to maintenance dredging at the intake structure. No specific exclusionary or avoidance criteria apply to this issue. The following evaluation, therefore, is a summary of available information related to the relative suitability of the sites.

Evaluation approach – Sites with high levels of contaminated sediment deposition at the intake structure will experience higher maintenance costs for the removal and disposal of the dredged material. Two factors were considered in performing the evaluation:

- The level of upstream contamination, and
- The rate of sedimentation at the site.

As addressed in Criterion 2.1.2 (Contaminated Sediments), no site-specific information about the level of sediment contamination at the sites was identified. Results for Criterion Section 2.1.2 were based on EPA data, which addressed general trends in levels of contamination in the water bodies at the candidate sites, and general water quality information for the major water bodies on which the candidate sites are located. Sedimentation rates are assumed to be the same at each site and were given a conservative rating of 3 based on incomplete information.

Based on available information, the sites were rated according to the expected levels of contamination and sedimentation rates for the general area of the two sites. Sites with the lowest

concentration of heavy metals and toxic organic compounds and the lowest sediment rates are the most suitable and were assigned a score of 5.

Discussion/Results – The results are summarized in the table below.

Criteria	SRS	VCSNS
Upstream contamination sources	3	4
Sedimentation rate	3	3
Rating	**3**	**3.5**

2.4 OPERATIONAL-RELATED EFFECTS ON TERRESTRIAL ECOLOGY

2.4.1 Drift Effects on Surrounding Areas

2.4.1.1 Important Species/Habitat Areas

2.4.1.2 Source Water Suitability

Objective – The objective of this criterion is to evaluate the relative suitability of the candidate sites with respect to potential concerns with cooling tower drift effects. This evaluation considered the potential effects on surrounding areas and the suitability of the cooling water source (EPRI Siting Guide). This issue does not apply to sites for which once-through cooling water systems are selected.

In every cooling tower, there is a loss of water to the environment in the form of pure water, which results from the evaporative cooling process. This evaporated water leaves the tower in a pure vapor state, and thus presents no threat to the environment. Drift, however, is the undesirable loss of liquid water to the environment, via small unevaporated droplets that become entrained in the exhaust air stream of a cooling tower. These water droplets carry with them minerals, debris and microorganisms and water treatment chemicals from the circulating water, thus potentially impacting the environment. High drift losses are typically caused by fouled, inefficient or damaged drift eliminators, excessive exit velocities or imbalances in water chemistry.

Minimizing drift losses in a cooling tower reduces the risk of impacting the environment. The principle environmental concern with cooling tower drift impacts are related to the emission and downwind deposition of cooling water salts (EPA 1987). Salt deposition can adversely affect sensitive plant and animal communities through changes in water and soil chemistry.

Evaluation approach – Sites considered with the most sensitive environments were assigned lower rating values. Sites with highest concentrations of dissolved solids and other potential contaminants in cooling tower makeup were also assigned lower rating values.

Discussion/Results – Information regarding important terrestrial and aquatic plant and animal communities, habitats, and wetlands in the vicinity of the candidate sites were previously addressed in Section 2.1.1 (Disruption of Important Species/Habitats) and Section 2.2.1 (Disruption of Important Species/Habitats and Wetlands). Cooling water makeup water quality is assumed to be similar at both sites.

In NUREG 1437, NRC concluded that potential adverse impacts due to drift from cooling towers to surrounding plants, primarily trees at these two sites, is minor. This potential impact can be minimized with the use of drift eliminators on the cooling towers.

Given all the above factors, both sites were given a rating of 4. A summary of the rating values are shown in the table below.

Criteria	**SRS**	**VCSNS**
Important Species Habitat Areas	4	4
Source Water Suitability	4	4
Potential for impact based on NUREG 1437	5	5
Composite Rating	**4**	**4**

3. SOCIOECONOMICS CRITERIA

3.1. SOCIOECONOMICS - CONSTRUCTION RELATED EFFECTS

Objective – The objective of this criterion is to evaluate the relative suitability of the site with respect to the number of construction workers who will move into the plant site vicinity with their families; and the capacity of the communities surrounding the plant site to absorb this new temporary (in-migrant) population.

Evaluation approach – The number of in-migrant workers is dependent on labor availability within commuting distance of the plant site. If an adequate supply of workers is available within reasonable commuting distance, few, if any workers, would choose to relocate to the site. The capacity of communities to absorb an increase in population depends on the availability of sufficient resources, such as adequate housing and community services to support the influx.
Steps 1 and 2 (Exclusionary and Avoidance criteria) are not applicable to this criterion. The plant construction workforce is likely to be available at any of the sites under consideration. The issue in siting, therefore, is the potential socioeconomic impact associated with any temporary influx of construction workers who live too far away to commute daily from their residence. With respect to suitability of the sites under consideration by SCE&G, socioeconomic impacts of nuclear power plant construction are directly related to two factors:

- number of construction workers who will move into the plant site vicinity with their families; and
- capacity of the communities surrounding the plant site to absorb this new temporary (in-migrant) population.

The number of in-migrant workers is dependent on labor availability within commuting distance of the plant site. If an adequate supply of workers is available within reasonable commuting distance, few (if any) workers would choose to relocate to the site vicinity. The capacity of communities to absorb an increase in population depends on the availability of sufficient resources, such as adequate housing and community services (e.g., schools, hospitals, police, transportation systems, and fire protection) to support the influx without straining existing services. Impacts to a small community located along the commuter route(s) (e.g., food, lodging, gas, and congestion) can also be significant and should be considered. The information that should be considered in rating sites from the perspective of construction impacts includes labor requirements, location of labor pool, number of immigrants, and the economic structure of affected communities.

Before the data could be compared between sites and the sites rated, certain assumptions were made regarding the construction labor requirements and construction schedule, labor pool, and affected area. Many of these assumptions were made without the benefit of site-specific information and may warrant future revision when site-specific data become available (i.e., full NEPA documentation for original plant construction and operation can be reviewed, and/or site-specific plant personnel can be interviewed regarding actual impacts from original plant construction). For purposes of this report, assumptions are based on professional judgment, the AP 1000 Siting Guide, and information contained in the U.S. Nuclear Regulatory Commission's *Generic Environmental Impact Statement for License Renewal for Nuclear Plants* (NUREG 1437) (May 1996).

ASSUMPTIONS

According to the AP 1000 Siting Guide, plant workforce (construction) indicates a monthly maximum construction workforce requirement of 1000 persons per unit. Construction of a nuclear power plant is very labor-intensive and for the AP 1000, skilled and unskilled construction workers would likely be needed over a 4 to 5 year period. The following assumptions were used in this analysis.

- Ratings are based on the assumption that two units would be constructed at a given site.
- Construction would require a peak construction work force of 2000 workers (1000 per unit); this estimate is not necessarily the "worst-case" but assumed to be a "realistic" estimate for purposes of site comparison.
- Analysis assumes that no other major construction project would occur in the site vicinity concurrently with the plant construction and operation. Thus, sites were rated without consideration of potential cumulative impacts of other potential demands for labor.

Available population and economic data were obtained from the US Census Bureau for each site. The data were collected by county to determine availability of an adequate labor force within commuting distance (based on an assumed location of the labor pool). Data relating to population and labor force (primarily construction industry) were compared with the construction labor requirement to determine availability of labor.

The study of economic structure examines employment because of its pre-eminent role in determining economic well-being of an area. Specifically, impacts are determined by comparing the number of direct and indirect jobs created by plant's construction with total employment of the local study area at the time of construction. Sites were rated according to economic impacts based on the following criteria: economic effects were considered small if peak construction related employment accounted for less than 5 percent of total study area employment; moderate if it accounted for 5 to 10 percent of total study area employment; and large if it accounted for more than 10 percent of total study area employment.

Discussion/Results

The available population and work force data are presented in the following tables.

SRS Site Population and Work Force

County (Projected Growth 2000-2010)	Total Pop (2000)	Total Pop (2010)	Total Employed Work Force (2000)	Total Construction Workforce (2000)
Aiken (17.8%)	142,552	167,926	63,756	7,917
Barnwell (15.7%)	23,478	27,164	9,410	1,029
Allendale (-4.4%)	11,211	10,738	3,425	277
Bamburg (-1.4%)	16,658	16,428	5,913	652
Columbia, GA (35.2%)	89,288	120,717	43,090	4,334
Richmond, GA (5.3%)	199,775	210,363	78,906	7,654
Total	**482,962**	**553,336**	**204,500**	**21,663**

Source: U.S. Census Bureau, http://quickfacts.census.gov/qfd/ for SC and GA

VCSNS Site Population and Work Force

County (Projected Growth 2000-2010)	Total Pop (2000)	Total Pop (2010)	Total Employed Work Force (2000)	Total Construction Workforce (2000)
Fairfield (5.2%)	23,454	24,673	10,074	1,277
Newberry (8.9%)	36,108	39,321	15,857	1,902
Richland (12.0%)	320,667	359,147	150,195	10,725
Lexington (28.9%)	216,014	278,442	110,330	13,051
Total	**596,243**	**701,583**	**286,456**	**26,955**

Source: U.S. Census Bureau, http://quickfacts.census.gov/qfd/ for SC and GA

Although the results show slightly higher population and workforce numbers available at VCSNS, the overall population levels for both sites in 2010 when construction is anticipated to begin, are sufficiently large that the impact on study area employment from construction of two new units would be low at each site. This is based on conservative workforce levels using 2000 Census Bureau data (without expected increases in 2010), although such increases might be used to support other large (non-nuclear) construction projects at that time). All sites show a percentage increase less than 5% when compared to total study area workforce (less than 10% when compared to construction workforce only).

Because of the large population projections and available workforce, it was also assumed that 100% of the workforce at each site would commute from within the area and there would be no in-migrant workforce population. As such, there would be no demands on housing and community services. Based on this information alone, both sites would receive a rating of 5.

However, to take it another step, should some workers in-migrate to the area, we have identified the following assumptions to help address potential impacts on local community services and housing:

- 30% of these workers will in-migrate (600 workers)
- 50% of these workers bring their families (2.5 additional persons per family) (750)
- An influx of direct workers will also brings an influx of indirect workers (0.4 ratio of direct to indirect workers – in absence of site-specific information - pertaining to the Regional Industrial Multiplier System direct/indirect ratios calculated for each plant (as found in NUREG/CR-2749) (240).
- 50% of these indirect workers bring their families (2.5 additional persons per family) (300), for a total population influx of 1890 persons.

When this population influx is compared to the total population projections in 2010, the increase is negligible and therefore the impact on housing and community services would be expected to be negligible. All sites are within reasonable commuting distance from a large city or metropolitan area. Each study area appears to have sufficient population centers within commuting distance and/or has experienced tremendous growth since 1990 such that its public services sector would be able to absorb the population in-migration associated with plant construction with minimal impact. Thus there is no significant difference between sites.

Finally, before assigning a final rating, this evaluation also incorporates more recent findings from a study conducted by Dominion Energy Inc., Bechtel Power Corporation, TLG, Inc., and MPR Associates for the US Department of Energy (2004) entitled: *Study of Construction Technologies and Schedules, O&M Staffing and Cost, Decommissioning Costs and Funding Requirements for Advanced Reactor Designs*. This report includes a more accurate and up-to-date assessment of labor availability that takes into account a U.S. labor pool that is aging and diminishing in number and skill level (with retirement of the baby boom generation that constructed the first set of nuclear power plants). It recognizes that attracting craft with the high skill levels and regulatory employment criteria for new nuclear plant construction is expected to be difficult given that the group of craft currently doing nuclear work is significantly smaller than the total construction craft population, and is in higher demand because of the higher skill levels and greater capability to meet strict employment standards (e.g., scrutiny of NRC background check). However, in an effort to reduce or minimize the labor supply concerns associated with new nuclear plant construction projects, a new strategy has been identified that would shift portions of the work force to areas of the country where skills and craft are available in sufficient quantity (national workforce). This would most effectively be done through modularizing portions of the plants to be built, and providing aggressive training of craftsmen before and during the construction phase of the project. Modularization is anticipated to become an important aspect of new nuclear construction.

Therefore, in light of this latest information and using best professional judgment, a comparison of socioeconomic conditions between the two candidate sites reveals minimal differences such that all are given the same rating.

Socioeconomic – Construction Related Effects	SRS	VCSNS
Rating	5	5

3.2 SOCIOECONOMICS – OPERATION

Socioeconomic impacts of operation relate primarily to the benefits afforded to local communities as a result of the plant's presence (e.g., tax plans, local emergency planning support, educational program support). These benefits tend to be a function of negotiations between the plant owner and local government; they are not indicative of inherent site conditions that affect relative suitability between sites. Each site has previously demonstrated that its local economy can support existing plant operations – an existing unit currently operates at VCSNS, and SRS has supported nuclear reactor operations in the past (although not at a commercial scale like VCSNS). Therefore, an additional unit will not adversely affect an area that has already shown its ability to support existing units. Accordingly, this criterion is not applicable to a comparison of SRS with VCSNS and in accordance with guidance in the Siting Guide, suitability scores were not developed.

3.3 ENVIRONMENTAL JUSTICE

Objective – The objective of the environmental justice evaluation is to ensure that the effects of proposed actions do not result in disproportionate adverse impacts to minority and low-income communities. In comparing sites, this principle is evaluated on the basis of whether any disproportionate impacts to these communities are significantly different when comparing one site to another.

Evaluation approach – The first step in this evaluation is to collect and compare population data for minorities and low-income populations across sites.
However, two additional questions comprising this evaluation also are relevant:

1. Does the proposed action result in significant adverse impacts?
2. Are impacts to minority or low-income populations significantly different between sites?

If the answer to the first question is "no" for all sites (i.e., no significant health and safety impacts are identified), then there would be no environmental justice concerns, regardless of the percentage of minority or low-income populations found within the surrounding communities of a site(s). If the answer to the first question is "yes" (i.e., significant health and safety impacts are expected), environmental justice concerns are relevant to site selection only if the answer to the second question is also "yes" (i.e., disproportionate adverse impacts on minority or low-income populations are identified at one or more sites, thereby resulting in significant differences between sites).

Discussion/Results – With regard to the sites under consideration, related environmental justice information is summarized for each candidate site below:

SRS Site Minority and Low Income Percentages

County	Population (2000)	White	Black	Other (including more than 1 race)	Low Income
Aiken	142,552	71.4% (101,782)	25.6% (36,493)	3.0%	13.8% (19,672)
Allendale	11,211	27.4% (3,072)	71% (7,960)	1.6%	34.5% (3,868)
Barnwell	23,478	55.2% (12,960)	42.6% (12,960)	2.2%	20.9% (4,907)
Bamburg	16,658	36.5% (6,080)	62.5% (10,411)	1.0%	27.8% (4,631)
Columbia (GA)	89,288	82.7% (73,841)	11.2% (10,000)	6.1%	5.1% (4,554)
Richmond (GA)	199,775	45.6% (91,097)	49.8% (99,488)	4.6%	19.6% (39,156)
Total	**482,962**	**59.8% (288,832)**	**36.7% (177,312)**	**4% (23,849)**	**15.9% (76,788)**

Source: U.S. Census Bureau, http://quickfacts.census.gov/qfd/ for SC and GA

VCSNS Site Minority and Low Income Percentages

County	Population (2000)	White	Black	Other (including more than 1 race)	Low Income
Fairfield	23,454	39.6% (9,282)	59.1 (13,859)	1.3%	19.6% (4,596)
Newberry	36,108	64% (23,115)	33.1 (11,958)	2.9%	13.7% (4,947)
Richland	320,667	50.3% (161,276)	45.2 (144,809)	4.5%	12.0% (38,480)
Lexington	216,014	84.2% (181,844)	12.6% (27,274)	3.2%	13.7% (29,593)
Total	**596,243**	**63.0% (375,517)**	**33.0% (197,900)**	**4% (23,849)**	**13% (77,616)**

Source: U.S. Census Bureau, http://quickfacts.census.gov/qfd/ for SC

Environmental justice data for the two sites are summarized below.

Site	Population (2000)	White	Minority	Low Income
SRS	482,962	59.8%	40.7%	15.9%
VCSNS	596,243	63.0 %	37.0 %	13.0 %

*State Average for SC is 67.2% white and 14.1% below poverty line. State Average for GA is 65.1% white and 13.0% below poverty line.

- Large minority populations (20% or higher, and slightly higher than state average) are found at both sites, but with slightly more evidence at SRS.
- Low-income populations are slightly more in evidence at SRS.
- No significant health impacts to human populations were identified at any of the sites under consideration
- Low-income population at VCSNS has directly benefited from economic impacts of the existing plant at VCSNS. Similar beneficial economic impacts are expected to occur for additional units at the VCSNS site.

Based on professional judgment in factoring in the above percentages alone, the site ratings would be as follows: SRS – 3, VCSNS – 4. However, given that no significant impacts to any human populations are expected to occur at any of the sites under consideration, there cannot be significant disproportionate impacts to minority or low-income populations; and based on actual employment experience, positive economic benefits have been shown to be available to all members of the population, without regard to income or ethnicity.

While disproportionate adverse impacts could be expected to occur to minority or low-income populations at both sites, if significant health and safety impacts were expected from a new nuclear reactor, no significant health and safety impacts are expected to human populations from reactor operations. Therefore, if no significant health and safety impacts are identified from reactor construction and operation, then there would be no environmental justice concerns, regardless of the percentage of minority or low-income populations found within the surrounding communities. Therefore, no significant differences in environmental justice impacts are expected between the candidate sites and both should receive a final comparative rating of 5.

Based on this analysis, there is no basis for differentiation between sites from an environmental justice perspective, despite differences in the percentages of minority and low-income populations found within the surrounding communities of each site. All sites are found to be equally and highly suitable. Therefore, the site ratings are as follows:

Environmental Justice	SRS	VCSNS
Rating	**5**	**5**

3.4 LAND USE

3.4.1 Construction- and Operation-Related Effects

Objective - The objective of this criterion is to evaluate the suitability of each site with respect to potential conflicts in existing land uses at each site. No exclusionary or avoidance criteria apply to this issue.

Evaluation Approach – The evaluation is based on the compatibility of a new nuclear station with existing land uses.

Discussion/Results – For VCSNS, land to be used for new units is already owned by SCE&G and is already zoned for uses compatible with development of a new unit; existing units are integrated into the surrounding land use patters.

With respect to SRS, no current or future regulatory land-use restrictions were identified that are incompatible with locating nuclear power generation plants on the SRS. Previous and proposed nuclear-related missions have received positive local public and political support. The Vogtle nuclear plant, located nearby in the state of Georgia, has been in commercial operation for many years. Given the size of SRS and the positive local public and political support for nuclear missions, no land-use issues are evident.

No significant differences in land use impact between sites under consideration are expected. Both sites receive a favorable rating of 5.

Land Use	SRS	VCSNS
Rating	5	5

4. ENGINEERING AND COST-RELATED CRITERIA

4.1 HEALTH AND SAFETY RELATED CRITERIA

4.1.1 Water Supply

Objective – The purpose of this criterion is to evaluate relative differences in the design and construction cost of developing water supply facilities.

Evaluation approach – Sites with local conditions that would require additional engineering costs to develop water supply capability (e.g., reservoirs to address water supply limitations or reliability issues (e.g., low flow constraints)) are rated lower than sites with no such requirements.

Discussion/Results – Site ratings are based on professional judgment, taking into account major river body flows (average annual and low flow/drought conditions), as well as the size and extent of on-site tributaries. Sites with no anticipated reservoir requirements received a 5; other ratings relate to anticipated reservoir requirements.

Both sites have access to cooling water sources that would appear to provide adequate supply volume and both sites will require installation of new and/or improved water intake structures and systems. However, the ability of the existing water supply system to physically transport the necessary volume at SRS has not been fully confirmed. Additional reservoir construction may be required (Par Pond is too contaminated to be used) may also be required at SRS, and control of the water supply (SRS versus SCE&G) is also a significant concern.

VCSNS is located near the Monticello Reservoir and additional water supply requirements are expected to be straightforward. For these reasons VCSNS is given the higher rating.

Water Supply	SRS	VCSNS
Rating	3	5

4.1.2 Pumping Distance

Objective – The purpose of this criterion is to evaluate relative differences in the operational costs associated with pumping makeup water from the source water body to the plant.

Evaluation approach – Sites located large distances from their makeup water supply source are rated lower than those located adjacent to the source. In general, the cost differential is expected to be a linear function of distance from the water source.

Discussion/Results – The intake at the Savannah River is built at the end of a channel approximately 1640 feet long. This channel has been subject to siltation in the past and was dredged during operation of the SRS facilities. For new power generation facilities, because of the required low flow rate as compared to the design flow for the channel, a higher rate of siltation may be expected in the channel. The channel will act as a settling basin for coarse and

medium sediment before it reaches the pump intake. However, fine sediment may have to be managed at the plant through suitable water treatment to remove the sediment, which may affect certain cooling water systems including heat exchangers. During a May 2002 site visit, it was observed that the channel had an extensive degree of aquatic growth and algae. These could affect the type of screening and potentially the water treatment plant. Although the existing intake structure can be assessed visually and through testing for its structural integrity, the condition of the piping system is unknown. Since the makeup water requirement is low compared to the design capacity of each conduit, installation of a new pipe with a smaller diameter would be prudent to ensure the dependability of the water supply to the new plants. The new pipe design size should maintain an adequate velocity to prevent deposition of suspended sediment along the pipe. The estimated pipe length is approximately 16 miles. The existing trash racks, traveling screens, and probably the pumps and valves at the intake structure would require replacement to fit the new pipeline design and flow capacity.

While SRS has had high-volume water systems operating in the past, the current condition of the existing cooling water supply system is not clear and substantive repair, modification and upgrades may be required. The proposed site also is a significant distance from the cooling water source (Savannah River) – as compared to VCSNS - and the cooling system piping network is extensive. VCSNS is given a higher rating than SRS based on the fact that VCSNS is an existing site located very near the cooling water supply source, and economical water withdrawal systems have been developed and are currently operating at the site.

Pumping Distance	SRS	VCSNS
Rating	3	5

4.1.3 Flooding

Objective – The purpose of this criterion is to rate sites with respect to differential costs associated with construction of flood protection structures necessary to address probable maximum floods at the sites under consideration.

Evaluation approach – Sites with the largest differences between site grade elevation and likely flood elevations are rated highest; sites with plant grade at or near flood level are rated lowest.

Discussion/Results – Although final plant layout locations have not been set for either site, an initial comparison of potential site locations with floodplain information indicate that proposed plant facilities are at sufficiently high elevations above major water bodies to protect the plant facilities from flooding. No requirement for flood protection structures is anticipated at either site; accordingly, they are assigned a rating of 5.

Flooding	SRS	VCSNS
Rating	5	5

4.1.4 Vibratory Ground Motion – *Deleted from evaluation*

The objective of this criterion is to provide a relative measure of cost associated with designing to different seismic requirements at different sites. Because both of the sites under consideration are expected to meet the site parameters for seismic design of the standardized designs under consideration, this criterion is not applicable to the SCE&G site selection process.

4.1.5 Civil Works

Objective – The objective of this criterion is to rate sites according to differences in the cost of civil works (e.g., non-flood related berms, stabilizing of graded slopes and banks) necessary to prepare the site for nuclear plant development.

Evaluation approach – Sites are rated highest to lowest according to the estimated level of cost of civil works required at each site.

Discussion/Results – VCSNS is a developed site with natural soils with varying depth to rock. SRS is an undeveloped deep soil site. Each of these sites have been shown to be capable of supporting conventional foundation designs and no significant cost variations can be identified at this time due to differences in the requirement for civil works. Accordingly, both sites are assigned a median rating of 3.

Civil Works	SRS	VCSNS
Rating	3	3

4.2 TRANSPORTATION OR TRANSMISSION-RELATED CRITERIA

4.2.1 Railroad Access

Objective – The purpose of this criterion is to rate sites according to the relative costs associated with providing rail access.

Evaluation approach – Sites are rated from highest to lowest in accordance with distance (in miles) from site to the nearest rail line and associated rail construction costs (lowest costs result in the highest rating). This criterion was evaluated as part of the initial screening process (Criterion P7, Appendix B). Additional site data are included below.

Discussion/Results – SRS has its own railroad system, which services all major facilities. The rail network includes a main line of the CXS railroad and the sites wide DOE-owned rail system. Rail traffic on the site is separated into two distinct categories according to ownership of the track: CXS operation and SRS operations. The CSX railroad has a through line between Augusta, GA and Yernassee, SC, and terminates in Port Royal, SC. In 1989 a second line from SRS to Florence SC was abandoned by CXS beyond Snelling, SC. CSX maintains service as required to the Dunbarton Station for SRS deliveries/pickups and a spur line into the Chem Nuclear site near Snelling, SC.

Based on USGS topographic maps, the closest rail line is 2.4 miles from the SRS site. In general, SRS is served by the CSX railroad. There are approximately 80 miles of onsite rail lines, with approximately 60 miles being maintained by DOE. Currently no rail spur exists at the preferred site. To avoid security issues associated with transportation through the SRS site, a preferred option may be to discuss with CSX the possibility of installing a spur line from the main line to the DOE property line at the proposed site [this would result in an estimated distance in the range of 10 miles or higher - which would lower the SRS site rating to a 1].

Railroad access is already provided to VCSNS with a spur from the Norfolk Southern line. The spur runs along the east side of the Broad River.

Sites with rail 1 mile or less away, receive a rating of 5; sites with rail between 1 and 5 miles away receive a rating of 4 and sites with rail greater than 5 miles away receive a rating of 3. Distances to rail service at each of the sites is as follows: VCSNS 0.3 mile; SRS 2.5 miles (no independent new line). Ratings are provided below.

Railroad Access	SRS	VCSNS
Rating	4	5

4.2.2 Highway Access

Objective – The purpose of this criterion is to rate sites according to the relative costs associated with providing highway access.

Evaluation approach – Sites are rated from highest to lowest in accordance with the length of additional or new highway construction required to provide car and truck access.

Discussion/Results – The VCSNS site is an operating facility and is served by adequate highways to allow access by operations staff and other vehicle access (e.g., delivery) to support operations. The VCSNS site has also had highway access necessary to support the construction of the unit now in operation.

SRS is served by more than 200 miles of primary roads and more than 1000 miles of unpaved road. Road access to the site is currently on unpaved roads via SH 125. US 278 cuts through a portion of SRS near the site to the north. Easy access to the site area could be accommodated by installing an access road from US 278 (a distance of approximately 4.3 miles). The major commuting route for the workforce is SH 125, which is on the opposite side of SRS and which should not be impacted by construction efforts at the preferred site location.

While some highway upgrades may be expected to support construction and operation of a new nuclear power plants at SRS, no significant upgrading is anticipated at VCSNS, as reflected in the site ratings below.

Highway Access	SRS	VCSNS
Rating	3	5

4.2.3 Barge Access

Objective – The purpose of this criterion is to rate sites according to the relative costs associated with providing barge access.

Evaluation approach – Sites are rated from highest to lowest in accordance with estimated cost of facilities construction required to provide barge access.

Discussion/Results – SRS is on the Savannah River with a barge slip situated on DOE property. It has been used in the past for heavy loads and large components such as steam generators, however, shipment is dependent on water level in the river. With drought conditions in 2000-2002, the river level was not high enough to support barge traffic. The site is on the opposite side of the reservation from the barge slip and would require that some additional heavy haul routes be constructed.

VCSNS is not accessible by barge, and is therefore the less desirable site with respect to barge access.

Barge Access	SRS	VCSNS
Rating	5	1

4.2.4 Transmission Cost Differentials

4.2.4.1 Transmission-Construction

4.2.4.2 Electricity Market Price Differentials

Objective – The purpose of this criterion is to rate sites according to the relative costs associated with providing transmission to the site.

Evaluation approach – Sites are rated from highest to lowest in accordance with distance (in miles) from site to nearest transmission connection on the existing grid, and associated transmission line costs (lowest costs resulting in highest rating). Because both sites are located within the SCE&G service area, no electricity market price differentials are expected between the sites, and this sub-criterion was not evaluated.

This criterion was evaluated as part of the initial screening process (Criterion P8, Appendix B). Additional site data are included below.

Discussion/Results

SRS - The transmission system on the Savannah River Site consists of multiple 115 kV transmission lines forming a ring of network around the site. Three switching stations for the 115 kV transmission lines exist around the sites to feed the different area loads. The 115 kV system for the site is fed from SCE&G. A single 115 kV transmission line runs along the edge of the proposed site. A 230 kV line from Graniteville runs parallel to the 115 kV line at the edge of the proposed site

SRS studies have estimated transmission capital and upgrade costs ranging from about $140 million to more than $240 million.

VCSNS - SCE&G has built eight transmission lines for the specific purpose of connecting the existing VC Summer Nuclear Station (VCSNS) to the transmission system. Two additional transmission lines were built by Santee Cooper, co-owner of VCSNS, to connect the station to the regional grid. A total of 10 transmission lines connect VCSNS to the transmission system. While some additional upgrading/modification is expected to tie in the new site, transmission lines already exist at the VC Summer Site. Therefore it is expected that relatively low transmission costs will be incurred in developing a new plant at the site, and it is given a favorable rating.

Given the above factors, the site ratings are as follows:

Barge Access	SRS	VCSNS
Rating	1	5

4.3 CRITERIA RELATED TO LAND USE AND SITE PREPARATION

4.3.1 Topography

Objective – The purpose of this criterion is to rate sites according to the relative costs associated with site grading and earth-moving necessary to prepare the site for construction of a nuclear power plant.

Evaluation approach – Ratings are based on the amount of topographic relief currently found at the site, with the most severe relief resulting in the highest estimated grading costs and therefore the poorest rating.

Discussion/Results – Because VCSNS is an existing site, it is given a rating of 4, based on the expectation that the land area within existing site boundaries does not exhibit significant topographic relief that would result in significant grading costs. The site at SRS is situated on top of a broad drainage divide that is fairly flat on top. In general, the overall slopes of the area are less than 2 percent, but can be as much as 5 percent in some small local areas. As such, SRS could require some additional grading costs for a new plant; it is given a slightly lower rating

than VCSNS. There are no topographic indicators of geologic or hydrologic hazards in either site area.

Topography	SRS	VCSNS
Rating	3	4

4.3.2 Land Rights

Objective – The purpose of this criterion is to rate sites according to the relative costs associated with purchasing land required to construct and operate a nuclear station on the site.

Evaluation approach – This criterion was evaluated as part of the initial screening process (Criterion P10, Appendix B).

Discussion/Results – The site and SRS on which site is located are currently owned by the Federal Government, it is assumed that the site property would be transferred to SCE&G for a nominal fee such that there would be no associated land acquisition costs. However, there may be additional hidden costs or schedule issues associated with negotiating lease agreements and access controls. Accordingly the site is given a slightly lower than "most suitable" rating of 4.5.

Site property at VCSNS is already owned by SCE&G and was given a rating of 5.

Land Rights	SRS	VCSNS
Rating	4.5	5

4.3.3 Labor Rates

Objective – The purpose of this criterion is to rate sites according to the relative costs associated with local labor costs that would be incurred during plant construction.

Evaluation approach – Sites are rated from highest to lowest in accordance with estimated local labor costs.

Discussion/Results – All sites assigned a 5 based on the expectation that the construction force will come from a national workforce of journeymen, whose rates will be set based on supply and demand within the overall nuclear industry, rather than by local workforce rates or skill sets.

Economic data are typically available by county, but were found to be provided in a variety of forms (e.g., by hour, by week, by year; by job type) that were not necessarily consistent between counties. For purposes of consistency, this evaluation relied on data from U.S. Department of Labor, Bureau of Labor Statistics – May 2004 Metropolitan Area Occupational Employment and Wage Estimates. Average hourly rates were provided for construction and extraction workers (e.g., structural iron and steel workers; sheet metal workers; and plumbers, pipefitters and

steamfitters) for the following representative Metropolitan Statistical Areas: Augusta, GA/Aiken, SC for SRS; and Columbia, SC for VCSNS.

VCSNS: Mean hourly wage in Columbia in category of plumbers, pipefitters and steamfitters is $14.83/hour.
SRS: Mean hourly wage in Augusta/Aiken area in category of boilermakers is $16.86/hour. [and $16.64/hour for plumbers, pipefitters and steamfitters].

In addition, from the Dominion Energy Report, craft availability at SRS is good. SRS has been a primary employer of building trades craftsmen for decades and local unions are accustomed to providing large numbers of workers to the site. Lower wages would probably require added incentives to draw out-of-state craftsmen tot the site. Wages and fringes currently paid include $15.79 hourly laborers (union) and $33.80 for Boilermakers. In general, the wages in SRS region appear slightly higher than in the vicinity of VCSNS; this slight difference is reflected in the ratings.

Labor Rates	SRS	VCSNS
Rating	3	4

It should be noted that a significant portion of the construction workforce is expected to come from a national workforce of journeymen, whose rates will be set based on supply and demand within the overall nuclear industry, rather than by local workforce rates or skill sets. If such is the case, then the ratings would be identical for both sites.