Ronald B. Clary
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SCE&G®
A SCANA COMPANY

August 7, 2009
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U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

ATTN: Document Control Desk

Subject: Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3 Combined License Application (COLA) - Docket Numbers 52-027 and 52-028 Response to NRC Request for Additional Information (RAI) Letter No. 058

Reference: Letter from Chandu P. Patel (NRC) to Alfred M. Paglia (SCE&G), Request for Additional Information Letter No. 058 Related to SRP Section 02.05.01 for the Virgil C. Summer Nuclear Station Units 2 and 3 Combined License Application, dated July 15, 2009.

The enclosure to this letter provides the South Carolina Electric & Gas Company (SCE&G) response to the RAI items included in the above referenced letter. The enclosure also identifies any associated changes that will be incorporated in a future revision of the VCSNS Units 2 and 3 COLA.

Should you have any questions, please contact Mr. Al Paglia by telephone at (803) 345-4191, or by email at apaglia@scana.com.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 7th day of August, 2009.

Sincerely,

Ronald B. Clary

Ronald B. Clary
General Manager
New Nuclear Deployment

JMG/RBC/jg

Enclosure
Attachment 1 - FSAR Figure 2.5.1-212

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NRO

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NRC RAI Letter No. 058 Dated July 15, 2009

SRP Section: 02.05.01 – Basic Geologic and Seismic Information

Questions for Geosciences and Geotechnical Engineering Branch 2 (RGS2)

NRC RAI Number: 02.05.01-50

The response to RAI 2.5.1-1 indicated that a revised FSAR Figure 2.5.1-202, a new Figure 2.5.1-232, and two new references will be incorporated into the FSAR to address potential issues raised in RAIs 2.5.1-1, 2.5.1-2, 2.5.1-13, and 2.5.1-31. However, modified Figure 2.5.1-202 is not readable at the scale provided in the response.

In order for the staff to fully understand the regional geologic setting of the Summer site in regard to geologic structures and lithotectonic elements, please ensure that Figure 2.5.1-202 is readable and illustrates the relationships between lithotectonic terranes, the faults which separate them (specifically including the Central Piedmont Shear Zone), and the Carolina Zone.

VCSNS RESPONSE:

FSAR Figure 2.5.1-202 was revised in response to NRC RAI 2.5.1-1, and this revised figure has been incorporated in Revision 1 of the VCSNS COLA. Figure 2.5.1-202 shows the Central Piedmont Shear Zone and its relationship with the Carolina Zone, as well as other faults and lithotectonic elements in the site region. When viewed digitally, the revised FSAR Figure 2.5.1-202 provided in VCSNS COLA Revision 1 is readable and may be magnified as needed for closer inspection.

ASSOCIATED VCSNS COLA REVISIONS:

None

ASSOCIATED ATTACHMENTS:

None

NRC RAI Letter No. 058 Dated July 15, 2009

SRP Section: 02.05.01 – Basic Geologic and Seismic Information

Questions for Geosciences and Geotechnical Engineering Branch 2 (RGS2)

NRC RAI Number: 02.05.01-51

The response to RAI 2.5.1-11 addressed the issue of whether Mesozoic structures could be readily identified using geophysical data. The response provided clarification of two seemingly incompatible statements on this topic which were made in FSAR Sections 2.5.1.1.2.3.2 and 2.5.1.1.2.4. These two FSAR sections do not presently contain this concise explanation, and the response did not indicate that the FSAR would be revised to include it for clarifying the two seemingly incompatible statements.

Please provide updated FSAR text to clarify these two seemingly incompatible statements related to whether Mesozoic structures can be identified using geophysical data.

VCSNS RESPONSE:

As previously described in the response to RAI 2.5.1-11, the usefulness of magnetic data in identifying faults and other geologic structures largely is a scale-dependent issue. Moreover, the recognition of faults and other geologic structures in magnetic data is based on the juxtaposition of rocks with varying magnetic susceptibility. As such, the seemingly incompatible FSAR statements are, in fact, compatible. The statement that discrete faults cannot necessarily be identified from regional-scale magnetic data is not inconsistent with the statement that most Mesozoic structures can be identified by a combination of geophysical and geologic means.

FSAR Subsections 2.5.1.1.2.3.2 and 2.5.1.1.2.4 will be modified in a future COLA revision to reconcile and clarify these seemingly incompatible statements.

ASSOCIATED VCSNS COLA REVISIONS:

1. The third paragraph of COLA Part 2, FSAR. Chapter 2, Section 2.5.1.1.2.3.2, will be revised as follows:

   ~~The magnetic data in the site region does not have sufficient resolution to identify or map discrete faults, such as border faults along the Triassic basins.~~ Not all mapped faults in the site region display a recognizable magnetic signature. ~~In particular~~For example, the southern segment of the East Coast Fault System has no expression in the magnetic field and cuts across anomalies with wavelengths on the order of tens of kilometers without noticeably perturbing or affecting them.

If the fault exists as mapped, then it has not accumulated sufficient displacement to juxtapose rocks of varying magnetic susceptibility, and thus does not produce an observable magnetic anomaly at the scale of Figures 2.5.1-205 and 2.5.1-206.

2. COLA Part 2, FSAR. Chapter 2, Section 2.5.1.1.2.4, will be revised as follows:

2.5.1.1.2.4 Principal Regional Tectonic Structures

Principal tectonic structures and features in the southeastern United States and within the 200-mile VCSNS site region are divided into four categories based on their age of formation or reactivation, and are shown in Figures 2.5.1-211 and 2.5.1-212. These categories include structures that were most active during Paleozoic, Mesozoic, Tertiary, or Quaternary time. Most of the Paleozoic and Mesozoic structures are regional in scale and ~~geologically and geophysically recognizable~~ are recognized on the basis of geologic and/or geophysical data. The Mesozoic rift basins and bounding faults show a high degree of parallelism with the structural grain of the Paleozoic Appalachian orogenic belt, which generally reflects reactivation of preexisting Paleozoic structures. Tertiary and Quaternary structures are generally more localized and may be related to reactivation of portions of older bedrock structures.

ASSOCIATED ATTACHMENTS:

None

NRC RAI Letter No. 058 Dated July 15, 2009

SRP Section: 02.05.01 – Basic Geologic and Seismic Information

Questions for Geosciences and Geotechnical Engineering Branch 2 (RGS2)

NRC RAI Number: 02.05.01-52

The response to RAI 2.5.1-21 discussed information related to the age of the Mulberry Creek fault and the timing of the development of silicified fault breccias in the site region, including a summary of the supporting data from West (1998) used to conclude that the fault is Mesozoic in age and a revised FSAR Figure 2.5.1-212. The response specifically cited the more recent work of Hatcher and others (2006) which corroborated a Mesozoic age for the Mulberry Creek fault, and clarified that Nystrom (2006) did not interpret Cenozoic movement on any faults in the region based on the presence of silicified breccias. FSAR Section 2.5.1.1.2.4.2 does not presently contain this information, and the RAI response did not indicate that the FSAR would be revised to include it for constraining age of the Mulberry Creek fault. In addition, the "diagonal line" symbol is not included in the legend of revised Figure 2.5.1-212.

Please include key parts of the response to RAI 2.5.1-21 in a revised FSAR Section 2.5.1.1.2.4.2 to document the conclusion that the Mulberry Creek fault is Mesozoic in age. Please also include the "diagonal line" symbol in the legend of revised Figure 2.4.1-212.

VCSNS RESPONSE:

The description of the Mulberry Creek fault in FSAR Subsection 2.5.1.1.2.4.2 will be revised to include additional information presented in the SCE&G response to NRC RAI 2.5.1-21. Specifically, FSAR Subsection 2.5.1.1.2.4.2 will be revised to include information documenting a Mesozoic age for the Mulberry Creek fault.

Additionally, FSAR Figure 2.4.1-212 will be revised to include the diagonal line symbol in the explanation. The diagonal line symbol in FSAR Figure 2.5.1-212 indicates shear zones that are mapped in their original source reference as having width greater than the plain line width in FSAR Figure 2.5.1-212.

ASSOCIATED VCSNS COLA REVISIONS:

1. COLA Part 2, FSAR Chapter 2, Section 2.5.1.1.2.4.2, the Mulberry Creek Fault paragraph will be revised as follows:

Mulberry Creek Fault

The Mulberry Creek fault is located approximately 45 miles northwest of the VCSNS site (Figure 2.5.1-212). This sub-vertical fault contains silicified breccia, microbreccia, and cataclasite (Reference 403). ~~Evidence for the timing of slip on the Mulberry Creek fault is indirect, but, by association with other similar silicified breccias in North and South Carolina, West (Reference 403) suggests a probable Late Triassic to Early Jurassic age for the Mulberry Creek fault.~~ The age of the Mulberry Creek fault is poorly constrained but, based on 180 ± 3 Ma whole rock dates (Reference 429) from similar silicified breccias and cataclasites elsewhere in the Carolinas, West (Reference 403) suggests a Late Triassic to Early Jurassic age for the Mulberry Creek fault. As additional support for a Mesozoic age for the Mulberry Creek fault, Secor et al. (Reference 368) suggest that silicified breccias are characteristic of Mesozoic faults in the Piedmont and likely reflect hydrothermal activity indicative of a Mesozoic age. Moreover, Hatcher (Reference 430) indicates silicified cataclasite fault zones in the Piedmont formed coevally with Mesozoic (170-190 Ma) diabase dikes.

2. Add the following new references to FSAR Section 2.5.1.3 as the next reference number in sequence:

   429 Fullagar P.D. and Butler, J.R., *Radiometric Dating in the Sauratown Mountains Area, North Carolina*, in Geological Investigations of Piedmont and Triassic Rocks, Central North Carolina and Virginia, Carolina Geological Society Field Trip Guidebook, V. Price, P.A. Thayer, and W.A. Ranson (eds), p. 1-11, Virginia of Division Mineral Resources, 1980.

   430 Hatcher, R.D. Jr., *Juxtaposed Mesozoic Diabase Dikes and Siliceous Cataclasite Fault Zones in the Carolinas and the Mechanics of Dike Emplacement*, Geological Society of America, Southeastern Section Abstracts with Programs, v. 38, no. 3, p. 8, 2006.

3. FSAR Figure 2.5.1-212 will be revised to include the "diagonal line" symbol in the figure key, as shown in Attachment 1.

ASSOCIATED ATTACHMENTS:

FSAR Figure 2.5.1-212 – Attachment 1

NRC RAI Letter No. 058 Dated July 15, 2009

SRP Section: 02.05.01 – Basic Geologic and Seismic Information

Questions for Geosciences and Geotechnical Engineering Branch 2 (RGS2)

NRC RAI Number: 02.05.01-53

The response to RAI 2.5.1-26 presented a table containing information on strike orientation and length of the 14 proposed Quaternary geologic structures which occur in the site region. FSAR Section 2 2.5.1.1.2.4.4 does not presently contain this information on the regional map of FSAR Figure 2.5.1-215 due to the scale of that map. In addition, the RAI response did not indicate that the FSAR would be revised to include it for specifying strike orientation and length of the proposed Quaternary structures which occur in the site region.

Please include the table which accompanied the response to RAI 2.5.1-26 in a revised FSAR Section 2.5.1.1.2.4.4 to present information on strike orientation and length of the proposed Quaternary features found in the site region.

VCSNS RESPONSE:

FSAR Section 2.5.1 will be revised to include a new table summarizing the 14 proposed Quaternary features of Crone and Wheeler (2000) (FSAR Reference 2.5.1-232) and Wheeler (2005) (FSAR Reference 2.5.1-406) within the site region. This table includes one new reference (Conley and Toewe 1968 [Reference 1]) that does not appear in the FSAR Section 2.5.1. FSAR Section 2.5.1 will be revised to include Conley and Toewe (1968) (Reference 1) in the reference list.

REFERENCES FOR THE RESPONSE:

1. Conley, J.F. and Toewe, E.C., *Geology of the Martinsville West Quadrangle, Virginia*, Virginia Division of Mineral Resources Report of Investigations 16, 1:24,000-scale, 1968.

ASSOCIATED VCSNS COLA REVISIONS:

1. COLA Part 2, FSAR. Chapter 2, Section 2.5.1.1.2.4.4, third paragraph, will be revised as follows:

~~Each of these 14 potential features is discussed in detail.~~ Table 2.5.1-202 presents orientation and length information for these fourteen potential Quaternary features. The Charleston features (including the East Coast Fault System; the Cooke fault, the Helena Banks fault zone; and the Charleston, Georgetown, and Bluffton paleoliquefaction features) are discussed in Subsection 2.5.1.1.3.2.1. The Eastern Tennessee Seismic Zone is discussed in Subsection 2.5.1.1.3.2.2. The remaining seven potential Quaternary features (namely, the Fall Lines of Weems (Reference 398), the Belair fault zone, the Pen Branch fault, the Cape Fear arch, the Hares Crossroads fault, the Stanleytown-Villa Heights faults, and the Pembroke faults) are discussed in detail below:

2. Add the following new reference to FSAR Section 2.5.1.3:

431 Conley, J.F. and Toewe, E.C., *Geology of the Martinsville West Quadrangle, Virginia*, Virginia Division of Mineral Resources Report of Investigations 16, 1:24,000-scale, 1968.

3. Add new table (Table 2.5.1-202) to FSAR Section 2.5.1:

Table 2.5.1-202

Summary of Proposed Quaternary Features Within the Site Region

Feature Name	Orientation	Length	Reference(s) [1]	Class [2]
1. Fall Lines of Weems	NE	450 mi	Weems (1998) (Reference 398)	C
2. Belair fault	NE	15+ mi	Dennis et al. (2004) (Reference 246)	C
3. Pen Branch fault	NE	20+ mi	Snipes et al. (1993) (Reference 374)	C
4. Cooke fault	ENE	6 mi	Behrendt et al. (1981) (Reference 210) Hamilton et al. (1983) (Reference 268)	C
5. East Coast Fault Zone / southern segment	NE / N35°E	375 mi / 125 mi	Marple and Talwani (2000) (Reference 325)	C
6. Eastern Tennessee Seismic Zone	NE	185 mi	Powell et al. (1994) (Reference 345)	C
7. Stanleytown-Villa Heights faults	NNE	600 ft each	Conley and Toewe (1968) (Reference 431)	C
8. Pembroke faults	ENE	330+ ft	Law et al. (2000) (Reference 313)	B
9. Bluffton liquefaction features	n/a (3)	n/a (3)	Talwani and Schaeffer (2001) (Reference 386)	A
10. Helena Banks fault	ENE	75 mi	Behrendt and Yuan (1987) (Reference 209) Behrendt at al. (1983) (Reference 211)	C
11. Charleston liquefaction features	[3]	[3]	Talwani and Schaeffer (2001) (Reference 386)	A
12. Georgetown liquefaction features	[3]	[3]	Talwani and Schaeffer (2001) (Reference 386)	A
13. Cape Fear Arch	NW	100+ mi	Crone and Wheeler (2000) (Reference 323)	C
14. Hares Crossroads fault	[4]	[4]	Prowell (1983) (Reference 346)	C

Notes:

(1) Source reference for feature orientation and/or length.

(2) Feature class from Crone and Wheeler (2000) (Reference 232) and Wheeler (2005) (Reference 406).

(3) Orientation and length data for individual liquefaction and paleoliquefaction features are not applicable. Taken together, however, the distribution of Bluffton, Charleston, and Georgetown features indicates a NE orientation, parallel to the South Carolina coast.

(4) The proposed Hares Crossroads fault was recognized in a single, two-dimensional roadcut exposure. As such, orientation and length information are not available.

ASSOCIATED ATTACHMENTS:

None

NRC RAI Letter No. 058 Dated July 15, 2009

SRP Section: 02.05.01 – Basic Geologic and Seismic Information

Questions for Geosciences and Geotechnical Engineering Branch 2 (RGS2)

NRC RAI Number: 02.05.01-54

The response to RAI 2.5.1-37 discussed a newly-discovered paleoliquefaction feature interpreted by Talwani and others (2008) to be associated with the Sawmill Branch fault. The response stated that none of the information presented by Talwani and others (2008) provided reliable constraints on timing, magnitude, or location of an associated paleoearthquake, with the conclusion that no modifications to the UCSS were required. FSAR Section 2.5.1.1.3.2.1 does not presently contain any information about this paleoliquefaction feature since it was discovered after the FSAR was prepared, and the RAI response did not indicate that the FSAR would be revised to include this information to assure that up-to-date characterization of paleoliquefaction features is captured in the FSAR.

Please summarize the response to RAI 2.5.1-37 and incorporate the summary into a revised FSAR Section 2.5.1.1.3.2.1 to provide a discussion about this recently-discovered paleoliquefaction reported by Talwani and others (2008).

VCSNS RESPONSE:

In an abstract published after Talwani and Schaeffer's (2001) (FSAR Reference 386) compilation and interpretation of South Carolina paleoliquefaction data, Talwani et al. (2008) (Reference 1) describe a previously undiscovered paleoliquefaction feature near Fort Dorchester in the meizoseismal area of the 1886 Charleston, South Carolina, earthquake. Talwani et al. (2008) (Reference 1) describe this feature as a 1-m-wide sandblow at a depth of approximately 0.5 m below the ground surface. There are no radiocarbon or other quantitative age constraints on this feature. Talwani et al. (2008) (Reference 1), however, indicate a pre-1886 age for this sandblow, presumably on the basis of burial depth and degree of soil formation. Based on unspecified back calculation techniques, Talwani et al. (2008) (Reference 1) estimate a magnitude of ~6.9 (magnitude scale unspecified) for the causative earthquake. Very little is known about the earthquake that produced Talwani et al.'s (2008) (Reference 1) recently discovered paleoliquefaction feature. As such, the discovery of this paleoliquefaction feature does not provide any additional constraints on the timing, magnitude, or location of Charleston paleoearthquakes, beyond those presented in Talwani and Schaeffer (2001) (FSAR Reference 386).

FSAR Subsection 2.5.1.1.3.2.1 will be revised to include a summary of the recently discovered paleoliquefaction feature described by Talwani et al. (2008) (Reference 1).

REFERENCES FOR THE RESPONSE:

1. Talwani, P., Dura-Gomez, I., Gassman, S., Hasek, M., and Chapman, A., *Studies Related to the Discovery of a Prehistoric Sandblow in the Epicentral Area of the 1886 Charleston SC Earthquake: Trenching and Geotechnical Investigations*, Program and Abstracts, Eastern Section of the Seismological Society of America, p. 50, 2008.

ASSOCIATED VCSNS COLA REVISIONS:

1. COLA Part 2, FSAR. Chapter 2, Section 2.5.1.1.3.2.1, Charleston Area Seismically Induced Liquefaction Features, will be revised as follows:

Charleston Area Seismically Induced Liquefaction Features

The presence of liquefaction features in the geologic record may be indicative of past earthquake activity in a region (*e.g.,* Reference 339). Liquefaction features are recognized throughout coastal South Carolina and are attributed to both the 1886 Charleston and earlier moderate to large earthquakes in the region.

- *1886 Charleston Earthquake Liquefaction Features.* Liquefaction features produced by the 1886 Charleston earthquake are most heavily concentrated in the meizoseismal area (References 249, 369, and 201), but are reported as far away as Columbia, Allendale, Georgetown (Reference 369) and Bluffton, South Carolina (Reference 386) (Figures 2.5.1-217 and 2.5.1-218).
- *Paleoliquefaction Features in Coastal South Carolina.* Liquefaction features predating the 1886 Charleston earthquake are found throughout coastal South Carolina (Figures 2.5.1-217 and 2.5.1-218). The spatial distribution and ages of paleoliquefaction features in coastal South Carolina constrain possible locations and recurrence rates for large earthquakes (References 340, 341, 201, 202, and 203). Talwani and Schaeffer (Reference 386) combine previously published data with their own studies of liquefaction features in the South Carolina coastal region to derive possible earthquake recurrence histories for the region. Talwani and Schaeffer's (Reference 386) Scenario 1 allows for the possibility that some events in the paleoliquefaction record are smaller in magnitude (approximately **M** 6+), and that these more moderate events occurred to the northeast (Georgetown) and southwest (Bluffton) of Charleston. In Talwani and Schaeffer's (Reference 386) Scenario 2, all earthquakes in the record are large events (approximately **M** 7+) located near Charleston. Talwani and Schaeffer (Reference 386) estimate recurrence intervals of about 550 years and approximately 900 to 1,000 years from their two scenarios. Subsection 2.5.2 provides discussion of the interpretation of the paleoliquefaction record used to define earthquake recurrence for the Charleston earthquake source.

Because there is no surface expression of faults within the Charleston seismic zone, earthquake recurrence estimates are based largely on dates of paleoliquefaction events. The most recent summary of paleoliquefaction data (Reference 386) suggests a mean recurrence time of 550 years for Charleston, which was used in the 2002 USGS hazard model (Reference 255). This recurrence interval is less than the 650-year recurrence interval used in the earlier USGS hazard model (Reference 254) and is roughly an order of magnitude less than the seismicity based recurrence estimates used in EPRI (Reference 250). Refinements of the estimate of Charleston area earthquake recurrence are presented in detail in Subsection 2.5.2.

In an abstract published after Talwani and Schaeffer's (Reference 386) compilation and interpretation of South Carolina liquefaction and paleoliquefaction data, Talwani et al. (Reference 432) describe a previously undiscovered paleoliquefaction feature near Fort Dorchester in the meizoseismal area of the 1886 Charleston, South Carolina, earthquake. Talwani et al. (Reference 432) describe this feature as a 1-m-wide sandblow at a depth of approximately 0.5 m below the ground surface. There are no radiocarbon or other quantitative age constraints on this feature. Talwani et al. (Reference 432), however, indicate a pre-1886 age for this sandblow, presumably on the basis of burial depth and degree of soil formation. Based on unspecified back calculation techniques, Talwani et al. (Reference 432) estimate a magnitude of ~6.9 (magnitude scale unspecified) for the causative earthquake. Very little is known about the earthquake that produced Talwani et al.'s (Reference 432) paleoliquefaction feature. As such, the discovery of this paleoliquefaction feature does not provide any additional constraints on the timing, magnitude, or location of Charleston paleoearthquakes, beyond those presented in Talwani and Schaeffer (Reference 386).

2. Add the following new reference to FSAR Section 2.5.1.3:

432 Talwani, P., Dura-Gomez, I., Gassman, S., Hasek, M., and Chapman, A., *Studies Related to the Discovery of a Prehistoric Sandblow in the Epicentral Area of the 1886 Charleston SC Earthquake: Trenching and Geotechnical Investigations*, Program and Abstracts, Eastern Section of the Seismological Society of America, p. 50, 2008.

ASSOCIATED ATTACHMENTS:

None

NRC RAI Letter No. 058 Dated July 15, 2009

SRP Section: 02.05.01 – Basic Geologic and Seismic Information

Questions for Geosciences and Geotechnical Engineering Branch 2 (RGS2)

NRC RAI Number: 02.05.01-55

The response to RAI 2.5.1-46 discussed in detail the shear zones mapped in the Unit 1 excavation, and provided a location map for the unsheared mineral samples taken from these zones for radiometric dating as modified FSAR Figure 2.5.1-230. However, although a reference to Garihan and others (1998) was provided, the response to RAI 2.5.1-46, Part (b), did not provide information to document the statement in FSAR Section 2.5.1.2.4 that minor shears are common in rocks of the Piedmont and may be encountered in the excavations for Summer Units 2 and 3. The RAI response addressed the concept that joints are common features, but without any discussion of shear zones, such that the accuracy of this statement in the FSAR is not documented.

For Part (b) of RAI 2.5.1-46, in order for the staff to assess the accuracy of the statement that minor shears such as those mapped in the Unit 1 excavation, and which may be found in the excavations for Summer Units 2 and 3, are common in rocks of the Piedmont, please provide information and references in FSAR Section 2.5.1.2.4 to support this conclusion.

VCSNS RESPONSE:

The statement that minor shears are common in rocks of the Piedmont and may be encountered in the excavations for VCSNS Units 2 and 3 is supported by: (1) published literature; (2) geologic investigations performed for other nuclear sites in the Piedmont; and (3) observations from geologic field reconnaissance performed for VCSNS.

1) Garihan et al. (1993) (Reference 1) note that "...brittle Mesozoic faults lined with quartz microbreccia and cataclasite are widespread in Georgia and the Carolinas from the Blue Ridge across the Inner Piedmont to the Charlotte belt" (p. 55). The features described by Garihan et al. (1993) (Reference 1) are similar to those encountered in the VCSNS Unit 1 excavation. The Mesozoic age and northeast orientation of brittle faulting noted by the regional Garihan et al. (1993) study (Reference 1) are similar to the age and orientation of shears exposed in the VCSNS Unit 1 excavation. This regional study also interprets that brittle faulting has developed along pre-existing joint sets similar to those in the VCSNS Unit 1 excavation.

   For rocks in the site vicinity, Secor et al. (1982) (FSAR Reference 364) observe that "In most outcrops in the study area, the rocks are cut by one or more joint sets in which the individual fractures have little or no lateral displacement" (p.

6,953). In spite of their use of the term "joint sets" to describe these features, Secor et al. (1982) (FSAR Reference 364) indicate at least some of these features are characterized by minor displacements. As such, the term "joint" is not appropriate for all of these features. Features showing minor displacements typically are called "minor shears" or "minor faults."

2) In addition to descriptions in the published literature, minor bedrock shears are documented at other nuclear sites in rocks of the Piedmont. Examples include: (a) the site of the proposed William States Lee III Nuclear Station, Units 1 and 2 near Gaffney, South Carolina; and (b) the Oconee site in Seneca, South Carolina. The minor shears encountered at these sites are described below:

   a) Subsection 2.5.3.1.1 of the Lee COLA FSAR (Reference 2) describes previous foundation excavations at the Lee site that expose minor bedrock shears related to mafic intrusions in a granodiorite pluton. Most of this minor deformation is associated with the contact between the mafic intrusions and the granodiorite pluton. None of the intrusive mafic bodies are offset by the minor brittle shears, suggesting that the minor brittle shears formed after the emplacement of the granodiorite pluton and during the intrusion of mafic bodies.

   b) As stated in Subsection 2.5.1.2.1 of the Oconee Units 1, 2, and 3 UFSAR (Reference 3), such minor shear features "should not be considered uncommon where hard rock or possibly slightly plastic rock has been folded. While the rock is being folded, minute cracks in the rock develop...The shear displacement noted in boring NA-20 was completely healed or recemented. There is no evidence noted of any recent displacements" (p. 2-49).

3) Geologic field reconnaissance performed to support the VCSNS Units 2 and 3 COLA documents minor bedrock shears in exposures and outcrops within the site vicinity. Similarly, geologic reconnaissance performed for the VCSNS Unit 1 UFSAR (Reference 4) documents eight "exposures containing minor displacement features" within 10 miles of the site, as shown in UFSAR Figure 2.5-13 (Aerial Geologic Map). The UFSAR report (Reference 4) provides scant detail regarding the characteristics of the deformation or faulting observed in these eight exposures. Other than slickensides encountered in a single boring at Parr Dam, it is not clear whether the observed features represent ductile or brittle deformation. A strike (N50°E) is provided for only a single location and no dip information is given for any of the exposures containing minor displacement features.

Taken together, the information summarized above indicates that minor shears are found in rocks throughout the Piedmont. FSAR Subsection 2.5.1.1.2.4 will be revised to include citations to references that support the statement that minor shears are common in rocks of the Piedmont and may be encountered in the excavations for VCSNS Units 2 and 3.

REFERENCES FOR THE RESPONSE:

1. Garihan, J.M., Preddy, M.S., and Ranson, W.A., *Summary of Mid-Mesozoic Brittle Faulting in the Inner Piedmont and Nearby Charlotte Belt of the Carolinas,* in Carolina Geological Society Field Trip Guidebook – Studies of Inner Piedmont Geology with a Focus on the Columbus Promontory, p. 55-66, 1993.

2. William States Lee III Nuclear Station, Units 1 and 2 COL Application FSAR, Revision 0, Chapter 2 Site Characteristics, NRC ADAMS accession number ML073510888, accessed 2009.

3. Oconee Units 1, 2, and 3 UFSAR, NRC ADAMS accession number ML003729515, accessed 2009.

4. VC Summer Nuclear Station Unit 1 UFSAR, accessed 2009.

ASSOCIATED VCSNS COLA REVISIONS:

1. COLA Part 2, FSAR. Chapter 2, Section 2.5.1.2.4, 3rd full paragraph, will be revised as follows:

   These minor shears and fractures are common to rocks throughout the Piedmont (References 364 and 433) and may be encountered within the foundation excavations for Units 2 and 3. During excavation for these units, detailed mapping of the foundation exposures will provide the ability to document the presence or absence of these minor bedrock shears, which typically cannot be recognized nor adequately characterized by surficial mapping or analysis of drill core.

2. Add the following new reference to FSAR Section 2.5.1:

   433. Garihan, J.M., Preddy, M.S., and Ranson, W.A., *Summary of Mid-Mesozoic Brittle Faulting in the Inner Piedmont and Nearby Charlotte Belt of the Carolinas,* in Carolina Geological Society Field Trip Guidebook – Studies of Inner Piedmont Geology with a Focus on the Columbus Promontory, p. 55-66, 1993.

ASSOCIATED ATTACHMENTS:

None

Attachment 1

Revised FSAR Figure2.5.1-212

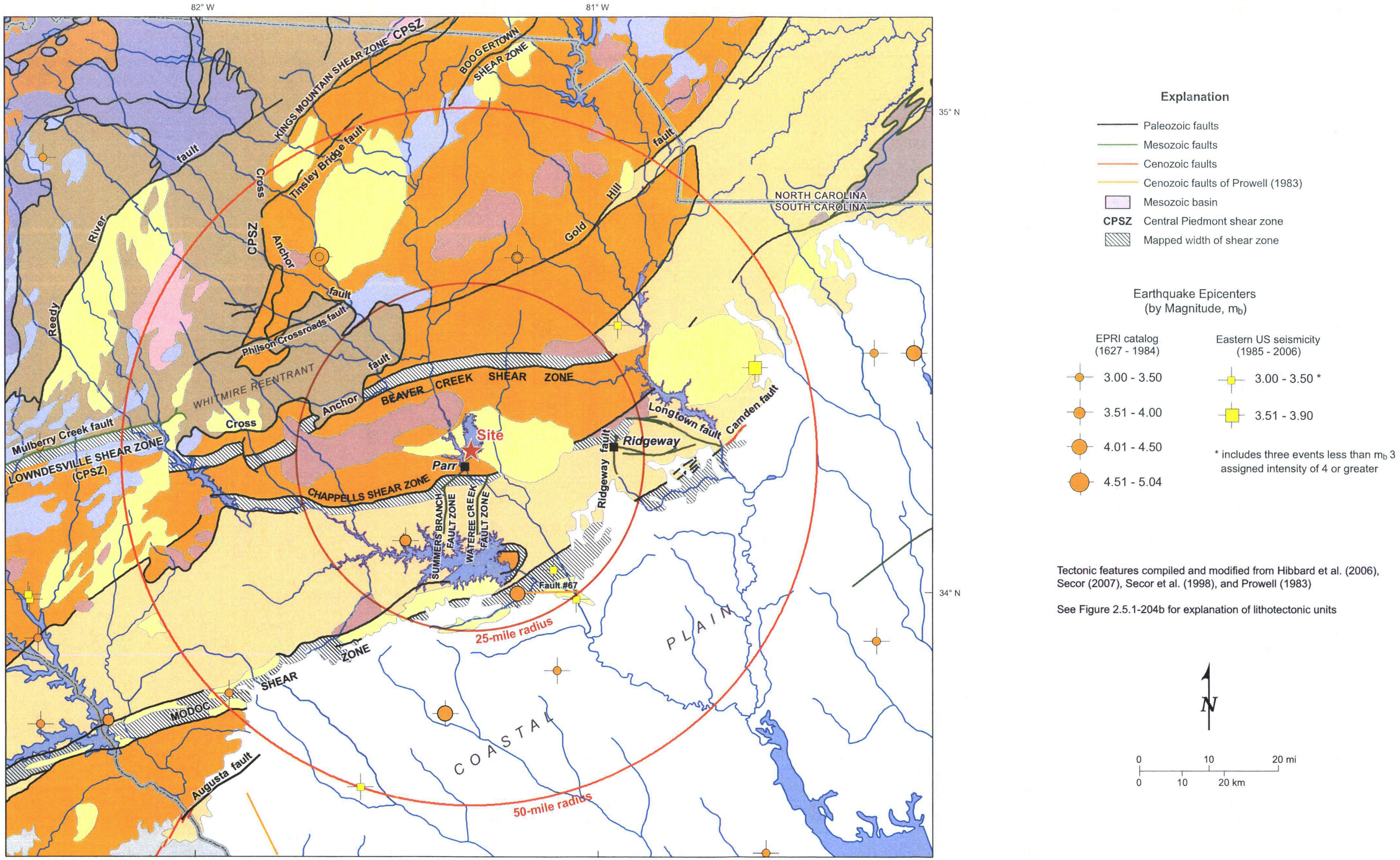

Figure 2.5.1-212 50-Mile Tectonic Features Map