CHAPTER 6, ENVIRONMENTAL MEASUREMENTS

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6.0 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

This chapter describes the environmental measurement and monitoring programs for VCSNS Unit 1, representing the baseline for preconstruction monitoring, and that proposed for Units 2 and 3. Programs now in place for Unit 1 would be modified to include requirements for Units 2 and 3 where appropriate. The discussion of environmental measurements and monitoring programs is divided into the following sections:

- Thermal Monitoring (Section 6.1)
- Radiological Monitoring (Section 6.2)
- Hydrological Monitoring (Section 6.3)
- Meteorological Monitoring (Section 6.4)
- Ecological Monitoring (Section 6.5)
- Chemical Monitoring (Section 6.6)
- Summary of Monitoring Programs (Section 6.7)

Monitoring details (*e.g.,* sampling equipment, constituents, parameters, frequency, and locations) for each specific phase of the overall program are described in each of these sections to the extent they can be known at the time of the COL application.

The standard for reporting elevations in the COLA is to use NAVD88 elevations. The difference between NAVD88 and NGVD29 elevations (the other system commonly used) is approximately 0.7 feet. Most of the elevations reported in Chapter 6 are for information only and could be rounded. Only in cases where precision is needed or where use of NGVD29 elevations is required (for example, to match permit limits) is the elevation system specified.

6.1 THERMAL MONITORING

The South Carolina Department of Health and Environmental Control (SCDHEC) identifies thermal monitoring requirements as part of the National Pollutant Discharge Elimination System (NPDES) permit process and lists any such requirements in a facility's NPDES permit.

6.1.1 EXISTING THERMAL MONITORING PROGRAM

NPDES permit number SC0030856 (SCDHEC 2007) for the existing VCSNS Unit 1 requires continuous monitoring of intake temperature (on inlet side of the condenser), discharge temperature (on outlet side of condenser before entering discharge canal), and plume temperature (at boundary of mixing zone, measured at the Fairfield Pumped Storage Facility intake structure when this facility is generating). NPDES permit limits for the discharge temperature and plume temperature are 45°C (113°F) and 32.2°C (90°F), respectively.

6.1.2 PREOPERATIONAL AND OPERATIONAL THERMAL MONITORING

Modeling conducted for this application indicates that the discharge from the proposed Units 2 and 3 would affect a very small area of the Parr Reservoir in the immediate vicinity of the blowdown line outfall and the effects would dissipate over a short distance upstream and downstream (Subsection 5.3.2).

An amended, NPDES permit (new outfalls) would be necessary for the combined operation of the existing unit and the proposed new units, but it is unlikely that routine thermal monitoring of cooling tower blowdown would be a requirement of the amended permit. SCDHEC normally does not require power plants with closed-cycle cooling systems to monitor blowdown temperatures.

Section 6.1 References

1. SCDHEC (South Carolina Department of Health and Environmental Control) 2007, *National Pollutant Discharge Elimination System Permit for Discharge to Surface Waters*, Water Facilities Permitting Division, Columbia, South Carolina, June 13, 2007.

6.2 RADIOLOGICAL MONITORING

The general features of the VCSNS radiological monitoring program are not expected to change as a result of adding Units 2 and 3. Some measurement locations would be changed or added.

6.2.1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM BASIS

The existing Radiological Environmental Monitoring Program is described in the VCSNS Offsite Dose Calculation Manual (SCE&G 2007) and is discussed in the following subsections.

6.2.2 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM CONTENTS

Preoperational data collected in the late 1970s and early 1980s provided a baseline for the existing unit and planned units. The measurement of radiation levels, concentrations (including surface area), and/or other quantities of radioactive material is used to evaluate potential exposures and doses to members of the public and the environment.

The following exposure pathways to radiation are monitored:

- Direct (dosimeters)
- Airborne (iodine and particulates)
- Waterborne (drinking water, surface water, and groundwater)
- Aquatic (sediment)
- Ingestion (milk and forage, fish tissue, and food products)

Sampling results and locations are evaluated to determine effects from seasonal yields and variations. Figures 6.2-1 and 6.2-2 show existing radiological sampling locations near the site. Table 6.2-1 provides details of the radiation exposure pathways monitored and the frequency of monitoring. Trending and comparison reviews provide information regarding changes in background levels and determine the adequacy of analytical techniques in light of program results and changes in technology, when compared to baseline measurements. Changes in program implementation (including sampling techniques, frequencies, and locations) may occur as a result of monitoring results.

6.2.2.1 Preoperational and Operational Radiological Monitoring Programs

The existing Unit 1 radiological monitoring program will serve as the preoperational radiological monitoring program. The Radiological Environmental Monitoring Program for the new units would be based on *Offsite Dose Calculation*

Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors, 1991 (NUREG-1301) and the NRC's Branch Technical Position Paper, *Acceptable Radiological Environmental Monitoring Program, Revision 1*, 1979.

The Offsite Dose Calculation Manual is based on the Technical Specifications and will address the requirements of 10 CFR 50 Appendix I. One of the requirements is the publication of the Annual Radiological Environmental Operating Report. As noted in the AP1000 DCD (Westinghouse 2008), Chapter 16, Section 5.6 (Reporting Requirements), a single report can be prepared for a multiple-unit station. Therefore, the Radiological Environmental Monitoring Program would address the releases from Units 2 and 3.

Additional direct radiation monitoring thermoluminescent dosimeter locations would be added at the exclusion area boundary around the new units, similar to that shown on Figure 6.2-2 for the existing unit. For preconstruction monitoring, thermoluminescent dosimeters would be placed at Units 2 and 3 to determine the external radiation exposure level at those locations. Figure 6.2-3 shows the proposed locations of these new thermoluminescent dosimeter stations.

As described in Sections 3.4 and 3.5, small amounts of radioactivity would be discharged from Units 2 and 3 to the Parr Reservoir. To monitor the potential impact of these releases, sampling locations would be established in the Broad River, both upstream (at the current Neal Shoals location) and downstream (the Parr Reservoir) of the proposed discharge point. At these locations, samples of surface water, sediment, and fish would be obtained on the frequencies shown in Table 6.2-1 and analyzed for the radionuclides listed in Table 6.2-1. The new waterborne pathway sample location is shown on Figure 6.2-3.

SCE&G currently monitors groundwater at 19 onsite and one offsite locations for radionuclides as required by Regulatory Guide 4.8 and the VCSNS Technical Specifications. Monitoring results are submitted to NRC annually in the Radiological Environmental Operating Report. Groundwater is sampled quarterly at 19 onsite wells and the Nuclear Training Center, which is approximately 2.5 miles south of VCSNS. Groundwater is analyzed for tritium and gamma emitters.

6.2.2.2 Quality Assurance Program

The Radiological Environmental Monitoring Program is conducted in accordance with NRC Regulatory Guide 4.15, *Quality Assurance for Radiological Monitoring Programs (Normal Operations) – Effluent Streams and the Environment, Revision 1*, 1979 (Regulatory Guide 4.15). Quality assurance is provided in the existing NRC-approved Radiological Environmental Monitoring Program through quality training, program implementation by periodic tests, the Inter-laboratory Comparison Program, and administrative and technical procedures. The Units 2 and 3 Radiological Environmental Monitoring Program for operations would be conducted in accordance with Revision 2 of NRC Regulatory Guide 4.15.

6.2.3 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REPORTING

An Annual Radiological Environmental Operating Report for the VCSNS site is submitted in accordance with the Unit 1 Offsite Dose Calculation Manual. Results from the Radiological Environmental Monitoring Program implementation and evaluation are compared to results from previous years for measurement trends, methodology consistency, and indications that the program is adequate and does not need revisions.

A land use census is conducted annually within a designated distance of the VCSNS site, currently 5 miles, to determine sampling yields and locations, and to ascertain if changes to the Radiological Environmental Monitoring Program are warranted. Information collected includes locations of nearest residence, milk-producing animal, and garden with broad-leaf vegetation in each of the 16 compass directions. The radius of this land use census would be expanded appropriately to accommodate Units 2 and 3.

Section 6.2 References

1. SCE&G 2007, *Offsite Dose Calculation Manual for SCE&G*, Virgil C. Summer Nuclear Station, Revision 25, 2007.

2. Westinghouse 2008, *AP1000 Design Control Document*, AP1000 Document No. APP-GW-GL-700, Revision 17, September 22, 2008.

Table 6.2-1
Pre-Application, Construction/Preoperational, and Operational Radiological Monitoring Program

Radiation Exposure Pathway Monitored	Parameters	Frequency of Analysis
Direct	Gamma dose	Quarterly
Airborne	Radioiodine	Weekly
	Particulates: Gross beta radioactivity; gamma isotopic analysis	Weekly Quarterly
Waterborne	Surface water: Gamma isotopic analysis	Monthly
	Surface water: Tritium	Monthly
	Groundwater: Gamma isotopic and tritium analysis	Quarterly
	Drinking water: Gross beta radioactivity and gamma isotopic analysis	Monthly
	Drinking water: Tritium	Quarterly
	Sediment: gamma isotopic analysis	Semiannually
Ingestion	Milk: gamma isotopic analysis and radioiodine	Semimonthly
	Fish: gamma isotopic analysis	Semiannually
	Grass or leafy vegetation: gamma isotopic analysis	Monthly

Source: SCE&G 2007

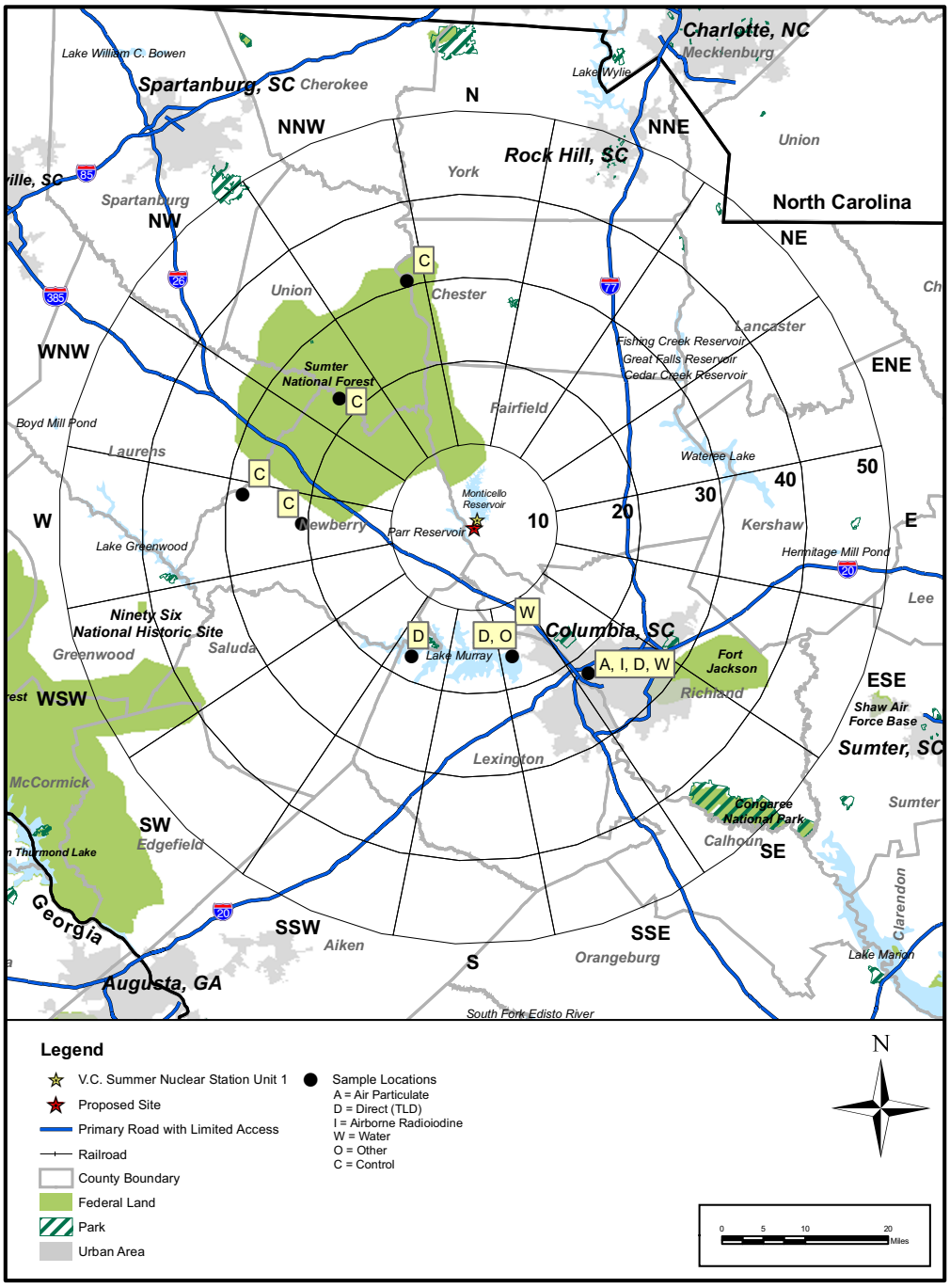

Figure 6.2-1. Existing Radiological Environmental Sampling Locations (Remote)

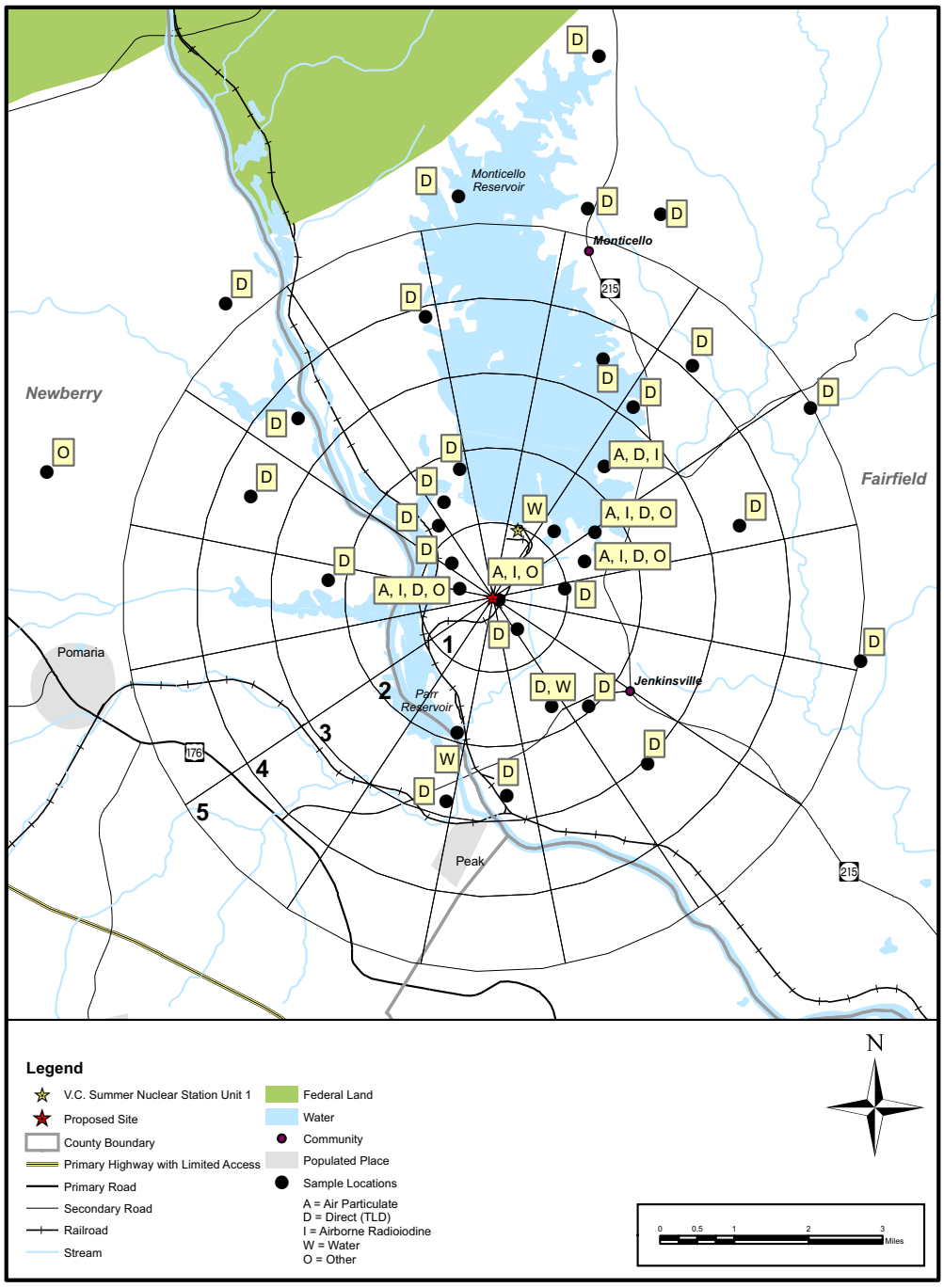

Figure 6.2-2. Existing Radiological Environmental Sampling Locations (Local)

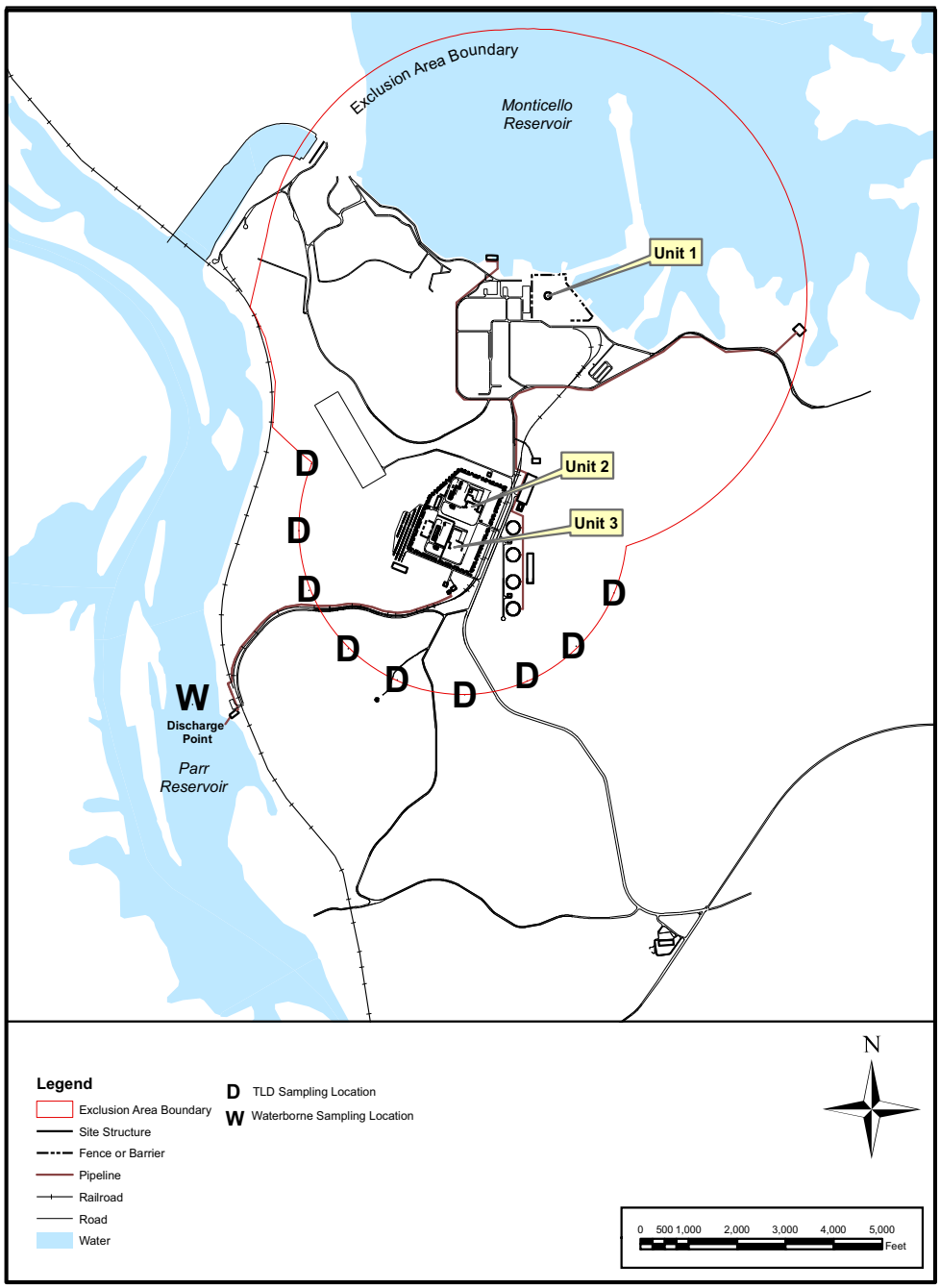

Figure 6.2-3. Proposed New Radiological Environmental Sampling Locations

6.3 HYDROLOGICAL MONITORING

This section discusses the hydrological monitoring program that would be implemented to monitor the effects of VCSNS Units 2 and 3, including monitoring of flow rates, water levels, sediment loads, and groundwater levels.

6.3.1 EXISTING HYDROLOGICAL MONITORING

Hydrological monitoring at the VCSNS site includes both surface water and groundwater. Each program is discussed below.

SCE&G conducts hydrological monitoring of surface waters in accordance with National Pollutant Discharge Elimination System (NPDES) Permit No. SC0030856 (SCDHEC 2007). Surface water monitoring includes monitoring flow from 11 permitted outfalls (Table 6.3-1).

There are no groundwater wells for process or potable use on the VCSNS site; all of the water used by the station is withdrawn from the Monticello Reservoir. There are two groundwater removal (dewatering) wells on the site; however, they are used to lower the water table in the area and alleviate problems with water seepage into below-grade portions of buildings. These wells are in the protected area, one outside near the control building and the other inside the auxiliary service building. Both wells discharge to the site storm water system. Dewatering flows (volumes) are not measured directly, but estimated from storm water outfall flows (Outfalls 012 and 013 in the station's NPDES permit).

SCE&G installed seven monitoring wells inside and outside of the protected area at the time of Unit 1 construction to address an NRC concern about the effect of the new cooling reservoir (Monticello Reservoir) on local groundwater levels. This "Piezometry Program" was discontinued around 1990.

6.3.2 CONSTRUCTION AND PREOPERATIONAL MONITORING

Figure 6.3-1 shows the locations of 31 wells (one was dry) that SCE&G installed in the vicinity of proposed Units 2 and 3 in mid-2006 to establish groundwater levels, flow paths, and gradients near Units 2 and 3. These wells were monitored monthly for groundwater elevation for one year. This monitoring program was implemented to establish baseline groundwater hydrological conditions for the new units.

The South Carolina Department of Health and Environmental Control (SCDHEC) requires parties with operational control of construction sites that disturb one acre or more to obtain an NPDES General Permit for Stormwater Discharges from Large and Small Construction Activities (see Subsection 4.3.2). This entails filing a Notice of Intent for Storm Water Discharges from Large and Small Construction Activities along with a Storm Water Pollution Prevention Plan. These Storm Water Pollution Prevention Plans normally provide for periodic visual inspection of erosion and sediment control best management practices. They also typically outline a monitoring program that meets specific criteria outlined in the General

Permit. The Storm Water Pollution Prevention Plan must be approved before the general permit can be issued. The permit holder and contractors ("co-permittees") must meet at the construction site to review the Storm Water Pollution Prevention Plan and sign off on its provisions, including design of erosion control measures, frequency of inspections (to ensure erosion control measures are working as designed), and reporting requirements (normally monthly to SCDHEC).

6.3.3 OPERATIONAL MONITORING

Operational monitoring programs for surface water and groundwater, if required, would be developed in coordination with the State of South Carolina (SCDHEC) and NRC and incorporated into new or amended NPDES and industrial stormwater discharge permits. Current plans call for using surface water exclusively. Based on preliminary discussions, it appears that SCDHEC would prefer to modify or amend the current Unit 1 NPDES permit to include new outfalls associated with Units 2 and 3 rather than issue a new permit or permits.

Section 6.3 References

1. SCDHEC (South Carolina Department of Health and Environmental Control) 2007, *National Pollutant Discharge Elimination System Permit for Discharge to Surface Waters*, Water Facilities Permitting Division, Columbia, South Carolina, June 13, 2007.

Table 6.3-1
Existing Surface Water Hydrological Monitoring Program

Monitoring Location	Parameter	Frequency	Sample Type
Outfall 001 (once-through noncontact cooling water to the Monticello Reservoir)	Flow	Continuous	Continuous
Outfall 003 (low-level radiological waste to Broad River)	Flow	One/month	Estimate
Outfall 004 (steam generator blowdown via Outfall 001 to Monticello Reservoir or via Outfall 003 to the Broad River)	Flow	One/month	Continuous
Outfall 005 (treated sanitary sewage via Outfall 014 to Monticello Reservoir)	Flow	One/month	Instantaneous
Outfall 006A (low volume waste from alum sludge basin via Outfall 014 to Monticello Reservoir)	Flow	One/month	Instantaneous
Outfall 006B (low volume waste and storm water from sumps in transformer and fuel oil storage areas via Outfall 014 to Monticello Reservoir)	Flow	One/month	Instantaneous
Outfall 007 (low volume waste from ion exchange regeneration and several sumps via Outfall 001 to Monticello Reservoir)	Flow	One/month	Instantaneous
Outfall 008 (metal cleaning wastewater via Outfall 014 to Monticello Reservoir)	Flow	One/month	Instantaneous
Outfall 12 (storm water runoff from north/northwest area of plant site to Broad River)	Flow	One/month	Instantaneous
Outfall 013 (storm water runoff from southeast area of plant site to Broad River)	Flow	One/month	Estimate
Outfall 014 (combination of four internal outfalls to Monticello Reservoir)	Flow	Continuous	Continuous

Source: SCDHEC (2007)

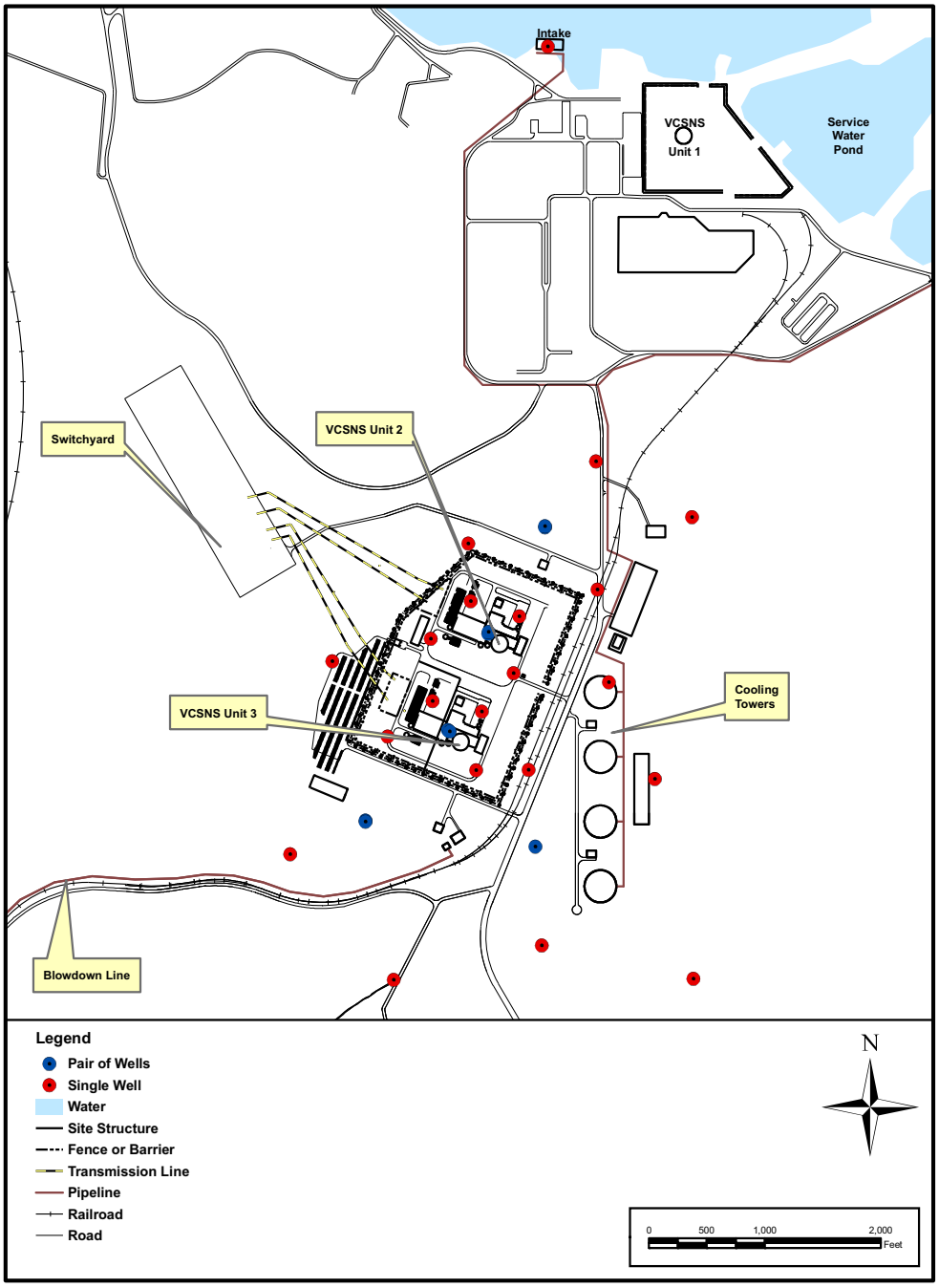

Figure 6.3-1. Construction and Preoperational Observation Wells

6.4 METEOROLOGICAL MONITORING

This section addresses the preoperational and operational meteorological monitoring programs for the proposed VCSNS Units 2 and 3.

6.4.1 SUMMARY OF THE VCSNS METEOROLOGICAL MONITORING PROGRAM

The onsite meteorological monitoring program is designed to measure the parameters needed to evaluate the dispersive characteristics of the site for both the routine operational and the hypothetical accidental releases of radionuclides to the atmosphere. The program has the following basic functions:

- Collecting meteorological data to determine the meteorological characteristics of the site that are necessary for safety analysis or that may have an impact on plant design in determining the acceptability of the site for a nuclear power plant.

- Evaluating the site atmospheric dispersion characteristics and establishing dispersion parameters such that radiological effluent release limits associated with normal operation from the type of facility proposed to be located at the site can be met for any individual located offsite, and radiological consequences of postulated accidents meet the prescribed dose limits at the exclusion area and low-population zone distances set forth in 10 CFR 50.34(a)(1).

The VCSNS Units 2 and 3 meteorological monitoring program consists of two phases:

- The preoperational monitoring phase provides baseline data for the VCSNS Units 2 and 3 site collected from a recently installed, onsite meteorological tower. The new tower, placed in service in December 2006, is dedicated to serve Units 2 and 3.

- The operational monitoring phase will continue use of the VCSNS Units 2 and 3 meteorological tower for data collection. Emergency preparedness support will use the current meteorological monitoring system for Units 2 and 3 as the basis of the data collection system during station operation.

The onsite meteorological monitoring program conforms to the requirements of 10 CFR 50.47 and the guidance criteria set forth in Regulatory Guide 1.23, *Meteorological Monitoring Programs for Nuclear Power Plants,* Revision 1, (U.S. NRC 2007) and the following documents:

- *Functional Criteria for Emergency Response Facilities, Final Report*, NUREG-0696, 1981 (U.S. NRC 1981)

- *Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants,*

NUREG-0654/FEMA-REP-1, Revision 1, Appendix 2, and Addenda, 2002 (U.S. NRC 2002)

- Regulatory Guide 1.111, *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors,* Revision 1, 1977 (U.S. NRC 1977)

- Regulatory Guide 1.21, *Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants*, Revision 1, 1974 (U.S. NRC 1974)

- *American National Standards for Determining Meteorological Information at Nuclear Power Facilities,* ANSI/ANS-3.11, 2005 (ANSI 2005)

Regulatory Guide 1.206, Subsection C III.1.2.3.3 (U.S. NRC 2007b) suggests that the applicant should provide meteorological data for at least two consecutive annual cycles, including the most recent one-year period, at the time of application submittal. Regulatory Guide 1.206 also stipulates if two years of onsite data is not available at the time the application is submitted, at least one annual cycle of meteorological data collected onsite should be provided with the application.

The first year of meteorological data for the period, January 2007 through December 2007, was used to establish a baseline for preparing the VCSNS Units 2 and 3 COL application. Onsite meteorological data collected from January 2008 through December 2008 provided the second year of data. Atmospheric dispersion estimates based on the complete two-year data set were made in accordance with Regulatory Guide 1.206.

The VCSNS Units 2 and 3 meteorological data collection system, meteorological tower location and instrumentation conform to Regulatory Guide 1.23 (U.S NRC 2007a). Instrument surveillance (i.e., operation, maintenance, and calibration), and data processing and validation are performed in accordance with the applicable regulatory and relevant industry guidance. The annualized data recovery rates for measurements made on the Units 2 and 3 tower during calendar years 2007 and 2008 well exceed the acceptable 90 percent recovery rate.

Due to the close proximity to the proposed Units 2 and 3, the meteorological data collection system for the VCSNS Unit 1 will serve as a backup data source for Units 2 and 3 during routine meteorological tower service and maintenance, and for any accidental atmospheric radiological releases.

6.4.2 EVALUATION OF VCSNS UNITS 2 AND 3 METEOROLOGICAL TOWER SITING AND INSTRUMENTATION

This section provides an evaluation of the general and local exposure of the meteorological tower and instruments relative to existing and planned structures

and other features of the Units 2 and 3 site. In the evaluation, the location of the meteorological tower, surrounding terrain and vegetation, power block buildings and cooling towers were examined to determine whether the measurements made on the tower represent the overall site meteorology.

6.4.2.1 VCSNS Site Description, Area Topographical Features, and Meteorological Tower Locations

The location where meteorological measurements are obtained depends largely on the characteristics of the terrain in the site vicinity. This subsection describes the topographical features of the VCSNS site area relevant to the siting of the primary meteorological tower for the proposed Units 2 and 3 and its backup tower (i.e., the existing Unit 1 tower).

The VCSNS site is located near the center of the state, approximately 140 miles northwest of the Atlantic Ocean and about 100 miles southeast of the Appalachian Mountains. Columbia, South Carolina is 26 miles south-southeast of the site. The terrain in the general area consists of gently to moderately rolling hills. Subsection 2.7.4.5 discusses topographical characteristics within the 50-mile radius of the Units 2 and 3 site. A topographical map of the area within 50 miles of the site is shown in Figure 2.7-14.

VCSNS Units 2 and 3 are located approximately one mile south of the VCSNS Unit 1. The site is bordered by the southerly running Broad River approximately one mile to the west and the Monticello Reservoir about one mile to the north. The north-south oriented Monticello Reservoir is about six miles long by about 2.5 miles wide. The design grade of the proposed Units 2 and 3 is elevation 400 feet (NAVD88). As shown in Figure 2.7-16, the terrain within five miles of Units 2 and 3 is gentle rolling hills with maximum variations about 70 feet higher than the site, except toward the south-southwest of the site at the edge of the 5-mile radius. The terrain at this location gradually rises to 160 feet higher than the nominal finished plant grade, marking the beginning of Little Mountain. Additional information describing these terrain variations by downwind sector is included in Subsection 2.7.4.5.

The Unit 1 meteorological tower is located approximately 188 feet off the Monticello Reservoir and 1563 feet west from the Unit 1 reactor building, the nearby tallest obstruction (i.e., 165 feet in height). The siting study for the Unit 1 tower is documented in the VCSNS Unit 1 FSAR, along with an analysis of the representativeness of the data collected at the Unit 1 tower for characterization of the dispersion meteorology in the site area. In early 2006, NRC assessed the Unit 1 tower siting based on near-field obstruction, ground cover, proximity to the Unit 1, and found the Unit 1 tower siting acceptable (U.S. NRC 2006a).

The location of the meteorological tower for Units 2 and 3 is shown in Figure 3.1-3. The siting considerations for the VCSNS Units 2 and 3 tower are discussed in the following subsection.

6.4.2.2 Siting of VCSNS Units 2 and 3 Meteorological Tower

The VCSNS Units 2 and 3 tower, a guyed 60-meter (197-foot), open-lattice, galvanized-steel structure, sits on a gently sloping plateau toward the west and south, along an existing dirt road leading to the General Pearson Cemetery, about 600 feet northeast of the tower. The tower is about 200 feet east of the major transmission corridor, which has large cleared areas in the vicinity. The selected location offers a northern exposure representative of the Units 2 and 3 site. The Universal Trans Mercator (UTM) coordinates of the tower are Northing/Y: 12443526.991 and Easting/X: 1541812.303.

6.4.2.2.1 Evaluation of Potential Airflow Alteration

The surrounding terrain, design finish grade, nearby trees and structures (existing and planned) were evaluated to determine whether these features might affect the wind measurements on the Units 2 and 3 tower. The findings are described below:

- Within five miles of Units 2 and 3, the surrounding terrain is gently rolling hills with small variations. Therefore, a minimal local wind flow alteration or disruption is expected at the site and its vicinity.

- The elevation difference of 35.5 feet between the Units 2 and 3 tower base (El. 435.5 feet NAVD88) and the VCSNS Units 2 and 3 design finish grade (El. 400 feet NAVD88) are minimal. No noticeable local wind flow alteration or disruption is expected. Therefore, the meteorological data collected at the tower for Units 2 and 3 can be considered representative of the location for Units 2 and 3 from the perspective of terrain effects.

- Prior to site preparation, the nearest treeline was approximately 620 feet to the south with tree heights above the tower base ranging from 40 feet to 64 feet. To the north, the treeline was 400 feet from the tower base and had trees of heights approximately 22 feet above the tower base. Therefore, wind flow pattern alterations caused by these trees were expected to be negligible based on the horizontal separation from the Units 2 and 3 tower.

- During site preparation for Units 2 and 3, most of the trees growing between the Units 2 and 3 meteorological tower and the Units 2 and 3 power block area were removed. Trees at the General Pearson Cemetery are preserved for historic reasons. All the trees to the north of the Units 2 and 3 tower, including the trees located within the boundary of the cemetery, met the 10-obstruction-heights-separation criteria contained in Regulatory Guide 1.23. The trees to the south were nearly 10 obstruction heights (approximately 9.7 for the upper height value) from the Units 2 and 3 meteorological tower. Therefore, no discernable influence was expected on the wind measurements at the Units 2 and 3 tower.

- The Units 2 and 3 tower is approximately 4,365 feet south-southwest from the center of the Unit 2 containment and 3,470 feet from the center of the

Unit 3 containment. The Units 2 and 3 shield buildings are approximately 229 feet high. Therefore, wind flow pattern alterations caused by the buildings are expected to be negligible based on the horizontal separation of the shield buildings from the Units 2 and 3 tower.

6.4.2.2.2 Heat and Moisture Source Influences and Evaluation

The location of the Units 2 and 3 tower was evaluated for heat and moisture sources that might influence the ambient temperature, dew point and relative humidity measurements. The existing and planned structures that would present heat and moisture sources are shown in Figure 3.1-3. These sources include, for example, ventilation sources, cooling towers, water bodies and large parking lots. The findings of the analysis follow:

- The VCSNS Units 2 and 3 meteorological tower is located in an open grassy field containing a small area of mixed grass, soil and gravel immediately underlying the tower base. Heat reflection characteristics of the surface underlying the meteorological tower that could have localized influence on the measurements are expected to be minimal.

- Currently, there are no large parking lots or temporary land disturbances such as plowed fields or storage areas nearby. The closest planned asphalt parking lots and ventilation sources for VCSNS Units 2 and 3 are located more than 3000 feet from the tower. Parr Reservoir is approximately 0.7 mile to the west and Monticello Reservoir is about 1.7 miles to the north of the VCSNS Units 2 and 3 meteorological tower. The influences on ambient temperature, dew point, and relative humidity measurements are expected to be minimal from these potential heat and moisture sources because of the large distance separation between the tower and these sources.

- The cooling system for VCSNS Units 2 and 3 includes a bank of four circular, mechanical-draft cooling towers. These cooling towers are located downwind of the VCSNS Units 2 and 3 meteorological tower under the predominantly westerly wind direction at the VCSNS site (that is, west-southwest and southwest). The nearest cooling tower is located more than 3000 feet east-northeast of the tower. As discussed in Subsection 5.3.3.1.1, the annual average modeled plume height ranges from 420 feet to 630 feet with an average median plume height of 360 feet. Based on these modeling results, the visible cooling tower plume height at 3000 feet downwind during most of the year is expected to exceed the height of the relative humidity and temperature sensors installed at the meteorological tower. Therefore, operation of these cooling towers would have minimal effects on the relative humidity and temperature measurements made on the Units 2 and 3 meteorological tower.

6.4.3 PREOPERATIONAL MONITORING PROGRAM

SCE&G constructed a new meteorological monitoring tower near the proposed VCSNS Units 2 and 3 site. The tower was placed into service in December 2006. The onsite meteorological monitoring program is conducted in accordance with the guidance criteria in Regulatory Guide 1.23 (U.S. NRC 2007a). The new system will support the onsite preoperational monitoring program for the proposed VCSNS Units 2 and 3.

As discussed in Section 2.7, meteorological data for the period, January 2007 through December 2007, was used to establish a preoperational baseline. Onsite meteorological data collected from January 2008 through December 2008 provided the second year of data. Analysis of the atmospheric dispersion estimates based on the complete two-year data set was made in accordance with Regulatory Guide 1.206 (U.S. NRC 2007).

6.4.3.1 Measurements Made and Instrument Elevations and Exposures

In general, the location and heights (elevations) of meteorological measurements depend on the planned data applications. For the purpose of making estimates of atmospheric dispersion for expected routine and postulated accidental effluent releases, it is important to measure or determine wind speed, wind direction, and atmospheric stability class in the area of interest, the nature of the release, the effluent atmospheric release height, and to consider the surrounding building configuration.

The Units 2 and 3 meteorological tower is a 60-meter high, galvanized steel, open lattice tower, supported by a concrete foundation and guy wires. The meteorological tower has instrumentation mounted on 8-foot instrument booms at the 10-, 30-, and 60-meter levels. The measurement levels represent levels that approximate plant vent and various ground level releases from the proposed units and the atmospheric moisture release height associated with the mechanical draft cooling towers. The following measurements are sampled on the Units 2 and 3 tower:

- Wind speed at three levels (10, 30, and 60 meters)
- Wind direction at three levels (10, 30, and 60 meters)
- Relative humidity at three levels (10, 30, and 60 meters)
- Ambient temperature at three levels (10, 30, and 60 meters)

Differential temperature between the (60 and 10 meter levels is calculated from the concurrent ambient temperature measurements made at these two levels for atmospheric stability class determination. Similarly, dewpoint temperature is calculated from the concurrent measurements of ambient temperature and relative humidity at the same level on the tower.

The most probable atmospheric release point from Units 2 and 3 is through the plant vent, which is 182.7 feet (55.7 meters) above ground. Other potential accident release points include releases from the passive containment cooling system air diffuser, 229 feet (69.8 meters) above ground and other atmospheric release points, all below the plant vent elevation. Since the plant vent and all other potential release points are among the building complex, none can be treated solely as an elevated release due to building wake effects. Based on the location and nature of these release points and the configuration of the nearby buildings, wind speed, wind direction, and temperature measurements made at the Units 2 and 3 tower conform to the guidance criteria set forth in Regulatory Guide 1.23 and provide a reasonable and adequate database for making atmospheric dispersion analyses.

Relative humidity and temperature sensors at three levels (i.e., 10, 30, and 60 meters) are installed on the Units 2 and 3 tower. These measurement heights represent a range of possible release heights of the moisture plume from the Units 2 and 3 mechanical draft cooling towers.

Due to the close proximity of the Unit 1 meteorological tower to the proposed Units 2 and 3, precipitation data for Units 2 and 3 is obtained from the VCSNS Unit 1 integrated plant computer system. Precipitation is measured on an individual 5-foot pedestal located approximately 8 feet from the southwest leg of the Unit 1 tower. The precipitation gauge is equipped with an aerodynamically shaped wind shield to minimize wind-caused loss of precipitation from the sample.

The wind sensors are mounted on booms into the prevailing wind direction and about 8 feet away from the open-lattice tower. This position on the boom is more than 2 tower widths (1 tower width is 1.5 feet) away from the tower. Wind sensors are mounted perpendicular to the southwest (SW) prevailing winds and oriented towards true north. Temperature and moisture sensors are mounted on booms at a distance of about 4 feet from the tower so the sensors are unaffected by thermal radiation from the tower. To further ensure that air temperature measurements avoid air modification by heat and moisture, the sensors are mounted in fan-aspirated solar radiation shields. The booms are attached to carriages on an elevator system to lower the sensors to ground level for service and maintenance.

The ground surface surrounding the base of the tower is covered mostly with grass to minimize adiabatic effects caused by concrete or asphalt that could result in air temperature and moisture modification.

An examination of the instrumentation at the VCSNS Units 2 and 3 tower concludes that the parameters measured, and levels and location of measurements, are in accordance with Regulatory Guide 1.23 and industry guidance provided in ANSI/ANS-3.11 (ANSI 2005a).

The tower is equipped with a lightning protection system to ground any direct lightning strikes to the tower. A lightning rod with grounding cable is attached to the tower and grounded at an appropriate distance away from the tower and

electronic components. In addition, the three anchors for the guyed-tower are grounded.

6.4.3.2 Meteorological Sensors Used

Wind direction and wind speed are measured using a WS425 ultrasonic wind sensor (heated option). The WS425 has no moving parts and is resistant to contamination and corrosion. The WS425 provides superior data availability and accuracy in all wind directions due to a three transducer layer. The WS425 requires virtually no maintenance and provides wind measurements in a way that completely eliminates the effects of altitude, temperature, and humidity. The measurement range for wind speed is zero to 144 miles per hour. The WS425 has a starting threshold of virtually zero and accuracy of ± 0.3 miles per hour.

Temperature and relative humidity are measured using the HMP45D relative humidity/temperature sensor. The sensor is installed with a fan-aspirated radiation shield. The temperature sensor has a measurement range of -40°F to 140°F, and an accuracy of ± 0.36°F at 68°F. The relative humidity sensor has a measurement range of 0.8 to 100% and an accuracy of ±2% between 0-90% RH, and ±3% between 90-100% RH at 68°F.

Meteorological sensor type and sensor performance are provided in Table 6.4-1. Meteorological sensors used onsite were designed to operate in the environmental conditions found at the VCSNS site. Specifically, the instrumentation is capable of withstanding the environmental conditions as described in Regulatory Guide 1.23 for the specification of the meteorological monitoring systems.

Operational experience indicates that ultrasonic wind sensors are durable and require much less calibration and maintenance services than conventional sensors (e.g., cup anemometer). A platinum resistance temperature device is used for temperature measurements. No inoperable effects on the sensors used onsite have been identified due to corrosion, blowing sand, salt, air pollutants, birds and insects.

6.4.3.3 Data Recording and Communication Systems

A processing computer, mounted at the base of the tower on a cabinet rack, is used to receive, process, manage and archive the collected data. The system calculates temperature difference and dew point temperature based on the temperature and humidity measurements. The processing computer includes a flash memory module (for data logging), processor modules, communication ports, system software, LCD display and keypad, backup batteries, and a removable compact flash memory card for onsite data retrieval. Normal system operation relies on an offsite power supply.

All sensor outputs are sampled from meteorological tower instrumentation for Units 2 and 3 by the tower base processing computer on the following frequencies:

- Wind speed/wind direction (1 second)
- Ambient temperature (5 seconds)
- Relative humidity/temperature (5 seconds)

Values for differential temperature and dew point are calculated by the processing computer.

Data is recorded by the processing computer on the following frequencies:

- Wind speed/wind direction (60 seconds-average value)
- Dew point (60 seconds-average value)
- Relative humidity (60 seconds-average value)
- Ambient temperature (60 seconds-average value)
- Differential temperature (60 seconds-average value)

The overall system accuracies include the errors introduced by sensors, cables, signal conditioners, and recording and processing equipment. The time-averaged accuracies have been calculated for the Units 2 and 3 meteorological data collection system and are provided in Table 6.4-1.

The overall system accuracy meets the regulatory requirements of Regulatory Guide 1.23.

Data are collected locally from the Units 2 and 3 processing computer at the base of the tower. The data logger compact flash card has sufficient storage capacity to archive several months of data. Data are downloaded on a weekly basis for data analysis and review.

6.4.3.4 Meteorological Data Analysis and Review

Meteorological data quality control and monitoring are performed in accordance with VCSNS Units 2 and 3 procedures. Data analysis for both wind distribution and diffusion characteristics requires three basic atmospheric parameters. These three parameters, together with their primary and secondary (backup) measurements, are:

Wind speed	primary measurement	10-meter wind speed
	secondary measurement	30-meter wind speed
	secondary measurement	60-meter wind speed
Wind direction:	primary measurement	10-meter wind direction
	secondary measurement	30-meter wind direction
	secondary measurement	60-meter wind direction
Differential temperature:	primary measurement	(60–10 meters)
	secondary measurement	(30–10 meters)

As discussed in Subsection 6.4.3.1, the plant vent and other potential radiological release points are within the building complex. Therefore none of these releases are at heights 2.5 times higher than their nearby tallest building. Thus, all releases are not qualified as elevated releases from air modeling perspective and they are all treated as ground level releases in calculating their associated atmospheric dispersion estimates (X/Qs) using wind conditions measured at the 10-meter level. If required, measurements made at the 30- and 60-meter levels would be used to substitute the missing data.

In addition, relative humidity and temperature are measured at the 10-, 30-, and 60-meter levels. The 30-meter level measurements best represent the approximate moisture release height from the cooling towers located at the Units 2 and 3 site. Measurements made at this level are used to predict the cooling tower plume impacts.

The following data analysis and review program has been implemented to ensure a valid, accurate, and representative meteorological database. SCE&G personnel are responsible for meteorological tower site surveillance checks, data collection/validation and to ensure this information is properly maintained on the designated remote computer.

Data screening and validation, and identification and handling of suspect data are accomplished using the following processes:

- The 15-minute and hourly averages calculated by the processing computer are used for data validation. Hourly data are reviewed based on the pre-determined expected range and data trending. In the screening process, each parameter is analyzed by data screening software. Subsequently, the data and screening results are reviewed to determine the data validity.

- In addition, questionable data are also compared to measurements from the VCSNS Unit 1 tower or a nearby NWS for a consistency check. Information from maintenance logs and calibration results are taken into consideration as well in determining data validity. Routine site visitation logs, calibration logs, and equipment maintenance logs are generated in accordance with the SCE&G procedures.

- The designated project personnel review the data and/or edit the data as appropriate. In the process, inconsistent data entries are identified for further review; questionable data are examined in detail; and, a determination is made whether the inconsistent data will be invalidated or replaced with substitute data.

Note that normal data validation does not include the wind speed and wind direction measurements at the 30-meter level. As for the relative humidity temperature measurement, only those collected at the 30-meter level are validated.

Data substitution, if required, is made by reviewing the 15-minute time-averaged data to determine if a valid 15-minute period average of continuous data can be obtained to replace the invalid hourly period. The invalid hourly data are edited by replacement with valid 15-minute data.

Although alternative substitution methods have not been implemented, if required, these methods can be considered:

- Where data for a given parameter is missing for brief periods (e.g., 1 to 5 hours), interpolation may be used to fill data gaps.

- If wind data is missing or is invalid from one sensor level on the Unit 2 and 3 tower, data from the other sensor level on the tower is substituted.

- When interpolation is necessary to fill stability gaps, time of day, season, and weather conditions at the time are considered.

- Meteorological data collected onsite for VCSNS Unit 1 may be used as backup.

For the 2007 through 2008 data collection period, no data substitution has been required and the annualized data recovery rates for all parameters measured at the Units 2 and 3 meteorological tower well exceed 90%.

The final step in the data analysis is the listing, in sequential order, of the concurrent, hourly averaged values of the meteorological variables observed at the site. The basic reduced data is compiled monthly and annually. A sequential listing of the hourly data for a full year constitutes the annual meteorological record of the site. The annual record provides the input data for all types of meteorological analyses needed to define the site atmospheric dispersive qualities.

6.4.3.5 Instrument Calibration and Maintenance

Calibration and maintenance activities of the onsite meteorological monitoring system are performed in accordance with Regulatory Guide 1.23, Section C5, Regulatory Position, Instrument Maintenance and Servicing Schedules (U.S. NRC 2007a) and ANSI/ANS3.11, Section 7, System Performance (ANSI 2005a). The instrumentation used to calibrate the meteorological system (where applicable) has been maintained such that the recordings can be traced to the National Institute of Standards and Technology.

Meteorological instrumentation is calibrated on a semi-annual basis. To ensure data quality and accuracy, the meteorological instruments and recorders are calibrated in accordance with the SCE&G procedures. Inspection of meteorological tower hardware is performed during the semi-annual calibration, while the tower structure and lighting are inspected every three years (ANSI 2005b) to ensure structure safety. Federal Aviation Administration lighting inspections are performed quarterly, as required.

As an integral part of the onsite meteorological monitoring system calibration and maintenance program, the following operational activities are performed:

- Meteorological monitoring site checks — To identify any abnormal functions, and to check site conditions (normally performed once per week), and

- Data review — To identify equipment failures and to validate data on a monthly basis.

During the meteorological monitoring site checks, tower instrumentation is visually checked and proper positioning of the instrument boom is verified. Maintenance activity includes cleaning the rain gauge, which is located at the Unit 1 meteorological monitoring tower site. Erroneous data displayed on the processing computer panel could indicate a failure in the cable between the boom and the processing computer, or an instrument failure. Any erroneous data are reported immediately to ensure timely corrective action can be taken.

If an equipment failure is suspected, a condition report is generated and SCE&G supervisory personnel are notified. The cause of the failure will be investigated and corrected, if required. SCE&G personnel will monitor instrumentation repairs or calibration to ensure timely completion.

6.4.4 OPERATIONAL MONITORING PROGRAM

The onsite meteorological monitoring program for the operational phase is expected to be similar to that described in Subsection 6.4.3 for the preoperational phase.

The functional requirements of the operational phase monitoring program are described below relative to the current system configuration for preoperational monitoring.

6.4.4.1 Description of Monitoring Program

The location of the meteorological tower and instrumentation are not anticipated to change during the operational monitoring phase, although monitoring of certain parameters not related to atmospheric dispersion may be discontinued. Instrumentation surveillance and methods for data recording, transmittal, acquisition and reduction, while expected to be similar during the operational phase, will be controlled by plant-specific instrumentation design and procedures to be developed at a later date. Other anticipated, phase-specific monitoring program differences are addressed below.

- Meteorological parameters measured during plant operation include wind speed, wind direction and ambient temperature at the 10- and 60-meter levels, a 60–10 meter delta-T (vertical temperature difference) being referenced to the 10-meter ambient temperature, and precipitation at ground level.

- During the preoperational phase, meteorological data is collected locally at the tower and recorded as hourly average values. In addition, the 15-minute averages are recorded for validation purpose. During the plant operational phase, 15-minute average values of wind speed, wind direction and atmospheric stability class are also required to be determined. Both the 15-minute and hourly averages would be calculated by the Units 2 and 3 integrated plant computer system and compiled for reporting purposes.

- The data collected at the meteorological tower would be transmitted to the Units 2 and 3 integrated plant computer system (IPCS).

- The 15-minute average data would be transmitted to the plant Control Room, Technical Support Center, and/or Emergency Operations Facility designated to serve the new units, in accordance with Regulatory Guide 1.97, Revision 3 (U.S. NRC 1983).

- Channel checks will be performed daily.

- During system servicing, channel checks would be performed no less than semiannually. System calibrations encompass the entire data channel, including all recorders and displays (e.g., those local at the meteorological tower and in the emergency response facilities, as well as those used to compile the historical data set).

- Meteorological data necessary for the estimation of offsite dose projections would be available via terminals to personnel in the Control

Rooms, the Technical Support Center, and the Emergency Operation Facility serving Units 2 and 3.

- Wind speed, wind direction, and atmospheric stability data collected by the IPCS will be submitted as input to the NRC Emergency Response Data System.

- Meteorological monitoring requirements for emergency preparedness and response support are discussed in Subsection 6.4.4.2.

Annual operating reports of effluent releases (both routine and batch) and waste disposal that include meteorological data collected onsite will be prepared and submitted in accordance with Regulatory Guide 1.21, Revision 1 (U.S. NRC 1974).

6.4.4.2 Emergency Preparedness Support

During the operational phase, the onsite meteorological monitoring program will provide representative data for real-time atmospheric transport and diffusion estimates within the plume exposure pathway emergency planning zone (i.e., within approximately 10 miles). These data will support the dose assessments that are required during and following any accidental radiological releases to the atmosphere based on NRC guidance given in NUREG-0737 (U.S. NRC 1980); NUREG-0696 (U.S. NRC 1981); NUREG-0654 (U.S. NRC 2002); and Regulatory Guide 1.97 (U.S. NRC 1983).

The dispersion estimates are input to the dose assessment calculations that will be made using the most recent 15-minute averages of wind speed, wind direction, and atmospheric stability class (based on data from the onsite meteorological measurement system or other alternative estimates) (U.S. NRC 2007a). These 15-minute average values will be compiled for real-time display in the Control Room, Technical Support Center, and/or Emergency Operations Facility designated to serve the new units. All the meteorological channels required for input to the dose assessment models will be available and presented in a format compatible for their use (U.S. NRC 1983).

Should the computerized information or the computer-based assessment system not be available or if results are suspect, the Unit 1 meteorological tower data will be used. When both onsite meteorological towers are not available for the estimation of offsite dose projections, meteorological data from the NWS in Columbia, South Carolina, will be acquired and used.

6.4.5 METEOROLOGICAL DATA

6.4.5.1 Representativeness and Adequacy of Data

A new meteorological tower, dedicated to serve Units 2 and 3, was placed in operation at the VCSNS site during late December 2006. The data collection system conforms to Regulatory Guide 1.23. In support of the VCSNS Units 2 and

3 COL application, two years of onsite data (i.e., 1/1/2007 - 12/31/2008) from the Units 2 and 3 tower was used to make the atmospheric dispersion estimates.

6.4.5.1.1 Long-Term and Climatological Conditions

In order to provide evidence to show how well the onsite data collected at the Units 2 and 3 tower represent long-term conditions at the site, a data comparison between the onsite and the nearby offsite data was made using data collected from Unit 1 (which has long-term meteorological data) as a surrogate.

Long-term meteorological data from the Columbia NWS, S.C. and onsite data at the VCSNS site have been examined and summarized, as follows:

Two periods of recent wind direction data (i.e., 1/1/2007-12/31/2007 and 7/2003-6/2006) collected at the Unit 1 tower were compared with two periods of long-term wind data (i.e., 1951-1960 and 1956-1975) at Columbia NWS, S.C. The results of the comparisons are presented in Tables 6.4-2, 6.4-3, and 6.4-4. As shown in Table 6.4-1, the wind frequency distributions between the Columbia NWS and the VCSNS site are in good agreement, with the same bi-modal prevailing wind (SW and NE). The majority of the winds are from four of the west southerly wind sectors (i.e., SSW, SW, WSW and W).

Similarly, the Unit 1 wind speed data for the same two recent periods (i.e., 1/1/2007 and 12/31/2007, 7/2003-6/2006) were compared with two periods of wind data (one recent year and 49 years of long-term data) at Columbia NWS, S.C. The results of the comparisons are given in Table 6.4-3. As shown in the table, the seasonal and annual mean wind speeds between these two data collection systems are in good agreement.

Since there are no delta-T measurements made at the Columbia NWS, methodology for determination of stability class is different for the NWS and the VCSNS site. Therefore, a comparison of stability class between these two locations will not be meaningful. Instead, a comparison of stability class was made based on three periods of data (i.e., 1975, 7/2003-6/2006 and 2007) at the Unit 1 tower. The results, as shown in Table 6.4-4, indicate a reasonable agreement with the highest frequencies occurring at class D and E. The major difference (22.4% versus 14.6%) was in stability class F and G, probably due to the influence of the Monticello Reservoir.

The comparison supports the conclusion that the onsite data used for VCSNS Units 2 and 3 is generally representative of the long-term climatological conditions at the site.

6.4.5.1.2 Need of Additional Data Sources for Airflow Trajectories

Topographic features and the dispersion characteristics of the site area were examined in Sections 2.7 and 6.4.2. The site area consists of gentle rolling hills and is generally an open terrain site. The airflow in the site area is dominated

mostly by large-scale weather patterns and infrequent recirculation of airflow during periods of prolonged atmospheric stagnation.

The NRC-sponsored computational model, XOQDOQ based on Regulatory Guide 1.111 (U.S. NRC 1977) is a constant mean wind direction model, using meteorological data from a single station to calculate dispersion estimates out to 50 miles of a site of interest. In the model, application of terrain induced airflow-recirculation factor options are provided to account for the effects of airflow recirculation phenomenon occurring within the area of interest, when meteorological data from a single station is used to represent the entire modeling domain. However, application of airflow-recirculation factor for sites located within open terrain is not required. This methodology implies that the meteorological data from an onsite station is reasonably representative of the entire modeling domain and adjustment to the dispersion estimates calculated by the model out to 50 miles of a site located within open terrain is not required. Therefore, using data collected from the onsite meteorological monitoring station for making dispersion estimates out to 50 miles of the site is considered to be reasonable.

Thus, data collected from the Units 2 and 3 meteorological tower was used for the description of atmospheric transport and diffusion characteristics within 50 miles of the VCSNS site. No other offsite data collection systems have been considered while determining the dispersion characteristics of the VCSNS site area.

6.4.5.2 Annual Data Recovery Rates

For the data collected from the Units 2 and 3 tower, the annualized data recovery rates for the period from January 1, 2007, through December 31, 2008 are presented in Table 6.4-5 for the individual parameters (i.e., wind speed, wind direction, ambient temperature, delta-T, relative humidity, dew point temperature and precipitation) and for the composite dispersion-related parameters (i.e., wind speed, wind direction, and delta-T). All data recovery rates well exceed the Regulatory Guide 1.23 (U.S. NRC 2007a) specification of at least 90%.

6.4.5.3 Annual Joint Frequency Distribution of Data

Joint frequency distributions of wind speed, wind direction, and atmospheric stability class for the two years of onsite data (i.e., January 2007 through December 2008) are presented in Tables 2.7-10 and 2.7-11 for the 10-meter and 60-meter wind measurement levels. The format follows the example shown in Table 3 of Regulatory Guide 1.23 (U.S. NRC 2007a) for each stability class and for all stability classes combined.

6.4.5.4 Submittal of Preoperational Meteorological Data

Regulatory Guide 1.23 (U.S. NRC 2007a) specifies that the minimum amount of onsite meteorological data to be provided at the time of application, for a combined license that does not reference an early site permit, is 24 consecutive months, including the most recent one-year period that is defendable, representative, and complete. Regulatory Guide 1.206 (U.S. NRC 2007b)

stipulates, if two years of onsite data are not available at the time the application is submitted, at least one annual cycle of meteorological data collected onsite should be provided with the application.

Data is provided for the collection period from January 1, 2007, through December 31, 2008. Specifically, an electronic sequential, hour-by-hour listing of the data set, in the format specified in Appendix A of Regulatory Guide 1.23 (U.S. NRC 2007a), is provided.

Two years of onsite data was used to calculate both the short-term and long-term atmospheric dispersion estimates presented in Section 2.7. Analysis of the atmospheric dispersion estimates, based on the two-year data set, was made in accordance with Regulatory Guide 1.206 (U.S. NRC 2007b).

Section 6.4 References

1. ANSI 2005a, *American National Standards for Determining Meteorological Information at Nuclear Power Facilities*, ANSI/ANS-3.11, 2005.

2. ANSI 2005b, *Structural Standard for Antenna Supporting Structures and Antennas*, Tower Maintenance and Inspection Procedures, ANSI/TIA/EIA-222G, 2005.

3. NCDC 2005, *2004 Local Climatological Data*, *Annual Summary with Comparative Data*, South Carolina (CAE), CD-ROM, LCD Annual 2004, National Climatic Center, July 2005.

4. U.S. NRC 1974, Regulatory Guide 1.21, *Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants*, Revision 1, June 1974.

5. U.S. NRC 1977, Regulatory Guide 1.111, *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors,* Revision 1, 1977.

6. U.S. NRC 1980, NUREG-0737, *Clarification of TMI Action Plan Requirements*, 1980.

7. U.S. NRC 1981, NUREG-0696, *Functional Criteria for Emergency Response Facilities*, Final Report, February 1981.

8. U.S. NRC 1983, Regulatory Guide 1.97, *Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following An Accident*, Revision 3, 1983.

9. U.S. NRC 2002, *Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants*, NUREG-0654/FEMA-REP-1, Revision 1, Appendix 2, and Addenda, March 2002.

10. U.S. NRC 2006a, *Virgil C. Summer Nuclear Station - NRC Inspection Report 05000395/2006009,* NRC Ascension No. ML061110240, March 9, 2006.

11. U.S. NRC 2007a, Regulatory Guide 1.23*, Meteorological Programs for Nuclear Power Plants*, Revision 1, March 2007.

12. U.S. NRC 2007b, Regulatory Guide 1.206*, Combined License Applications for Nuclear Power Plants (LWR Edition)*, Revision 0, June 2007.

Table 6.4-1
VCSNS Units 2 and 3 Onsite Meteorological Tower Instruments

Parameter (Manufacturer/Model)	Range	System Accuracy	Starting Threshold/ Resolution	Elevation (m)
Wind speed (Vaisala/WS425)	0 to144 mph (0 to 64 mps)	0-5 mph ±0.32 mph (±0.143 mps) (Instantaneous) ±0.011 mph (±0.0049 mps) (15-minute average)	virtually zero/ 0.1 mph (0.1 mps)	10, 30, 60
—	—	5-50 mph ±3.4% (Instantaneous) ±0.11% (15-minute average)	—	—
—	—	50-100 mph ±3.4% (Instantaneous) ±0.11% (15-minute average	—	—
Wind direction (Vaisala/WS425)	0° to 360°	±6.48° (Instantaneous) ±0.22° (15-minute average)	virtually zero/ 1°	10, 30, 60
Relative Humidity (Vaisala/HMP45D)	0.8% to 100% RH	±8.81% RH (Instantaneous) ±0.96% RH (15-minute average)	—	10, 30, 60
Ambient temperature (Vaisala/HMP45D)	–40°F to 140°F (–40°C to 60°C)	±1.98 °F (±1.1 °C) (Instantaneous) ±0.48 °F (±0.27 °C) (15-minute average)	—	10, 30, 60
Dew Point[a]	—	±9.71 °F (±5.39 °C) (Instantaneous) ±0.98 °F (±0.54 °C) (15-minute average)	—	10, 30, 60
Vertical temperature difference[b]	—	±2.30°F (±.1.28°C) (Instantaneous) ±0.17°F (±0.09°C) (15-minute average)	—	30–10, 60–10

a) Calculated from relative humidity and ambient temperature measurements.
b) Calculated from the concurrent ambient temperature measurements at two levels.

Table 6.4-2
Comparison of Onsite Data with Long-Term Climatological Data: Wind Direction

	Frequency Distribution (%)			
Wind Direction	**VCSNS Unit 1 One Year Jan 2007—Dec 2007**	**VCSNS Unit 1 Onsite Data Three Years (Jul 2003–Jun 2006)**	**Columbia NWS Ten Years 1951–1960[a]**	**Columbia NWS 20 Years 1956–1976[a]**
N	5.6	3.8	4.9	6.8
NNE	6.8	5.2	6.5	6.5
NE	8.6	9.0	8.1	7.9
ENE	6.1	6.6	5.3	7.0
E	3.6	4.1	3.7	6.3
ESE	2.9	2.2	3.1	4.4
SE	3.8	2.9	3.1	3.3
SSE	6.1	5.6	3.0	2.6
S	7.6	7.1	4.5	6.3
SSW	9.0	9.0	7.4	6.4
SW	10.3	11.6	10.1	10.7
WSW	10.1	10.5	7.4	9.8
W	8.4	9.2	5.4	8.4
WNW	4.2	4.1	4.7	5.5
NW	3.8	3.4	4.3	4.2
NNW	3.3	2.8	4.1	4.0

a) Data Source: NCDC 2005

Table 6.4-3
Comparison of Onsite Data with Long-term Climatological Data:
Seasonal and Annual Mean Wind Speed Distribution

Time Period	Distribution of Mean Wind Speed (meters per second)			
	VCSNS Unit 1 Onsite Data Recent One Year (2007)	VCSNS Unit 1 Onsite Data Three Years (Jul 2003–Jun 2006)	Columbia NWS Short-Term (2004)[(a)]	Columbia NWS Long-Term (49 years)[(a)]
Winter (Dec, Jan, Feb)	2.8	3.3	3.0	3.2
Spring (Mar, Apr, May)	3.1	3.3	3.0	3.5
Summer (Jun, Jul, Aug)	2.5	2.9	2.5	2.7
Fall (Sep, Oct, Nov)	3.2	3.5	2.7	2.7
Annual	3.0	3.2	2.8	3.0

Data Sources:

a) NCDC 2005

Table 6.4-4
Comparison of Onsite Data with Long-Term Climatological Data:
VCSNS Unit 1 Annual Percentage by Stability Class (%)

Record Period	Stability Class					
	A	B	C	D	E	F&G
1975	3.6	2.0	5.4	35.0	31.8	22.4
2003–2006	8.8	6.5	8.6	34.3	22.2	15.3
2007	5.6	7.5	11.1	37.6	23.5	14.6

Table 6.4-5
Annual Data Recovery Rate for VCSNS Units 2 and 3
Meteorological Monitoring System (January 2007–December 2008)

Parameter	Recovery Rate (in Percent)
Wind Speed (10 meters)	99.4
Wind Speed (60 meters)	99.3
Wind Direction (10 meters)	99.4
Wind Direction (60 meters)	99.3
Delta-T (60 meters – 10 meters)[a]	99.4
Ambient Temperature (10 meters)	99.2
Dew Point/Relative Humidity (30-meters)	98.5
Precipitation (ground)[b]	—
Composite Parameters	
WS/WD (10 meters), delta-T (60 meters–10 meters)[a]	99.4
WS/WD (60 meters), delta-T (60 meters–10 meters)[a]	99.2

a) Temperature difference (delta-T) between 60-meters and 10-meters levels.
b) Precipitation is measured at the base of the Unit 1 meteorological tower and events confirmed for consistency with Columbia NWS precipitation events.

6.5 ECOLOGICAL MONITORING

NUREG-1555 recommends that ecological monitoring programs encompass the elements of the ecosystems for which a causal relationship is established or strongly suspected between the construction or operation of a new unit and adverse change.

This section discusses ecological monitoring for terrestrial resources (Subsection 6.5.1) and aquatic resources (Subsection 6.5.2).

6.5.1 TERRESTRIAL ECOLOGY

This subsection demonstrates that terrestrial ecological monitoring is not warranted for construction or operation of the new units.

6.5.1.1 Existing Ecological Monitoring

As described in Subsection 4.3.1, approximately 56 acres of the proposed site for Units 2 and 3 consist of open and recently cleared areas. Forested areas at the proposed site consist largely of planted pines where plant species diversity is low, but the site does include areas of hardwood forest and mixed pine-hardwood forest. The wooded areas (especially the hardwood and mixed pine-hardwood forests) are used by wildlife species common to the area (*e.g.,* deer, gray squirrel, various birds), but the site provides no high-quality or unique habitat. In addition, the site is devoid of rare plants and animals and no forest on the VCSNS site is a virgin or near-virgin stand. Wildlife and plant species found at the proposed site are those typically found in Piedmont forests of South Carolina. Electric transmission corridors that originate at the Unit 1 switchyard pass through forested and agricultural lands typical of central South Carolina. No areas designated by the U.S. Fish and Wildlife Service as “critical habitat” exist at the VCSNS site or adjacent to associated transmission corridors.

SCE&G and Santee Cooper have established maintenance procedures for transmission corridors (SCE&G 2006, Santee Cooper 2006). The transmission corridors are managed to prevent woody growth from encroaching on the transmission lines and potentially causing disruption in service or becoming a general safety hazard. Corridor vegetation management involves light equipment (e.g., saws, mowers), herbicides, and hand tools. EPA-registered and state-approved herbicides are handled and applied by specialty contractors in accordance with manufacturer specifications and guidance from jurisdictional regulatory agencies. (See Subsection 5.6.1 for additional detail).

As discussed in Subsection 2.4.1, bald eagles are commonly observed along the Monticello and Parr Reservoirs and the Broad River. The nearest known eagle nest is located near the entrance road to Unit 1, approximately 1 mile northeast of the new reactor units. Another eagle nest is located on the north end of the jetty in the Monticello Reservoir, approximately 1.7 miles north of the proposed new reactor units. There is also an eagle nest west of Parr Reservoir approximately 1.8 miles northwest of the proposed new reactor units. With the exception of bald

eagles, the proposed site does not provide habitat for terrestrial animal or plant species that are federally or state-listed as threatened or endangered, proposed for listing as threatened or endangered, essential to the maintenance or survival of species that are rare or commercially or recreationally valuable, critical to the structure and function of the local terrestrial ecosystem, or that serve as biological indicators. Game species such as deer, gray squirrel, eastern cottontail, northern bobwhite, and wild turkey exist within the proposed site; such species are included in the "commercially or recreationally valuable" category of important species as defined by NUREG-1555. However, the proposed site provides no high-quality habitat or unique habitat for game species.

Approximately 1 acre of wetlands exists within the area of disturbance associated with construction of the proposed site (see Subsection 4.3.1.1). With the exception of these wetlands, no important habitats as defined by NUREG-1555 (See Subsection 2.4.1) exist within the proposed site. Streamside management zones at the VCSNS site are protected in accordance with best management practices established by the South Carolina Forestry Commission (SCE&G 2002).

No resource protection agency has required monitoring of wildlife at the VCSNS site or along the transmission corridors since the early years of plant operations.

6.5.1.2 Construction, Preoperational, and Operational Monitoring

The proposed site consists largely of cleared areas and managed pine "plantations" where plant species diversity is low, and the site does not provide habitat for rare species or significant habitat for commercially or recreational valuable species. Therefore, construction would not reduce the local or regional diversity of plants or plant communities. Because the potentially impacted forested habitat represents a small portion of the available undeveloped land in the region of the VCSNS site, the displacement and construction-related mortality of wildlife would be small relative to wildlife populations in the region. The footprint for the proposed site has been configured so that disturbance of wetlands by construction or operation of the proposed units would be minimized. However, a portion of a narrow wetland would be impacted by construction of the cooling towers. The new main access road would require a bridge over Mayo Creek but no wetland impacts are expected. The intersection of the blowdown line with the Parr Reservoir (Subsection 4.3.1) would impact an area at the reservoir's edge.

Because no important species (other than common game species) or critical or important habitats (NUREG-1555) would be impacted by construction or operation of the proposed units, and because the vegetation community on the proposed new units' footprint does not provide good wildlife habitat, monitoring of terrestrial plant and animal resources at VCSNS during plant construction, or during preoperational or operational periods, is not warranted, and is not proposed. Similarly, plant and animal resources along existing transmission corridors would not be impacted by construction or operation of the new units, and therefore, monitoring is not warranted. Corridor clearing and line construction for the new transmission lines would be accomplished in accordance with applicable regulations and procedures. As discussed in Subsection 2.4.1, the transmission

corridors are managed to prevent woody growth from reaching the transmission lines, and transmission line corridors are maintained in accordance with established procedures. The removal of woody species can provide outstanding grassland and marsh habitat for many rare plant species dependent on open conditions, and for these species, the corridors can actually result in beneficial impacts. Monitoring of terrestrial resources is not warranted nor planned for any new transmission corridors.

6.5.2 AQUATIC ECOLOGY

6.5.2.1 Existing Monitoring

The current Unit 1 National Pollutant Discharge Elimination System permit does not require monitoring of aquatic populations. No protected fish species and no protected invertebrate species, including rare mussels, are known to exist in the Monticello Reservoir or Parr Reservoir, the two bodies of water potentially affected by VCSNS operation.

SCE&G environmental staff stays abreast of aquatic resource issues related to the Broad River. These individuals track the status of species of interest, including state and federally protected species, regularly interface with state and federal resource agencies, participate in recovery groups (*e.g.,* Robust Redhorse Conservation Committee), and are active members of professional societies and nonprofit organizations that are dedicated to conserving sensitive aquatic species and habitats.

6.5.2.2 Construction, Preoperational, and Operational Monitoring

The construction activities that could adversely affect aquatic organisms include work in support of the proposed new raw water and water treatment plant intake structures on the Monticello Reservoir and proposed new discharge structure (cooling tower blowdown line) that would extend into the Parr Reservoir. These construction activities would disturb sediments (dredging, pile-driving) and soils (shoreline construction) at the three construction sites. However, SCE&G would use best construction management practices (*e.g.,* cofferdams, sediment basins) to limit the amount of soil and sediment-laden water entering the two reservoirs. The dredging and construction activities may require permits from the U.S. Army Corps of Engineers and South Carolina Department of Health and Environmental Control. The proposed construction activities would be of relatively short duration.

SCE&G concludes that impacts to aquatic communities from construction would be small, localized, and temporary, and would not require formal monitoring based on:

- Permitted and overseen by state and federal regulators
- Guided by an approved Storm Water Pollution Prevention Plan (see Subsections 4.2.3 and 4.3.2)

- Any small spills would be mitigated according to a Spill Prevention, Control, and Countermeasures Plan

- There are no sensitive habitats or populations in the areas proposed for construction

Closed-cycle cooling systems require only modest amounts of cooling tower makeup water and discharge small volumes of cooling tower blowdown. As a consequence, power plants with cooling tower-based cooling systems typically have small, highly localized impacts on aquatic ecosystems. Because closed-cycle cooling systems are known to be relatively benign, agencies involved in the National Pollutant Discharge Elimination System permitting rarely require operational monitoring of aquatic communities in waters potentially affected by their operation. SCE&G concludes that operational impacts to aquatic communities would be small and localized, and would not require formal monitoring.

Section 6.5 References

1. SCE&G 2002, *V.C. Summer Nuclear Station Applicant's Environmental Report, Operating License Renewal Stage*, August 2002.

2. SCE&G 2006, *230kV Electric Transmission Right-of-Way Vegetation Management Program*, Revision 2, January 3, 2006.

3. Santee Cooper 2006, *Santee Cooper Transmission Vegetation Management Program*, February 17, 2006.

4. U.S. NRC, *Environmental Standard Review Plans for Environmental Reviews for Nuclear Power Plants*, NUREG-1555, Washington, D.C., October 1999.

6.6 CHEMICAL MONITORING

The following section describes the chemical monitoring programs for surface water and groundwater quality, which include:

- Pre-application monitoring that supports, in part, the baseline water quality descriptions in Chapter 2 and Chapter 3.
- Construction/preoperational monitoring intended to identify potential impacts of site preparation and new unit construction and provide a basis for identifying and assessing environmental impacts from operation of the new units.
- Operational monitoring intended to identify impacts from operation of the new units.

6.6.1 EXISTING MONITORING

The pre-application chemical monitoring program includes surface water quality monitoring of the Monticello and Parr Reservoirs, surface water monitoring required by the current VCSNS Unit 1 National Pollutant Discharge Elimination System (NPDES) permit, and groundwater/drinking water monitoring required by Regulatory Guide 4.8, *Environmental Technical Specifications for Nuclear Power Plants* and the VCSNS Technical Specifications.

6.6.1.1 Chemical Surface Water Monitoring

SCE&G conducts water quality surveys monthly in the Monticello Reservoir (three stations) that include measurements of temperature, dissolved oxygen, conductivity, and pH (SCE&G 2006a). Measurements are taken from surface to near bottom, yielding basic information on the nature and extent of the plant's thermal plume, depth of thermocline in summer and early fall, and areas of the reservoir where aquatic organisms might be experiencing temperature or oxygen-related stresses. These surveys were implemented in the late 1990s when SCE&G was considering a change in the plant's cooling water intake structure, and plant operations and environmental staff were interested in the volume of cool water below the thermocline in late summer. The water quality surveys yielded information useful to environmental personnel, so they were continued even after the modification of the system was determined to be infeasible. SCE&G has also initiated expanded monthly water quality sampling of the Monticello and Parr Reservoirs.

SCE&G monitors plant discharges in accordance with its NPDES permit (SC0030856), which was issued by the South Carolina Department of Health and Environmental Control in June 2007. Table 6.6-1 lists the surface water quality parameters currently monitored for the NPDES permit.

SCE&G currently monitors drinking water for radionuclides at three offsite locations as required by Regulatory Guide 4.8 and the VCSNS Technical

Specifications. Monitoring results are submitted to NRC annually in the Radiological Environmental Monitoring Report. Drinking water samples are obtained monthly from the Nuclear Training Center, Lake Murray Water Treatment Facility (14 miles southeast of VCSNS), and the Columbia Water Works (25 miles southeast of VCSNS) (SCE&G 2006b). Drinking water is analyzed for tritium, gross beta, and gamma emitters. Section 6.2 presents more information on the Radiological Environmental Monitoring Program.

6.6.1.2 Chemical Groundwater Monitoring

VCSNS currently monitors five wells in accordance with an established groundwater monitoring program as required by the VCSNS NPDES permit (SCDHEC 2007). These wells are located outside the Unit 1 protected area around the biological waste treatment area. There are two additional wells available for backup. Metal analysis, general chemistry, and radionuclides are measured seminannually while volatile organic compounds are measured annually.

SCE&G also has seven groundwater monitoring wells inside the Unit 1 protected area around the auxiliary boiler fuel oil storage tank. Two of these wells are monitored annually, or at the request of SCDHEC, for polynuclear aromatic hydrocarbons, naphthalene, and BTEX compounds. These wells are monitored in accordance with a remediation plan agreement between VCSNS and SCDHEC.

SCE&G has 20 groundwater monitoring wells that are sampled quarterly for tritium and gamma isotopic analyses. Nineteen of these wells provide indicator samples taken within the exclusion area boundary of Unit 1 and in the direction of potentially affected groundwater supplies, while one well serves as a control sample from an unaffected location.

6.6.2 CONSTRUCTION AND PREOPERATIONAL MONITORING

The required surface water quality monitoring program and groundwater monitoring programs for Unit 1 would continue. These ongoing monitoring programs provide the data necessary to assess potential changes in groundwater and surface water quality associated with construction of the new units and provide a baseline for the identification and measurement of water quality impacts from operation of the new units.

6.6.3 OPERATIONAL MONITORING

An operational monitoring program would be implemented to identify any changes in water quality that may result from the operation of the new units and to assess the effectiveness of the related effluent treatment systems. The specific elements of the operational monitoring program would be developed in consultation with the state of South Carolina in the course of revising the existing NPDES permit and the NRC in the course of developing Technical Specifications for the new units. Based on preliminary discussions, it appears that SCDHEC would amend or

modify the existing NPDES permit for Unit 1, adding new outfalls, rather than issue a separate permit for Units 2 and 3.

Section 6.6 References

1. SCDHEC (South Carolina Department of Health and Environmental Control) 2007, *National Pollutant Discharge Elimination System Permit for Discharges to Surface Waters,* Water Facilities Permitting Division, Columbia, South Carolina, June 13, 2007.

2. SCE&G 2006a, *Water Quality Monitoring Report for Monticello Reservoir.* Prepared by Environmental Services Department, February 2006.

3. SCE&G 2006b, *Radiological Environmental Monitoring Report: Virgil C. Summer Nuclear Station, for the operating period January 1, 2005 – December 31, 2005*, April 2006.

Table 6.6-1 (Sheet 1 of 2)
Surface Water Quality Monitoring Program

Monitoring Location	Parameter	Frequency	Sample Type
Outfall 001 (once-through cooling water to Monticello Reservoir)	Iron	One/month	Grab
	Manganese	One/month	Grab
	pH	One/month	Grab
Outfall 003 (low-level radiological waste to Broad River)	Total suspended solids	One/month	Grab
	Oil and grease	One/month	Grab
	pH	One/month	Grab
	Copper, total	One/month	Grab
Outfall 004 (steam generator blowdown via Outfall 001 to Monticello Reservoir or via Outfall 003 to the Broad River)	Total suspended solids	One/month	Grab
	Oil and grease	One/month	Grab
Outfall 005 (treated sanitary sewage via Outfall 014 to Monticello Reservoir)	BOD_5	One/month	24-Hour Composite
	Total suspended solids	One/month	24-Hour Composite
	Fecal Coliform	One/month	Grab
Outfall 006A (low volume waste from alum sludge basin via Outfall 014 to Monticello Reservoir)	Total suspended solids	One/month	Grab
	Oil and grease	One/month	Grab
Outfall 006B (low volume waste and stormwater from sumps in transformer and fuel oil storage areas via Outfall 014 to Monticello Reservoir)	Total suspended solids	One/month	Grab
	Oil and grease	One/month	Grab
Outfall 007 (low volume waste from ion exchange regeneration and several sumps via Outfall 001 to Monticello Reservoir)	Total suspended solids	One/month	Grab
	Oil and grease	One/month	Grab
	pH	One/month	Grab
Outfall 008 (metal cleaning wastewater via Outfall 014 to Monticello Reservoir)	Total suspended solids	One/occurrence[(a)]	Grab
	Oil and grease	One/occurrence[(a)]	Grab
	Copper, total	One/occurrence[(a)]	Grab
	Iron	One/occurrence[(a)]	Grab

Table 6.6-1 (Sheet 2 of 2)
Surface Water Quality Monitoring Program

Monitoring Location	Parameter	Frequency	Sample Type
Outfall 12 (stormwater runoff from north/northwest area of plant site to Broad River)	Total suspended solids	Twice/year	Grab
	Oil and grease	Twice/year	Grab
	pH	One/month	Grab
	Copper, total	One/month	Grab
Outfall 013 (stormwater runoff from southeast area of plant site to Broad River)	Total suspended solids	Twice/year	Grab
	pH	Twice/year	Grab
	Copper, total	One/month	Grab
	Zinc, total	One/month	Grab
Outfall 014 (combination of four internal outfalls to Monticello Reservoir)	pH	One/month	Grab
	Whole Effluent Toxicity	One/permit term	Grab
	Phosphorous, total	One/month	Grab

a) Samples will be taken per discharge occurrence but need not be more than once per month.

Source: SCDHEC (2007)

6.7 SUMMARY OF MONITORING PROGRAMS

The following subsections summarize the monitoring programs described in detail in Sections 6.1 through 6.6. Also, Table 6.7-1 describes the monitoring programs to be implemented during site preparation and construction activities, before operation, and during operation.

6.7.1 SITE PREPARATION AND CONSTRUCTION MONITORING

The VCSNS Unit 1 ongoing radiological, chemical, hydrological, and meteorological monitoring programs have been used to characterize the conditions at the proposed VCSNS Units 2 and 3 location. In addition to preexisting hydrological monitoring, additional observation wells were installed as discussed in Subsection 6.3.2 in and around the proposed project footprint to better characterize the site hydrologically. Additional thermoluminescent dosimeters would be placed at the proposed site before construction and the existing radiological monitoring program expanded to include these dosimeters. Information collected historically and ongoing will form a basis from which to assess the impacts of Units 2 and 3 during site preparation and construction activities. Any monitoring requirements imposed by the construction storm water permit would also be implemented.

6.7.2 PREOPERATIONAL MONITORING

The ongoing radiological, hydrological, and chemical monitoring programs for Unit 1 will serve to provide baseline data before operation of Units 2 and 3. A new meteorological tower has been installed and a program for monitoring meteorological conditions has been developed. This new program and instrumentation would be used to characterize meteorological conditions for the proposed Units 2 and 3 during the preoperational and operational periods.

6.7.3 OPERATIONAL MONITORING

While specific requirements for radiological, hydrological, and chemical monitoring programs for operation of Units 2 and 3 have not yet been established, they are expected to be similar to and tiered from or added to the ongoing Unit 1 monitoring programs described in the previous sections. The meteorological monitoring program established for Units 2 and 3 is described in Section 6.4. In addition, SCE&G plans to continue its voluntary monthly water quality surveys at the Monticello and Parr Reservoirs as described in Subsection 6.6.1.1.

Table 6.7-1 (Sheet 1 of 4)
Summary of Monitoring Programs

Resource	Program	Scope/content	Status	Requiring Agency
		Site Preparation and Construction		
Human Health	Radiological monitoring	Before construction, thermoluminescent dosimeters would be placed at the proposed Units 2 and 3 to determine the external radiation exposure level at those locations.	Proposed	NRC
Water	Hydrological monitoring	Thirty-one wells were installed in the vicinity of the proposed Units 2 and 3 to establish baseline hydrological conditions (groundwater levels, flow paths, and gradients).	Existing	NA
Water	Storm water monitoring (hydrological monitoring)	The General Permit requires a monitoring program to ensure pollution (e.g., sediment loading) from storm water is minimized.	Proposed	SCDHEC
Water	Chemical monitoring	Ongoing surface water monitoring program for Unit 1 required by the current NPDES permit would be used to identify potential impacts of site preparation and construction of Units 2 and 3. Parameters measured are presented in Table 6.6-1.	Existing	SCDHEC
Water	Chemical monitoring	Ongoing groundwater monitoring program for Unit 1 required by the NPDES permit and SCDHEC remediation plan agreement would be used to identify potential impacts of site preparation and construction of Units 2 and 3.	Existing	NA
Human Health	Meteorological monitoring	New meteorological tower has been installed with instrumentation listed in Table 6.4-1. The data recorded by the instrumentation would be used to determine meteorological conditions at the new units for assessing safety and environmental factors that would influence radiological exposure in the event of a radiological release.	Existing	NRC

Table 6.7-1 (Sheet 2 of 4)
Summary of Monitoring Programs

Resource	Program	Scope/content	Status	Requiring Agency
		Site Preparation and Construction (cont.)		
Water	Radiological monitoring	Ongoing groundwater monitoring program required by RG 4.8 and Unit 1 Technical Specifications would be used to assess changes in water quality during construction of Units 2 and 3.	Existing	NRC
		Preoperational		
Human Health	Radiological monitoring	Existing Unit 1 radiological monitoring program will serve as the preoperational radiological monitoring program for Units 2 and 3. The following exposure pathways to radiation are monitored. Direct (dosimeters) Airborne (iodine and particulates) Waterborne (drinking water, surface water, and groundwater) Aquatic (sediment) Ingestion (milk and forage, fish tissue, and food products) Parameters measured are presented in Table 6.2-1	Existing	NRC
Human Health	Meteorological monitoring	New meteorological tower has been installed with instrumentation listed in Table 6.4-1. The data recorded by the instrumentation would be used to determine meteorological conditions at the new units for assessing safety and environmental factors that would influence radiological exposure in the event of a radiological release.	Existing	NRC

Table 6.7-1 (Sheet 3 of 4)
Summary of Monitoring Programs

Resource	Program	Scope/content	Status	Requiring Agency
		Preoperational (cont.)		
Water	Chemical monitoring	Ongoing surface water monitoring program for Unit 1 required by the current NPDES permit will be used to provide a baseline for identifying water quality impacts from operation of Units 2 and 3. Parameters measured are presented in Table 6.6-1.	Existing	SCDHEC
Water and Ecological (Aquatic)	Chemical monitoring	Monthly water quality surveys in Monticello Reservoir, measuring temperature, dissolved oxygen, conductivity, and pH, provide a baseline for assessing impacts from operation of Units 2 and 3.	Existing	NA
Water	Radiological monitoring	Ongoing groundwater monitoring program required by RG 4.8 and Unit 1 Technical Specifications will provide a baseline for identifying water quality impacts from operation of Units 2 and 3.	Existing	NRC
		Operational		
Human Health	Radiological monitoring	Existing Unit 1 radiological monitoring program will be expanded as necessary to monitor the potential impacts from operation of Units 2 and 3. The following exposure pathways to radiation would be monitored. Direct (dosimeters) Airborne (iodine and particulates) Waterborne (drinking water, surface water, and groundwater) Aquatic (sediment) Ingestion (milk and forage, fish tissue, and food products)	Proposed	NRC

Table 6.7-1 (Sheet 4 of 4)
Summary of Monitoring Programs

Resource	Program	Scope/content	Status	Requiring Agency
		Operational (cont.)		
Human Health	Radiological monitoring	Samples would be collected in the Broad River (upstream and downstream) to sample surface water, river sediment, and fish. Additional direct radiation monitoring thermoluminescent dosimeter locations would be added at the Exclusion Area Boundary around the new units. The radius of the annual land use census would be expanded appropriately to accommodate Units 2 and 3 to ensure potential impacts from operation of the new units are factored into sampling locations.	Proposed	NRC
Water	Hydrological monitoring	Monitoring for hydrological conditions in surface water at NPDES outfalls used by Units 2 and 3.	To be specified	SCDHEC
Water	Hydrological monitoring	Industrial storm water permit required monitoring	To be specified	SCDHEC
Human Health	Meteorological monitoring	New meteorological tower has been installed with instrumentation listed in Table 6.4-1. The data recorded by the instrumentation would be used to determine operational airborne release impacts and when measures should be considered to protect health, safety, and property.	Existing	NRC
Water and Ecological (Aquatic)	Chemical monitoring	Monthly water quality surveys in Monticello Reservoir, measuring temperature, dissolved oxygen, conductivity, and pH, provide a baseline for assessing impacts from operation of Units 2 and 3.	Existing	NA
Water	Chemical monitoring	Monitoring for water quality parameters in surface water at NPDES outfalls used by Units 2 and 3.	To be specified	SCDHEC