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SCE&G®
A SCANA COMPANY

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

ATTN: Document Control Desk

Subject: V. C. Summer Nuclear Station Units 2 and 3
Docket Numbers 52-027 and 52-028
Combined License Application – Response to NRC
Environmental Report (ER) Requests for Additional Information
(RAI): Met-3 Revision 1

Reference:
1. Letter from Ronald B. Clary to Document Control Desk, Submittal of Revision 1 to Part 3 (Environmental Report) of the Combined License Application for the V. C. Summer Nuclear Station Units 2 and 3, dated February 13, 2009.
2. Letter from Patricia J. Vokoun to Ronald B. Clary, Requests for Additional Information Related to the Environmental Review for the Combined License Application for the V. C. Summer Nuclear Station, Units 2 and 3, dated June 22, 2009.

By letter dated March 27, 2008, South Carolina Electric & Gas Company (SCE&G) submitted a combined license application (COLA) for V.C. Summer Nuclear Station (VCSNS) Units 2 and 3, to be located at the existing VCSNS site in Fairfield County, South Carolina. Subsequently the Environmental Report (ER), Part 3 of the application, was revised and submitted to the NRC (reference 1).

The enclosure to this letter provides revised information for the SCE&G response to RAIs transmitted by the NRC via reference 2. Specifically a revised response to Met-3 is provided to reflect a recent change to the Seasonal/Annual Cooling Tower Impact (SACTI) analysis. The input and output files are also provided for the SACTI analysis. Please note that the enclosed CD with the input and output files is provided to support the NRC's review of the VCSNS Environmental Report, but does not comply with the requirements for electronic submissions as stated in NRC Guidance Document, "Guidance for Electronic Submissions to the NRC," dated October 29, 2008. The NRC staff requested that the input/output files be provided in native format. Formatting the CD to comply with the guidance on electronic submissions would not serve the request to provide this information in its native format.

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Please address any questions to Mr. Alfred M. Paglia, Manager, Nuclear Licensing, New Nuclear Deployment, P. O. Box 88, Jenkinsville, S.C. 29065; by telephone at 803-345-4191; or by email at apaglia@scana.com.

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

Executed on this 1st day of December 2009

Ronald B. Clary

Ronald B. Clary
Vice President
New Nuclear Deployment

ARR/RBC/ar

Enclosures

c (with Enclosures):
- Patricia Vokoun
- Carl Berkowitz
- FileNet

c (without Enclosures):
- Luis A. Reyes
- John Zeiler
- Chandu Patel
- Stephen A. Byrne
- Ronald B. Clary
- Bill McCall
- William M. Cherry
- Randolph R. Mahan
- Kathryn M. Sutton
- Rich Louie
- John J. DeBlasio
- April Rice

NRC RAI Letter Dated June 22, 2009

NRC RAI Number: RAI Met-3 **Revision:** 1

Reference ER Information Needs Item: Met-3

Question Summary (RAI):

The amount of salt drift from the cooling towers reported in the ER was quite small. Provide the assumptions (including the total solids concentration within the Monticello Reservoir) used to confirm this calculation, or provide a revised calculation (with assumptions) if needed.

Full Text (supporting information):

Regulatory Guide 4.7 describes nonradiological atmospheric considerations including cooling tower plumes. The amount of salt drift quoted in the ER, 0.025 pound per acre per month, is very small. Is this value correct?

VCSNS Response:

This is a revision to the previous response issued in letter NND-09-0247 dated August 17, 2009. The response is being updated to reflect a recent update to the applicable Seasonal/Annual Cooling Tower Impact (SACTI) analysis, which resulted in a change in the maximum salt deposition value from 0.27 pound per acre per month to 0.28 pound per acre per month. Also, the analysis determined that a small (but insignificant) amount of deposition occurs at less than 2600 feet from the cooling towers, whereas the previous analysis determined that no deposition would occur at less than 2600 feet.

The previous response and associated ER change is therefore revised as shown below:

The salt deposition value of 0.025 pound per acre per month reported in ER Section 5.3.3 "Heat Dissipation Systems" is no longer applicable. The value is replaced by the maximum salt deposition value determined from a recent SACTI analysis. The maximum salt deposition based on that analysis is 0.28 pound per acre per month.

Significant inputs to the SACTI code related to salt deposition are as follows:

1) The cooling tower drift rate is chosen to be 0.005% which is slightly higher than the conceptual cooling tower design value of 0.001%.
2) Monticello Reservoir has a low total dissolved solids (TDS) concentration. Based on July 2006 sampling data the TDS value used is 65 mg/L and is considered representative of the reservoir concentration. All the TDS is evaluated as salt at four cycles of concentration (higher end of conceptual range of two to four cycles of concentration chosen to yield a larger TDS value in the tower exhaust).
3) Three years (2006 – 2008) of weather data from the Columbia NWS, South Carolina at the Columbia Metropolitan Airport are used.

The input and output files of the applicable SACTI analysis are provided with this response.

A copy of the applicable SACTI analysis will be made available for NRC review in the Reading Rooms.

ER changes are being made for consistency with the recent SACTI analysis. ER Chapter 5 changes, which include the solids deposition results, are included with this response ER RAI response.

Associated COLA Revisions:

Following are the proposed changes to be incorporated in a future ER revision:

5.3.3.1 Heat Dissipation to the Atmosphere

SCE&G would use two circular mechanical draft cooling towers for each AP1000 unit to remove excess heat from the circulating water system. Cooling towers evaporate water to dissipate heat to the atmosphere. The evaporation is followed by partial recondensation which creates a visible mist or plume. The plume creates the potential for shadowing, fogging, icing, localized increases in humidity, and possibly water deposition. In addition to evaporation, small water droplets drift out of the tops of the cooling towers. The drift of water droplets can deposit dissolved solids on vegetation or equipment.

For Units 2 and 3, SCE&G modeled the impacts from fogging, icing, shadowing, and drift deposition using EPRI's Seasonal/Annual Cooling Tower Impact prediction code. This code incorporates the modeling concepts presented by Policastro et al. (1994), which were endorsed by NRC in NUREG-1555 (U.S. NRC 1999). The model provides predictions of seasonal and annual cooling tower impacts from mechanical or natural draft cooling towers. It predicts average plume length, rise, drift deposition, fogging, icing, and shadowing, providing results that have been validated with experimental data (Policastro et al. 1994).

Engineering data for the AP1000 was used to develop input to the Seasonal/Annual Cooling Tower Impact model. As described in Section 3.4, the model assumed four identical cooling towers, each with a heat rejection rate of 3.8 x 10^9 Btu's per hour and circulating water flows of 300,000 gpm. The tower height was set at 70 feet. Although the cooling towers could operate from two to four cycles of concentration, four cycles of concentration were assumed for the analysis. The meteorological data were ~~from the Units 2 and 3 meteorological tower for the year 2007, and~~ from the National Climatic Data Center for the Columbia Metropolitan Airport for the years 2006 through 2008.

5.3.3.1.1 Length and Frequency of Elevated Plumes

The Seasonal/Annual Cooling Tower Impact code calculated the expected plume lengths for each season by direction for the combined effect of four mechanical draft cooling towers. The plumes would occur in all compass directions. The average plume length and height were~~was~~ calculated from the frequency of occurrence for each plume by distance from the tower. The median plume length and height is the distance where half of all the plumes would be expected to be shorter than that distance. The average plume length would range from ~~0.49~~0.34 mile~~s~~ in the summer season to ~~1.5~~0.74 mile~~s~~ in the winter season. The annual prediction for the average plume length is ~~0.83~~0.49 mile from the cooling towers. The median plume length would range from 0.19 mile during the spring, summer, and fall seasons to ~~0.81~~0.25 mile in the winter season. The annual prediction for the median plume length is 0.19 mile. The average plume height above the cooling towers ranges from ~~820 feet to 1,900 feet~~420 feet in the summer season to 630 feet for the winter. The median plume height would range from ~~360~~330 feet in the summer season to ~~3,100~~430 feet for the winter. The annual prediction for the median plume height would be ~~390~~360 feet. The average plume height or length is different from the median height or length and reveals characteristics of the plumes. When the median is smaller than the average, as in the case of the plume length and height, it reveals that the majority of the visible plumes are shorter than the average length.

The cooling tower plumes would occur in each direction of the compass and would be spread over a wide area, reducing the time that the plume would be visible from a particular location. The average plume lengths would be relatively short and would not leave the site boundary during the spring and summer seasons. The visible plume would resemble clouds from a distance, and would not be distinguishable from existing clouds during overcast weather conditions. Due to the varying directions and short average plume lengths, impacts from elevated plumes would be SMALL and not warrant mitigation.

Modeled plumes from proposed cooling towers would be as follows:

	Winter	Spring	Summer	Fall	Annual
Predominant direction	East	~~North~~East	~~North~~East-northeast	~~Southwest~~East	East
Average plume length (miles)	~~1.5~~0.74	~~0.60~~0.37	~~0.49~~0.34	~~0.75~~0.53	~~0.83~~0.49
Median plume length (miles)	~~0.81~~0.25	0.19	0.19	0.19	0.19
Average plume height (feet)	~~1,900~~630	~~980~~460	~~820~~420	~~1,200~~520	~~1,200~~510
Median plume height (feet)	~~3,100~~430	~~390~~360	~~360~~330	~~390~~360	~~390~~360

5.3.3.1.3 Solids Deposition

Water droplets drifting from the cooling towers would have the same concentration of dissolved and suspended solids as the water in the cooling tower basin. As these droplets evaporate, either in the air or on vegetation or equipment, they deposit these solids. The water in the cooling tower basin is assumed to have solid concentrations four times that of the Monticello Reservoir, the source of cooling water makeup. All solids deposited are assumed to be composed of salt, for comparison with the NUREG-1555 significance level for visible impacts to vegetation of 8.9 pounds of salt deposition per acre per month.

The maximum predicted salt deposition rate from the towers would be as follows:

Maximum deposition (lbs/acre-month)	~~0.025~~0.28
Distance to maximum deposition (feet)	~~980~~3,280
Direction to maximum deposition	~~West-Southwest~~East
Maximum deposition at the Unit 2 and 3 switchyard (lbs/acre-month)	~~0.00018~~0.02
Maximum deposition at the Unit 1 switchyard (lbs/acre-month)	~~0.000089~~0.02

The maximum predicted salt deposition is ~~0.025~~0.28 pound per acre per month. This is much less than the NUREG-1555 significance level for possible visible effects to vegetation of 8.9 pounds per acre per month. NRC (U.S. NRC1996) reports that visible damage from salt deposition to terrestrial vegetation at operating nuclear power plants with mechanical draft cooling towers has not been observed. The impacts from the proposed cooling towers are not expected to be different from the impacts of the currently operating nuclear power plants.

The switchyard for Units 2 and 3 is located to the northwest, approximately ~~3,500~~3,200 feet from the center of the proposed location of the cooling towers. A maximum predicted salt deposition of ~~0.000089~~0.02 pound per acre per month would be expected at ~~this location~~the Units 2 and 3 switchyard area during the winter and summer seasons. The switchyard for Unit 1 is located to the north, approximately ~~4,000~~4,500 feet from the center of the proposed location of the cooling towers. The maximum salt deposition at ~~this location~~the Unit 1 switchyard area is ~~0.000089~~0.02 pound per acre per month in the ~~spring and summer~~winter season~~s~~. An existing transmission line parallels the cooling towers approximately 600 feet to the east. ~~The code predicted minimal salt deposition at this location.~~On a seasonal or annual basis, no significant salt deposition was predicted at distances shorter than 2,600 feet from the cooling towers.

The predicted salt deposition from the operation of the cooling towers would be much less than the NUREG-1555 significance level where visible effects may be observed. Salt deposition in other areas, including at the Unit 1 switchyard, and Units 2 and 3 switchyard are not expected to impact these facilities. The impact from salt deposition from the cooling towers would be SMALL and would not require mitigation.

5.3.3.1.4 Cloud Shadowing and Additional Precipitation

Vapor from cooling towers can create clouds or contribute to existing clouds. Rain and snow from vapor plumes are known to have occurred. The Seasonal/Annual Cooling Tower Impact code predicted the precipitation expected from the proposed cooling towers. The maximum precipitation would occur during the ~~spring~~winter, with a seasonal total of less than an inch of precipitation at ~~980~~3,280 feet ~~southeast~~east of the towers. This value is very small compared to the average annual precipitation of ~~31~~40 inches ~~from~~for the same years ~~of~~as the meteorological data used in this analysis. The average annual rainfall at Columbia is 47 inches (for the period 1948-2005) (SCSCO 2006). Impacts from precipitation would be SMALL and would not require mitigation.

The formation of clouds could also prevent sunlight from reaching the ground, ~~or~~i.e., cloud shadowing. This is especially important for agricultural fields or other sensitive areas. As shown in Figure 2.2-2, the closest agricultural area is approximately 1 mile to the southeast; the most extensive agricultural area in the vicinity of the proposed site is approximately 2 miles to the west-northwest; and a large wetland is present approximately 4 miles to the west of the proposed cooling towers. The Seasonal/Annual Cooling Tower Impact code predicted that shadowing at the closest agricultural area would ~~occur for a maximum of 43~~range from 42 hours per month during the summer to 103 hours per month during the winter with an annual average of 71 hours per month. ~~hours per month during the winter season and 80 hours annually.~~ The predicted shadowing at the most extensive agricultural area ranges from approximately 42 hours per month during the summer season to ~~is~~ approximately ~~37~~50 hours per month during the winter season with ~~71~~an annual average of 47 hours per month. ~~annually.~~ Shadowing at the large wetland to the west would ~~occur for a maximum of 5~~range from approximately 22 hours per month during the summer season to 31 hours per month during the ~~fall~~spring season ~~and 14~~with an annual average of approximately 26 hours per month. ~~annually~~. The shadowing hours presented above include hours that occur after dark. The impacts from cloud shadowing at other agricultural areas within the site vicinity would be less than the shadowing for the three areas discussed above. Due to the limited amount of agricultural areas and short duration of the shadowing at those and other sensitive areas, the impacts from cloud shadowing would be SMALL and would not require mitigation.

5.3.3.2.1 Salt Drift

Vegetation near the cooling towers could be subjected to salt deposition attributable to drift from the towers. Salt deposition could potentially cause vegetation stress, either directly by deposition of salts onto foliage or indirectly from accumulation of salts in the soil.

An order-of-magnitude approach was used to evaluate salt deposition on plants, since some plant species are more sensitive to salt deposition than others, and tolerance levels of most species are not known with precision. Deposition of sodium chloride at rates of approximately 1 to 2 pounds per acre per month is generally not damaging to plants, while deposition rates approaching or exceeding 8.9 pounds per acre per month in any month during the growing season could cause leaf damage in many species (NUREG-1555). An alternate approach for evaluating salt deposition is to use 8.9 to 18 pounds per acre per month of sodium chloride deposited on leaves during the growing season as a general threshold for visible leaf damage (NUREG-1555).

As presented in Subsection 5.3.3.1.3, the maximum expected salt deposition rate from the combination of all four towers would be ~~0.025~~0.28 pound per acre per month. This maximum rate is less than ~~1~~4% of the 8.9 pounds per acre per month rate that is considered a threshold value for leaf damage in many species. Any impacts from salt drift on the local terrestrial ecosystems would therefore be SMALL and would not warrant mitigation. Cumulative impacts are discussed in Section 10.5.

5.3.3.2.2 Vapor Plumes and Icing

As concluded in Subsection 5.3.3.1.1, the expected average plume length would range from ~~0.49~~0.34 to ~~1.5~~0.74 mile~~s,~~ and the expected median plume length would range from 0.19 to ~~0.81~~0.25 mile. As discussed in Subsection 5.3.3.1.2, ground level fogging is not predicted to occur from the operation of the cooling towers. Therefore, the impacts of fogging and icing on terrestrial ecosystems would be SMALL and would not warrant mitigation.

Table 5.10-1

Revise the Impact Description or Activity for 5.3.3 Heat Dissipation Systems, 5.3.3.1 Heat Dissipation to the Atmosphere as follows:

Based on modeling, the expected effects from Units 2 and 3 cooling towers are as follows: average plume length ~~0.49~~0.34 mile~~s~~ (summer) to ~~1.5~~0.74 mile~~s~~ (winter), average plume height ~~820~~420 feet (summer) above towers to ~~1,900~~630 feet (winter), no fogging, no icing, annual average shadowing on closest agricultural area of ~~80~~71 hours per ~~year~~month (includes hours after dark), increases in humidity onsite only, less than 1 inch of precipitation per season, and salt deposition would be a fraction of the level needed to have visible effects on vegetation.

Associated Attachments:

Attached CD containing SACTI input/output files in their native format (ASCII text).