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SCE&G®
A SCANA COMPANY

February 23, 2009
NND-09-0034

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

ATTN: Document Control Desk

Subject: Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3 Combined License Application (COLA) - Docket Numbers 52-027 and 52-028 Response to NRC Request for Additional Information (RAI) Letter No. 017

Reference: Letter from Ravindra G. Joshi (NRC) to Alfred M. Paglia (SCE&G), Request for Additional Information Letter No. 017 Related to SRP Section 11.02 for the Virgil C. Summer Nuclear Station Units 2 and 3 Combined License Application, dated January 22, 2009.

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

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

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

Executed on this 23rd day of February, 2009.

Sincerely,

Ronald B Clary

Ronald B. Clary
General Manager
New Nuclear Deployment

AMM/RBC/am

Enclosure

D083
NRO

c (with attachment):

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NRC RAI Letter No. 017 Dated January 22, 2009

SRP Section: 11.02 – Liquid Waste Management System

Question from Health Physics Branch (CHPB)

NRC RAI Number: 11.02-1

FSAR Sections 11.2.3.5.2 and 11.2.5.2 (including VCS COL Item 11.2-2) reference draft NEI Template 07-11 as the basis of the cost-benefit analysis for justifying, in part, the design of the Liquid Waste Management System (LWMS). The NEI template proposed a bounding envelope of population doses associated with liquid effluent releases, which, if met, would demonstrate compliance with ALARA cost-benefit requirements of Section II.D of Appendix I to Part 50. However, NEI Template 07-11 was withdrawn from further consideration by NEI. Accordingly, please explain how the applicant intends to develop a plant and site-specific cost-benefit analysis demonstrating compliance with Section II.D of Appendix I to Part 50 with respect to the LWMS, and provide sufficient information for the staff to evaluate the bases and assumptions used in the analysis against the applicable NRC regulations and guidance.

VCSNS RESPONSE:

A plant-specific cost-benefit analysis has been developed demonstrating compliance with Section II.D of Appendix I to Part 50 with respect to the LWMS. This cost-benefit analysis replaces use of NEI 07-11; thus, reference to NEI 07-11 will be removed from the FSAR. The total annual costs of the liquid radwaste system augments listed in Regulatory Guide 1.110, Revision 0, were developed using the methodology and parameters provided in the regulatory guide. Conservative values were chosen for parameters not specified in the regulatory guide. The following variable parameters were used:

- Capital Recovery Factor (CRF) – This factor is taken from Table A-6 of Regulatory Guide 1.110 and reflects the cost of money for capital expenditures. A cost-of-money value of 7% per year is assumed in this analysis, consistent with the "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission" (NUREG/BR-0058). A CRF of 0.0806 was obtained from Table A-6.

- Indirect Cost Factor (ICF) – This factor takes into account whether the radwaste system is unitized or shared (in the case of a multi-unit site) and is taken from Table A-5 of Regulatory Guide 1.110. It is assumed that the radwaste system for this analysis is a unitized system at a 2- unit site, which equals an ICF of 1.625.

- Labor Cost Correction Factor (LCCF) – This factor takes into account the differences in relative labor costs between geographical regions and is taken from Table A-4 of Regulatory Guide 1.110. A LCCF of 1.0 (the lowest value) is assumed in this analysis.

The lowest-cost option for liquid radwaste treatment system augments is a 20 gpm Cartridge Filter at $11,140 per year per unit for a two unit PWR, which yields a threshold value of 11.14 person-rem total body or thyroid dose from liquid effluents.

The population doses are given in FSAR Section 11.2.3.5*. As discussed above, the lowest cost liquid radwaste system augment is $11,140. Assuming 100% efficiency of this augment, the minimum possible cost per person-rem is determined by dividing the cost of the augment by the population dose. This is $2,060 per person-rem total body ($11,140/5.4 person-rem) and $4,640 per person-rem thyroid ($11,140/2.4 person-rem). These costs per person-rem reductions exceed the $1,000 per person-rem criterion prescribed in Appendix I to 10 CFR Part 50 and are therefore not beneficial.

The associated application revisions include items that are both PLANT-SPECIFIC and items that are expected to be STANDARD as shown in the COLA Revisions section below. The portion of this response which describes the methodology and parameters used to develop the total annual costs of the radwaste system augments is expected to be STANDARD and has been adapted from the TVA response to NRC Request for Additional Information Letter No. 031 Related to SRP Section 11.02 for the Bellefonte Units 3 and 4 Combined License Application (Reference). The remaining portions are PLANT-SPECIFIC.

* It should be noted that the site-specific population doses for liquid releases due to normal operation are being revised to reflect decreased transit time from plant discharge to the Broad River and for swimming and recreational activity. In addition, a commercial fishing pathway is added based on average fish consumption rates per Regulatory Guide 1.110 and the 50-mile population. Consequently, the population doses are being revised in FSAR Section 11.2.3.5.2 and FSAR Table 11.2-204 to reflect a calculated total body annual dose of 5.4 person-rem and a thyroid dose of 2.4 person-rem. A full description and incorporation of the data associated with these changes will be provided in a future revision of the COLA.

Reference for the Response:

Letter from J. A. Bailey (TVA) to NRC, "Bellefonte Combined License Application - Response to Request for Additional Information - Liquid Waste Management System," dated August 1, 2008, (ML082180116).

This response is PLANT SPECIFIC.

ASSOCIATED VCSNS COLA REVISIONS:

1. COLA Part 2, FSAR, Chapter 11, Subsection 11.2.3.5.2, will be revised to delete the next to the last paragraph and the second sentence of the last paragraph and to add new Subsections 11.2.3.5.3 and 11.2.3.5.4 as shown below:

~~This section adopts NEI 07-11 (Reference 201) which is currently under review by the NRC staff. The application of the methodology of NEI 07-11 satisfies the cost-benefit analysis requirements of 10 CFR Part 50, Appendix I, Section II.D. The augments provided in NEI 07-11 were reviewed and were found not to be cost beneficial due to the low VCSNS population doses.~~

Table 11.2-204 shows that the ~~whole~~ total body and thyroid population doses per unit are approximately ~~2.1~~ 5.4 and ~~2.3~~ 2.4 person-rem per unit, respectively. ~~All the population doses are below the NEI guideline value of 16.83 person-rem for whole body or thyroid from liquid effluents.~~

11.2.3.5.3 Liquid Radwaste Cost-Benefit Analysis Methodology

STD COL 11.2-2

The application of the methodology of Regulatory Guide 1.110 was used to satisfy the cost benefit analysis requirements of 10 CFR Part 50, Appendix I, Section II.D. The parameters used in calculating the Total Annual Cost (TAC) are fixed and are given for each radwaste treatment system augment listed in Regulatory Guide 1.110, including the Annual Operating Cost (AOC) (Table A-2), Annual Maintenance Cost (AMC) (Table A-3), Direct Cost of Equipment and Materials (DCEM) (Table A-1), and Direct Labor Cost (DLC) (Table A-1). The following variable parameters were used:

- Capital Recovery Factor (CRF) – This factor is taken from Table A-6 of Regulatory Guide 1.110 and reflects the cost of money for capital expenditures. A cost-of-money value of 7% per year is assumed in this analysis, consistent with the "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission" (NUREG/BR-0058). A CRF of 0.0806 was obtained from Table A-6.

- Indirect Cost Factor (ICF) – This factor takes into account whether the radwaste system is unitized or shared (in the case of a multi-unit site) and is taken from Table A-5 of Regulatory Guide 1.110. It is assumed that the radwaste system for this analysis is a unitized system at a 2-unit site, which equals an ICF of 1.625.

- Labor Cost Correction Factor (LCCF) – This factor takes into account the differences in relative labor costs between geographical regions and is taken from Table A-4 of Regulatory Guide 1.110. A LCCF of 1.0 (the lowest value) is assumed in this analysis.

Appendix I to 10 CFR Part 50 prescribes a $1,000 per person-rem criterion for determining the cost benefit of actions to reduce radiation exposure.

The analysis used a conservative assumption that the respective radwaste treatment system augment is a "perfect" system that reduces the effluent and dose by 100%. The liquid radwaste treatment system augments annual costs were determined and the lowest annual cost considered a threshold value. The lowest-cost option for liquid radwaste treatment system augments is a 20 gpm Cartridge Filter at $11,140 per year, which yields a threshold value of 11.14 person-rem total body or thyroid dose from liquid effluents.

For AP1000 sites with population dose estimates less than 11.14 person-rem total body or thyroid dose from liquid effluents, no further cost-benefit analysis is needed to demonstrate compliance with 10 CFR 50, Appendix I Section II.D.

11.2.3.5.4 Liquid Radwaste Cost-Benefit Analysis

VCS COL 11.2-2

As discussed in Section 11.2.3.5.3, the lowest cost liquid radwaste system augment is $11,140. Assuming 100% efficiency of this augment, the minimum possible cost per person-rem is determined by dividing the cost of the augment by the population dose. This is $2,060 per person-rem total body ($11,140/5.4 person-rem) and $4,640 per person-rem thyroid ($11,140/2.4 person-rem). These costs per person-rem reduction exceed the $1,000 per person-rem criterion prescribed in Appendix I to 10 CFR Part 50 and are therefore not beneficial.

2. COLA Part 2, FSAR, Chapter 11, Subsection 11.2.5.2, will be revised as shown below:

STD COL 11.2-2 This COL Item is addressed in Subsection 11.2.3.5.3.

VCS COL 11.2-2 This COL Item is addressed in Subsections 11.2.3.3, 11.2.3.5, 11.2.3.5.1, ~~and~~ 11.2.3.5.2, and 11.2.3.5.4.

3. COLA Part 2, FSAR, Chapter 11, Subsection 11.2.6, Reference 201, reference to NEI 07-11, will be deleted as shown below:

201. ~~NEI 07-11, "Generic Template Guidance for Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors," Revision 0, September 2007.~~ Deleted

ASSOCIATED ATTACHMENTS:

None

NRC RAI Letter No. 017 Dated January 22, 2009

SRP Section: 11.02 – Liquid Waste Management System

Question from Health Physics Branch (CHPB)

NRC RAI Number: 11.02-2

Please explain how the application demonstrates that the site can meet the general environmental radiation standard in 40 CFR Part 190 (per 10 CFR 20.1301(e)), and provide sufficient information for the staff to evaluate the bases and assumptions used in the applicant's analysis. Please incorporate this analysis into the FSAR or justify its exclusion.

VCSNS RESPONSE:

Plant and site-specific offsite dose analyses have been developed for normal release of both liquid and gaseous effluents that demonstrate compliance with applicable federal regulations, including 40 CFR Part 190. 40 CFR Part 190 requires that the annual doses to any member of the public do not exceed 25 mrem to the total body, 75 mrem to the thyroid, and 25 mrem to any other organ as the result of exposures to planned discharges of radioactive materials to the general environment or operation of uranium fuel cycle facilities. Other than the operating Unit 1 and the two proposed new units, there are no other uranium fuel cycle facilities in the vicinity of the site which would contribute to the dose received by the maximally exposed individual. Thus, to demonstrate compliance with the site dose limits, the effluent and direct radiation doses from Units 1, 2, and 3 need to be considered.

For Units 2 and 3, the direct radiation from the containment and other plant buildings is negligible based on information presented in the AP 1000 DCD, Tier 2, Chapter 12, Subsection 12.4.2.1, which also indicates that there is no contribution from refueling water because the refueling water is stored inside the containment instead of in an outside storage tank. In addition, there is no outside storage of solid radwaste. For Unit 1, site thermoluminescent dosimeter (TLD) data from 2001 to 2005 (References 1 to 5) indicate that dose rates at the site boundary are comparable to pre-operational measurements from 1978 to 1982. Hence, direct radiation from all site sources is negligible.

As indicated in FSAR Subsection 11.2.3.5.1, the total site doses due to liquid and gaseous effluents from Units 1, 2, and 3 are presented in Table 11.3-206 and are within the regulatory limits of 40 CFR 190. Since the application was originally submitted, the dispersion factors have been revised slightly to reflect meteorological data collected at the new tower for Units 2 and 3 in 2007. Based on the new meteorological data, the atmospheric dispersion and ground deposition factors have been revised. The following

revised atmospheric dispersion factors and ground deposition factors are used to calculate doses:

Receptor	Direction from Site	Distance (mi)	Atmospheric Dispersion Factor (sec/m^3)			Ground Deposition (m^{-2})
			Undecayed, Undepleted	2.26 Days Decayed, Undepleted	8 Days Decayed, Depleted	
EAB	SE	0.50	6.0E-06	6.0E-06	5.5E-06	1.7E-08
Residence, Meat Animal, Milk Animal, Vegetable Garden	SE	1.68	9.0E-07	8.9E-07	7.5E-07	3.4E-09

The meat animal, milk animal, and vegetable garden actually have equal or lower dispersion values but the residence values are conservatively used for all four receptors (See FSAR Table 2.3-225).

The values in FSAR Table 11.3-206 are obtained as follows:

- Units 2 and 3 Liquid Doses – As footnote "a" of the table indicates, the single-unit doses from Table 11.2-203 are doubled to account for two units. The doses in Table 11.2-203 are calculated using LADTAP II, based on the inputs provided in Tables 11.2-201 and 11.2-202.

- Units 2 and 3 Gaseous Doses – As footnote "b" of the table indicates, the single-unit doses from Table 11.3-203 are doubled to account for two units. The doses in Table 11.3-203 are calculated using GASPAR II, based on the inputs provided in Table 11.3-201. Table 11.3-203 will be revised as indicated in the response to VCSNS RAI 11.03-2.

- Units 2 and 3 Total Doses – These are obtained by adding the liquid and gaseous doses.

- Unit 1 Doses – These are due to liquid and gaseous effluents and are obtained from the annual effluent report for 2005 (FSAR Section 11.2, Reference 202). The total body dose of 1.2 mrem is primarily due to gaseous effluents; the liquid effluent dose is only 0.0042 mrem. The organ dose of 0.040 mrem is the sum of 0.036 mrem from gaseous effluents and 0.0048 mrem from liquid effluents.

- Site Total Doses – These are obtained by adding the doses from Units 1, 2, and 3.

References for the Response:

1. *Radiological Environmental Operating Report*, Virgil C. Summer Nuclear Station, for the Operating Period January 1, 2001 – December 31, 2001, April 2002, ML030300769.

2. *Radiological Environmental Operating Report*, Virgil C. Summer Nuclear Station, for the Operating Period January 1, 2002 – December 31, 2002, April 2003.

3. *Radiological Environmental Operating Report*, Virgil C. Summer Nuclear Station, for the Operating Period January 1, 2003 – December 31, 2003, April 2004.

4. *Radiological Environmental Operating Report*, Virgil C. Summer Nuclear Station, for the Operating Period January 1, 2004 – December 31, 2004, April 2005, ML051170123.

5. *Radiological Environmental Operating Report*, Virgil C. Summer Nuclear Station, for the Operating Period January 1, 2005 – December 31, 2005, April 2006, ML062770462.

This response is PLANT SPECIFIC.

ASSOCIATED VCSNS COLA REVISIONS:

Proposed changes to FSAR Table 11.3-206 are attached. Additionally, Chapter 2 will be revised to reflect the updated atmospheric dispersion and ground deposition factors, as shown above.

ASSOCIATED ATTACHMENTS:

FSAR Table 11.3-206

Table 11.3-206
Comparison of Maximally Exposed Individual Doses with 40 CFR Part 190 Criteria

	Dose (mrem/yr)					
	Units 2 and 3			Unit 1[(c)]	Site Total	Regulatory Limit
	Liq[(a)]	Gas[(b)]	Total			
Total Body	0.10	0.80	0.9	1.2	2.1	25
Thyroid	0.14	14.4	14.6	0.040	14.6	75
Other Organ - Bone	0.082	3.8	3.9	0.040	4.0	25

a) Doses from Table 11.3-203 are doubled for two units.

b) Maximum doses (by age group) from Table 11.3-203 are doubled for two units.

c) Unit 1 doses are based on annual effluent reports.

NRC RAI Letter No. 017 Dated January 22, 2009

SRP Section: 11.02 – Liquid Waste Management System

Question from Health Physics Branch (CHPB)

NRC RAI Number: 11.02-3

Please provide detailed information to enable the staff to validate and verify the estimated doses in FSAR section 11.2.3.5 with respect to the dose objectives of Appendix I to 10 CFR Part 50 and the dose limits in 10 CFR 20.1301(e); please revise the FSAR to include this information, or justify its exclusion. The information should include the following:

• a complete description of how the applicant derived all the values listed in Tables 11.2-201 and 11.2-202, including all assumptions made

• citations to any reference material used (for documents not publicly available please provide a copy for staff's use)

• detailed breakdown of individual doses by pathway and organ

• detailed breakdown of population doses by pathway and organ

VCSNS RESPONSE:

Regulatory Guide 1.206, Revision 0, and Standard Review Plan 11.2, Revision 3, require the parameters used to determine estimated doses from the liquid effluent system to be provided in the FSAR, but neither requires the FSAR to provide a detailed basis for each parameter. Existing footnotes to Tables 11.2-201 and 11.2-202 already provide the bases for the parameters used to calculate liquid effluent doses. Although it is not being proposed to modify these FSAR tables to include more detail, further information on the table data is provided below, along with any applicable references.

The bases for the parameters in Table 11.2-201 are as follows:

- Broad River flow rate of 4811 cfs – As indicated in table footnote a, this is based on historical flow data for 1981-1982 and 1997-2006. The average flow rate is calculated based on data at the United States Geological Survey website (Reference 12). At the time that the analysis was done, data was not available for the years 1983 to 1996. It is now available, but the average flow increases when this previously missing data is included. Hence, the flow rate used is conservative in terms of dilution.

- Dilution factor – Beyond full mixing in the river flow rate, no further dilution is assumed.

The bases for the parameters in Table 11.2-202 are as follows:

1) Freshwater site – River is fresh water.

2) Release source terms – DCD Table 11.2-7 provides the annual liquid effluent releases by isotope.

3) Discharge flow rate – This is the average Broad River flow rate from Table 11.2-201.

4) Transit time to receptor – For the maximally exposed individual (MEI), a conservative value of 0.1 hr is assumed. For the population, the transit times for sport fishing, swimming, boating, and shoreline usage in the Broad River are also assumed to be 0.1 hr. For population commercial fishing and drinking water, a delay of 4 days is assumed to reflect the retention time in the Parr Reservoir (Reference 1), which is a portion of the Broad River.

5) Impoundment reconcentration model – Because discharge is directly into the Broad River, including Parr Reservoir, impoundment reconcentration is not modeled. As indicated in the LADTAP II manual, impoundment models allow for decay and dilution and may be discounted if release is directly into the receiving water body (Reference 2, Section 3.1.1). The decay time in the Parr Reservoir is accounted for through Item 4 (transit time to receptor) while no dilution is credited beyond that provided by the river.

6) 50-mile population – The 2060 population is 2,131,394, obtained from FSAR Figures 2.1-211 and 2.1-219, as indicated. This represents an increase of a factor of 2.073 from the current population of 1,028,075 (FSAR Figure 2.1-213). This factor is applied to other parameters below, such as consumption and production rates.

7) Shore width factor – For a river, this parameter is 0.2 according to the LADTAP II manual (Reference 2).

8) Sport fish consumption – Maximum and average consumption rates from Regulatory Guide 1.109 are used for the MEI and the population, respectively.

9) Drinking water consumption – Maximum and average consumption rates from Regulatory Guide 1.109 are used for the MEI and the population, respectively.

10) Sport fishing harvest – The number of registered boats within the four surrounding counties is 43,238 (Reference 13). It is assumed that there are two people per boat and that 10% of the boat population uses the Broad River. The sport fishing harvest is estimated by multiplying this boating population by the

maximum fish consumption rate of 21 kg/yr (Regulatory Guide 1.109). Also, the boating population is assumed to increase by a factor of 2.073 in 2060 (Item 6), consistent with the projected increase in the 50-mile population, yielding 3.77E+05 kg/yr.

11) 50-mile drinking water population – The Broad River is a source of drinking water for part of the population within 50 miles of the plant. The city of Columbia, SC, which has a population of 223,660, receives half of its water from the Broad River (Reference 3). Fort Jackson (U.S. Army), which has a population of 32,841, receives all its water from the city of Columbia (Reference 3). Adding half of the Columbia population to the Fort Jackson population yields a total drinking water population of 144,671 persons. This is multiplied by the population increase factor of 2.073 (Item 6) to estimate the 2060 drinking water population of 299,930.

12) 50-mile boating usage – The number of registered boats within the four surrounding counties is 43,238 (Reference 13). It is assumed that there are two people per boat and that 10% of the boat population uses the Broad River for 4 hours per week for 50 weeks per year. Also, the boating population is assumed to increase by a factor of 2.073 in 2060 (Item 6), consistent with the projected increase in the 50-mile population.

13) 50-mile shoreline usage – The population shoreline usage time is assumed to be the same as the boating population exposure time.

14) 50-mile swimming usage – The population swimming time is assumed to be 10% of the boating population exposure time.

15) Fraction of SC crops irrigated – The total areas of irrigated and harvested cropland in South Carolina in 2006 were 95,642 and 1,374,617 acres, respectively (Reference 4). The ratio of irrigated to harvested cropland is 0.0696.

16) Fraction of population using contaminated water for drinking and food production – This is the ratio of the number of people using the Broad River for drinking (144,671 persons from Item 11) to the 50-mile population (1,028,075 persons from Item 6), yielding 0.141.

17) Fraction of SC agricultural products within 50 miles – It is assumed that the total land area within 50 miles less the water surface areas of Lake Murray (78 m^2 from Reference 5) and Monticello and Parr Reservoirs (17 mi^2 from Reference 1) is used for agriculture. Dividing this net land area by the total South Carolina land area of 30,109 mi^2 (Reference 6) yields the fraction of 0.258.

18) Irrigation rate for food products – The irrigation rate for food products is assumed to be 1 inch per week. Multiplying by 4 weeks per month and converting to metric units yields a monthly irrigation rate of 102 l/m^2.

19) Fraction of contaminated water not used for feed or drinking water – It is conservatively assumed that all of the contaminated water is used for feed or drinking water.

20) Total production of vegetables within 50 mi radius – The total production rate of fruits and vegetables in South Carolina is 1.28E+08 kg/yr (References 7, 8). This is increased by the population factor of 2.073 (Item 6) to estimate the production in 2060. The production rate within 50 miles is determined by multiplying the total state production rate by the land fraction of 0.258 (Item 17).

21) Production rate for irrigated vegetables – The production rate using irrigation water is determined by multiplying the 50-mile production rate (Item 20) by the fraction of water users (0.141 from Item 16) and the fraction of irrigated to harvested cropland (0.0696 from Item 15).

22) Total production of leafy vegetables within 50 mi radius – The production rate of leafy vegetables in South Carolina is 3.36E+07 kg/yr (Reference 9). This is increased by the population factor of 2.073 (Item 6) to estimate the production in 2060. The production rate within 50 miles is determined by multiplying the total state production rate by the land fraction of 0.258 (Item 17).

23) Production rate for irrigated leafy vegetables – The production rate using irrigation water is determined by multiplying the 50-mile production rate (Item 22) by the fraction of water users (0.141 from Item 16) and the fraction of irrigated to harvested cropland (0.0696 from Item 15).

24) Total production of milk within 50 mi radius – The production rate of milk in South Carolina is 1.27E+08 l/yr (Reference 10). This is increased by the population factor of 2.073 (Item 6) to estimate the production in 2060. The production rate within 50 miles is determined by multiplying the total state production rate by the land fraction of 0.258 (Item 17).

25) Production rate for irrigated milk – The production rate using irrigation water is determined by multiplying the 50-mile production rate (Item 24) by the fraction of water users (0.141 from Item 16) and the fraction of irrigated to harvested cropland (0.0696 from Item 15).

26) Total production of meat within 50 mi radius – The production rate of meat in South Carolina is 1.71E+09 kg/yr (Reference 11). This is increased by the population factor of 2.073 (Item 6) to estimate the production in 2060. The production rate within 50 miles is determined by multiplying the total state production rate by the land fraction of 0.258 (Item 17).

27) Production rate for irrigated meat – The production rate using irrigation water is determined by multiplying the 50-mile production rate (Item 26) by the fraction of

water users (0.141 from Item 16) and the fraction of irrigated to harvested cropland (0.0696 from Item 15).

Since the FSAR was submitted, the following change has been made to the parameters:

- Commercial fishing harvest – The average fish consumption rates are 6.9 kg/yr for adult, 5.2 kg/yr for teen, and 2.2 kg/yr for child (Regulatory Guide 1.109, Table E-4). The age distribution of the 50-mi population is assumed to be 0.71 for adult, 0.11 for teen, and 0.18 for child (Regulatory Guide 1.109, Page 1.109-33). Weighting the consumption rates by the age distribution yields an average rate of 5.9 kg/yr. This average consumption rate is multiplied by the 50-mi population of 2,131,394 (Item 6 above) to obtain the total consumption rate of 1.25E+07 kg/yr for the population. The sport fishing consumption rate of 3.77E+05 kg/yr (Item 10) is subtracted from this total consumption rate to estimate the commercial fish consumption rate of 1.21E+07 kg/yr.

FSAR Tables 11.2-203 and 11.2-204 will be revised in a future COLA revision to show a detailed breakdown of the calculated individual and population doses by pathway and organs, as shown in the COLA Revisions section below.

References for the Response:

1. NUREG-1437, Supplement 15, *Appendix E, Applicant's Environmental Report, Operating License Renewal Stage, Virgil C. Summer Nuclear Station,* Jenkinsville, South Carolina, August 2002.

2. NUREG/CR-4013, *LADTAP II – Technical Reference and User Guide*, Prepared for the U. S. Nuclear Regulatory Commission (NRC) by Pacific Northwest Laboratory, April 1986.

3. *The 100 Largest Public Water Supplies in South Carolina – 2005*, State of South Carolina, Department of Natural Resources, Water Resources, Land, Water and Conservation Division, Water Resources Report 37, 2005. Retrieved from http://www.dnr.sc.gov/water/admin/pubs/pdfs/Report%2037%20Largest%20Users.pdf.

4. United States Department of Agriculture, National Agricultural Statistics Service, 2002 Census of Agriculture: http://www.nass.usda.gov/census/census02/volume1/us/st99_2_009_009.pdf http://www.nass.usda.gov/census/census02/volume1/us/st99_2_010_010.pdf

5. United States Environmental Protection Agency, WWW site: http://www.epa.gov/fedrgstr/EPA-WATER/1999/March/Day-04/w5381.htm.

6. United States Census Bureau, State and County Quick Facts WWW site: http://quickfacts.census.gov/qfd/states/45000.html.

7. United States Department of Agriculture, National Agricultural Statistics Service, interactive web site for U.S. and State Crops, South Carolina, State-Vegetables, 34 major vegetables, 2005 and 2006: http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp.

8. United States Department of Agriculture, National Agricultural Statistics Service, interactive web site http://www.nass.usda.gov/Statistics_by_State/South_Carolina/Publications/County_Estimates/Apple06-Bul.pdf and Peaches06-Bul.pdf.

9. United States Department of Agriculture, Integrated Pest Management Center web site: http://www.ipmcenters.org/CropProfiles/docs/scleafygreens.pdf.

10. *Milk Production, Disposition, and Income, 2006 Summary,* United States Department of Agriculture, National Agricultural Statistics Service, April 2007: http://usda.mannlib.cornell.edu/usda/nass/MilkProdDi//2000s/2007/MilkProdDi-04-27-2007.pdf.

11. *South Carolina Agricultural Statistics, Crops, Livestock, and Poultry, 2005-2007,* United States Department of Agriculture, National Agricultural Statistics Service: http://www.nass.usda.gov/Statistics_by_State/South_Carolina/Publications/Annual_Statistical_Bulletin/index.asp.

12. United States Geological Survey website, National Water Information Service, water data interactive site: http://waterdata.usgs.gov/nwis/annual?site_no=02161000&agency_cd=USGS&por_02161000_1=1098368,00060,1,1897,2006&year_type=W&partial_periods=on&referred_module=sw&format=rdb.

13. State of South Carolina Statistical Abstract, Recreation and Tourism, Chapter 15, Table 7. http://ors2.state.sc.us/abstract/chapter15/recreation7.asp.

This response is PLANT SPECIFIC.

ASSOCIATED VCSNS COLA REVISIONS:

Proposed replacement FSAR Tables 11.2-203 and 11.2-204 are attached. Furthermore, FSAR Table 11.2-202 will be revised to reflect the commercial fishing harvest of 1.21E+07 kg/yr, as described above.

ASSOCIATED ATTACHMENTS:

FSAR Tables 11.2-203 and 11.2-204

Table 11.2-203
Annual Individual Doses from Liquid Effluents (per Unit)

	Adult Dose (mrem/yr)							
Pathway	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
Fish		1.7E-02	2.9E-02	2.1E-02	2.2E-03	9.9E-03	3.4E-03	2.3E-03
Drinking		3.7E-04	1.1E-02	1.1E-02	1.5E-02	1.1E-02	1.0E-02	1.3E-02
Shoreline	2.5E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05
Irrigated Vegetables		2.1E-03	1.0E-02	9.5E-03	9.5E-03	8.7E-03	7.6E-03	2.1E-02
Irrigated Leafy Vegetables		2.6E-04	1.3E-03	1.2E-03	1.7E-03	1.1E-03	9.4E-04	2.6E-03
Irrigated Milk		1.5E-03	7.0E-03	6.3E-03	7.9E-03	5.3E-03	4.7E-03	4.7E-03
Irrigated Meat		2.2E-03	1.9E-03	2.0E-03	1.7E-03	5.5E-03	1.6E-03	1.3E-01
Total	2.5E-05	2.3E-02	6.0E-02	5.1E-02	3.8E-02	4.1E-02	2.9E-02	1.7E-01

	Teen Dose (mrem/yr)							
Pathway	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
Fish		1.7E-02	3.0E-02	1.2E-02	2.0E-03	1.0E-02	3.9E-03	1.7E-03
Drinking		3.6E-04	7.7E-03	7.4E-03	1.1E-02	7.5E-03	7.3E-03	9.1E-03
Shoreline	1.4E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04
Irrigated Vegetables		3.5E-03	1.4E-02	1.1E-02	1.2E-02	1.1E-02	9.5E-03	2.6E-02
Irrigated Leafy Vegetables		2.4E-04	9.3E-04	7.4E-04	1.3E-03	7.5E-04	6.4E-04	1.8E-03
Irrigated Milk		2.7E-03	1.0E-02	7.5E-03	1.1E-02	7.2E-03	6.3E-03	6.0E-03
Irrigated Meat		1.8E-03	1.2E-03	1.2E-03	1.0E-03	4.2E-03	9.5E-04	8.1E-02
Total	1.4E-04	2.6E-02	6.4E-02	4.0E-02	3.9E-02	4.1E-02	2.9E-02	1.3E-01

Table 11.2-203
Annual Individual Doses from Liquid Effluents (per Unit)

(Continued)

	Child Dose (mrem/yr)							
Pathway	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
Fish		2.2E-02	2.6E-02	4.9E-03	2.1E-03	8.5E-03	3.1E-03	7.6E-04
Drinking		1.0E-03	1.5E-02	1.4E-02	2.4E-02	1.4E-02	1.4E-02	1.6E-02
Shoreline	2.9E-05	2.5E-05	2.5E-05	2.5E-05	2.5E-05	2.5E-05	2.5E-05	2.5E-05
Irrigated Vegetables		8.3E-03	2.2E-02	1.6E-02	2.1E-02	1.8E-02	1.5E-02	2.8E-02
Irrigated Leafy Vegetables		4.3E-04	1.1E-03	7.9E-04	1.7E-03	9.0E-04	7.6E-04	1.4E-03
Irrigated Milk		6.4E-03	1.7E-02	1.0E-02	2.0E-02	1.2E-02	9.9E-03	9.2E-03
Irrigated Meat		3.4E-03	1.4E-03	1.6E-03	1.3E-03	5.5E-03	1.2E-03	5.0E-02
Total	2.9E-05	4.1E-02	8.2E-02	4.8E-02	7.0E-02	5.9E-02	4.4E-02	1.0E-01

	Infant Dose (mrem/yr)							
Pathway	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
Fish		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Drinking		1.1E-03	1.5E-02	1.4E-02	2.9E-02	1.4E-02	1.4E-02	1.5E-02
Shoreline		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Total	0.0E+00	1.1E-03	1.5E-02	1.4E-02	2.9E-02	1.4E-02	1.4E-02	1.5E-02

	Maximum Dose (mrem/yr)[a]							
	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
Dose	1.4E-04	4.1E-02	8.2E-02	5.1E-02	7.0E-02	5.9E-02	4.4E-02	1.7E-01
Age Group	Teen	Child	Child	Adult	Child	Child	Child	Adult

(a) Doses meet 10 CFR 50, Appendix I limits of 3 mrem for total body and 10 mrem for any organ

Table 11.2-204

Annual Population Doses from Liquid Effluents (per Unit)

	Population Dose (person-rem/yr)							
Pathway	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
Sport Fishing		3.7E-01	6.0E-01	3.7E-01	2.8E-02	2.0E-01	7.2E-02	3.8E-02
Commercial Fishing		3.3E+00	5.4E+00	3.3E+00	1.6E-01	1.8E+00	6.5E-01	3.3E-01
Drinking		7.3E-02	1.7E+00	1.7E+00	2.2E+00	1.7E+00	1.6E+00	2.0E+00
Hydrosphere Tritium		0.0E+00	7.7E-03	7.7E-03	7.7E-03	7.7E-03	7.7E-03	7.7E-03
Shoreline	7.5E-03			6.4E-03	6.4E-03			
Swimming				1.6E-05	1.6E-05			
Boating				7.7E-05	7.7E-05			
Irrigated Vegetables		4.1E-03	1.6E-02	1.4E-02	1.1E-02	1.3E-02	1.2E-02	2.7E-02
Irrigated Leafy Vegetables		9.0E-04	3.8E-03	3.4E-03	5.1E-03	3.2E-03	2.8E-03	7.4E-03
Irrigated Milk		5.7E-03	2.0E-02	1.5E-02	2.1E-02	1.4E-02	1.2E-02	1.2E-02
Irrigated Meat		4.3E-02	3.1E-02	3.4E-02	2.8E-02	9.8E-02	2.6E-02	2.0E+00
Total	7.5E-03	3.8E+00	7.8E+00	5.4E+00	2.4E+00	3.8E+00	2.4E+00	4.4E+00