

J. A. "Buzz" Miller
Senior Vice President
Nuclear Development

**Southern Nuclear
Operating Company, Inc.**
42 Inverness Center Parkway
Post Office Box 1295
Birmingham, Alabama 35201
Tel 205.992.5754
Fax 205.992.6165



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U.S. Nuclear Regulatory Commission
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Southern Nuclear Operating Company
Vogtle Electric Generating Plant Units 3 and 4 Combined License Application
Response to Request for Additional Information Letter No. 021

Ladies and Gentlemen:

By letter dated March 28, 2008, Southern Nuclear Operating Company (SNC) submitted an application for combined licenses (COLs) for proposed Vogtle Electric Generating Plant (VEGP) Units 3 and 4 to the U.S. Nuclear Regulatory Commission (NRC) for two Westinghouse AP1000 reactor plants, in accordance with 10 CFR Part 52. During the NRC's detailed review of this application, the NRC identified a need for additional information, involving radiation protection, required to complete their review of the COL application's Final Safety Analysis Report (FSAR) Section 12.4, "Dose Assessment." By letter dated December 19, 2008, the NRC provided SNC with Request for Additional Information (RAI) Letter No. 021 concerning this radiation protection information need. This RAI letter contains three RAI questions numbered 12.03-12.04-1, -2 and -3. The enclosure to this letter provides the SNC response to these RAIs.

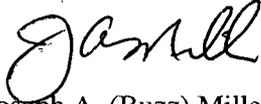
If you have any questions regarding this letter, please contact Mr. Wes Sparkman at (205) 992-5061.

DO92
NRO

Mr. J. A. (Buzz) Miller states he is a Senior Vice President of Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company and to the best of his knowledge and belief, the facts set forth in this letter are true.

Respectfully submitted,

SOUTHERN NUCLEAR OPERATING COMPANY



Joseph A. (Buzz) Miller

Sworn to and subscribed before me this 16 day of January, 2009

Notary Public: Glenn H. Bowie

My commission expires: 05/06/09

JAM/BJS/lac

Enclosure: Response to NRC RAI Letter No. 021 on the VEGP Units 3 & 4 COL Application Involving Radiation Protection

cc: Southern Nuclear Operating Company

Mr. J. H. Miller, III, President and CEO (w/o enclosure)
Mr. J. T. Gasser, Executive Vice President, Nuclear Operations (w/o enclosure)
Mr. T. E. Tynan, Vice President - Vogtle (w/o enclosure)
Mr. D. M. Lloyd, Vogtle Deployment Director
Mr. C. R. Pierce, Vogtle Development Licensing Manager
Mr. M. J. Ajluni, Nuclear Licensing Manager
Mr. W. A. Sparkman, COL Project Engineer
Document Services RTYPE: AR01.1053
File AR.01.02.06

Nuclear Regulatory Commission

Mr. L. A. Reyes, Region II Administrator (w/o enclosure)
Ms. S. M. Coffin, AP1000 Manager of New Reactors (w/o enclosure)
Mr. C. J. Araguas, Lead Project Manager of New Reactors
Mr. B. Hughes, Project Manager of New Reactors
Mr. R. G. Joshi, Project Manager of New Reactors
Ms. T. E. Simms, Project Manager of New Reactors
Mr. B. C. Anderson, Project Manager of New Reactors
Mr. M. M. Comar, Project Manager of New Reactors
Mr. W. F. Burton, Chief – Environmental Technical Support
Mr. M. D. Notich, Environmental Project Manager
Mr. J. H. Fringer, III, Environmental Project Manager
Mr. G. J. McCoy, Senior Resident Inspector of VEGP

Georgia Power Company

Mr. O. C. Harper, IV, Vice President, Resource Planning and Nuclear Development (w/o enclosure)

Oglethorpe Power Corporation

Mr. M. W. Price, Executive Vice President and Chief Operating Officer (w/o enclosure)

Municipal Electric Authority of Georgia

Mr. C. B. Manning, Jr., Senior Vice President, Participant and Corporate Affairs (w/o enclosure)

Dalton Utilities

Mr. D. Cope, President and Chief Executive Officer (w/o enclosure)

Bechtel Power Corporation

Mr. J. S. Prebula, Project Engineer (w/o enclosure)
Mr. R. W. Prunty, Licensing Engineer

Tetra Tech NUS, Inc.

Ms. K. K. Patterson, Project Manager

Shaw Stone & Webster, Inc.

Mr. K. B. Allison, Project Manager (w/o enclosure)
Mr. J. M. Oddo, Licensing Manager
Mr. D. C. Shutt, Licensing Engineer

Westinghouse Electric Company, LLC

Mr. N. C. Boyter, Vice President, AP1000 Vogtle 3 & 4 Project (w/o enclosure)
Mr. J. L. Whiteman, Principal Engineer, Licensing & Customer Interface

Southern Nuclear Operating Company

ND-09-0005

Enclosure

**Response to NRC RAI Letter No. 021
on the VEGP Units 3 & 4 COL Application
Involving
Radiation Protection**

FSAR Section 12.4, Dose Assessment

eRAI Tracking Nos. 1748, 1751 and 1752

NRC RAI Number 12.03-12.04-1:

Vogtle COL FSAR Section 12.4.1.9 provides a description of the potential sources of exposure to construction workers. The dose limits to the workers are reviewed by the staff to ensure compliance with 10 CFR 20.1301. 10 CFR 20.1301 (a)(1) states "Each licensee shall conduct operations so that the total effective dose equivalent to individual members to the public from the licensed operation does not exceed 0.1 rem (1 mSv) in a year."

Review of related Vogtle SCOL documents to support an independent assessment of compliance with the regulations, requires the staff to request additional information to make a determination of reasonable assurance. The supplemental information item VEGP SUP 12.4-1 provides information regarding dose to construction workers in the new FSAR Subsection 12.4.1.9 (Subsections 12.4.1.9.1 through 12.4.1.9.4). The information provided in FSAR Section 12.4.1.9.1-4 is not sufficient for the staff to validate and verify the estimated doses for Unit 3 and 4 construction workers. NRC staff is unable to make a determination that the application meets the acceptance criteria in SRP 12.3-4 and complies with the dose limits to a member of the public in 10 CFR 20.1301 and 1302.

The SCOL applicant used two years of environmental monitoring data (TLD measurements) to evaluate the potential direct radiation dose to construction workers associated with Units 1 and 2 operations. Provide the rationale as to why this two- year data set is representative of the average annual dose that would be received by a construction worker at this location. If the applicant has determined that the data set is applicable, describe the detection level and error bounds for doses based on the TLD measurements. Provide the information necessary to reproduce the calculations or reference where the information was obtained so that it is available to the staff to make an independent determination of construction worker dose estimates. Revise FSAR Section 12.4, as appropriate, to include the necessary information (e.g., rationale for using one year TLD data).

SNC Response:

The VEGP Units 1 and 2 TLD data from 2003 was used to calculate the estimated direct radiation dose to construction workers because it was the most complete and representative data set at the time the Vogtle Early Site Permit Application (ESPA) was submitted. The VEGP Units 3 and 4 COL Application discussion of construction worker's radiation exposure was first presented in the Vogtle ESPA Environmental Report. This data set from 2003 was determined to be representative because of the plant capacity factor of 95 percent for that year and the location of the TLD measurements at the protected area fence-line nearest the proposed construction site. The TLD data set for 2003 included the semi-annual TLD measurement results from the chosen locations (close to the construction site) and the quarterly TLD measurement results at the background levels, therefore the data for 2003 was determined to be the most complete. Evaluations using more recent TLD data from 2006 yield similar results to the 2003 TLD data (see Reference 1). The TLD measurements used to determine the dose estimate for construction workers is available in Southern Nuclear Operating Company (SNC) correspondence to the NRC, References 1, 2 and 3.

The TLD data used to estimate radiation exposure to construction workers is part of the VEGP Units 1 and 2 Radiological Environmental Monitoring Program. These TLDs are processed and evaluated by a dosimetry processor in accordance with 10 CFR 20.1501(c).

References:

1. Southern Nuclear Operating Company, Inc. (Southern). 2007a. Vogtle Early Site Permit Application Environmental Site Audit Information Needs - 2nd Round. Letter Report AR-07-0924 from Southern Nuclear Operating Company (Birmingham, Alabama) to the U.S. Nuclear Regulatory Commission (Washington, D.C.), May 10, 2007. Southern Company, Birmingham, Alabama. Accession No. **ML071510102**.
2. Southern Nuclear Operating Company, Inc. (Southern). 2007b. Southern Nuclear Operating Company, Vogtle Early Site Permit Application, Response to Requests for Additional Information on the Environmental Report. Letter report AR-07-0061 from Southern Nuclear Operating Company (Birmingham, Alabama) to the U.S. Nuclear Regulatory Commission (Washington D.C.), January 31, 2007. Southern Company, Birmingham, Alabama. Accession No. **ML070460323**.
3. Southern Nuclear Operating Company, Inc. (Southern). 2004a. Offsite Dose Calculation Manual for Southern Nuclear Operating Company Vogtle Electric Generating Plant, Version 22 June 25, 2004, Southern Company, Birmingham, Alabama. Accession No. **ML070360150**.

Associated VEGP COL Application Revisions:

COLA Part 2, FSAR Chapter 12, Subsection 12.4.1.9.3.1 will be revised to add the following to Units 1 and 2 External Radiation Exposure, at the beginning of the first paragraph:

“TLD data from 2003 is representative of annual results from Units 1 and 2, based on the completeness of the data set and having operated with a 95 percent plant capacity factor for that year.”

NRC RAI Number 12.03-12.04-2:

Vogtle COL FSAR section 12.4.1.9 provides a description of the potential sources of exposure to construction workers. The dose limits to the workers are reviewed by the staff to ensure compliance with 10CFR20.1301. 10 CFR 20.1301 (a)(1) states “Each licensee shall conduct operations so that the total effective dose equivalent to individual members to the public from the licensed operation does not exceed 0.1 rem (1 mSv) in a year.”

Review of related Vogtle SCOL documents to support an independent assessment of compliance with the regulations requires the staff to request additional information to make a determination of reasonable assurance. The supplemental information item VEGP SUP 12.4-1 provides information regarding dose to construction workers in the new FSAR Subsection 12.4.1.9 (Subsections 12.4.1.9.1 through 12.4.1.9.4). The information provided in FSAR Section 12.4.1.9.1-4 is not sufficient for the staff to validate and verify the estimated doses for Unit 3 and 4 construction workers. NRC staff is unable to make a determination that the application meets the acceptance criteria in SRP 12.3-4 and complies with the dose limits to a member of the public as specified in 10 CFR 20.1301 and 1302.

In FSAR section 12.4, the applicant addresses the direct dose component from Unit 3 to Unit 4 construction workers. The dose presented is based on an assumption that the Unit 3 dose to a Unit 4 construction worker would be 1/2 that determined from Units 1 and 2, which is based on TLD data. The applicant has not provided sufficient information to substantiate this assumption. The SCOL applicant should describe the basis for the estimated dose contribution from Unit 3 to a Unit 4 construction worker

and/or provide an explanation of the sources of that dose. The applicant should include the applicability of radiation sources and the different location for Unit 4 construction workers as opposed to Unit 3 construction workers relative to their distance from Units 1 and 2.

The SCOL applicant's description of external exposure to the construction workers for Unit 3 includes a 15 millirem per year contribution from the Independent Spent Fuel Storage Installation (ISFSI). However, the dose to construction workers for Unit 4 does not include this ISFSI dose contribution. The applicant only states that the ISFSI will be placed west of Unit 2 and does not provide any other specific information that is necessary for evaluating the ISFSI dose contribution to Unit 3 and 4 construction workers. Please provide a detailed description of where the ISFSI is to be placed and/or update Figure 1.1-202 to identify its intended placement. The applicant is also requested to describe the basis used for estimating the dose contribution from the proposed ISFSI.

SNC Response:

The source and bases of the TLD measurements used to estimate the dose to VEGP Units 3 and 4 construction workers from VEGP Units 1 and 2 is identified in the previous response (see RAI 12.03-12.04-1 discussion). The TLD measurements from the existing units (3625 MWt each) were estimated to be 33.5 mrem per year per unit. It is recognized that the distance from Units 1 and 2 to the construction workers is greater than the distance from the 3400 MWt Unit 3 to the construction workers on Unit 4.

For Unit 3, the radiation exposure at the site boundary is considered in DCD Subsection 12.4.2, which is incorporated by reference into the FSAR. As stated in that section and as concluded by the staff in the AP1000 Final Safety Evaluation Report (NUREG 1793), direct radiation from the containment and other plant buildings is negligible. Additionally, there is no contribution from refueling water since the refueling water is stored inside the containment instead of in an outside storage tank. Therefore, the direct radiation to Unit 4 construction workers from Unit 3 is negligible. For conservatism, the annual dose to a Unit 4 construction worker from Unit 3 direct radiation was assumed to be the same as the contribution from one existing unit (i.e., 1/2 that determined from Units 1 and 2).

The Independent Spent Fuel Storage Installation (ISFSI) area is currently shown on FSAR Figure 1.1-202. Subsection 12.4.1.9.2.1 provides the general locator description that it is west of Unit 2. To be more specific, it is the fenced-in area shown immediately south of the new proposed switchyard and north of the Unit 3 footprint. Given that information, SNC does not plan to update Figure 1.1-202 at this time due to the fact that there are currently plans to relocate the ISFSI area to a location significantly further from the construction site. This new location will result in lower doses to the construction workers and therefore, the current estimates are conservative.

For consistency in describing the dose contributions of the ISFSI to construction workers as presented in the Early Site Permit Application (ESPA), the basis of the evaluation is contained in ESPA Environmental Report RAI E4.5.3-1 response (Reference 1).

Reference:

1. Southern Nuclear Operating Company, Inc. (Southern). 2007b. *Southern Nuclear Operating Company, Vogtle Early Site Permit Application, Response to Requests for Additional Information on the Environmental Report*. Letter report AR-07-0061 from Southern Nuclear Operating Company (Birmingham, Alabama) to the U.S. Nuclear Regulatory Commission (Washington D.C.), January 31, 2007. Southern Company, Birmingham, Alabama. Accession No. **ML070460323**.

NRC RAI Number 12.03-12.04-3:

Vogtle COL FSAR section 12.4.1.9 provides a description of the potential sources of exposure to construction workers. The dose limits to the workers are reviewed by the staff to ensure compliance with 10CFR20.1301. 10 CFR 20.1301 (a)(1) states "Each licensee shall conduct operations so that the total effective dose equivalent to individual members to the public from the licensed operation does not exceed 0.1 rem (1 mSv) in a year."

The supplemental information item VEGP SUP 12.4-1 provides information regarding dose to construction workers in the new FSAR Subsection 12.4.1.9 (Subsections 12.4.1.9.1 through 12.4.1.9.4). The information provided in FSAR section 12.4.1.9.1-4 was not sufficient for the staff to validate and verify the estimated doses for Unit 3 and 4 construction workers. NRC staff is unable to make a determination that the application meets the acceptance criteria in SRP 12.3-4 and complies with the dose limits to a member of the public specified in 10 CFR 20.1301 and 1302.

- a. The Vogtle Units 3 & 4 COL FSAR appears to use the offsite dose calculations provided by the ODCM to estimate doses to the onsite construction workers from gaseous effluents. It should be recognized that construction workers may be located inside the site boundary (i.e., closer to release points). Please provide information that demonstrates that the doses based on site boundary dispersion parameters are conservative. Also describe the methodology for calculating the dose to the maximally exposed individual (construction worker) from this source.
- b. The Vogtle Units 3 & 4 COL FSAR assumptions for construction worker dose from liquid effluents appear to assume that the workers receive the same dose as that modeled for an off-site member of the public (i.e., drinking water and fish pathway). Please provide assumptions and explanation as to the applicability of these effluent doses to the construction workers. Also, the applicant should provide an explanation for omitting the estimated dose to the construction workers due to the liquid effluent interconnects between Units 3 and 4.
- c. The Vogtle Units 3 & 4 COL FSAR Section 12.4.1.9.2.2 includes a discussion of releases from Units 1 and 2 indicating that dose calculations for construction workers from particulates are limited to those with half-lives greater than 8 days. The 8-day half-life is a 10 CFR 50, Appendix I criterion; it does not appear to be applicable to dose calculation for construction workers. SCOL applicant should provide clarification, additional calculations and/or remove from the discussion from this COL FSAR section.

SNC Response:

- a. As indicated in FSAR Subsection 12.4.1.9.3.2, the atmospheric pathway doses to Units 3 and 4 construction workers were calculated using GASPARE. The actual Units 1 and 2 releases from 2002, the maximum calculated dose year among the years 2001-2004, were simulated with the distance and direction from the existing units to the new units' construction workers being 0.36 miles to the west-southwest (Units 1 and 2 releases to Unit 3 construction workers) and 0.52 miles to the west (Units 1 and 2 releases to Unit 4 construction workers). The former yielded higher doses and was used to represent the dose to all new units' construction workers from normal gaseous releases from the existing units.

Atmospheric pathway doses from an assumed operating Unit 3 on Unit 4 construction workers was simulated by using the DCD values for normal gaseous release activities from one new unit. The exposed Unit 4 construction workers were taken to be 0.15 miles west-southwest clockwise through west-northwest of the Unit 3 releases. Of those directions, the west direction was found to result in the maximum exposure and was used to represent the dose to Unit 4 construction workers from normal Unit 3 gaseous releases.

All releases and receptors were conservatively modeled as ground-level, with no receptor shielding. The offsite Maximally Exposed Individual (MEI) was not considered in determining dose to the construction worker from the gaseous effluent pathway.

- b. The Units 3 and 4 construction worker liquid pathway dose was conservatively assumed the same as the offsite MEI (Maximally Exposed Individual). The offsite MEI is assumed to obtain drinking water and fish for consumption downstream of the liquid effluent release from Units 1-4 to the Savannah River. In reality, the source of worker onsite drinking water is not from the river and will be unaffected by normal-liquid releases from the site.

Each of Units 3 and 4 has a dedicated liquid radwaste line. The only potential liquid effluent interconnect between Units 3 and 4 is where these lines join the outfall, just prior to the discharge to the river. During the course of construction when the interconnect is made, operating procedures, radiation controls, and trained individuals will be utilized to perform this work activity such that potential contact with the Unit 3 liquid effluent system will be managed appropriately.

- c. As noted in the response to part a above, the actual radioactive releases from VEGP Units 1 and 2 were used to simulate the atmospheric pathway exposure of Units 3 and 4 construction workers to normal gaseous releases from the existing units. The existing units' radioactive releases are given in their Annual Radioactive Release Reports. Those reports meet the requirements of 10 CFR 50, Appendix I and Regulatory Guide 1.21. The data from the Annual Radioactive Release Reports is based on gross radioactivity measurements, which are often the only practical means of continuous monitoring. The gross radioactivity measurements are acceptable when they are a small fraction of the 10 CFR 20 applicable limits, that is, when they are so low as to be insignificant contributors to exposure. The gross radioactivity measurements are not subject to any half-life limit and measurements are made as soon as practicable after collection to minimize loss of short-lived radionuclides by decay.

Because of in-plant control measures, e.g., system holdups such as gaseous and solid waste storage (decay) tanks, short-lived radionuclides are insignificant contributors to exposure. This is demonstrated by the existing units' gross gamma and beta measurements, which are (for the years investigated for this analysis indicated in part a above) at least five orders of magnitude less than the applicable limits.