February 12, 2008

Mr. Jeffery B. Archie
Vice President, Nuclear Plant Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
Post Office Box 88
Jenkinsville, South Carolina 29065

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION LEAD TEST ASSEMBLY ENVIRONMENTAL ASSESSMENT (TAC NO. MD5699)

Dear Mr. Archie:

Enclosed is a copy of the Environmental Assessment and Finding of No Significant Impact related to your application dated May 31, 2007, as supplemented on October 11, 2007, for an extension of exemptions that were issued on January 14, 2005. Those exemptions allowed operation with up to four lead test fuel assemblies (LTAs) containing fuel rods with Optimized ZIRLO™ and AXIOM™ fuel rod cladding, up to a burnup of 62,000 megawatt days/metric ton uranium (MWd/MTU). The extended exemptions would allow one LTA containing fuel rods that are all clad with Optimized ZIRLO™ cladding or one LTA containing both Optimized ZIRLO™ and AXIOM™ fuel rod cladding to continue to be irradiated up to a burnup of 75,000 MWd/MTU.

Your requests for exemptions related to the regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) 50.44, "Combustible gas control for nuclear power reactors," 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and 10 CFR 50, Appendix K, "ECCS Evaluation Models." The regulations in 10 CFR 50.44 were revised in 2003 so that they do not refer to specific types of zirconium cladding (68 FR 54123, September 16, 2003). Accordingly, the Nuclear Regulatory Commission staff is not issuing an exemption from 10 CFR 50.44 because the revisions to 10 CFR 50.44 noted above remove the need for such an exemption. This was discussed with your staff on January 17, 2008.

The assessment is being forwarded to the Office of the Federal Register for publication.

Sincerely,

/RA/

Robert E. Martin, Senior Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-395

Enclosure: As stated

cc w/encl: See next page

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UNITED STATES NUCLEAR REGULATORY COMMISSION

SOUTH CAROLINA ELECTRIC & GAS COMPANY

DOCKET NO. 50-395

VIRGIL C. SUMMER NUCLEAR STATION

ENVIRONMENTAL ASSESSMENT AND FINDING OF

NO SIGNIFICANT IMPACT

The U.S. Nuclear Regulatory Commission (NRC) is considering issuance of an exemption from Title 10 of the *Code of Federal Regulations*, Part 50, (10 CFR), Section 50.46, “Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors,” (10 CFR 50.46) and 10 CFR 50, Appendix K, “ECCS Evaluation Models,” (Appendix K) for the Renewed Facility Operating License No. NPF-12, issued to South Carolina Electric & Gas Company (SCE&G, the licensee), for operation of the Virgil C. Summer Nuclear Station (VCSNS), located in Fairfield County, South Carolina. Therefore, as specified in 10 CFR 51.21, the NRC has performed an environmental assessment as described in this notice and has made a finding of no significant impact.

The action proposed by the licensee also included a request for an exemption from 10 CFR Section 50.44, “Combustible gas control for nuclear power reactors,” (10 CFR 50.44). The proposed exemption from 10 CFR 50.44 is not being considered further by the NRC staff because revisions to 10 CFR 50.44 (68 FR 54123, dated September 16, 2003), such that it does not refer to specific types of zirconium cladding, remove the need for such an exemption.

ENVIRONMENTAL ASSESSMENT

Identification of the Proposed Action:

The proposed action would allow a third cycle of irradiation (i.e., burnup) for one lead test assembly (LTA) containing fuel rods with advanced cladding alloys. This third cycle of irradiation is expected to begin in the Cycle 18 core for VCSNS in the spring of 2008. An exemption previously issued by the NRC on January 14, 2005, authorized the use of four LTAs up to a lead rod average burnup limit of 62,000 megawatt days per metric ton uranium (MWd/MTU). The cladding in two of those four LTAs is entirely Optimized ZIRLO™ cladding. Each of the other two LTAs uses sixteen fuel rods with AXIOM™ cladding with the remainder of the rods using Optimized ZIRLO™ cladding. Based upon the results of examinations of these four LTAs during the VCSNS Cycle 17/18 refueling outage, the licensee may select either one of the Optimized ZIRLO™ LTAs or one of the LTAs containing both Optimized ZIRLO™ plus AXIOM™ cladding for the third cycle of irradiation. The third cycle of irradiation is expected to take the LTA from a burnup of about 55,000 up to 75,000 MWd/MTU. The burnup limits are not part of the technical specifications (TS), but are design bases limits, and limit the current fuel rod-average burnup to less than or equal to 62,000 MWd/MTU. The proposed action is in accordance with the licensee's application dated May 31, 2007, as supplemented by letter dated October 11, 2007. Also, information in the licensee's letters dated September 3 and November 11, 2004, that supported the exemption previously issued on January 14, 2005, has been considered in this action.

The Need for the Proposed Action:

As the licensee states in its letter dated September 3, 2004, "As the nuclear industry pursues longer operating cycles with increased fuel discharge burnups and more aggressive fuel management, corrosion performance requirements for nuclear fuel

cladding become more demanding. In addition, fuel rod internal pressures (resulting from increased fuel duty, use of integral fuel burnable absorbers (IFBAs) and corrosion/temperature feedback effects) have become more limiting with respect to fuel rod design criteria. Available industry data [. . .] indicate the corrosion resistance improves for cladding with a lower tin content," and "In addition, developmental testing has shown that small additions of some alloying elements will further improve the corrosion resistance, microstructure and mechanical properties of the cladding," and "To meet these needs, Westinghouse Electric Company has developed a lead test assembly program in cooperation with the V. C. Summer Nuclear Station. One element of the program is use of Optimized ZIRLO™ cladding [. . .]" and another element of the program is the use of LTAs with AXIOM™ cladding.

As the licensee states in its application, 10 CFR 50.46 specifically refers to fuel with Zircaloy or ZIRLO™ cladding and does not include Optimized ZIRLO™ or AXIOM™ cladding. Appendix K, paragraph I.A.5, references an analysis that utilizes the Baker-Just equation which assumes use of a zirconium alloy different than the Optimized ZIRLO™ or AXIOM™ cladding used in the LTAs. Therefore, the exemption is needed because the NRC regulations identified above specifically refer to light-water reactors containing fuel consisting of uranium oxide pellets enclosed in zircaloy or ZIRLO™ cladding and the newer zirconium-based alloys of Optimized ZIRLO™ and AXIOM™ are not specifically of the same composition as zircaloy or ZIRLO™. Therefore, the licensee needs an exemption to insert one of the four above mentioned LTAs into the VCSNS reactor core for further irradiation.

Environmental Impacts of the Proposed Action:

The NRC has completed its evaluation of the proposed action and concludes that there are no significant environmental impacts associated with the use of one fuel assembly using either all Optimized ZIRLO™ cladding or a combination of Optimized ZIRLO™ and AXIOM™ cladding for a third cycle of irradiation up to a burnup of 75,000 MWd/MTU. The following is a summary of the staff's evaluation:

In this environmental assessment, the NRC staff is also relying on the results of a study conducted for it by the Pacific Northwest National Laboratory (PNNL) entitled, "Environmental Effects of Extending Fuel Burnup Above 60 GWd/MTU [gigawatt days per metric ton uranium]," (NUREG/CR-6703, PNNL-13257, January 2001). Although the study evaluated the environmental impacts of high burnup fuel up to 75,000 MWd/MTU, certain aspects of the review were limited to evaluating the impacts of extended burnup up to 62,000 MWd/MTU because of the need for additional data about the effect of extended burn-up on gap-release fractions. During the study, all aspects of the fuel-cycle were considered, from mining, milling, conversion, enrichment and fabrication through normal reactor operation, transportation, waste management, and storage of spent fuel.

The staff has concluded that such changes would not adversely affect plant safety, and would have no adverse effect on the probability of any accident. For accidents that involve damage or melting of the fuel in the reactor core, fuel rod integrity has been shown to be unaffected by the extended burnup under consideration; therefore, the probability of an accident will not be affected. For accidents in which the core remains intact, the increased burnup may slightly change the mix of fission products that could be released in the event of a serious accident, however the staff

concludes that the limited number of high burnup fuel rods in one LTA will not result in a significant change during core-wide events.

Accidents that involve the damage or melting of the fuel in the reactor core and spent-fuel handling accidents were also evaluated in NUREG/CR-6703. The accidents considered were a loss-of-coolant accident (LOCA), a steam generator tube rupture, and a fuel-handling accident.

For LOCAs, the amount of radionuclides that would be released from the core (1) is proportional to the amount of radionuclides in the core and (2) is not significantly affected by the gap-release fraction. The gap-release fraction is a small contributor to the amount of radionuclides available for release when the fuel is severely damaged. Any increase in the amount of some longer-lived radionuclides available for release from the single LTA (1) will be small and (2) will not result in a significant increase in the overall core inventory of radionuclides. Therefore, there would be no significant increase in the previously calculated dose from a LOCA and the dose would remain below regulatory limits.

The pressurized-water reactor steam generator tube rupture accident involves direct release of radioactive material from contaminated reactor coolant to the environment. No change is being requested by the licensee in the VCSNS TS pertaining to allowed cooling-water activity concentrations. The maximum coolant activity is regulated through TS that are independent of fuel burnup. Therefore, the gap-release fraction does not significantly affect the amount of radionuclides available for release during a steam generator tube rupture. Therefore, there would be no significant increase in the previously calculated dose from a steam generator tube rupture and the calculated dose would remain below regulatory limits.

The scenario postulated to evaluate potential fuel-handling accidents involves a direct release of gap activity to the environment. The assumptions regarding gap activity are based on guidance in Regulatory Guide 1.25, “Assumptions Used for Evaluating the Potential Radiological Consequences of Fuel Handling Accidents in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors (Safety Guide 25)” and NUREG/CR-5009, “Assessment of the Use of Extended Burnup Fuel in Light Water Power Reactors,“ February 1988; the gap activity consists primarily of noble gases and iodine. The isotopes that contribute significant fractions of the whole body and thyroid doses are ^{87}Kr and ^{131}I, respectively. The inventory of iodine, the primary dose contributor, decreases with increasing burnup. In addition, the single LTA will only contribute a small variation in the isotopic population of the entire VCSNS core (157 assemblies).

The licensee assessed, in its letter dated October 11, 2007, the conservatisms associated with the spent fuel pool decontamination factor, the assembly relative power, the thyroid dose conversion factors, fuel offloading time, the reactor building purge isolation and the likely mechanical damage to a fuel assembly from the fuel handling accident. In summarizing these factors the licensee estimates that the calculated doses for the fuel handling accident would be reduced by approximately 77 percent.
Based on the considerations discussed above, the staff concludes (1) that the increase in the previously calculated dose resulting from a fuel-handling accident involving the one LTA would not be significant and (2) that the dose would remain below regulatory limits.

Regulatory limits on radiological effluent releases are independent of burnup. The requirements of 10 CFR 50.36a and Appendix I to 10 CFR 50 ensure that any release of gaseous, liquid, or solid radiological effluents to unrestricted areas are kept

"as low as reasonably achievable." Therefore, the staff concluded that during routine operations, there will be no significant increase in the amount of gaseous radiological effluents released into the environment as a result of the proposed action, nor will there be a significant increase in the amount of liquid radiological effluents or solid radiological effluents released into the environment.

No significant increase in the allowable individual or cumulative occupational radiation exposure will occur. The impacts to workers is expected to be reduced with higher irradiation due to the need for less frequent outages for fuel changes and less frequent fuel shipments to and from reactor sites.

The use of extended irradiation will not change the potential environmental impacts of incident-free transportation of spent nuclear fuel or the accident risks associated with spent fuel transportation if the fuel is cooled for 5 years after discharge from the reactor. The NUREG/CR-6703 report, concluded that doses associated with incident-free transportation of spent fuel with burnup to 75 GWd/MTU are bounded by the doses given in 10 CFR 51.52, Table S-4, for all regions of the country if dose rates from the shipping casks are maintained within regulatory limits. Increased fuel burnup will decrease the annual discharge of fuel to the spent fuel pool, which will postpone the need to remove spent fuel from the pool.

With regard to potential non-radiological environmental impacts of reactor operation with extended irradiation, the proposed changes involve systems located within the restricted area as defined in 10 CFR 20. Therefore, the proposed action does not result in any significant changes to land use or water use, or result in any significant changes to the quality or quantity of effluents. The proposed action does not affect nonradiological plant effluents, and no changes to the National Pollution Discharge Elimination System permit are needed. No effects on the aquatic or terrestrial habitat in

the vicinity or the plant, or to endangered or threatened species, or to the habitats of endangered or threatened species are expected. The proposed action does not have a potential to affect any historical or archaeological sites.

The proposed action will not change the method of generating electricity or the method of handling any influents from the environment or non-radiological effluents to the environment. Therefore, no changes or different types of non-radiological environmental impacts are expected as a result of the amendments.

Accordingly, the NRC concludes that there are no significant environmental impacts associated with the proposed action.

For more detailed information regarding the environmental impacts of extended fuel burnup, please refer to the study conducted by PNNL for the NRC, which is entitled, "Environmental Effects of Extending Fuel Burnup Above 60 GWd/MTU," (NUREG/CR-6703, PNL-13257, January 2001).

The details of the staff's safety evaluation will be provided in the exemption that will be issued as part of the letter to the licensee approving the exemption to the regulation.

Environmental Impacts of the Alternatives to the Proposed Action:

As an alternative to the proposed action, the staff considered denial of the proposed action (i.e., the "no-action" alternative). Denial of the amendment request would result in no change in current environmental impacts. The environmental impacts of the proposed amendment and this alternative are similar. However, it would deny to the licensee and the NRC operational data on Optimized ZIRLO™ and AXIOM™ LTAs and the performance of fuel at extended burnup conditions.

Alternative Use of Resources:

The action does not involve the use of any different resources than those previously considered in the Final Environmental Statement for the Virgil C. Summer Nuclear Station, NUREG-0719, dated May 1981, or in NUREG-1437, Supplement 15, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 15, Regarding Virgil C. Summer Nuclear Station."

Agencies and Persons Consulted:

In accordance with its stated policy, on December 31, 2007, the staff consulted with the South Carolina State official, R. Mike Gandy of the South Carolina Department of Health and Environmental Control, regarding the environmental impact of the proposed action. The State official had no comments.

FINDING OF NO SIGNIFICANT IMPACT

On the basis of the environmental assessment, the NRC concludes that the proposed action will not have a significant effect on the quality of the human environment. Accordingly, the NRC has determined not to prepare an environmental impact statement for the proposed action.

For further details with respect to the proposed action, see the licensee's letter dated May 31, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML071550105), as supplemented on October 11, 2007 (ADAMS Accession No. ML072890083). Documents may be examined, and/or copied for a fee, at the NRC's Public Document Room (PDR), located at One White Flint North, 1555 Rockville Pike, Rockville, Maryland 20852. Publicly available records will be accessible electronically from the ADAMS Public Electronic Reading Room on the Internet at the NRC Website: http://www.nrc.gov/reading-rm/adams.html. Persons who do not have access to ADAMS or who encounter problems in accessing the documents

located in ADAMS should contact the NRC PDR Reference staff by telephone at 1-800-397-4209 or 301-415-4737, or send an e-mail to pdr@nrc.gov.

Dated at Rockville, Maryland, this 12th day of February, 2008.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/
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