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SCE&G®
A SCANA COMPANY

May 31, 2007
RC-07-0084

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

Dear Sir / Madam:

Subject: VIRGIL C. SUMMER NUCLEAR STATION (VCSNS)
DOCKET NO. 50/395
OPERATING LICENSE NO. NPF-12
REQUEST FOR BURNUP EXTENSION OF EXEMPTION REQUEST

Reference: Letter from K. R. Cotton (NRC) to J. B. Archie (SCE&G), "V. C. Summer Nuclear Station - Exemption from the Requirements of 10 CFR Part 50, Sections 50.44, 50.46, and Appendix K (TAC No. MC4462)," January 14, 2005

South Carolina Electric & Gas (SCE&G) requests a burnup extension of the current exemption for the VCSNS lead test assemblies (LTAs). In the referenced letter of January 14, 2005, the NRC approved the use of up to four LTAs containing fuel rods with Optimized ZIRLO™ and several different developmental clad alloys. Westinghouse has since trademarked these developmental clad alloys as AXIOM™. The NRC approval of the exemption request was contingent on the fuel rod burnup remaining within the applicable licensed limit for ZIRLO™. These LTAs are currently in their second cycle of irradiation. SCE&G proposes to reinsert one of the LTAs with Optimized ZIRLO™ and AXIOM™ fuel rod cladding for a third cycle of irradiation. During the third cycle, this LTA will reach a lead rod average burnup of up to 75,000 MWD/MTU.

There is no specific Technical Specification that imposes a limit on fuel rod burnup; however, the current lead rod average burnup limit for the VCSNS core is 62,000 MWD/MTU. SCE&G requests that the NRC provide approval to extend the exemption request in order to irradiate this LTA beyond the current licensed burnup limit. The reinsertion of the LTA is currently scheduled to occur during the next refueling outage, which is expected to begin in April 2008. Therefore, SCE&G requests that NRC action on this matter be completed on or before December 31, 2007.

Attached is justification for exceeding the fuel rod burnup limit on the VCSNS LTAs.

A001

Should you have any questions, please call Mr. Bruce Thompson (803) 931-5042.

Very truly yours,

Jeffrey B. Archie

JT/JBA/dr
Attachment: Burnup Extension of Exemption Request

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South Carolina Electric & Gas Company (SCE&G)

Burnup Extension of Exemption Request

for

Virgil C. Summer Nuclear Station (VCSNS)

Background

SCE&G inserted four lead test assemblies (LTAs) into the VCSNS Cycle 16 core. The LTAs were identical to the existing fuel assembly design except that the fuel rods were clad in advanced Westinghouse alloys. The cladding material in two of the four LTAs is entirely Optimized ZIRLO™. Each of the other two LTAs incorporates sixteen fuel rods with AXIOM™ alloy cladding with the remainder of the fuel rods using Optimized ZIRLO™ cladding.

During VCSNS refueling outage 16 (RF-16) , the four LTAs were inspected and reinserted into the core. VCSNS is currently operating in Cycle 17 and the next refueling outage (RF-17) is expected to begin in April 2008. During RF-17, the two LTAs containing Optimized ZIRLO™ fuel rod cladding and one of the two AXIOM™ LTAs will be discharged. It is planned to reinsert the remaining AXIOM™ LTA into the Cycle 18 core. If the AXIOM™ LTA shows unexpected results during the refueling outage inspection, one of the LTAs with all Optimized ZIRLO™ cladding will be used instead of the AXIOM™ LTA.

Lead Test Assembly Conditions

The purpose of irradiating the LTA is to evaluate fuel rod and fuel assembly performance at a projected lead rod burnup of less than 75,000 MWD/MTU.

It is proposed that one LTA will be inserted into the VCSNS Cycle 18 core with expected startup in May 2008. The LTA will be located at the center of the core. The LTA lead rod average burnup is estimated to be 55,000 MWD/MTU at the beginning of Cycle 18 and less than 75,000 MWD/MTU at the end of Cycle 18.

The LTA was a typical production fuel assembly with the exception of the fuel rod cladding material. Pre-characterization will be performed during the Cycle 17/18 refueling outage which is expected to begin in April 2008. It will include measurements of cladding oxide, fuel assembly and fuel rod growth, and overall visual examinations. If anomalous behavior is observed or measured characteristics are outside acceptable bounds, the AXIOM™ LTA will not be irradiated in Cycle 18. An LTA with all Optimized ZIRLO™ cladding will then be similarly inspected, and if acceptable, will be substituted.

Additionally, the LTA will be evaluated with current fuel performance methods and codes to ensure that all current design criteria are met for the projected burnup. If all current design criteria are not met, the AXIOM™ LTA will not be irradiated in Cycle 18. An LTA with all Optimized ZIRLO™ cladding will then be similarly evaluated, and if acceptable, will be substituted.

The post irradiation examinations of the LTA after 3 cycles of operation will include measurements of cladding oxide, fuel assembly and fuel rod growth, and overall visual examinations. The post irradiation examinations are expected to begin in January 2010.

Prior to irradiating the LTA in Cycle 18, the LTA will be evaluated with current fuel performance methods and codes to ensure that all current design criteria are met for the projected burnup. If all current design criteria are not met, the AXIOM™ LTA will not be irradiated in Cycle 18. An LTA with all Optimized ZIRLO™ cladding will then be similarly evaluated, and if acceptable, will be substituted.

Justification for Exceeding Fuel Rod Burnup Limit

There is no specific Technical Specification that imposes a limit on fuel rod burnup; however, the current lead rod average burnup limit for the VCSNS core is 62,000 MWD/MTU. In Reference 1 of this attachment, as supplemented by Reference 2, SCE&G requested an exemption to allow the use of up to four LTAs containing fuel rods with Optimized ZIRLO™ and several different developmental clad alloys. These LTAs are currently in their second cycle of irradiation. It is planned to reinsert one of the LTAs with Optimized ZIRLO™ and AXIOM™ fuel rod cladding for a third cycle of irradiation. During the third cycle, this LTA will reach a lead rod average burnup of up to 75,000 MWD/MTU.

The NRC approval of the exemption request (Reference 3) was contingent on the fuel rod burnup remaining within the applicable licensed limit for ZIRLO™. However, the Justification of Exemption (i.e., the exemption is authorized by law; the exemption will not present an undue risk to the health and safety of the public; the exemption is consistent with the common defense and security) and Special Circumstances provided in Reference 1 continue to apply to the LTA with a lead rod average burnup of up to 75,000 MWD/MTU.

Fuel rod design criteria that become more limiting for high burnup fuel rods include fuel rod growth, clad fatigue, rod internal pressure and cladding corrosion. Evaluations have been performed using NRC approved fuel rod design methodologies. These models have been used to perform similar evaluations for other high burnup LTAs. In addition, a developmental corrosion model for ZIRLO™ will be used as an evaluation tool based primarily on data from high burnup fuel and accounts for observed corrosion from the ZIRLO™ clad fuel rods that were examined in previous post-irradiation examination (PIE) campaigns. Both the ZIRLO™ developmental corrosion model and the NRC-approved model will be used in the VCSNS Cycle 18 specific reload safety evaluation to confirm that the fuel rod design limits will be met.

Figure 1 presents the peak oxide measurements for Zircaloy-4, Standard ZIRLO™, and Optimized ZIRLO™ compared to the recent measurements taken of the VCSNS AXIOM™ and Optimized ZIRLO™ LTAs at the end of one cycle of irradiation. Optimized ZIRLO™ shows significantly lower corrosion than Standard ZIRLO™. At burnups above 50 GWd/MTU, the Optimized ZIRLO™ cladding has at least 30-50% lower oxide thickness than the Standard ZIRLO™ cladding. Both AXIOM™ and Optimized ZIRLO™ have similar behavior in VCSNS and hence it is predicted that AXIOM™ cladding will also have lower oxide thickness compared to Standard ZIRLO™ cladding at burnups >70 GWd/MTU.

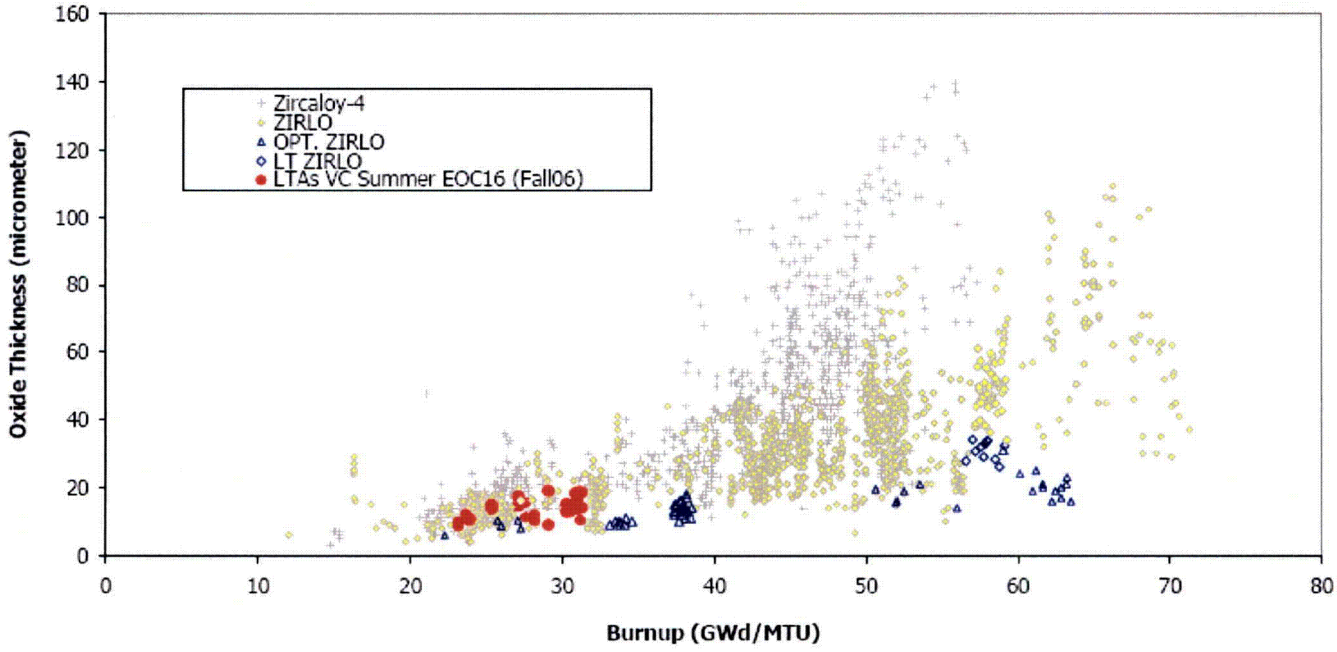

Figure 1 – Peak Oxide Measurements

The Optimized ZIRLO™ and AXIOM™ high burnup fuel rods will continue to meet all current design criteria. The clad integrity of the Optimized ZIRLO™ and AXIOM™ high burnup rods will be maintained as the subject fuel assembly will be placed in a less than limiting core location and will continue to meet the safety parameter requirements. The acceptability of using the Optimized ZIRLO™ and AXIOM™ high burnup rods will be evaluated in the VCSNS Cycle 18 Reload Safety Evaluation. Taking one LTA with Optimized ZIRLO™ and AXIOM™ fuel rods to higher burnup would not result in a safety concern. The assembly will retain a coolable geometry and the plant dose criterion will not be exceeded or approached in the event that the Optimized ZIRLO™ or AXIOM™ high burnup rods fail.

The effects of burnup levels up to 75,000 MWD/MTU on source terms and associated doses are discussed in Reference 4. The assessment concluded that the fuel handling accident (FHA) thyroid doses are not adversely affected by extended burnup. Also, the overall increase in the gamma-body dose is not of consequence, since it is the thyroid dose, not the gamma-body dose that is bounding for the FHA. For accidents other than FHA, even though there are variations in core inventories of isotopes due to extended burnup up to 75,000 MWD/MTU, there are no significant increases of isotopes that are major contributors to accident doses. It is worthy to note that, at higher burnups, there is actually a reduction in certain isotopes that are major dose contributors under accident situations (e.g., Kr-88). With less than 1% of Optimized ZIRLO™ and AXIOM™ high burnup rods in the entire core, any variation of isotopes will be extremely small. Thus, the radiation dose limitations of 10 CFR 100, "Reactor Site Criteria," will not be exceeded. The use of an LTA with Optimized ZIRLO™ and AXIOM™ fuel rods at higher burnup will not result in an increased risk of radiological consequences.

Conclusion

SCE&G is proposing to insert one LTA into a non-limiting core location during VCSNS Cycle 18 for the purpose of obtaining high burnup data. The LTA contains both Optimized ZIRLO™ and AXIOM™ fuel rod cladding. Based on the above assessment, extending the lead rod-average burnup limit to 75,000 MWD/MTU will not create a safety concern, as all fuel design limits will continue to be met.

SCE&G respectfully requests that the NRC approve this burnup extension of the exemption request by December 31, 2007 in order to support VCSNS Cycle 18 operations scheduled to begin in April 2008.

References

1. Letter from J. B. Archie (SCE&G) to U. S. Nuclear Regulatory Commission, "Virgil C. Summer Nuclear Station, Docket No. 50-395, Operating License No. NPF-12, Request for Exemption for Cladding Material Specified in 10CFR50.44, 10CFR50.46 and 10CFR 50 Appendix K," September 3, 2004

2. Letter from J. B. Archie (SCE&G) to U. S. Nuclear Regulatory Commission, "Virgil C. Summer Nuclear Station (VCSNS), Docket No. 50/395, Operating License No. NPF-12, Request for Additional Information – Request for Exemption for Cladding Material Specified in 10CFR50.44 and 10CFR 50 Appendix K," November 11, 2004

3. Letter from K. R. Cotton (NRC) to J. B. Archie (SCE&G), "V. C. Summer Nuclear Station – Exemption from the Requirements of 10 CFR Part 50, Sections 50.55, 50.46, and Appendix K (TAC No. MC4462)," January 14, 2005

4. Davidson, S. L. (Ed.), et al., "VANTAGE + Fuel Assembly Reference Core Report," WCAP-12610-P-A, April 1995