January 17, 2001

Mr. J. A. Scalice
Chief Nuclear Officer and
Executive Vice President
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

SUBJECT: SAFETY EVALUATION OF LOCTA_JR CODE FOR LOSS-OF-COOLANT ACCIDENT ANALYSIS OF FUEL RODS - WATTS BAR NUCLEAR PLANT, UNIT 1, AND SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 (TAC NOS. MA9520, MA9583, MA9584)

Dear Mr. Scalice:

On June 23, 2000, the Tennessee Valley Authority (TVA) submitted the Westinghouse Topical Report WCAP-15409, "Description of the Westinghouse LOCTA_JR 1-D Heat Conduction Code for LOCA Analysis of Fuel Rods," April 2000, for the Nuclear Regulatory Commission (NRC) staff's review and approval. The LOCTA_JR code is used to perform one dimensional radial heat conduction calculations for a fuel rod. The topical report was submitted to the U.S. Nuclear Regulatory Commission (NRC) staff in support of closure of one of the interface items in the NRC staff's report, NUREG-1672, "Safety Evaluation Report related to the Department of Energy's topical report on the tritium production core," May 1999.

The NRC staff has completed its review of the WCAP-15409 topical report and the staff's safety evaluation is provided in the enclosure. The staff finds that the report is acceptable for referencing in licensing analyses and that interface item number 16 in NUREG-1672 is closed. In accordance with customary staff practices, further staff review of the application of the code may occur within the staff's review of plant-specific licensing applications for the code.

Sincerely,

/RA/
Robert E. Martin, Senior Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-390, 50-327, 50-328

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION OF THE LOCTA_JR CODE FOR APPLICATION TO TRITIUM PRODUCING BURNABLE ABSORBER RODS

1.0 INTRODUCTION

On July 30, 1998, the Department of Energy (DOE) submitted a Licensing Topical Report (LTR) entitled "Tritium Production Core." This report described a generic assessment of the use of Tritium Producing Burnable Absorber Rods (TPBAR) in commercial pressurized water reactors (PWRs). DOE is intending to use TPBARs in Tennessee Valley Authority PWRs so the LTR used Westinghouse design and safety analyses methods. During the course of the review the staff noted that the LOCTA_JR code which was being used to evaluate the thermal response of TPBARs to loss-of-coolant accident (LOCA) had not been reviewed and approved for licensing applications. The review of this code was identified as open Item 16 in the U.S. Nuclear Regulatory Commission staff NUREG-1672 safety evaluation approving the DOE LTR for a tritium producing core. A further LTR describing LOCTA_JR, WCAP-15409, “Description of the Westinghouse LOCTA_JR 1-D Heat Conduction Code for LOCA Analysis of Fuel Rods,” April 2000, was prepared and submitted to the staff on June 23, 2000, and this safety evaluation documents the results of the staff's review.

1.1 Description of the Code

LOCTA_JR is derived from the approved LOCTA code which is used to predict fuel rod behavior during a LOCA. Although LOCTA_JR contains models for fuel rod performance, they are not used to analyze TPBARs and were, therefore, not considered in the staff's review. TPBARs are modeled with the thimble tube heatup model which solves the one-dimensional transient conduction and radiation equations. This model relies heavily on the quality of the user input time dependent heat transfer coefficients and surrounding cladding surface temperatures. The thimble tube model allows the specification of one average material in the thimble tube so it only applies to transients with slow heatup rates where one can assume that there is no significant temperature variation within the thimble tube insert.

2.0 DISCUSSION

The governing equations are described in the report. The solution to the heat conduction equations are a straightforward application of accepted methods to solve the radial conduction equations and they need no further discussion (see Reference). The radiation model takes a geometry consisting of a cylinder surrounded by eight cylinders arranged in a regular square pitch and converts it to an equivalent geometry consisting of two concentric cylinders. Appropriate view factors are computed and it is assumed that the surfaces are gray with emmissivities for Zircaloy.

ENCLOSURE

The most significant assumption relative to TPBAR application is that the thimble tube model in LOCTA_JR can only model one homogeneous material. This forces the analyst to define an equivalent material and provide appropriate thermal properties. As noted in the LTR this requires the analyst to make a judgment as to whether the heatup rates are small enough to justify the assumption that there are no significant temperature gradients across the thimble tube insert during the transient. Without the existence of a prior objective criterion for making this judgement, the staff will require justification for the application of this model on a case-by-case basis as it is used in plant-specific applications.

3.0 CONCLUSION

The staff has reviewed the LTR describing LOCTA_JR. This code will be used to predict the thermal behavior of TPBARs during a LOCA. The staff concludes that the LTR provides sufficient information to close the open item 16 in NUREG-1672, but will require that application of LOCTA_JR to TPBAR analysis be justified on a plant-specific basis due to the simplified modeling of thimble tube inserts as a homogeneous material.

4.0 REFERENCE

Incropera and Dewitt, *Introduction to Heat Transfer*, Chapter 5, John Wiley and Sons, 1990.

Principal Contributor: T. Ulses

Date: January 17, 2001

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