January 28, 2010

MEMORANDUM TO: Eric J. Leeds, Director
Office of Nuclear Reactor Regulation

Michael R. Johnson, Director
Office of New Reactors

FROM: Brian W. Sheron, Director ***/RA/***
Office of Nuclear Regulatory Research

SUBJECT: IMPENDING PUBLICATION OF NUREG-1922, "COMPUTATIONAL FLUID DYNAMICS ANALYSIS OF NATURAL CIRCULATION FLOWS IN A PRESSURIZED WATER REACTOR LOOP UNDER SEVERE ACCIDENT CONDITIONS"

I am forwarding for your information the enclosed final version of NUREG-1922, "Computational Fluid Dynamics Analysis of Natural Circulation Flows in a Pressurized-Water Reactor Loop under Severe Accident Conditions," that the Office of Nuclear Regulatory Research (RES) will submit for publication in 2 weeks. The NRC staff has completed this work, and the results have been incorporated into the latest thermal-hydraulic predictions completed by RES in support of Section 3.4 in the steam generator action plan (SGAP). Section 3.4 of the SGAP addresses Advisory Committee on Reactor Safeguards (ACRS) criticism and develops a better understanding of the thermal-hydraulic conditions that can lead to induced failures of the reactor coolant system during severe accidents.

This report documents an updated computational fluid dynamics analysis of the natural circulation flows in a pressurized-water reactor (PWR) loop during specific severe accident conditions. The purpose of the analysis is to expand upon the existing experimental and analytical understanding of the severe accident flows in a PWR loop and to define best-estimate mixing and flow parameters for one-dimensional systems codes such as SCDAP/RELAP5 or MELCOR. The work addresses prior ACRS concerns (ML041420237) regarding the determination of the hot leg flows. The staff agreed with these concerns, and a new model has been developed that improves the technical basis for the hot leg flow rates under severe accident conditions. The ACRS reviewed these latest models during the October 2009 review of the overall SGAP (ML092890375) and referred to the thermal-hydraulic work as "pioneering" and "impressive." Their suggestion for additional validation of the computational methods to further reduce uncertainty in the hottest tube predictions is not considered to be a priority since these uncertainties are not considered to be significant in the overall risk assessment.

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The predictions provide valuable insights into the severe accident natural circulation flows for a Westinghouse PWR. Mixing fractions and other parameters are defined for application to one-dimensional system codes utilized to model the three-dimensional natural circulation flows during a severe accident. These mixing and flow parameters reduce our overall thermal-hydraulic uncertainties and improve the technical basis of the severe accident induced failure predictions. Staff members from the Office of Nuclear Reactor Regulation and the Office of New Reactors have reviewed the report, and their comments have been addressed.

RES has established an on-line quality survey to collect feedback from User Offices on the usefulness of RES products and services. The URL for this survey is sent by the RES Branch Chief responsible for this product/service to (his/her) counterpart(s) in your Office via email. I would appreciate it if you would see that this short -- approximately 5 minutes -- survey is completed by the responsible manager or supervisor, giving your Office's views of the delivered RES (product/service), within the next 10 working days.

Enclosure:
As stated

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