December 19, 2003

MEMORANDUM TO: Farouk Eltawila, Director
Division of Systems Analysis and Regulatory Effectiveness
Office of Nuclear Regulatory Research

FROM: E. William Brach, Director /RA/
Spent Fuel Project Office
Office of Nuclear Material Safety and Safeguards

SUBJECT: USER NEED MEMORANDUM – REQUEST FOR RESEARCH ASSISTANCE TO DEVELOP A THREE-DIMENSIONAL CFD MODEL OF HI-STORM 100 AND TO PERFORM THERMAL-HYDRAULIC ANALYSIS OF THE STORAGE CASK

The Office of Nuclear Material Safety and Safeguards (NMSS) requests assistance from the Office of Nuclear Regulatory Research (RES) regarding the development of a three-dimensional (3-D) FLUENT CFD model of the HI-STORM 100 storage cask. A thermal-hydraulic analysis of the storage cask, based on this 3-D model is also requested.

Background

Currently, the Spent Fuel Project Office (SFPO) is performing the technical review of proposed Amendment No. 2 of Certificate of Compliance 1014 for the HI-STORM 100 storage cask. Based on ongoing SFPO review and RES recommendations, staff has concluded that applicant's provided analysis models might have potential modeling problems. Therefore, staff has decided to develop its own confirmatory analysis model. A 3-D model may be necessary to better capture the heat transfer and gas flow in the storage cask.

Area of Needed Assistance

SFPO has identified an area where further assistance is needed from RES to support our technical review of the HI-STORM 100 storage cask:

> Develop a 3-D FLUENT CFD model of the HI-STORM 100 storage cask and perform a thermal-hydraulic analysis for the normal storage conditions.

CONTACT: Jorge Solis, NMSS/SFPO
(301)415-3040

The developed model should have as a minimum the following characteristics:

> Explicit representation of the fuel assemblies, basket plates, neutron absorber/sheathing/box wall sandwich, downcomer, etc. should be included in the model.
>
> Use of a fuel basket effective thermal conductivity should be avoided. However, effective thermal conductivity for the fuel region may be acceptable.

Use of porous media to represent each of the fuel assemblies may be an acceptable approach. The fuel assemblies should be divided axially in a sufficient number of regions (at least 8) and each of these axial regions of individual fuel assemblies may be modeled using porous media.

The analysis conditions should correspond to normal storage as described in the applicant's Safety Analysis Report.

This request is of high priority to ensure full core offload capabilities for operating reactors. We discussed this activity with Jack Rosenthal, of your staff. It is our understanding that development of the analytic computer model and evaluations will take on the order of four months. Preliminary results will be discussed with Dr. Solis, of SFPO, as they are completed. Your attention and assistance to this effort is greatly appreciated.

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