June 24, 2002

Mr. Howard Bergendahl
Vice President-Nuclear, Davis-Besse
FirstEnergy Nuclear Operating Company
Davis-Besse Nuclear Power Station
5501 North State Route 2
Oak Harbor, OH 43449-9760

SUBJECT: DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1 - REQUEST FOR ADDITIONAL INFORMATION REGARDING SAFETY SIGNIFICANCE ASSESSMENT OF THE REACTOR PRESSURE VESSEL HEAD DEGRADATION (TAC MB4799)

Dear Mr. Bergendahl:

By letter dated April 8, 2002 (Serial Number 1-1268), FirstEnergy Nuclear Operating Company, submitted the Safety Significance Assessment of the Davis-Besse Nuclear Power Station, Unit 1, Reactor Pressure Vessel Head Degradation.

We have reviewed your submittal and, based on our review, we have determined that additional information is required in order for the staff to complete its review. The enclosed request for additional information was discussed with your staff on June 20, 2002. It is our understanding that your response will be provided by July 12, 2002.

Sincerely,

/RA/

Douglas V. Pickett, Senior Project Manager, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-346

Enclosure: As stated

cc w/encl: See next page

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REQUEST FOR ADDITIONAL INFORMATION

DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1

SAFETY SIGNIFICANCE ASSESSMENT

DOCKET NO. 50-346

Failure Criterion

(1) What is the technical basis of the failure criterion (e.g., strain exceeding 11.15 percent) used to determine the failure conditions of the cladding layer? Provide specific technical references in the literature that support the failure criterion used in this evaluation.

(2) How does the failure criterion (e.g., based on ultimate strain in a uniaxial tensile test) account for the effects of biaxial loading in the cladding, or triaxial loading in the cladding at the edges of the degradation cavity?

(3) The failure criterion applied in Structural Integrity Analysis (SIA) report W-DB-01Q-301 (e.g., the minimum cross-sectional strain exceeding the failure strain of 11.15 percent) allows the strain levels in the cladding to exceed the critical strain value entirely through the thickness, leading to very large strains at the surface of the cladding, up to 49 percent in Table 5 of the SIA report. What is the technical basis for this approach, as opposed to the average cross-sectional strain, or the maximum cross-sectional strain?

(4) Did you explore a continuum damage mechanics analysis to give guidance of the failure criterion once the strains exceed the critical strain where necking/void growth starts? If not, provide the technical basis for not using a continuum damage mechanics analysis. [Poisson's ratio of 0.5 no longer applies once this critical strain level is exceeded, so the analysis is strictly not valid. (Poisson's ratio is continuously changing as the voids grow at the strains beyond the start of necking.) This results in a stress redistribution that is not accounted for in a standard elastic-plastic analysis.]

(5) How would the strain values change if the stress free temperature was assumed to be the stress relief temperature instead of 70 °F, and the analysis accounted for the differential thermal expansion of the cladding and head steel at the operating temperature of 605 °F?

Geometry/Meshing

(A) Does the size of the degradation cavity and the transition from the cladding thickness to the head thickness that was used in the SIA report reflect current knowledge regarding the cavity geometry, in particular the undercut area described in Figure 13 on page 103 of the Davis-Besse Root Cause Analysis Report (CR2002-0891), dated April 15, 2002? What is the transition geometry assumed in the analyses?

(B) Is there sufficient mesh refinement through the cladding thickness to adequately capture the bending and shear strains at the edge of the cavity? Describe any sensitivity studies used to demonstrate the adequacy of the mesh refinement.

(C) Was the cladding deposited by weld wire? Do the thinner cladding thickness measurements from ultrasonic testing coincide with the locations of weld bead toes? In what direction do the cladding weld beads run relative to the long axis of the degradation?

Davis-Besse Nuclear Power Station, Unit 1

cc:

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