UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
801 WARRENVILLE ROAD
LISLE ILLINOIS 60532-4351

May 6, 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: REQUEST FOR ADDITIONAL INFORMATION RELATED TO THE DAVIS-BESSE NUCLEAR POWER STATION SAFETY SIGNIFICANCE ASSESSMENT

Dear Mr. Bergendahl:

Based on our ongoing review of the "Safety Significance Assessment of the Davis-Besse Nuclear Power Station, Unit 1 Reactor Pressure Vessel Head Degradation" that you submitted on April 8, 2002, we have developed the enclosed request for additional information (RAI). This Davis-Besse RAI is necessary for our independent assessment of the safety significance of this event.

We understand that you plan to provide an addendum to your April 8, 2002, submittal by May 10, 2002. Please incorporate your response to the RAI with your May 10, 2002, submittal. Should you have any questions on this issue, please contact me at (630) 829-9619. — estimate by June 7

Sincerely,

Christine A. Lipa

Christine A. Lipa, Chief
Branch 4
Division of Reactor Projects

Docket No. 50-346
License No. NPF-3

Enclosure: Request for Additional Information (RAI)

See Attached Distribution

B/155

cc: B. Saunders, President - FENOC
Plant Manager
Manager - Regulatory Affairs
M. O'Reilly, FirstEnergy
Ohio State Liaison Officer
R. Owen, Ohio Department of Health
Public Utilities Commission of Ohio
President, Board of County Commissioners
Of Lucas County

Request for Additional Information
Concerning the FENOC "Probabilistic Safety Assessment" for the
Void in the RPV Head at Davis Besse

1. The probabilistic safety assessment does not address the probabilities that the cavity could have become larger before being detected or that the void could have formed at a location in the RPV head that had thinner cladding material. Please provide the following information to support the staff's estimation of the risk. Should the requested information be difficult to produce, provide the justification for your basis that the actual measurements are representative of the worst case values.

a. All records of the clad thickness on the RPV head that were produced in the fabrication, quality control, and acceptance testing processes. The staff expects that some thickness measurements were made to verify that the cladding is within the design specifications of 1/16" to 3/8" in thickness.
1/8"

b. All UT measurements that show clad thickness on the RPV head, including the head location coordinates for each of the measurements.

c. The estimated rate of growth of the cavity at the time just prior to the plant shutdown on February 16, 2002. The average growth rate for the entire period of cavity development is not an appropriate response unless it is also demonstrated with appropriate evidence that the growth rate was constant over the period. Any discussion of assumed rates of cavity growth should address the difference between the aspect ratios of the cavities found at nozzles 2 and 3. Please provide growth rate estimates in terms of linear rate of cavity expansion in the directions perpendicular to the cavity walls. Volumetric estimates for growth rates are not useful for the intended analyses. Please provide an estimate of the uncertainty in the cavity growth rate at the end of the period, in a form suitable for use in probabilistic assessment.

d. The estimated areas of exposed clad material that would cause the cladding to fail at normal operating pressure for clad thicknesses of 0.297" and 0.125".

2. The probabilistic safety assessment uses a log-normal equation to represent the probability distribution for the strength of the clad material. Please provide the following information:

a. The value of the constant, β_c, used to represent the randomness of the material strength parameter.

b. Any data on the strength properties of stainless steel alloy 308 that demonstrate the degree of randomness exhibited by that material.

c. The mathematical relationship between the data and the value of β_c used in the safety assessment.

3. In Table 2 in Section B.3.2, the probabilistic safety assessment provides a set of RCS pressure ranges and the corresponding values for the number of events experienced in those ranges at Davis Besse and the estimated frequency for experiencing events in those ranges.

Please clarify the following information:

a. The pressure ranges are all shown as greater than a specific numerical value, indicating a cumulative distribution, but the number of events experienced at ">2300 psig" is larger than the number shown as ">2250 psig," which indicates that the distribution is not cumulative with respect to the number of events experienced. Is the distribution for the number of events cumulative, or should the table indicate pressure ranges? For the last pressure, ">2500 psig," is the frequency value intended to be cumulative for all pressures above 2500, or does it apply to a pressure interval limited by an upper bound? If an upper bound is applicable, what is it?

b. The text states that the frequency column entries for RCS pressures above 2405 psig were based on "a Bayesian update with a non-informative prior..." Please describe the shape of the prior as a function of pressure, including any limits used on the pressures to which the prior distribution is assumed to be applicable. Please provide the other statistical information used to perform the update, in sufficient detail for the staff to duplicate the computation.

4. In the Davis Besse IPE submittal dated February, 1993, it is stated in the description of a large LOCA: "A large LOCA is, by definition, sufficient to depressurize the RCS to the point at which reflooding of the core would be required by the core flood tanks, with makeup in the longer term by the decay heat removal (DHR) system operating in the low pressure injection (LPI) mode. ... It is assumed that rate of loss from the RCS would be large enough that the high pressure injection (HPI) and makeup pumps would not be capable of providing sufficient flow to keep the core covered without running out. ... The break size that defines the large LOCA therefore ranges from the smallest break that could be accommodated solely by the LPI and the core flood tanks, up to a double ended rupture of a reactor coolant hot or cold leg. The large LOCA ... is therefore any break whose equivalent flow area exceeds 0.5 ft^2."

The description of a medium LOCA in the IPE submittal includes: "For Davis Besse, this corresponds to a range of equivalent break areas of 0.02 to 0.5 ft^2. ... It should be noted that, at the lower end of this range (approximately 0.02 to 0.1 ft^2),... only HPI is needed to provide adequate makeup to the RCS. ... As a practical matter, the frequency of a medium LOCA is estimated in part that there have been no initiating breaks in this range. Hence, it is reasonable to define one event that covers the full range to simplify the analysis..."

This seems to indicate that the medium LOCA category should be considered to be two classes of LOCAs, which we will designate "big-medium" and "little-medium" to avoid nomenclature confusion. The "big-medium LOCA" appears to be break sizes between 0.1 ft^2 and 0.5 ft^2, and require success of only core flood tanks and LPI (injection and recirculation modes) to prevent core damage. The "little-medium LOCA" appears to be break sizes between 0.02 ft^2 and 0.1 ft^2, and require success of at least HPI (injection mode) to prevent core damage.

With respect to the conditional core damage probability for these two parts of the medium LOCA spectrum, there seems to be a discrepancy between the IPE submittal and the "probabilistic safety assessment" for the RPV head cavity. The IPE submittal states "It should be noted that, at the lower end of this range (approximately 0.02 to 0.1 ft^2), the success criteria are actually substantially less restrictive than those applied later for the full range of medium breaks. ... From a qualitative perspective, therefore, it is conservative to include these smaller breaks in the medium LOCA category." However, in section B.4, on page12 of 19 in the safety assessment it is stated that "The largest LOCA within the postulated range [for cavity failure] allows the shortest time to transfer to recirculation, but exceeds the LOCA size that would require high pressure injection. Therefore, a smaller LOCA that requires high pressure injection could be more limiting."

In order to clarify the risk analyses, please provide the following information:

a. For the Davis Besse PSA, what systems/modes of operation are required to perform successfully to prevent core damage for the "little-medium" LOCAs? Can the need for ECCS recirculation mode be avoided? If ECCS recirculation mode is not avoided, is recirculation required in the high, low or both pressure ranges?

b. For the current Davis Besse PSA, what is an appropriate CCDP for "big-medium LOCAs?"

c. The core damage frequency contribution from medium LOCAs that is calculated in the Davis Besse IPE submittal appears to be applicable to "big-medium LOCAs." What is the value of the CCDP for "big-medium LOCAs in the IPE submittal?" If it differs from the value in the current Davis Besse PSA, is that due solely to requantification or were success criteria changed between the two PSA versions? If success criteria were changed, please clearly specify what changes were made.

5. For the analysis provided in your April 8, 2002 submittal, please quantitatively describe (1) the uncertainty in the resulting value for the frequency of cavity rupture and (2) the uncertainty in the CCDP value used for the resulting medium LOCA. If the analysis for the cavity rupture frequency is altered or augmented as a result of responding to the preceding questions, please provide a quantitative description of the uncertainty in that result, also.