November 29, 2002

MEMORANDUM TO: Richard J. Laufer, Chief, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

FROM: Daniel S. Collins, Project Manager, Section 1 ***/RA/***
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

SUBJECT: BEAVER VALLEY POWER STATION, UNIT NOS. 1 AND 2 - DRAFT REQUEST FOR ADDITIONAL INFORMATION (RAI), REGARDING AMENDMENT REQUEST TO ALLOW PLANT OPERATION WITH ASSOCIATED CONTAINMENT AT ATMOSPHERIC PRESSURE (TAC NOS. MB5303 AND MB5304)

The attached draft RAI was transmitted by facsimile on November 4, 2002, to Mr. Brian Sepelak of FirstEnergy Nuclear Operating Company in preparation for a conference call conducted on November 6, 2002. Review of the RAI would allow the licensee to identify areas where clarification may be needed, as well as determine and agree upon a schedule for responding to the RAI. This memorandum and its attachment do not convey a formal request for information or represent a Nuclear Regulatory Commission position. A formal RAI letter will be issued separately to FirstEnergy Nuclear Operating Company and contain Sections 1.0 and 3.0 of the attached draft. Six additional questions have been added to Section 3.0 in the formal RAI. In addition, a formal RAI to Westinghouse Electric Company, LLC, will be issued to address the questions of Section 2.0.

Docket Nos. 50-334 and 50-412

Attachment: As stated

CONTACT: D. Collins, NRR
301-415-1427

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BEAVER VALLEY POWER STATION, UNIT NOS. 1 AND 2

DOCKET NOS. 50–334 AND 50-412

The U.S. Nuclear Regulatory Commission (NRC) staff, with support from its contractor, is reviewing FirstEnergy Nuclear Operating Company's (FENOC) June 5, 2002, application (L-02-069) for an amendment to Facility Operating License Nos. DPR-66, and NPF-73 for the Beaver Valley Power Station, Unit Nos. 1 and 2 (BVPS1 and 2), which would allow operation of the Beaver Valley units with the containments at atmospheric pressure. The NRC staff has identified questions or concerns regarding the following documents associated with the amendment request:

• Enclosure 2 of Beaver Valley Power Station, Conversion Licensing Report, May 2002 that describes the revised containment integrity and radiological analyses conducted to support proposed amendment;

• Topical Report on the MAAP5 PWR Large Dry Containment Model, WCAP-15844, Rev 0, March 2002.

The following questions and concerns require clarification or additional information in order for the NRC staff to complete its review. The discussion items here do not represent an exhaustive list since the review of Beaver Valley calculations and MAAP5 code is currently in progress. For the purpose of organization, the items are listed under general and clarification headings dealing in turn with each report mentioned above. The final section provides the NRC staff's questions specific to the radiological assessment discussion provided in the application.

1.0 Enclosure 2

1.1 General Items:

1. What is the involvement of Beaver Valley personnel in the DBA containment integrity calculations; i.e., who ran and analyzed the MAAP5 containment calculations?

2. Have MAAP5 and LOCTIC code comparison calculations been made where both codes use essentially an identical single node containment description with similar limiting assumptions (flashing and natural vs. forced convection) to show a degree of equivalency? What is the purpose of the MAAP5/LOCTIC comparison calculations?

3. How does the flashing model in LOCTIC and the MAAP5 codes compare? Compare the uncertainties associated with the MAAP parameter (FELOCA) with the LOCTIC treatment for pressure flash.

4. What amounts of peak pressure and temperature margins are associated with the new MAAP5 models for a) forced condensation using the momentum-driven velocity, b) nodalization, and c) water entrainment? Discuss for MSLB and LOCA.

5. What peak pressure and temperatures would have been calculated with the LOCTIC code for MSLB and LOCA cases (e.g. 15M as the MSLB, and Case 8L for LOCA) using the safety analysis methodology followed in the previous FSAR?

1.2 Clarification Items:

1. Show MAAP pressure and temperature time history profiles for MSLB (e.g. 15MN13-1.4) and LOCA representative calculations. Label temperature profiles by compartment number (include all compartments).

2. Why is the upper containment initial pressure shown in Figure 4.1-4 below the maximum initial pressure specified in Table 4.1-3? 3. When does the quench spray flow inject into the containment for the MSLB calculation 15M-N13-1.4?

4. Show water entrainment and pool temperature profiles in containment compartments for representative MSLB and LOCA calculations.

5. Provide MAAP5 momentum-driven velocity time history profiles for compartments using representative MSLB and LOCA cases (as above).

6. How are the MAAP5 water and steam discharges modeled? For instance, is the modeling represented as a pressure flash assumption with a percentage of water fallout going to the MAAP aerosol model? How is the water aerosol model initialized or seeded for added water from the discharge? How does the aerosol dropout compare to the LOCTIC model for liquid water removal from the atmosphere?

7. Are liquid water (aerosol), gas and vapor masses summed to define a fluid density for the compartment flow equations and momentum-driven velocity equations?

8. Are quantities set in the parameter files in British units converted to SI in the code? Comment on the form of the ideal gas equation used for determining the accumulator nitrogen gas mass when accumulator volumes and gas temperatures are set according to British units. (See files U1_MIN_ACCUM_N2 and CONTAINMENT_IAR_TABLE.)

2.0 MAAP5 Topical Report

2.1 General Items:

1. Have the new MAAP5 general containment models and validation of those models been independently reviewed? What is the technical review process for new modeling in the MAAP code?

2. Have descriptions of the new MAAP5 general containment models and validation been published in any Journals or Conference papers? Has there been a peer review of these models?

3. How will documentation of the new MAAP5 GCM be presented in the MAAP manuals? Will the topical report be absorbed into the manual set?

4. What uncertainties (modeling or input parameters) associated with a) mixed and forced convection condensation, 2) momentum-driven velocity, and 3) water entrainment have been identified through separate effects tests?

5. Does the term "momentum-driven velocity," as calculated in the MAAP code, have a definition that would allow measurement and/or validation of the momentum velocity model equations? In other words, is the momentum-driven velocity a physical quantity or an abstraction?

2.2 Clarification Items:

1. How does an empirical calibration of the natural convection condensation model (improved MAAP5 condensation) apply to other modes of condensation, such as mixed or forced convection condensation?

2. Why were no forced convection condensation separate effects tests used in the validation of the improved MAAP condensation modeling?

3. What is the source of the apparent modeling error in the MAAP4 condensation model as indicated in the Dehbi tests? Discuss usage of a sensible heat transfer Grashof number (using temperature differences) vs. a composition Grashof number using density differences. Why is a sensible heat transfer Grashof number used for steam condensation in the presence of noncondensible gases?

4. What is the justification for using the Dittus-Boelter equation (duct internal flow) for turbulent convection within confined enclosures?

5. What is the justification for using the Dittus-Boelter or any other one-dimensional heat transfer correlation with the "momentum-driven velocity" derived as having a property value with no directional dependence? Same question for entrainment correlations?

6. What is the technical basis for a momentum balance constructed using scalar forces and non-directional momentum influx terms? Isn't the classical momentum balance equation a vector equation? Where in the technical literature does one find a similar equation or momentum defined as a fluid property that can be transported as such? Can one transport momentum with an inter-compartment velocity that is significantly different in value than the momentum-driven velocity?

7. Are the FFMULT and FCOND pessimistic, realistic, and optimistic values used for the CVTR calculations those values defined on page 8-6 and 7 of the Topical?

8. To what degree does water entrainment enter into the CVTR calculation? Provide a water entrainment time history profile in compartments for test 3.

9. It appears that FAI is using the CVTR test#3 measured velocity as a partial validation of the "momentum-driven velocity" model. However, measurements (both direct and indirect), as well as published CFD calculations for test #3, all indicate that the peak wall velocity is 5-6 times lower than calculated using MAAP. Further, the annular gap velocity calculated by MAAP is approximately twice the value reported in the CVTR final report. Please comment. What additional, direct validation of calculated momentum-driven velocity has been obtained (other than CVTR) through the 5SSTAR process?

10. Provide a comparison of CVTR heat plug #2 heat transfer coefficients calculated for the MAAP uncertainty parameters.

3.0 <u>Radiological Assessment</u>:

If FENOC believes that any of the following requested information has already been docketed, please provide a specific reference.

1. The text of the submittal states that the analyses were performed at a higher power level that BVPS 1 and 2 are currently licensed to operate at. This was apparently done to support a future power uprate. However, as the staff understands your submittal, only the LOCA and CREA analyses were done at this power level. The remaining analyses (offsite and control room) were performed at the currently licensed power level, and will need to be revised to support the future power uprate. Please confirm the staff's understanding.

2. On page 17, §4.0, there is a statement that the revised analyses were performed at a bounding future power uprate code power level of 2900 MWt. Page 1-1 of the Licensing Report states an uprate to 2910 MWt. Additionally, there are several references to an analysis power level of 2918 MWt, which apparently includes the correction for measurement uncertainty. Please confirm that the LOCA and CREA were analyzed at the 2918 MWt power level.

3. The BVPS common control room is currently isolated by a containment isolation signal or a high radiation monitor signal. FENOC is proposing to eliminate the automatic isolation signal from the radiation monitor and, instead, rely on manual operator action triggered by the radiation monitor alarm for the locked rotor accident. Although the dose calculations indicate that isolation may not be needed, the staff believes that this is a non-prudent reduction in defense-in-depth. The staff requests that FENOC justify this proposed change specifically addressing the guidance in §1.1.2 of RG 1.183 that

"Modifications proposed for the facility generally should not create a need for compensatory programmatic activities, such as reliance on manual operator actions."

- Unlike many other reactors with Westinghouse solid state protection, BVPS does not have a control room isolation actuated by a safety injection signal. With the proposed change, automatic isolation would occur only for LOCAs that cause CNMT pressures high enough to trigger containment isolation. There would be no automatic isolation available for any other accident.

- The staff understands that there is not a dedicated main bench board annunciator window for the control room area radiation monitors, but rather, a generic window that signifies that a radiation monitor channel has alarmed. At Unit 1, operators must leave the controls area to examine the radiation monitor racks to determine the channel in alarm.

4. Does the proposed cavitating venturi flow elements in the Unit 1 AFW injection lines change the thermodynamic inputs to the MSLB and SGTR accidents, warranting a re-calculation of the radiological consequences these accidents? For example, are steam flows affected? Duration of tube uncovery?

5. Page 5-3 of the licensing report identifies that updated control room atmospheric dispersion factors using the ARCON96 methodology were utilized. The submittal did not provide sufficient information for the staff to evaluate this change to your design basis. Please provide the following information:

   a. Unit 1 and Unit 2 release point and receptor configuration information (e.g., height, velocity, distances, direction, etc.), release mode (e.g., ground, elevated, surface), and meteorological sensor configuration, as input to ARCON96.

   b. A floppy disk containing the meteorological data input to ARCON96, in the ARCON96 input data format.

6. Page 5-7 (and page 5-43) of the licensing report states that the MSLB and LRA were assessed using existing licensing basis methodology/assumptions. However, the submittal does not tabulate the assumptions as was done for the LOCA and CREA. Please provide a tabulation of the assumptions and inputs (in particular, steam releases, steam generator masses, T/S and accident-induced (ARC) primary-to-secondary leakrates, credit for mitigation, etc.) used in assessing the impact on the control room dose of eliminating the automatic initiation of CREBAPS/CREVS via radiation monitors for the MSLB and LRA accidents. If this information has been previously docketed, please provide a specific reference.

7. Page 5-7 through 5-9 addresses the impact on EQ doses and vital area access. Please identify whether or not that these discussions were based on the 2918 MWt power level?

8. On Page 5-31 of the licensing report, it appears that containment sprays are not effective until 722 seconds, or about 12 minutes. Please explain the basis of this delay. If sprays are effective prior to this, please provide flow rate and droplet radius information for the earlier time period.

9. On Page 5-32 of the licensing report, it is stated that the steam condensation rates used by SWNAUA were calculated using the LOCTIC code. However, the containment performance analyses were performed using MAAP. Please explain why MAAP was not used for this purpose and the sensitivity of the SWNAUA results to the differences between LOCTIC and MAAP. Specify which code will be the licensing basis code for radiological analyses.

10. On Page 5-41 of the licensing report, the source term for the CREA is discussed. The first half of this paragraph is valid. However, the paragraph goes on to address gap fractions from Table 3 of RG 1.183. The latter portion of this paragraph appears to be irrelevant to the CREA analysis. Please explain.

11. For both the Unit 1 and Unit 2 MSLB discussions, a brief reference is made development of a scaling factor. The development and use of these factors is not clear. Please explain how this scaling was done. Please include in the explanation how time-dependent changes in parameters (release rate, co-incident iodine spike, intake prior to 30 minutes vs intake after 30 minutes, X/Q changes) are incorporated in the scaling factor development and use.

12. §5.3.7.3.2 addresses ERF habitability. Unfiltered inleakage during normal operation is stated to be 2090 cfm while emergency mode inleakage is stated as 910 cfm, which includes 10 cfm for ingress and egress.

    - Please explain the basis of these inleakage values. Are these the result of testing?

    - Given the multiple points of ingress and egress to the ERF, and the large numbers of people expected to populate the ERF, please explain why only 10 cfm is considered appropriate for ingress and egress.

13. At the top of page 5-53, a statement is made that it is conservative to model the ERF as a point receptor. Please explain the conclusion that this is conservative. Treating the ERF in this manner removes the source of exposure as soon as the plume blows by. However, given the 30 minute delay in placing the ERF in emergency mode and the high amount of inleakage, the internal atmosphere of the ERF could be contaminated and be the source for extended exposure, even after the plume has cleared.

14. In Table 5.3.6-2, the duration of the containment vacuum release is given as 5 seconds. What is the basis of this assumption. Why is this release path not considered for the containment leakage path in the CREA analysis?