November 22, 2002

Mr. Mark B. Bezilla
Vice President
FirstEnergy Nuclear Operating Company
Beaver Valley Power Station
Post Office Box 4
Shippingport, PA 15077

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

Dear Mr. Bezilla:

By letter dated June 5, 2002, FirstEnergy Nuclear Operating Company (FENOC) submitted an amendment request to allow plant operation of the Beaver Valley Power Station, Unit Nos. 1 and 2 (Beaver Valley), with containments at atmospheric pressure. The Nuclear Regulatory Commission (NRC) staff's review of your application is being conducted in parallel with the NRC staff's review of WCAP-15844, "Topical Report on Modular Accident Analysis Program Version 5 (MAAP5) Pressurized Water Reactor (PWR) Large Dry Containment Model," which was submitted separately by Westinghouse (W).

The NRC staff has conducted an initial review of your submittal and has determined that additional information is required in order for the NRC staff to complete its review. Enclosed is the NRC staff's RAI associated with your application. These questions were discussed in a joint conference call with representatives from FENOC and W on November 6, 2002. A separate RAI is also being sent to W regarding the analysis methodology of WCAP-15844.

The staff of Beaver Valley has proposed that a joint meeting with the NRC and W be held at NRC headquarters on December 10, 2002, to discuss the NRC staff's questions in Section 1.0 of the enclosed RAI. That date is tentative and is contingent upon the NRC staff receiving docketed responses to Section 1.0 of this RAI, and the RAI being sent to W, at least 7 days prior to the meeting. This has been discussed with Mr. B. Sepelak of your staff, and December 3, 2002, was agreed to as a target date for submittal of FENOC's response to the questions in Section 1.0; January 24, 2003, was agreed to as a target date for submittal of FENOC's responses to the questions in Section 2.0 of the enclosed RAI. Please contact me as soon as possible if circumstances arise that require changes to these proposed completion dates. If you have any questions, please contact me at 301-415-1427.

Sincerely,

/RA/

Daniel S. Collins, Project Manager, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-334 and 50-412

Enclosure: RAI

cc w/encl: See next page

questions in Section 1.0; January 24, 2003, was agreed to as a target date for submittal of FENOC's responses to the questions in Section 2.0 of the enclosed RAI. Please contact me as soon as possible if circumstances arise that require changes to these proposed completion dates. If you have any questions, please contact me at 301-415-1427.

Sincerely,

/RA/

Daniel S. Collins, Project Manager, Section 1
Project Directorate I
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Docket Nos. 50-334 and 50-412

Enclosure: RAI

cc w/encl: See next page

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REQUEST FOR ADDITIONAL INFORMATION (RAI)

BEAVER VALLEY POWER STATION, UNIT NOS. 1 AND 2

REQUEST TO ALLOW PLANT OPERATION WITH ASSOCIATED

CONTAINMENT AT ATMOSPHERIC PRESSURE

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 Beaver Valley Power Station, Unit Nos. 1 and 2 (BVPS-1 and 2), which would allow operation of the BVPS-1 and 2 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 the proposed amendment;

- Topical Report on the Modular Accident Analysis Program, Version 5 (MAAP5), Pressurized Water Reactor (PWR) Large Dry Containment Model, WCAP-15844, Revision 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 BVPS-1 and 2 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 BVPS-1 and 2 personnel in the design-basis analysis (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 main steamline break (MSLB) and loss-of-coolant accident (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 Updated Final Safety Analysis Report (UFSAR)?

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 the International System of Units (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 Radiological Assessment

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 than 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 control rod ejection accident (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, Section 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 Section 1.1.2 of Regulatory Guide (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-1 and 2 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 containment (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 auxiliary feedwater (AFW) injection lines change the thermodynamic inputs to the MSLB and steam generator tube rupture accidents, warranting a re-calculation of the radiological

consequences of these accidents? For example, are steam flows affected? Duration of tube uncovery affected?

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 locked rotor accident (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 (alternate repair criteria) 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 environmental qualification (EQ) doses and vital area access. Please identify whether or not 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 to the 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. Section 5.3.7.3.2 addresses Emergency Response Facility (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?

15. In its submittal, FENOC has proposed the use of a proprietary computer code, SWNAUA, to determine containment spray removal coefficients. As noted in the submittal, SWNAUA is an extension of the NAUA mode, that incorporates an aerosol removal by spray model not in the original code. Although the staff has, in limited cases, accepted the <u>value</u> of a spray removal coefficient based on SWNAUA in a design-basis application, the staff has not approved the NAUA or SWNAUA code. The staff has not been asked to review any topical report supporting the use of SWNAUA that would allow the staff to find the code generally acceptable for design-basis applications. The results of the BVPS spray removal assessment is shown in Figure 5.3.6.1 of the FENOC submittal. The staff is concerned that the shape and magnitude of the removal curve may not be adequately conservative for a DBA analysis. Please explain why FENOC believes that the conservatism of the determined removal rates is appropriate for use in a DBA analysis.

16. The fourth paragraph on Page 5-27, indicates that credit is taken for aerosol removal by diffusiophoresis and spray.

    a. Is the diffusiophoresis based on steam condensation on heat sinks alone, or also on spray droplets?

b. If condensation on spray droplets is included, please provide a description of the condensation model and the spray droplets area used.

c. For condensation on the heat sinks: is the area used a nominal (FSAR) area, or a minimum one?

17. In the table on Page 5-31, the spray flow rates are not credited prior to 722 seconds, about 12 minutes. The blowdown of the reactor coolant system (RCS) occurs largely before this time. At BVPS, CNMT quench sprays start much earlier on 2/4 CNMT hi-hi pressure signals. Did the LOCTIC runs that established the steam condensate rates assume the same time delay? Was a sensitivity analysis performed?

18. In the table on Page 5-31, the spray droplet radius is identified as 350 micro in the early part of the scenario. Justify the value of this parameter.

19. The table on Page 5-32 provides values for parameters that have a significant impact on the value of the spray removal rate.

a. Did you perform a sensitivity study on maximum aerosol radius and maximum number of size bins? If yes, please provide the results. If not, is it possible to run a case with smaller maximum radius (e.g., 50 microns), and smaller maximum number of size bins (e.g., 30)?

b. Please justify the conservatism of the aerosol densities of 3.7 and 4.6 gm/cc. Do these values reflect the effective densities (i.e., accounting for the porosity) or that of pure materials?

c. Please provide the basis of the values for mean geometrical radii and standard deviation and justify their conservatism.

20. Please provide an explanation of the relatively high removal rates (i.e., 40 - 60 per hour) between 1800 and 6600 seconds of the accident shown on Figure 5.3.6-1 on Page 5-85.