January 29, 2002

Mr. L. W. Myers
Senior 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 - ISSUANCE OF AMENDMENT RE: REDUCTION IN MINIMUM DECAY TIME REQUIRED PRIOR TO FUEL MOVEMENT (TAC NOS. MB3294 AND MB3295)

Dear Mr. Myers:

The Commission has issued the enclosed Amendment No. 247 to Facility Operating License No. DPR-66 and Amendment No. 126 to Facility Operating License No. NPF-73 for the Beaver Valley Power Station, Unit Nos. 1 and 2. These amendments consist of changes to the Technical Specifications (TSs) and associated Bases in response to your application dated October 29, 2001, as supplemented December 17, 2001.

These amendments revise TS Section 3.9.3 to reduce the minimum decay time required prior to fuel movement from 150 hours to 100 hours.

A copy of our safety evaluation is also enclosed. The Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

***/RA/***

Lawrence J. Burkhart, Project Manager, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-334 and 50-412

Enclosures: 1. Amendment No. 247 to DPR-66
2. Amendment No. 126 to NPF-73
3. Safety Evaluation

cc w/encls: See next page

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| JMa | | | | | |

*See previous concurrence
**No significant changes made to SE input

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| DATE | 1/17/02 | 1/25/02 | 1/25/02 | 1/18/02 |

| OFFICE | SPSB/SC | EMEB/SC | RORP/SC | OGC | PDI-1/SC(A) |
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| NAME | FMReinhart* | KManoly** | RDennig* | AHodgdon* | JMunday |
| DATE | 1/18/02 | 1/15/2002 | 1/22/02 | 1/23/02 | 1/28/02 |

OFFICIAL RECORD COPY

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PENNSYLVANIA POWER COMPANY

OHIO EDISON COMPANY

FIRSTENERGY NUCLEAR OPERATING COMPANY

DOCKET NO. 50-334

BEAVER VALLEY POWER STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 247
License No. DPR-66

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by FirstEnergy Nuclear Operating Company, et al. (the licensee) dated October 29, 2001, as supplemented December 17, 2001, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. DPR-66 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 247, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance and shall be implemented within 60 days.

FOR THE NUCLEAR REGULATORY COMMISSION

***/RA/***

Joel T. Munday, Acting Chief, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: January 29, 2002

ATTACHMENT TO LICENSE AMENDMENT NO. 247

FACILITY OPERATING LICENSE NO. DPR-66

DOCKET NO. 50-334

Replace the following page of Appendix A Technical Specifications with the attached revised page. The revised page is identified by amendment number and contains marginal lines indicating the areas of change.

| Remove | Insert |
| --- | --- |
| 3/4 9-3 | 3/4 9-3 |

PENNSYLVANIA POWER COMPANY

OHIO EDISON COMPANY

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

THE TOLEDO EDISON COMPANY

FIRSTENERGY NUCLEAR OPERATING COMPANY

DOCKET NO. 50-412

BEAVER VALLEY POWER STATION, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 126
License No. NPF-73

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by FirstEnergy Nuclear Operating Company, et al. (the licensee) dated October 29, 2001, as supplemented December 17, 2001, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. NPF-73 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 126, and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto are hereby incorporated in the license. FENOC shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of the date of its issuance and shall be implemented within 60 days.

FOR THE NUCLEAR REGULATORY COMMISSION

***/RA/***

Joel T. Munday, Acting Chief, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: January 29, 2002

ATTACHMENT TO LICENSE AMENDMENT NO. 126

FACILITY OPERATING LICENSE NO. NPF-73

DOCKET NO. 50-412

Replace the following page of Appendix A Technical Specifications with the attached revised page. The revised page is identified by amendment number and contains marginal lines indicating the areas of change.

| Remove | Insert |
| --- | --- |
| 3/4 9-3 | 3/4 9-3 |

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 247 AND 126 TO FACILITY OPERATING

LICENSE NOS. DPR-66 AND NPF-73

PENNSYLVANIA POWER COMPANY

OHIO EDISON COMPANY

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

THE TOLEDO EDISON COMPANY

FIRSTENERGY NUCLEAR OPERATING COMPANY

BEAVER VALLEY POWER STATION, UNIT NOS. 1 AND 2

DOCKET NOS. 50-334 AND 50-412

## 1.0 INTRODUCTION

By letter dated October 29, 2001, as supplemented December 17, 2001, the FirstEnergy Nuclear Operating Company (FENOC; the licensee) submitted a request for changes to the Beaver Valley Power Station, Unit Nos. 1 and 2 (BVPS-1 and 2), Technical Specifications (TSs). The requested changes would revise TS Section 3.9.3 to reduce the minimum decay time required prior to fuel movement from 150 hours to 100 hours.

Delaying movement of recently irradiated fuel allows time for radioactive decay of the fission product inventory in the fuel, and thereby reduces the amount of decay heat that must be removed by the spent fuel pool (SFP) cooling system. FENOC has requested a reduction in the required decay time because it expects that decay time could become a critical path item during future refueling outages.

A reduction in decay time can lead to increases in peak temperatures of the SFP water and the SFP concrete structure, due to a relatively higher level of decay heat generation in the most recent batch of offloaded fuel. A reduction in decay time can also affect the calculated dose consequences resulting from a postulated design-basis fuel handling accident (FHA) as described in the licensee's Updated Final Safety Analysis Report (UFSAR) FHA safety analysis. The licensee requested the incorporation of the 100-hour decay time assumption into the BVPS-1 and 2 FHA safety analyses in separate amendment requests dated March 19, 2001. The Nuclear Regulatory Commission (NRC) approved the March 19, 2001, amendment requests on August 30, 2001, in Amendment Nos. 241 and 121 to Facility Operating License Nos. DPR-66 (BVPS-1) and NPF-73 (BVPS-2), respectively. Therefore, the BVPS-1 and 2

UFSAR FHA safety analyses currently incorporate the assumption of a decay time of 100 hours. Accordingly, this license amendment request is considered in terms of the reduction in decay time potential effects upon the capability to remove heat from the SFP water and structural integrity of the SFP due to heating of the SFP concrete.

The December 17, 2001, letter contained clarifying information and did not change the initial no significant hazards consideration determination and did not expand the scope of the original *Federal Register* notice.

## 2.0 BACKGROUND

The proposed change to the decay time was originally requested as part of a March 19, 2001, amendment request. In addition to the decay time reduction, the licensee proposed other changes to the BVPS-1 and 2 TSs regarding the requirements for handling irradiated fuel assemblies in the reactor containment and fuel handling building. The NRC staff, as part of its review of the March 19, 2001, letter, requested additional information on May 23, 2001, concerning the impact of the decreased decay time on the hydrothermal performance of the SFP cooling system. In a letter dated July 6, 2001, the licensee withdrew the change regarding the reduction in decay time to facilitate an expedited review of the other portions of the March 19, 2001, amendment request. The remaining portions of the licensee's March 19, 2001, amendment request were approved by the NRC in Amendment No. 241 to Facility Operating License No. DPR-66 and Amendment No. 121 to Facility Operating License No. NPF-73.

With respect to the SFP cooling capacity, the NRC staff requested the licensee to provide an analysis of the effects on the SFP cooling system due to the proposed decrease in decay time. This analysis was requested to include the resultant maximum SFP temperature for "planned" spent fuel offloads under the conditions of (1) the decay heat load resulting from the "planned" core offload and all other SFP storage locations filled (the BVPS-1 and 2 "planned" offload is a full core offload) and (2) the worst-case single active failure for the SFP cooling system, including common cause failures (not just the inoperability of a redundant train). If the resultant maximum SFP temperature exceeded the current licensing-basis temperature and was greater than 150 $^{o}$F, the licensee was also requested to provide an analysis to demonstrate that the structural integrity of the SFP concrete structure is maintained based on the criteria contained in concrete code ACI-349-85.

The licensee was also requested to address the effects on the SFP cooling capacity for "unplanned" offload conditions that included the decay heat load based on a full core offload plus a refueling load that has decayed for 36 days and with all other storage locations filled. No single failure needed to be considered for this case. The resultant maximum SFP temperature should be shown to remain below boiling.

With respect to SFP inventory make-up capacity, the licensee was requested to determine the time to boil in a loss of all SFP cooling event assuming that the SFP temperature at the start of this event was equal to the peak temperature from a planned offload with the worst case single active failure occurring and all storage locations filled. This analysis should confirm (1) that make-up water could be provided prior to boiling of the SFP water and (2) that a make-up water source exists that could provide water at a rate equal to or greater than the boil-off rate so that the SFP water level could be maintained.

The licensee provided its response to these requests in its letter dated October 29, 2001, as supplemented on December 17, 2001.

## 3.0 EVALUATION

### 3.1 Spent Fuel Pool Cooling System and Make-up Source Evaluation

The licensee proposes to replace "150 hours" with "100 hours" in Limiting Condition for Operation (LCO) 3.9.3 and Surveillance Requirement 4.9.3.

The SFP cooling systems of BVPS-1 and 2 are similar and consist of 2 highly reliable 100-percent capacity pumps and heat exchangers. The pumps and heat exchangers can be cross-connected so the flow from one pump can go through both heat exchangers. The heat exchangers are cooled by component cooling water. Operators can monitor the SFP temperature in the control room and are alerted to a high-temperature condition by an alarm. The licensee performed analyses on the impact of the proposed TS change on the SFP with the following results:

#### 3.1.1 SFP Temperatures

The licensee evaluated the following fuel offload cases for the impact of the decrease in decay time on SFP temperatures. These analyses were performed at 2918 MWt to incorporate a large (9.4 percent) planned thermal power uprate, a discharge rate of 6 assemblies per hour, and decay time of 100 hours.

##### 3.1.1.1 Planned Offloads

The decay heat load is based on a full core offload with all other storage locations filled and both trains of SFP cooling operational. Under these conditions the licensee determined the maximum bulk SFP water temperatures are 155.7 °F and 159.2 °F for BVPS-1 and 2, respectively. The bulk SFP water temperatures will exceed 150 °F for a duration of approximately 60 hours at BVPS-1 and for a duration of approximately 100 hours at BVPS-2.

To address the worst-case single active failure condition under the same decay heat load, the licensee committed to use administrative controls to limit the peak SFP temperature to 170 °F by varying component cooling water (CCW) temperature and/or decay time. The worst-case single active failure is assumed to be the loss of a SFP cooling pump. In its letter dated October 29, 2001, the licensee submitted a graph of decay time versus CCW to determine the maximum CCW temperature for a given decay time that will limit SFP temperature to 170 °F. For a decay time of 100 hours, the maximum CCW temperature is 91.4 °F and 95.4 °F for BVPS-1 and 2, respectively. In its October 29, 2001, letter, the licensee made a formal commitment to establish administrative controls to control decay times prior to the movement of irradiated fuel assemblies from the reactor core based on the graphs discussed here.

With respect to the SFP cooling capacity, the NRC staff finds that the licensee has adequately analyzed the effects of reducing the decay time to 100 hours for the planned offloads. The licensee has committed to use administrative controls to limit the peak SFP water temperature to no greater than 170 °F by varying the decay time and CCW temperature as described in its letter dated October 29, 2001. The NRC staff finds the use of these administrative controls

acceptable because it adequately limits the ability to control the decay heat load in the SFP. Therefore, the NRC staff finds the SFP capacity for the planned offload conditions acceptable.

3.1.1.2 Unplanned Offloads

The decay heat load is based on a full core offload plus refueling load that has decayed for 36 days with all other storage locations filled. Both trains of SFP cooling are operating. The requirement in this case is that bulk SFP temperature must remain below boiling. Under these conditions the licensee determined the maximum bulk SFP water temperatures are:

- BVPS-1: 168.7 °F with a CCW temperature of 91.4 °F.
- BVPS-2: 172.7 °F with a CCW temperature of 95.4 °F.

The NRC staff finds that the licensee has adequately analyzed the unplanned offload condition and that the maximum bulk SFP water temperatures remain below the boiling temperature. The assumption of a decay time of 100 hours has been incorporated into the analysis with acceptable results. Therefore, the NRC staff finds the SFP cooling capacity acceptable for the unplanned offload conditions.

3.1.1.3 Time to Boil and Make-up Water

The licensee determined that the highest evaporation rate occurs at boiling if all SFP cooling is lost after an abnormal (unplanned) refueling. In that case, the required make-up rate to maintain SFP levels is 101.2 gallons-per-minute (gpm) and 96.2 gpm for BVPS-1 and 2, respectively, assuming a make-up water temperature of 100 °F. The minimum times-to-boil in this scenario are 2.33 hours and 2.58 hours for BVPS-1 and 2, respectively. The licensee identified several sources of make-up water with sufficient flow rates that can be placed in service within 30 minutes. These include:

| Make-up Water Source | BVPS-1 Flow Rate | BVPS-2 Flow Rate |
|---|---|---|
| Primary Grade Water | >170 gpm | 168 gpm |
| Reactor Water Storage Tank | 125 gpm | 75 gpm |
| Engine Driven Fire Pump | 100 gpm each hose (3 hoses) | 100 gpm each hose (2 hoses) |

The licensee identified that the SFP temperatures will exceed the 150 °F criterion for planned and unplanned offload conditions. The licensee has multiple sources of make-up water that are available within the time to boil in the unlikely event that a worst case loss of all SFP cooling should occur. The availability of adequate make-up water sources ensures that the licensee continues to meet the design requirements of both units. The NRC staff finds that the SFP cooling systems for BVPS-1 and 2 have sufficient make-up water sources and meet the design criteria in their respective UFSARs. Therefore, the NRC staff finds the SFP cooling system acceptable with respect to the availability of make-up water sources.

Although operation of the SFP cooling system has been analyzed by the licensee, it would be undesirable to enter a refueling outage with an unreliable SFP cooling system. The licensee acknowledges this and stated in its December 17, 2001, letter that it utilizes shutdown risk and outage risk management efforts, which incorporate risk insights and information into outage planning and scheduling efforts; existing maintenance programs and practices; and procedures addressing refueling prerequisites to ensure that a refueling outage is entered with a reliable SFP cooling system. Also, the licensee acknowledged the need for optimum SFP cooling performance to ensure the licensing basis SFP temperature limits are not violated. The licensee considers maintaining SFP temperatures as low as reasonably achievable an important objective during refueling outage activities to protect personnel safety, plant equipment, and to prevent economic inefficiencies. In addition, the licensee has made a formal commitment to establish administrative controls to control decay times prior to the movement of irradiated fuel assemblies from the reactor core based on the graphs discussed in Section 3.1.1.1 of this safety evaluation. The licensee's commitment provides assurance that BVPS-1 and 2 will continue to meet their design criteria for removing the decay heat from the stored spent fuel assemblies with the decreased decay time.

3.1.2 SFP Cooling Capacity Conclusion

The NRC staff finds that the licensee has adequately analyzed the ability of the SFP cooling system to remove decay heat from the SFP under planned and unplanned offload conditions. Furthermore, the assumption of a decay time of 100 hours has been incorporated in this analysis with acceptable results. The licensee also has committed to administratively control the offloading of fuel based on CCW temperature and decay time. Therefore, the NRC staff finds that the SFP cooling capacity is acceptable for the analyzed conditions and supports the reduction in decay time to 100 hours.

3.2 Structural Integrity of the Spent Fuel Pool

The licensee calculated the maximum SFP water temperatures for normal (planned) offload conditions for BVPS-1 and 2. The results indicate that the maximum SFP water temperatures are 155.7 °F and 159.2 °F, for BVPS-1 and 2, respectively. The durations of the periods in which the SFP water temperatures exceed 150 °F are approximately 60 hours and 100 hours for BVPS-1 and 2, respectively. The American Concrete Institute (ACI) 349 Code limits the concrete temperature to (1) 150 °F for normal operation or any other long-term period, 200 °F for local areas, (2) 350 °F for accident or any other short-term period, and (3) 650 °F from steam or water jets in the event of a pipe failure.

The licensee performed an analysis for the SFP structures of BVPS-1 and 2, assuming a temperature of 175 °F at the concrete interior surface while the fuel remains in the SFP indefinitely. The results indicate that the stresses in the concrete and the reinforcing steel meet the structural acceptance criteria for abnormal conditions. The maximum compressive stress in the concrete is less than 800 pounds-per-square inch (psi) for loading combinations incorporating the concrete surface temperature of 175 °F. This compressive stress is far less than the design compressive strength of 3000 psi. The assumption of the fuel remaining in the SFP indefinitely is conservative for the reasons that (1) for a normal offload, approximately two-thirds of the offloaded assemblies are returned to the reactor pressure vessel and (2) for an abnormal offload, the full core that would be offloaded would be returned to the reactor pressure vessel once the initiating emergency condition was cleared or resolved. In both of

these scenarios the heat load to the SFP would be reduced significantly as compared to the heat load that would result from the fuel's remaining in the SFP indefinitely.

The NRC staff finds that the conditions of the maximum SFP bulk water temperatures of 155.7 °F for BVPS-1 with a duration of approximately 60 hours, and 159.2 °F for BVPS-2 with a duration of approximately 100 hours are within the ACI 349 Code criteria limits on concrete temperatures of 150 °F for long-term periods and 350 °F for short-term periods. The NRC staff also finds that the licensee has used a conservative assumption for the SFP structural analysis by considering the concrete interior surface at 175 °F while the fuel remains in the SFP indefinitely. The assumed temperature of 175 °F is greater than the maximum temperatures, 155.7 °F for BVPS-1 and 159.2 °F for BVPS-2, which would be experienced during the offload period. The assumption of considering the fuel to remain in the SFP indefinitely is more conservative than the actual condition during the offload. The licensee's analysis results have demonstrated that the integrity of the SFP structures at BVPS-1 and 2 would not be compromised if the decay time was reduced from 150 hours to 100 hours. Therefore, the NRC staff finds the effects of the reduced decay time on the structural integrity of the BVPS-1 and 2 SFP acceptable.

3.3 TS Change

The NRC staff finds that the licensee has adequately analyzed the SFP cooling capacity and structural integrity with acceptable results. The decrease in decay time to 100 hours has been incorporated into the analysis. The effects of the decrease in decay time on the dose consequences of a postulated design-basis FHA have already been reviewed and approved by the NRC. Therefore, the NRC staff finds the reduction in decay time in BVPS-1 and 2 TS 3.9.3 from 150 hours to 100 hours acceptable.

## 4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Pennsylvania State official was notified of the proposed issuance of the amendments. The State official had no comments.

## 5.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and change surveillance requirements. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (66 FR 66465). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

## 6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: D. Cullison, J. Ma

Date: January 29, 2002