FENOC

FirstEnergy Nuclear Operating Company

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December 21, 2007

L-07-517

10 CFR 50.90

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Beaver Valley Power Station, Unit Nos. 1 and 2
BV-1 Docket No. 50-334, License No. DPR-66
BV-2 Docket No. 50-412, License No. NPF-73
License Amendment Request Number 204 Revision 1 (TAC Nos. MD2377 and MD2378)

Pursuant to 10 CFR 50.90, FirstEnergy Nuclear Operating Company (FENOC) hereby requests the following amendment:

The proposed changes will revise the Technical Specification to incorporate the results of a new spent fuel pool criticality analysis documented in WCAP-16518-P, "Beaver Valley Unit 2 Spent Fuel Pool Criticality Analysis", Revision 2 (Reference 1) for Beaver Valley Power Station (BVPS) Unit No. 2.

License Amendment Request Nos. 333 (Unit 1) and 204 (Unit 2) were transmitted by FENOC Letter L-06-094, dated June 14, 2006 (Reference 2). Responses to an NRC Request for Additional Information (RAI) were transmitted by FENOC Letter L-07-084, dated July 20, 2007 (Reference 3). The resolution of some of the NRC concerns required a revision to WCAP-16518 and a revision to the originally proposed Technical Specification changes. The WCAP revision was transmitted by FENOC Letter L-07-103, dated July 26, 2007 (Reference 4). Since this revision does not involve changes to the Beaver Valley Power Station Unit 1 Technical Specifications, License Amendment Request No. 333 (Unit 1) is withdrawn. The License Amendment Request being transmitted by this letter completely replaces License Amendment Request No. 204 (Unit 2) that was transmitted by Reference 2.

Enclosure 1 contains the evaluation of the proposed changes. This enclosure also contains markups of the Technical Specifications and Bases. The Bases changes are provided for information only.

A001
NRR

This changes have been reviewed by the Beaver Valley Power Station review committees. The changes were determined to be safe and do not involve a significant hazard consideration as defined in 10 CFR 50.92 based on the attached safety analysis and no significant hazard evaluation.

FENOC requests approval of the proposed amendment no later than March 15, 2008. Approval is needed to support the upcoming Unit 2 Refueling Outage scheduled for the spring of 2008. Once approved, the amendment shall be implemented within 30 days.

There are no regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – FENOC Fleet Licensing, at 330-761-6071.

I declare under penalty of perjury that the foregoing is true and correct. Executed on December 21, 2007.

Sincerely,

Peter P. Sena III

Enclosures:
1. FENOC Evaluation of the Proposed Changes

References:

1. WCAP-16518-P, "Beaver Valley Unit 2 Spent Fuel Pool Criticality Analysis", Revision 2, July 2007.
2. FENOC Letter L-06-094, License Amendment Request Nos. 333 and 204, dated June 14, 2006.
3. FENOC Letter L-07-084, Responses to a Request for Additional Information (RAI dated May 21, 2007) in Support of License Amendment Request Nos. 333 and 204 (TAC Nos. MD2377 and MD2378), dated July 20, 2007.
4. FENOC Letter L-07-103, Supplemental Information for License Amendment Request Nos. 333 and 204 (Revision 2 of WCAP-16518) (TAC Nos. MD2377 and MD2378), dated July 26, 2007

cc: Mr. S. J. Collins, NRC Region I Administrator
Mr. D. L. Werkheiser, NRC Senior Resident Inspector
Ms. N. S. Morgan, NRR Project Manager
Mr. D. J. Allard, Director BRP/DEP
Mr. L. E. Ryan (BRP/DEP)

ENCLOSURE

FENOC Evaluation of the Proposed Changes

Beaver Valley Power Station
License Amendment Request No. 204 Revision 1

Subject: Unit 2 New Spent Fuel Storage Configuration

Table of Contents

Attachments

1.0 DESCRIPTION

This is a request to amend Operating License NPF-73 (Beaver Valley Power Station Unit No. 2). The proposed changes to the Beaver Valley Power Station (BVPS) Operating License will revise the Technical Specifications to incorporate the results of a new spent fuel pool criticality analysis for Unit No. 2. The new criticality analysis will permit utilization of vacant storage locations dictated by the existing Technical Specification storage configurations in the Unit No. 2 spent fuel pool.

This License Amendment Request (LAR) replaces a LAR submitted by FirstEnergy Nuclear Operating Company (FENOC) letter L-06-094 (Reference 1) dated June 14, 2006. The original LAR contained a change to the Unit No. 1 Technical Specifications. Since this replacement LAR does not require a change to the Unit No. 1 Technical Specifications, the Unit No. 1 LAR designation of 333 has been dropped from this replacement LAR. The original LAR also stated that the proposed changes were submitted in the Improved Technical Specification (ITS) format because the BVPS Technical Specifications had not been converted to the ITS format. Since that time conversion of the BVPS Technical Specifications to the ITS format has been approved and implemented at BVPS. Thus, all references to the ITS format have been removed from this replacement LAR.

2.0 PROPOSED CHANGES

The BVPS Technical Specifications, submitted for NRC review and approval, are provided in Attachment A[1]. The changes proposed to the Technical Specification Bases are provided in Attachment B[1]. The proposed Technical Specification Bases do not require NRC approval. The Beaver Valley Power Station Technical Specification Bases Control Program controls the review, approval and implementation of Technical Specification Bases changes. The Technical Specification Bases change is provided for information only.

To meet format requirements the Index, Technical Specifications and Technical Specification Bases pages will be revised and repaginated as necessary to reflect the changes being proposed by this LAR.

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[1] The proposed changes to the Technical Specifications and Technical Specification Bases have been prepared electronically. Deletions are shown with a strike-through and insertions are shown double-underlined. This presentation allows the reviewer to readily identify the information that has been deleted and added.

Technical Specification 3.7.14 Change

Technical Specification 3.7.14, Spent Fuel Pool Storage, is modified by adding a conditional requirement to meet the requirements of Specification 4.3.1.1 for Unit No. 2. This reference to a specification in the Design Features Section of the Technical Specifications appears in the Limiting Conditions for Operation (LCO), Required Action A.1 and Surveillance Requirement 3.7.14.1.

Specification 4.3.1.1 Change

Specification 4.3.1.1.e is split into two parts, one applicable to Unit No. 1 and another applicable to Unit No. 2. There is no change made to the Unit No. 1 requirements other than adding a Unit No. 1 designation. The Unit No. 2 portion reflects the content of NUREG-1431, "Standard Technical Specification - Westinghouse Plants", Revision 3. The Unit No. 2 information dictates into which storage configuration a particular fuel assembly is stored.

Change Justification

The justification for the proposed changes is a new criticality analysis described in Section 4.0 and documented in WCAP-16518-P/ WCAP-16518-NP, "Beaver Valley Unit 2 Spent Fuel Pool Criticality Analysis," Revision 2, July 2007 (Reference 2) and to achieve conformance with NUREG-1431.

Technical Specification Bases Change

Technical Specification Bases 3.7.14 and 3.7.16 are revised to reflect the changes made to the Technical Specification and the new criticality analysis. The justification for these changes is the new criticality analysis described in Section 4.0 and documented in Reference 2.

3.0 BACKGROUND

Existing Licensing Basis

FENOC previously submitted a Unit No. 2 license amendment request to credit boron in the spent fuel pool. This request was granted in Amendment 128 on February 11, 2002 (Reference 5).

The credit for soluble boron in the spent fuel rack criticality analysis was based on the methodology described in Westinghouse topical report WCAP-14416-NP-A, Revision 1, "Westinghouse Spent Fuel Rack Criticality Analysis Methodology," (Reference 3). This report was approved by the NRC on October 25, 1996 and issued by Westinghouse in November 1996.

The methodology of WCAP-14416-NP-A provided for limited credit for soluble boron in the spent fuel pool to maintain $k_{eff} < 0.95$. The criteria set forth in this topical report were that k_{eff} remains less than 1.0 with zero soluble boron and that k_{eff} remains less than or equal to 0.95 with credit for soluble boron with a 95% probability at a 95% confidence level (95/95). Fuel enrichments up to 5 weight percent (5 w/o) U-235 were considered in the analysis. In some cases, it was necessary to credit burnup in order to ensure that the spent fuel pool k_{eff} remained less than 1.0 with zero soluble boron.

Issues With Current Licensing Basis Methodology

Subsequent to the issuance of WCAP-14416-NP-A, Westinghouse issued a Nuclear Safety Advisory Letter (NSAL-00-015) reporting potential non-conservatisms in the axial shape bias and the reactivity equivalencing techniques used in the analysis. In addition, Regulatory Issue Summary (RIS) 01-012, "Nonconservatism in Pressurized Water Reactor Spent Fuel Storage Pool Reactivity Equivalencing Calculations," (Reference 4), was issued to notify the industry of the reactivity equivalencing technique issue.

An evaluation of these non-conservatisms was performed for BVPS Unit No. 2 as part of NSAL-00-015. This evaluation resulted in the use of margin in the existing analysis to demonstrate that the current Technical Specifications continue to provide their intended level of protection.

Proposed Changes to Licensing Basis

Westinghouse performed a new criticality analysis using methods that address the non-conservatisms of WCAP-14416-NP-A, Revision 1 (Reference 3). The new analysis is documented in WCAP-16518-P/ WCAP-16518-NP, "Beaver Valley Unit 2 Spent Fuel Pool Criticality Analysis", Revision 2, July 2007 (Reference 2). The methodology is analogous to that described in WCAP-14416-NP-A; however the 2D-to-3D axial burnup biasing methodology is not used. Instead, the 3D axial burnup distribution effects are explicitly modeled. Reactivity equivalency techniques were not used in the new analysis.

The new criticality analysis for BVPS Unit No. 2 spent fuel rack utilizes methods that address the non-conservatisms previously described to provide more flexibility in the utilization of existing space in the spent fuel pool. The results of the analysis provided updated soluble boron, burnup credit, decay credits, Integral Fuel Burnable Absorber (IFBA) credit requirements and specific storage configurations. No physical plant changes are being made (no changes to the spent fuel pools or racks, heat loads, supporting systems, etc.).

Precedent

The application of the methods used in the new criticality analysis has been approved by the NRC for the following plants.

- R. E. Ginna (Amendment 79 to Facility Operating License DPR-18, dated December 7, 2000),
- Diablo Canyon Power Plant (Amendment 154 to Facility Operating Licenses DPR-80 and DPR-82, dated September 25, 2002),
- Millstone Power Station Unit 2 (Amendment 274 to Facility Operating License DPR-65, dated April 1, 2003) and
- Vogtle Electric Generating Plant (Amendment 139 to Facility Operating License NPF-68 and Amendment 118 to Facility Operating License NPF-81, dated September 22, 2005).

The methodology has been reviewed and determined to be applicable to BVPS Unit No. 2.

4.0 TECHNICAL ANALYSIS

The new criticality analysis, documented in Reference 2, provides the enrichment, decay, burnup, and IFBA limits, and identifies specific storage configurations required to comply with 10 CFR 50.68, "Criticality accident requirements." The boron dilution evaluation that supported Amendment 128 (Reference 5) to permit credit for soluble boron at BVPS Unit No. 2 continues to remain valid. Consistent with the analysis supporting Amendment 128, the new criticality analysis does not take credit for the Boraflex, a neutron absorber material, currently in the Unit No. 2 spent fuel pool.

The primary objectives of the new criticality analysis documented in Reference 2 are as follows:

1. To determine the fuel assembly burnup versus initial enrichment limits required for safe storage of fuel assemblies in the "All Cell," "1-out-of-4 5.0 w/o at 15,000 MWD/MTU" and "1-out-of-4 3.85 w/o Fresh with IFBA" storage configurations.
2. To determine the burnup versus initial enrichment limits required for safe storage of fuel assemblies in the "3x3" configuration with credit for 5, 10, 15, and 20 years of Pu-241 decay.
3. To determine the number of IFBA pins versus initial enrichment limits required for safe storage of fuel assemblies in the "1-out-of-4 3.85 w/o Fresh with IFBA" storage configuration.
4. To determine that fuel rod storage canisters containing fuel rods with a maximum enrichment of 5.0 w/o U-235 may be safely stored in any storage configuration.
5. To determine the assembly loading requirements at the interface between storage configurations.
6. To determine the amount of soluble boron required to maintain k_{eff} less than or equal to 0.95 in the spent fuel pool, including all biases and uncertainties, assuming the most limiting plausible reactivity accident.

These objectives were met and resulted in the Technical Specification changes being proposed by this LAR.

Calculations were performed for the entire pool with various fuel storage configurations to demonstrate that the k_{eff} for the entire pool remains below 1.0 with zero soluble boron. Computer modeling was used to determine the soluble boron requirements for non-accident and accident conditions to ensure that k_{eff} remains less than or equal to 0.95.

The new criticality analysis demonstrates that k_{eff} remains below 1.0 for the various storage configurations considered with zero soluble boron and that k_{eff} remains less than or equal to 0.95 for the entire pool with credit for soluble boron under non-accident and accident conditions with a 95% probability at a 95% confidence level (95/95).

The new criticality analysis also determined that the most limiting plausible reactivity accident is the misloaded fresh fuel assembly (5.0 w/o U-235 enrichment) in an incorrect storage rack location for the "1-out-of-4 5.0 w/o at 15,000 MWD/MTU" configuration.

Boron Dilution Event

A spent fuel pool dilution evaluation was presented in support of Amendment 128 (Reference 5). The dilution evaluation addressed a dilution from the minimum boron concentration requirement of 2000 ppm to 450 ppm. The evaluation concluded, and the staff agreed, that an unplanned or inadvertent event that would dilute the spent fuel pool to 450 ppm is not credible for BVPS Unit No. 2. The new analysis calculates that 441.8 ppm of soluble boron is needed to maintain k_{eff} less than or equal to 0.95, including all biases and uncertainties. Thus, no new dilution evaluation is required for the changes proposed by this LAR.

Conclusions

Based on the results of the analysis discussed above and in Reference 2, the following conclusions can be drawn:

1. k_{eff} remains below 1.0 for the various storage configurations considered with zero soluble boron with a 95% probability at a 95% confidence level (95/95) thereby meeting the requirements of Title 10 of the Code of Federal Regulations, Part 50 (10 CFR 50), Appendix A, General Design Criteria (GDC) 62.

2. k_{eff} remains less than or equal to 0.95 for the entire pool with credit for soluble boron under non-accident and accident conditions with a 95% probability at a 95% confidence level (95/95).

3. The current minimum spent fuel pool boron concentration limit in Technical Specification 3.7.16 and the current dilution event analysis continue to ensure that any credible dilution event could be terminated before reaching a boron concentration corresponding to k_{eff} greater than 0.95.

5.0 REGULATORY SAFETY ANALYSIS

The current licensing basis for Beaver Valley Power Station (BVPS) Unit No. 2 permits credit for soluble boron in the spent fuel rack criticality analysis. This analysis is based on the methodology described in Westinghouse topical report

WCAP-14416-NP-A, Revision 1, "Westinghouse Spent Fuel Rack Criticality Analysis Methodology." Regulatory Issue Summary (RIS) 01-012, "Nonconservatism in Pressurized Water Reactor Spent Fuel Storage Pool Reactivity Equivalencing Calculations," dated May 18, 2001, notified the industry of potential non-conservatisms in the reactivity equivalencing techniques used in this analysis. An evaluation of these non-conservatisms was performed for BVPS Unit No. 2 that resulted in the use of margin in the existing analysis to demonstrate that the current Technical Specifications continue to provide their intended level of protection.

FirstEnergy Nuclear Operating Company (FENOC) has chosen to perform a new criticality analysis for the BVPS Unit No. 2 spent fuel storage racks that will permit utilization of vacant storage locations dictated by the existing Technical Specification storage configurations in the Unit No. 2 spent fuel pool. The new criticality analysis also uses methods that address the non-conservatisms identified in RIS 01-012. The analysis is documented in WCAP-16518-P/ WCAP-16518-NP, "Beaver Valley Unit 2 Spent Fuel Pool Criticality Analysis," Revision 2, July 2007. The methodology is analogous to that described in WCAP-14416-NP-A, however the 2D-to-3D axial burnup biasing methodology is not used. Instead, the 3D axial burnup distribution effects are explicitly modeled. Reactivity equivalency techniques were not used in the new criticality analysis.

This License Amendment Request (LAR) proposes revisions to BVPS Technical Specification 3.7.14, Spent Fuel Storage, and Specification 4.3.1.1. The revisions to Technical Specification 3.7.14 consist of replacing the Unit No. 2 table and adding compliance with Specification 4.3.1.1 for Unit No. 2. The revisions to Specification 4.3.1.1, specifically Specification 4.3.1.1.e, consist of requiring compliance with WCAP-16518-P for certain storage requirements for Unit No. 2. The changes being proposed apply to only Unit No. 2. The methodologies used for the new criticality analysis documented in WCAP-16518-P have been previously approved for use by the NRC.

5.1 No Significant Hazards Consideration

FirstEnergy Nuclear Operating Company (FENOC) has evaluated whether or not a significant hazards consideration is involved with the proposed amendments by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No. The relevant accidents previously evaluated are limited to the fuel handling and criticality accidents.

   Administrative controls during fuel fabrication ensure that the fuel is fabricated to ensure proper loading of fuel in the fuel assemblies. Administrative and operational controls used to load fuel assemblies into the spent fuel pool ensure that fuel assemblies are stored in compliance with the allowed storage configurations. Fuel handling is performed under administrative controls and physical limitations. These controls will remain in effect and continue to protect against criticality and fuel handling accidents involving new storage configurations dictated by the new analysis. There is therefore no impact on the probability of fuel handling or criticality accidents.

   The new criticality analysis defines new spent fuel storage configurations with new enrichment and burnup limits. Integral Fuel Burnable Absorber (IFBA) limits are used to comply with the 1-out-of-4 configuration for fresh fuel. The boron dilution evaluation that supported Amendment 128, permitting credit for soluble boron at BVPS Unit No. 2 continues to remain valid. The new analysis demonstrates that k_{eff} remains below 1.0 for the various storage configurations considered with zero soluble boron, and that k_{eff} remains less than or equal to 0.95 for the entire pool with credit for soluble boron under non-accident and accident conditions with a 95% probability at a 95% confidence level (95/95). Potential consequences of accidents previously analyzed remain unchanged.

   Therefore, the proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No. The relevant types of accidents previously evaluated are limited to criticality and fuel handling accidents. Although the new analysis will allow utilization of additional storage capacity, implementation of fuel loading configurations and fuel handling activities will continue to be performed under administrative and operational controls. No new or different activities are introduced as a result of the proposed changes. The utilization of additional storage capacity within the allowances of the revised analysis will introduce no new or other kind of accident.

Therefore, the proposed changes do not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

Response: No. The margin to safety with respect to analyzed accidents involves maintaining k_{eff} through fuel storage configurations and boron concentration controls in the spent fuel pool. The boron dilution evaluation that supported Amendment 128 permitting credit for soluble boron at BVPS Unit No. 2 remains valid. The Amendment 128 evaluation concluded that a boron dilution event is not credible for BVPS Unit No. 2. The new analysis calculates the non-accident soluble boron concentration to maintain k_{eff} less than or equal to 0.95 to be less than was determined in the Amendment 128 evaluation. Thus, there is no significant reduction in a margin of safety because of the new analysis and the conclusions of the Amendment 128 dilution evaluation remain valid.

Under accident conditions, the soluble boron needed to maintain k_{eff} below 0.95 with the new storage configurations is less than what is assumed in current analysis. The proposed change does not involve a significant reduction in a margin of safety for accident conditions.

Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

Based on the above, FENOC concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements/Criteria

A review of 10 CFR 50, Appendix A, "for Nuclear Power Plants" (Reference 7), was conducted to determine the impact associated with the proposed change. The General Design Criteria (GDC) were evaluated as follows:

1. General Design Criterion 2, as it relates to structures housing the facility and the facility itself being capable of withstanding the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, and floods.

2. General Design Criterion 4, as it relates to structures housing the facility and the facility itself being capable of withstanding the effects of environmental conditions, external missiles, internally generated missiles, pipe whip, and jet impingement forces associated with pipe breaks, such that safety functions will not be precluded.

3. General Design Criterion 5, as it relates to shared structures, systems, and components important to safety being capable of performing required safety functions.

4. General Design Criterion 61, as it relates to the facility design for fuel storage and handling of radioactive materials.

5. General Design Criterion 62, as it relates to the prevention of criticality by physical systems or processes utilizing geometrically safe configurations.

6. General Design Criterion 63, as it relates to monitoring systems provided to detect conditions that could result in the loss of decay heat removal capabilities, to detect excessive radiation levels, and to initiate appropriate safety actions.

The new and spent fuel storage racks are designed in accordance with GDC 62 and NUREG-0800. The new fuel storage rack accommodates one third of a core plus 17 spare assemblies. The spent fuel storage pool accommodates the spent fuel rack and the required spent fuel shipping cask area.

The spent fuel racks are arranged so that the spacing between fuel elements cannot be less than that prescribed. Borated water is maintained in the spent fuel pool. Even if fully flooded with unborated water, the spacing and fuel storage configurations ensure $k_{eff} < 1.0$.

The spent fuel storage area, located in the fuel building, is designed to provide a safe and effective means of storing spent fuel.

The Unit No. 2 spent fuel pool also complies with the requirements of the following Regulatory Guides.

1. Regulatory Guide 1.13, Fuel Storage Facility Design Basis
2. Regulatory Guide 1.29, Seismic Design Classification
3. Regulatory Guide 1.115, Protection Against Low-Trajectory Turbine Missiles
4. Regulatory Guide 1.117, Tornado Design Classification

<u>Assessment</u>

No change to the UFSAR description of conformance to the GDCs or the listed Regulatory Guides is required as a result of the change proposed in this LAR.

In conclusion, based on the considerations discussed above, (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 amendment will not be inimical to the common defense and security or to the health and safety of the public.

6.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or

(iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

7.0 REFERENCES

1. FENOC Letter L-06-094, License Amendment Request Nos. 333 and 204, dated June 14, 2006.

2. WCAP-16518-P/ WCAP-16518-NP, "Beaver Valley Unit 2 Spent Fuel Pool Criticality Analysis", Revision 2, July 2007.

3. WCAP-14416-NP-A, "Westinghouse Spent Fuel Rack Criticality Analysis Methodology", Revision 1, November 1996.

4. Regulatory Issue Summary (RIS) 01-012, "Nonconservatism in Pressurized Water Reactor Spent Fuel Storage Pool Reactivity Equivalencing Calculations," May 18, 2001.

5. NRC Safety Evaluation Report for Beaver Valley Power Station Unit 2 Amendment 128, letter dated February 11, 2002.

6. Westinghouse Electric Company Letter, FENOC-00-110, "NSAL-00-015, "Axial Burnup Shape Reactivity Bias," November 2000.

7. 10 CFR 50, Appendix A, "General Design Criteria for Nuclear Power Plants."

Enclosure, Attachment A

Beaver Valley Power Station
Proposed Technical Specification Changes

License Amendment Request No. 204 Revision 1

The following is a list of the affected pages:

3.7.14 - 1 *
3.7.14 - 2 *
3.7.14 - 3
4.0 – 1 *
4.0 - 2
4.0 - 3 **

* No change. Page included for context only.

** Page included showing repagination. No changes made to text.

3.7 PLANT SYSTEMS

3.7.14 Spent Fuel Pool Storage

LCO 3.7.14 The combination of initial enrichment and burnup of each fuel assembly stored in the spent fuel storage pool shall be within the limits specified in Table 3.7.14-1A (Unit 1), Table 3.7.14-1B (Unit 2), or in accordance with Specification 4.3.1.1 (Unit 2).

APPLICABILITY: Whenever any fuel assembly is stored in the spent fuel storage pool.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Requirements of the LCO not met.	A.1	- NOTE – LCO 3.0.3 is not applicable.	
		Initiate action to move the noncomplying fuel assembly to a location that complies with Table 3.7.14-1A (Unit 1), Table 3.7.14-1B (Unit 2), or in accordance with Specification 4.3.1.1 (Unit 2).	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.14.1	Verify by administrative means the initial enrichment and burnup of the fuel assembly is in accordance with Table 3.7.14-1A (Unit 1), Table 3.7.14-1B (Unit 2) or Specification 4.3.1.1 (Unit 2).	Prior to storing the fuel assembly in the spent fuel storage pool.

Table 3.7.14-1A (page 1 of 1)
(Unit 1 Spent Fuel Pool Storage)

Fuel Assembly Minimum Burnup versus U-235 Initial Enrichment for Storage in Spent Fuel Rack Regions 1, 2, and 3

Nominal Enrichment (w/o U-235)	**Region 3** Assembly Discharge Burnup (MWD/MTU)	**Region 2** Assembly Discharge Burnup (MWD/MTU)	**Region 1** Assembly Discharge Burnup (MWD/MTU)
2.0	0	2585	0
2.348	0	7911 (calculated)	0
2.5	1605	9551	0
3.0	6980	15784	0
3.5	11682	21643	0
4.0	16239	27260	0
4.5	20672	33710	0
5.0	25000	40000	0

NOTES:

Region 2: The data in the above Table may be interpreted linearly or may be calculated by the conservative equation below. This equation provides a linear fit to the design burnup limits.

Minimum Burnup, MWD/MTU = 12,100 * E% - 20,500

Where E = Enrichment ($E \leq 5\%$)

Region 3: The data in the above Table may be interpreted linearly or may be calculated by the conservative equation below. This equation provides a best fit to the design burnup limits.

Minimum Burnup, MWD/MTU = $-480 * (E\%)^2 + 12,900 * E\% - 27,400$

Where E = Enrichment ($E \leq 5\%$)

Table 3.7.14-1B (page 1 of 1)
(Unit 2 Spent Fuel Pool Storage)

~~Fuel Assembly Minimum Burnup versus U-235 Initial Enrichment for Storage in Spent Fuel Rack Regions 1, 2, and 3~~

~~Nominal Enrichment (w/o U-235)~~	~~**Region 3**~~ ~~4-out-of-4 Burnup (MWD/MTU)~~	~~**Region 2**~~ ~~3-out-of-4 Checkerboard Burnup (MWD/MTU)~~	~~**Region 1**~~ ~~2-out-of-4 Checkerboard Burnup (MWD/MTU)~~
~~1.9~~	~~0~~	~~0~~	~~0~~
~~2.0~~	~~1615~~	~~0~~	~~0~~
~~2.2~~	~~4629~~	~~0~~	~~0~~
~~2.4~~	~~7295~~	~~0~~	~~0~~
~~2.6~~	~~9677~~	~~0~~	~~0~~
~~2.8~~	~~11877~~	~~1798~~	~~0~~
~~3.0~~	~~13995~~	~~3556~~	~~0~~
~~3.2~~	~~16112~~	~~5268~~	~~0~~
~~3.4~~	~~18235~~	~~6940~~	~~0~~
~~3.6~~	~~20349~~	~~8581~~	~~0~~
~~3.8~~	~~22443~~	~~10198~~	~~0~~
~~4.0~~	~~24503~~	~~11800~~	~~0~~
~~4.2~~	~~26519~~	~~13394~~	~~0~~
~~4.4~~	~~28492~~	~~14979~~	~~0~~
~~4.6~~	~~30428~~	~~16552~~	~~0~~
~~4.8~~	~~32329~~	~~18110~~	~~0~~
~~5.0~~	~~34201~~	~~19650~~	~~0~~

~~NOTE:~~

~~Linear interpolation yields conservative results.~~

Fuel Assembly Minimum Burnup versus Initial Enrichment for the

"All-Cell" Storage Configuration

Initial Enrichment (w/o U-235)	Burnup (MWD/MTU)
1.856	0
3.000	13,049
4.000	23,792
5.000	34,404

NOTES:

Any fuel assembly may be loaded at the interface with another configuration.

The required minimum assembly burnup (in MWD/MTU) for an assembly of a given initial enrichment may be calculated using the equation below, where E% is the assembly initial enrichment in weight percent U-235.

Assembly Burnup = $78.116(E\%)^3 - 1002.647(E\%)^2 + 14871.032(E\%) - 24649.599$

Where E = Enrichment ($E \leq 5\%$)

4.0 DESIGN FEATURES

4.1 Site Location

The Beaver Valley Power Station is located in Shippingport Borough, Beaver County, Pennsylvania, on the south bank of the Ohio River. The site is approximately 1 mile southeast of Midland, Pennsylvania, 5 miles east of East Liverpool, Ohio, and approximately 25 miles northwest of Pittsburgh, Pennsylvania. The Unit 1 exclusion area boundary has a minimum radius of 2000 feet from the center of containment. The Unit 2 exclusion area boundary has a minimum radius of 2000 feet around the Unit No. 1 containment building.

4.2 Reactor Core

4.2.1 Fuel Assemblies

The reactor shall contain 157 fuel assemblies. Each assembly shall consist of a matrix of Zircalloy or ZIRLO fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

4.2.2 Control Rod Assemblies

The reactor core shall contain 48 control rod assemblies. The control material shall be silver indium cadmium as approved by the NRC.

4.3 Fuel Storage

4.3.1 Criticality

4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. Fuel assemblies having a maximum U-235 enrichment as specified in LCO 3.7.14, "Spent Fuel Pool Storage",

b. Unit 1
$K_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.12 of the UFSAR,

4.0 DESIGN FEATURES

4.3 Fuel Storage (continued)

Unit 2
K_{eff} < 1.0 if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.1 of the UFSAR,

c. Unit 2 only. $K_{eff} \leq 0.95$ if fully flooded with water borated to 450 ppm, which includes an allowance for uncertainties as described in Section 9.1 of the UFSAR,

d. Unit 1
A nominal center to center distance between fuel assemblies placed in the fuel storage racks of 10.82 inch for Region 1, with 9.02 inch for Regions 2 and 3,

Unit 2
A minimum center to center distance between fuel assemblies placed in the fuel storage racks of 10.4375 inches, and

e. Unit 1
Fuel assembly storage shall comply with the requirements of LCO 3.7.14, "Spent Fuel Pool Storage",

Unit 2
New or partially spent fuel assemblies within the limits of Table 3.7.14-1B may be allowed unrestrictive storage in the fuel storage racks, and

New or partially spent fuel assemblies not within the limits of Table 3.7.14-1B will be stored in compliance with NRC approved WCAP-16518-P, "Beaver Valley Unit 2 Spent Fuel Rack Criticality Analysis," Revision 2, July 2007.

Page included showing repagination. No changes made to text.

4.0 DESIGN FEATURES

4.3 Fuel Storage (continued)

Reviewer Note. Moved from previous page without any changes.

4.3.1.2 The new fuel storage racks are designed and shall be maintained with:

a. Fuel assemblies having a maximum U-235 enrichment of 5.00 weight percent with a tolerance of + 0.05 weight percent,

b. $K_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.12 of the Unit 1 UFSAR and Section 9.1 of the Unit 2 UFSAR,

c. Unit 1
$K_{eff} \leq 0.98$ if moderated by aqueous foam, which includes an allowance for uncertainties as described in Section 9.12 of the UFSAR,

Unit 2
$K_{eff} \leq 0.95$ if moderated by aqueous foam, which includes an allowance for uncertainties as described in Section 9.1 of the UFSAR, and

d. A nominal 21 inch center to center distance between fuel assemblies placed in the storage racks.

4.3.2 Drainage

Unit 1
The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 750 feet - 10 inches.

Unit 2
The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 751 feet - 3 inches.

4.3.3 Capacity

Unit 1
The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1627 fuel assemblies.

Unit 2
The fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1088 fuel assemblies.

Enclosure, Attachment B

Beaver Valley Power Station
Proposed Technical Specification Bases Changes

License Amendment Request No. 204 Revision 1

The following is a list of the affected pages:

B 3.7.14 - 1
B 3.7.14 - 2
B 3.7.14 - 3
B 3.7.14 - 4
B 3.7.14 - 5 (New page)
B 3.7.14 - 6 (New page)
B 3.7.16 - 1
B 3.7.16 - 2
B 3.7.16 - 3
B 3.7.16 - 4 *
B 3.7.16 - 5

* No change. Page included for context only.

B 3.7 PLANT SYSTEMS

B 3.7.14 Spent Fuel Pool Storage

BASES

BACKGROUND

The spent fuel storage racks contain storage locations for 1627 fuel assemblies (Unit 1) and 1088 fuel assemblies (Unit 2). The racks are designed to store Westinghouse 17X17 fuel assemblies with nominal enrichment up to 5.0 weight percent.

For Unit 1, tThe spent fuel storage racks are divided into three regions with different fuel burnup-enrichment limits associated with each region. Fuel assemblies may be stored in any location, as specified in Table 3.7.14-1A, provided the fuel burnup-enrichment combinations are within the limits specified for the associated storage rack region in the accompanying LCO.

For Unit 1, the spent fuel storage racks are constructed, in part, from a boron carbide and aluminum-composite material with the trade name "Boral." The Boral material provides a neutron absorbing function to maintain the stored fuel in a subcritical condition. Therefore, soluble boron is not required in the Unit 1 spent fuel pool to maintain the spent fuel rack multiplication factor, k_{eff}, ≤ 0.95 when the fuel assemblies are stored in the correct fuel pool location in accordance with the accompanying LCO and no fuel movement is in progress (i.e., the pool is in a static condition). The fact that soluble boron concentration is not required to maintain the Unit 1 spent fuel rack multiplication factor, k_{eff}, ≤ 0.95 is confirmed in Holtec Report HI-92791 (Ref. 1). However, a boron concentration is maintained in the Unit 1 spent fuel pool to provide negative reactivity for postulated accident conditions (i.e., a misplaced fuel assembly resulting from fuel movement) consistent with the guidelines of ANSI 16.1-1975 (Ref. 2) and the April 1978 NRC letter (Ref. 3). The required Unit 1 spent fuel pool boron concentration for a reactivity excursion due to accident conditions is 1050 ppm.

Safe operation of the Unit 1 spent fuel pool with no movement of assemblies may therefore be achieved (without reliance on soluble boron) by controlling the location of each stored fuel assembly in accordance with the accompanying LCO.

For Unit 2, spent fuel storage is dictated by four different storage configurations associated with fuel burnup, enrichment, decay, interface and Integral Fuel Burnable Absorber (IFBA) requirements. Fuel assemblies must be stored in the configurations specified in Table 3.7.14-1B or Specification 4.3.1.1.

For Unit 2, new or partially spent fuel assemblies within the limits of Table 3.7.14-1B may be allowed unrestrictive storage in the fuel storage racks. New or partially spent fuel assemblies not within the limits of Table 3.7.14-1B will be stored in compliance with Specification 4.3.1.1, Reference 4.

In the first Unit 2 configuration, designated as "All-Cell", Westinghouse 17x17 standard fuel assemblies can be stored in a repeating 2x2 matrix of storage cells where all the assemblies have nominal enrichments less than or equal to 1.856 w/o U-235. Fuel assemblies with initial nominal enrichments greater than 1.856 w/o U-235 must satisfy a minimum burnup requirement as shown in Table 3.7.14-1B, to be eligible for storage in this configuration.

BASES

BACKGROUND (continued)

In the second Unit 2 configuration, designated as "3x3", Westinghouse 17x17 standard fuel assemblies can be stored in a repeating 3x3 matrix of storage cell with eight storage cell locations forming a ring of depleted fuel assemblies that surround a fuel assembly with initial nominal enrichment up to 5.0 w/o. The depleted fuel assemblies for this configuration must have an initial nominal enrichment of less than or equal to 1.194 w/o U-235, or satisfy a minimum burnup requirement for higher initial enrichments as shown in Reference 4 for this configuration. The burnup requirements for the depleted assemblies in this configuration can be reduced by crediting decay time.

In the third Unit 2 configuration, designated as "1-out-of-4 5.0 w/o at 15,000 MWD/MTU", Westinghouse 17x17 standard fuel assemblies can be stored in a repeating 2x2 matrix of storage cells with a fuel assembly having an initial nominal enrichment of up to 5.0 w/o U-235 and a burnup of at least 15,000 MWD/MTU occupying one storage cell location and depleted fuel assemblies occupying the three remaining locations. The depleted fuel assemblies for this configuration must have an initial nominal enrichment of less than or equal to 1.569 w/o U-235, or satisfy a minimum burnup requirement for higher initial enrichments as shown in Reference 4 for this configuration.

In the fourth Unit 2 configuration, designated as "1-out-of-4 3.85 w/o with IFBA", Westinghouse 17x17 standard fuel assemblies can be stored in a repeating 2x2 matrix of storage cells with a fuel assembly having nominal initial enrichment up to 3.85 w/o U-235 occupying one of the four storage cell location and depleted fuel assemblies occupying the three remaining locations. The depleted fuel assemblies for this configuration must have an initial nominal enrichment of less than or equal to 1.279 w/o U-235, or satisfy a minimum burnup requirement for higher initial enrichments as shown in Reference 4 for this configuration. The fresh fuel assembly must have an initial nominal enrichment of less than or equal to 3.85 w/o U-235, or must contain a minimum number of IFBA pins for higher initial enrichments as shown in Reference 4 for this configuration. The IFBA stack in the fresh assemblies must be at least 120 inches long and have a nominal loading of at least 1.5X to meet the requirements.

For Unit 2, the interfaces between these four configurations must be maintained such that only the depleted assemblies from each of the configurations are located along the interface. Using the depleted assemblies at the interface precludes locating the more highly reactive assemblies (fresh or 15,000 MWD/MTU) next to each other where the configurations meet. Each configuration has its own requirements for its depleted assemblies, which are identified in Reference 4. In the case of the "All-Cell" configuration, all of the assemblies are depleted and, therefore, can be located at the interface with any of the other configurations.

BASES

BACKGROUND (continued)

For Unit 2, spent fuel racks have been analyzed in accordance with the methodology contained and documented in Reference 4.in WCAP-14416-NP-A (Ref. 4), as supplemented by Westinghouse Electric Company letter, FENOC-00-110 (Ref. 5). and documented in WCAP-16518-P (Ref 4). This methodology ensures the spent fuel rack multiplication factor, k_{eff} is ≤ 0.95, as recommended by the April 1978 NRC letter (Ref. 3) and ANSI/ANS-57.2-1983 (Ref. 65). The codes, methods, and techniques contained in the methodology are used to satisfy this k_{eff} criterion.

The four storage configurations for the Unit 2 spent fuel storage racks are analyzed for a range of initial assembly enrichment up to 5.0 w/o utilizing credit forcheckerboard configurations, burnup, burnable absorbers, decay time and soluble boron, to ensure k_{eff} is maintained ≤ 0.95, including uncertainties, tolerances, and accident conditions. The Unit 2 spent fuel pool k_{eff} can only beis maintained < 1.0, including uncertainties and tolerances on a 95/95 probability/confidence level, without crediting soluble boron.

Therefore, the safe operation of the Unit 2 spent fuel pool with no movement of assemblies necessitates both the storage requirements of the accompanying LCO as well as the fuel pool boron concentration requirements of LCO 3.7.16 be met.

APPLICABLE SAFETY ANALYSES

The hypothetical accidents can only take place during or as a result of the movement of an assembly (Ref. 76). For these accident occurrences, the presence of soluble boron in the spent fuel storage pool (controlled by LCO 3.7.16, "Fuel Storage Pool Boron Concentration") prevents criticality in both regionsthe spent fuel storage pool. By closely controlling the movement of each assembly and by checking the location of each assembly after movement, the time period for potential accidents may be limited to a small fraction of the total operating time. Conformance with the applicable spent fuel storage pool criticality analyses is assured through compliance with the accompanying LCO and refueling procedures.

BASES

APPLICABLE SAFETY ANALYSES (continued)

For Unit 1, during the remaining time period with no potential for accidents, the operation may be under the auspices of the accompanying LCO without reliance on soluble boron.

For Unit 2, however, when no potential for an accident exists, safe operation of the spent fuel storage pool must include the boron concentration within the limit specified in LCO 3.7.16 as well as the fuel being stored in accordance with the accompanying LCO. The boron concentration specified in LCO 3.7.16, as well as the storage location requirements of the accompanying LCO, are necessary to meet the requirement to maintain $k_{eff} \leq 0.95$ in the Unit 2 spent fuel pool under normal (i.e., static) conditions. Operation within the storage location requirements of the accompanying LCO with no soluble boron in the Unit 2 spent fuel pool would only maintains $k_{eff} < 1.0$., including uncertainties and tolerances on a 95/95 probability/confidence level. In accordance with Reference 4, the interface boundaries between the various storage requirement configurations are maintained such that only the depleted assemblies are at the boundary.

The configuration of fuel assemblies in the fuel storage pool satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

For Unit 1, the restrictions on the placement of fuel assemblies within the spent fuel pool, in accordance with Table 3.7.14-1A, in the accompanying LCO, ensures the k_{eff} of the spent fuel storage pool will always remain ≤ 0.95, assuming the pool to be flooded with unborated water.

For Unit 2, operation within the storage location requirements specified in Table 3.7.14-1B of the accompanying LCO or Specification 4.3.1.1, with no soluble boron in the spent fuel storage pool would only maintain k_{eff} <1.0, including uncertainties and tolerances on a 95/95 probability/confidence level. Therefore, Unit 2 must also maintain the spent fuel storage pool boron concentration within the limit specified in LCO 3.7.16 as well as the storagelocation requirements of the accompanying LCO, in order to meet the requirement to maintain $k_{eff} \leq 0.95$.

APPLICABILITY

This LCO applies whenever any fuel assembly is stored in the spent fuel storage pool.

ACTIONS

A.1

Required Action A.1 is modified by a Note indicating that LCO 3.0.3 does not apply.

When the configuration of fuel assemblies stored in the spent fuel storage pool is not in accordance with Table 3.7.14-1A (Unit 1) and Table 3.7.14-1B (Unit 2) or Specification 4.3.1.1 (Unit 2), as applicable, the immediate action is to initiate action to make the necessary fuel assembly movement(s) to bring the configuration into compliance with Table 3.7.14-1A (Unit 1) and Table 3.7.14-1B (Unit 2) or Specification 4.3.1.1 (Unit 2), as applicable.

The Required Actions are modified by a Note that takes exception to LCO 3.0.3. If unable to move irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not be applicable. If unable to move irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the action is independent of reactor operation. Therefore, inability to move fuel assemblies is not sufficient reason to require a reactor shutdown.

SURVEILLANCE REQUIREMENTS

SR 3.7.14.1

This SR verifies by administrative means that the initial enrichment and burnup of the fuel assembly is in accordance with Table 3.7.14-1A (Unit 1) and Table 3.7.14-1B (Unit 2) in the accompanying LCO or Specification 4.3.1.1 (Unit 2). For Unit 2 fuel assemblies not within the limits of Table 3.7.14-1B, performance of this SR will ensure compliance with Specification 4.3.1.1.

Verification by administrative means may be accomplished through fuel receipt records for new fuel or burnup analysis as necessary in accordance with refueling procedures. The Frequency of prior to storing a fuel assembly ensures that fuel assemblies are stored within the configurations analyzed in the spent fuel criticality analyseis.

REFERENCES

1. Holtec Report HI-92791, Rev. 6, "Spent Fuel Pool Modification For Increased Storage Capacity, Beaver Valley Power Station Unit 1," April 1992 as supplemented by Letter to the NRC (License Change Request No. 202, Supplement 1, Spent Fuel Pool Rerack) dated June 28, 1993.

2. ANSI 16.1-1975 (ANS-8.1), Nuclear Criticality Safety In Operations With Fissionable Materials Outside Reactors.

3. NRC Letter to All Power Reactor Licensees from B. K. Grimes, "OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications," April 14, 1978.

BASES

ACTIONS

A.1

Required Action A.1 is modified by a Note indicating that LCO 3.0.3 does not apply.

When the configuration of fuel assemblies stored in the spent fuel storage pool is not in accordance with Table 3.7.14-1A (Unit 1) and Table 3.7.14-1B (Unit 2) or Specification 4.3.1.1 (Unit 2), as applicable, the immediate action is to initiate action to make the necessary fuel assembly movement(s) to bring the configuration into compliance with Table 3.7.14-1A (Unit 1) and Table 3.7.14-1B (Unit 2) or Specification 4.3.1.1 (Unit 2), as applicable.

The Required Actions are modified by a Note that takes exception to LCO 3.0.3. If unable to move irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not be applicable. If unable to move irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the action is independent of reactor operation. Therefore, inability to move fuel assemblies is not sufficient reason to require a reactor shutdown.

SURVEILLANCE REQUIREMENTS

SR 3.7.14.1

This SR verifies by administrative means that the initial enrichment and burnup of the fuel assembly is in accordance with Table 3.7.14-1A (Unit 1) and Table 3.7.14-1B (Unit 2) in the accompanying LCO or Specification 4.3.1.1 (Unit 2). For Unit 2 fuel assemblies not within the limits of Table 3.7.14-1B, performance of this SR will ensure compliance with Specification 4.3.1.1.

Verification by administrative means may be accomplished through fuel receipt records for new fuel or burnup analysis as necessary in accordance with refueling procedures. The Frequency of prior to storing a fuel assembly ensures that fuel assemblies are stored within the configurations analyzed in the spent fuel criticality analyseis.

REFERENCES

1. Holtec Report HI-92791, Rev. 6, "Spent Fuel Pool Modification For Increased Storage Capacity, Beaver Valley Power Station Unit 1," April 1992 as supplemented by Letter to the NRC (License Change Request No. 202, Supplement 1, Spent Fuel Pool Rerack) dated June 28, 1993.

2. ANSI 16.1-1975 (ANS-8.1), Nuclear Criticality Safety In Operations With Fissionable Materials Outside Reactors.

3. NRC Letter to All Power Reactor Licensees from B. K. Grimes, "OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications," April 14, 1978.

BASES

REFERENCES (continued)

4. ~~WCAP-14416-NP-A, Westinghouse Spent Fuel Rack Criticality Analysis Methodology," Revision 1, November 1996.~~

5. ~~Westinghouse Electric Company Letter, FENOC-00-110, "NSAL-00-015, "Axial Burnup Shape Reactivity Bias," November 2000.~~

~~6~~4. WCAP-16518-P, "Beaver Valley Unit 2 Spent Fuel Rack Criticality Analysis," Revision 2, July 2007.

~~6~~5. ANSI/ANS-57.2-1983, "Design Requirements for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Stations."

~~7~~6. UFSAR Section 14 (Unit 1) and UFSAR Section 15 (Unit 2).

B 3.7 PLANT SYSTEMS

B 3.7.16 Fuel Storage Pool Boron Concentration

BASES

BACKGROUND

The spent fuel storage racks contain storage locations for 1627 fuel assemblies (Unit 1) and 1088 fuel assemblies (Unit 2). The racks are designed to store Westinghouse 17X17 fuel assemblies with nominal enrichment up to 5.0 weight percent.

For Unit 1, tThe spent fuel storage racks are divided into three regions with different fuel burnup-enrichment limits associated with each region. Fuel assemblies may be stored in any location, as specified in Table 3.7.14-1A, provided the fuel burnup-enrichment combinations are within the limits specified for the associated storage rack region in LCO 3.7.14, "Spent Fuel Assembly Storage."

For Unit 1, the spent fuel storage racks are constructed, in part, from a boron carbide and aluminum-composite material with the trade name "Boral." The Boral material provides a neutron absorbing function that helps to maintain the stored fuel in a subcritical condition. Therefore, soluble boron is not required in the Unit 1 spent fuel pool to maintain the spent fuel rack multiplication factor, k_{eff}, ≤ 0.95 when the fuel assemblies are stored in the correct fuel pool location in accordance with LCO 3.7.14 and no fuel movement is in progress (i.e., the pool is in a static condition). The fact that soluble boron concentration is not required to maintain the Unit 1 spent fuel rack multiplication factor, k_{eff}, ≤ 0.95 is confirmed in Holtec Report HI-92791 (Ref. 1). However, a boron concentration is maintained in the Unit 1 spent fuel pool to provide negative reactivity for postulated accident conditions (i.e., a misplaced fuel assembly resulting from fuel movement) consistent with the guidelines of ANSI 16.1-1975 (Ref. 2) and the April 1978 NRC letter (Ref. 3). The required Unit 1 spent fuel pool boron concentration for a reactivity excursion due to accident conditions is 1050 ppm.

Safe operation of the Unit 1 spent fuel pool with no movement of assemblies may therefore be achieved (without reliance on soluble boron) by controlling the location of each stored fuel assembly in accordance with LCO 3.7.14. However, prior to fuel movement and during movement of fuel assemblies it is necessary to perform SR 3.7.16.1 to assure the required boron concentration is available until fuel movement is finished and a verification is complete that assures fuel assemblies are stored in accordance with LCO 3.7.14.

BASES

BACKGROUND (continued)

For Unit 2, spent fuel racks have been analyzed in accordance with the methodology contained and documented in Reference 4.in WCAP-14416-NP-A (Ref. 4), as supplemented by Westinghouse Electric Company letter, FENOC-00-110 (Ref. 5). This methodology ensures the spent fuel rack multiplication factor, k_{eff} is ≤ 0.95, as recommended by the April 1978 NRC letter (Ref. 3) and ANSI/ANS-57.2-1983 (Ref. 65). The codes, methods, and techniques contained in the methodology are used to satisfy this k_{eff} criterion.

The four storage configurations for the Unit 2 spent fuel storage racks are analyzed for a range of initial assembly enrichment up to 5.0 w/o utilizing credit for checkerboard configurations, burnup, burnable absorbers, decay time and soluble boron, to ensure k_{eff} is maintained ≤ 0.95, including uncertainties, tolerances, and accident conditions.

The soluble boron concentration required to maintain k_{eff} ≤ 0.95 in the Unit 2 spent fuel pool under normal conditions is 450 ppm. A spent fuel pool boron concentration of 2000 ppm ensures no credible boron dilution event will result in k_{eff} exceeding 0.95. Safe operation of the Unit 2 spent fuel pool requires the specified fuel pool boron concentration be maintained at all times when fuel assemblies are stored in the spent fuel pool. Therefore, for Unit 2, SR 3.7.16.1 is applicable whenever fuel assemblies are stored in the spent fuel pool.

During refueling, the water volume in the spent fuel pool, the transfer canal, the refueling canal, the refueling cavity, and the reactor vessel form a single mass. As a result, the soluble boron concentration is relatively the same in each of these volumes.

APPLICABLE SAFETY ANALYSES

The most limiting reactivity excursion event evaluated in the spent fuel pool criticality analyses (for both Unit 1 and 2) is a misplaced new fuel assembly with the highest permissible U-235 enrichment (5.0 weight percent).

For Unit 1, the amount of soluble boron required to maintain the spent fuel rack multiplication factor, k_{eff}, ≤ 0.95 with the worst case misplaced new fuel assembly is approximately 400 ppm. The ≥ 1050 ppm boron concentration specified in the Unit 1 LCO conservatively assures k_{eff} is maintained within the limit for the worst case misplaced assembly accident. The Unit 1 boron concentration requirement of 1050 ppm includes a conservative margin of 600 ppm with a 50 ppm allowance for uncertainties.

BASES

APPLICABLE SAFETY ANALYSES (continued)

For Unit 2, the amount of soluble boron required to maintain the spent fuel storage rack multiplication factor, k_{eff}, ≤ 0.95 with the worst case misplaced new fuel assembly is ≥ ~~1400~~ 837 ppm. The ≥ 2000 ppm limit specified in the Unit 2 LCO conservatively assures k_{eff} is maintained within the limit for the worst case misplaced fuel assembly accident. In addition, the ≥ 2000 ppm limit specified in the Unit 2 LCO ensures no credible boron dilution event will reduce the boron concentration below the 450 ppm required during normal non-accident conditions to maintain k_{eff} ≤ 0.95.

The concentration of dissolved boron in the fuel storage pool satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

The fuel storage pool boron concentration is required to be ≥ 1050 ppm (Unit 1) and ≥ 2000 ppm (Unit 2). The specified concentration of dissolved boron in the fuel storage pool preserves the assumptions used in the analyses of the potential criticality accidents as discussed in the UFSAR (Ref. ~~7~~6). In addition, for Unit 2, soluble boron is credited to maintain k_{eff} ≤ 0.95 during normal operating conditions whenever fuel is stored in the spent fuel pool.

APPLICABILITY

For Unit 1 this LCO applies whenever fuel assemblies are stored in the spent fuel storage pool, until a complete spent fuel storage pool verification has been performed following the last movement of fuel assemblies in the spent fuel storage pool. This LCO does not apply to Unit 1 following the verification, since the verification would confirm that there are no misloaded fuel assemblies. With no further fuel assembly movements in progress, there is no potential for a misloaded fuel assembly or a dropped fuel assembly.

For Unit 2 this LCO applies whenever fuel assemblies are stored in the spent fuel storage pool to ensure k_{eff} is maintained ≤ 0.95 during normal operating as well as for potential criticality accident scenarios.

ACTIONS

A.1, A.2.1, and A.2.2

The Required Actions are modified by a Note indicating that LCO 3.0.3 does not apply.

In addition, Required Action A.2.2 is modified by a Note that states Required Action A.2.2 is only applicable to Unit 1. The Action is restricted to Unit 1 because Unit 1 does not credit soluble boron during normal (non-accident) conditions to ensure k_{eff} is maintained ≤ 0.95.

No change. Page included for context only.

BASES

ACTIONS (continued)

When the concentration of boron in the fuel storage pool is less than required, immediate action must be taken to preclude the occurrence of an accident or to mitigate the consequences of an accident in progress. This is most efficiently achieved by immediately suspending the movement of fuel assemblies. Action is also initiated to restore the boron concentration simultaneously with suspending movement of fuel assemblies. Alternatively, for Unit 1 only, beginning a verification of the fuel storage pool fuel locations, to ensure proper locations of the fuel, can be performed. However, prior to resuming movement of fuel assemblies, the concentration of boron must be restored. This does not preclude movement of a fuel assembly to a safe position.

The Required Actions are modified by a Note that takes exception to LCO 3.0.3. If the LCO is not met while moving irradiated fuel assemblies in MODE 5 or 6, LCO 3.0.3 would not be applicable. If moving irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the fuel movement is independent of reactor operation. Therefore, inability to suspend movement of fuel assemblies is not sufficient reason to require a reactor shutdown.

SURVEILLANCE REQUIREMENTS

SR 3.7.16.1

This SR verifies that the concentration of boron in the fuel storage pool is within the required limit. As long as this SR is met, the analyzed accidents are fully addressed. The 7 day Frequency is appropriate because no major replenishment of pool water is expected to take place over such a short period of time.

For Unit 1 the Surveillance must be performed within the specified Frequency prior to initiating fuel movement and must continue to be performed at the specified Frequency until fuel movement is finished and a verification is complete that assures fuel assemblies are stored in accordance with LCO 3.7.14.

For Unit 2 the Surveillance must be performed within the specified Frequency whenever fuel assemblies are stored in the spent fuel storage pool.

BASES

REFERENCES

1. Holtec Report HI-92791, Rev. 6, "Spent Fuel Pool Modification For Increased Storage Capacity, Beaver Valley Power Station Unit 1," April 1992 as supplemented by Letter to the NRC (License Change Request No. 202, Supplement 1, Spent Fuel Pool Rerack) dated June 28, 1993.

2. ANSI 16.1-1975 (ANS-8.1), Nuclear Criticality Safety In Operations With Fissionable Materials Outside Reactors.

3. NRC Letter to All Power Reactor Licensees from B. K. Grimes, "OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications," April 14, 1978.

4. ~~WCAP-14416-NP-A, "Westinghouse Spent Fuel Rack Criticality Analysis Methodology," Revision 1, November 1996.~~WCAP-16518-P, "Beaver Valley Unit 2 Spent Fuel Rack Criticality Analysis," Revision 2, July 2007.

~~5. Westinghouse Electric Company Letter, FENOC-00-110, "NSAL-00-015, Axial Burnup Shape Reactivity Bias," November 2000.~~

~~6~~5. ANSI/ANS-57.2-1983, "Design Requirements for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Stations."

~~7~~6. UFSAR Sections 3.3.2.7 and 9.12.2.2 (Unit 1) and UFSAR Sections 4.3.2.6 and 9.1.2 (Unit 2).