FENOC

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April 9, 2009

L-09-086

10 CFR 50.90

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

SUBJECT:
Beaver Valley Power Station, Unit No. 2
Docket No. 50-412, License No. NPF-73
License Amendment Request No. 08-027, Unit 2 Spent Fuel Pool Rerack

Pursuant to 10 CFR 50.90, FirstEnergy Nuclear Operating Company (FENOC) hereby requests an amendment to the operating license for Beaver Valley Power Station (BVPS) Unit No. 2. The proposed amendment would revise the Technical Specifications to support the installation of high density fuel storage racks in the BVPS Unit No. 2 spent fuel pool. The reracking will replace the existing storage racks that utilize the neutron absorber Boraflex, with high density storage racks that utilize the neutron absorber Metamic. The reracking will increase the capacity of the BVPS Unit No. 2 spent fuel pool from 1,088 to 1,690 total storage locations.

The FENOC evaluation of the proposed change is provided in Enclosure A. The proprietary version of the Holtec Licensing Report supporting the installation of the high density racks is provided in Enclosure B. The non-proprietary version of the aforementioned Holtec Licensing Report is provided in Enclosure C. The affidavit required by 10 CFR 2.390 is provided in Enclosure D. FENOC requests that the proprietary version of the Holtec Licensing Report provided in Enclosure B be withheld from public viewing.

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

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FENOC requests approval of the proposed amendment by April 15, 2010 to support the installation phase of the reracking project that is scheduled to begin in May 2010. The reracking will support the Unit No. 2 refueling outage (2R15) scheduled for the spring of 2011. Once approved, the amendment shall be implemented within 30 days.

The regulatory commitment contained in this submittal is listed in the attachment. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at 330-761-6071.

I declare under penalty of perjury that the foregoing is true and correct. Executed on April 9, 2009.

Sincerely,

Peter P. Sena III

Attachment:
Regulatory Commitment List

Enclosures:
A FENOC Evaluation of the Proposed Changes
B Holtec Licensing Report for Beaver Valley Unit 2 Rerack (Proprietary Version)
C Holtec Licensing Report for Beaver Valley Unit 2 Rerack (Non-proprietary Version)
D Holtec Affidavit Pursuant to 10 CFR 2.390

cc: NRC Region I Administrator
NRC Senior Resident Inspector
NRR Project Manager
Director BRP/DEP
Site Representative (BRP/DEP)

Regulatory Commitment List

The following list identifies those actions committed to by FirstEnergy Nuclear Operating Company (FENOC) for Beaver Valley Power Station (BVPS) Unit No. 2 in this document. Any other actions discussed in the submittal represent intended or planned actions by FENOC. They are described only as information and are not Regulatory Commitments. Please notify Mr. Thomas A. Lentz, Manager - Licensing, at (330) 761-6071 of any questions regarding this document or associated Regulatory Commitments.

Regulatory Commitment	Due Date
A Metamic™ surveillance program will be implemented for the BVPS Unit No. 2 spent fuel pool in order to monitor the integrity and performance of Metamic™.	Prior to, or current with, the first fuel offload following installation of the Metamic™ racks and coupon tree.

ENCLOSURE A

FENOC Evaluation of the Proposed Changes

Beaver Valley Power Station

License Amendment Request No. 08-027

Subject: Unit No. 2 Spent Fuel Pool Rerack

Table of Contents

1.0 SUMMARY DESCRIPTION

This evaluation supports a request to amend Operating License NPF-73 for Beaver Valley Power Station (BVPS) Unit No. 2. FirstEnergy Nuclear Operating Company (FENOC) intends to expand the Beaver Valley Power Station (BVPS) Unit No. 2 spent fuel storage capacity through the use of high density fuel storage racks. This license amendment request will revise the Technical Specifications to reflect the installation of high density fuel storage racks, which will increase the capacity of the BVPS Unit No. 2 spent fuel pool from 1,088 to 1,690 total storage locations.

Installation of the high density fuel storage racks may take seven months to complete. During this time, the BVPS Unit No. 2 spent fuel pool will contain a combination of the existing racks and the high density racks. Once the installation has been completed, the BVPS Unit No. 2 spent fuel pool will contain only the high density racks. In order to provide adequate control of the fuel storage requirements associated with each type of rack, the BVPS Unit No. 2 Technical Specifications will need to address both types of racks during the installation phase of the reracking project. This will be accomplished by the issuance of an amendment referencing both the existing (Boraflex) racks and the high density (Metamic) racks.

<u>Installation of the Metamic Racks</u>

During installation of the new racks into the spent fuel pool, a new (Metamic) rack will temporarily be placed in the cask pit to provide additional fuel storage space. This is needed to provide enough fuel storage space to permit emptying the existing (Boraflex) racks for removal. Only fuel assemblies with at least 18 months of cooling time may be placed in the rack in the cask pit. As part of the new rack installation sequence, all fuel in the rack in the cask pit will eventually be moved into the spent fuel pool and the rack moved to its final position in the spent fuel pool. Following the movement of fuel from the spent fuel pool to the rack temporarily placed in the cask pit, the emptied existing rack will be removed from the spent fuel pool. A cover will be placed over the loaded rack in the cask pit to protect the rack and fuel during the movement of the racks. A new rack will then be installed into the spent fuel pool and loaded with fuel from existing racks. The emptied existing rack will then be replaced by a new rack. This fuel shuffling and rack removal and installation will continue until all the existing racks have been replaced with new racks. Once this has been completed, the fuel and rack temporarily placed in cast pit will be moved to the spent fuel pool.

2.0 DETAILED DESCRIPTION

The proposed Technical Specification changes are provided in Attachment 1. Retyped Technical Specification replacement pages are provided in Attachment 2. The retyped replacement pages are provided to show the Technical Specification pages after the proposed changes have been incorporated and are labeled as "Unofficial" because the license amendment has not been issued and other BVPS amendments are expected to be issued prior to the issuance of the amendment requested by this submittal. The proposed Technical Specification Bases changes are provided in Attachment 3. The proposed Technical Specification Bases changes are provided for information only and do not require NRC approval. The BVPS Technical Specification Bases Control Program controls the review, approval and implementation of Technical Specification Bases changes. There are no proposed changes to the Licensing Requirements Manual.

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.

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 license amendment request.

Proposed Technical Specification Changes

The Technical Specifications listed below are addressed in the submittal because their applicability includes the spent fuel pool.

3.7.12, "Supplemental Leak Collection and Release System (SLCRS)"

3.7.14, "Spent Fuel Pool Storage"

3.7.15, "Fuel Storage Pool Water Level"

3.7.16, "Fuel Storage Pool Boron Concentration"

4.3.1, "Criticality"

4.3.2, "Drainage"

4.3.3, "Capacity"

Technical Specifications 3.7.12, 3.7.15 and 4.3.2 do not require a change due to the installation of the high density racks. They are provided for context and because their applicability includes the spent fuel pool which is impacted by a note added to Technical Specification 3.7.14.

Technical Specification 3.7.14, "Spent Fuel Pool Storage," is to be revised to show that Table 3.7.14-1B applies to the existing racks, those containing Boraflex, and adds Table 3.7.14-1C that applies to the high density racks, those containing Metamic. The Technical Specification is also to be revised to show the applicability of Specification 4.3.1.1.e for both types of racks. The Required Action and Surveillance are being simplified for Unit No. 2 by referring to the requirements of the Limiting Condition for Operation (LCO). This simplification is designed to reduce human performance errors associated with interpretation of the requirements imposed on the two different types of racks for Unit No. 2. A Note is also being added that extends the spent fuel pool to include the fuel cask area for only Unit No. 2. The Note also states it is applicable only during the installation phase of the reracking project. The Note will make it clear that the Unit No. 2 fuel cask area is temporarily included in the applicability of Technical Specifications 3.7.12, Supplemental Leak Collection and Release System (SLCRS), 3.7.15, Fuel Storage Pool Water Level, 3.7.16, Fuel Storage Pool Boron Concentration and 4.3.2, Drainage.

Specification 4.3.1, "Criticality," is to be revised to show: 1) the boron concentration necessary to maintain $k_{eff} \leq 0.95$ when the spent fuel pool is fully flooded with borated water, 2) the minimum center to center distance between fuel assemblies in each type of rack, and 3) the fuel storage constraints for each type of rack. The minimum boron concentration necessary to maintain $k_{eff} \leq 0.95$ when the spent fuel pool is fully flooded with borated water is 472 ppm which is the value from the new criticality analysis. This Specification also contains a requirement to have two empty rows of storage locations between the fuel assemblies stored in adjacent Boraflex and Metamic racks in the spent fuel pool during the installation phase of the reracking project. The basis for this temporary requirement is described in Section 3.11 of this enclosure.

Specification 4.3.3, "Capacity," is to be revised to show the maximum capacity of the BVPS Unit No. 2 spent fuel pool with each type of rack.

The proposed reracking of the BVPS Unit No. 2 spent fuel pool does not involve any changes to the BVPS Unit No. 2 new fuel storage area.

3.0 TECHNICAL EVALUATION

The design and licensing bases associated with the storage of fuel in the existing, Boraflex, racks are not changed from what was approved by Amendment 165 for BVPS Unit No. 2 issued on March 27, 2008. Since no characteristics of the existing (Boraflex) racks are changed by this submittal, the design and licensing basis for the existing racks remain valid while they are present in the spent fuel pool.

Enclosure B, Licensing Report for Beaver Valley Power Station Unit No. 2 Rerack, provides the details of the various analyses and evaluations conducted to support the reracking project. The following sections provide a synopsis of each of the sections contained in Enclosure B.

3.1 Introduction

Section 1.0 of Enclosure B provides a summary of the contents of the enclosure and brief description of the BVPS Unit No. 2 spent fuel pool. Presently the BVPS

Unit No. 2 spent fuel pool contains 1,088 storage cells in 17 spent fuel storage racks. The 17 existing racks will be removed and replaced by 15 high density freestanding racks. This will increase the storage capacity of the spent fuel pool to 1,690 cells.

All of the high density racks are non-flux-trap racks and are designated in a mixed-zone three-region (MZTR) array, where loading patterns are used to control criticality. All spent fuel pool storage high density racks are freestanding and self-supporting. The principal construction materials for the high density racks are stainless steel sheet. The only non-stainless material utilized in the high density racks is the neutron absorber material, which is a boron carbide and aluminum metal matrix composite available under the patented product name Metamic™.

3.2 Fuel Storage Racks

Section 2.0 of Enclosure B provides a detailed description of the high density fuel storage racks. All of the 15 high density fuel storage racks will consist of freestanding modules, made primarily from austenitic stainless steel containing honeycomb storage cells interconnected through longitudinal welds. A panel of Metamic™ metal matrix composite containing a high areal loading of the boron-10 isotope provides appropriate neutron attenuation between adjacent storage cells.

The baseplates on all high density spent fuel rack modules extend out beyond the high density rack module periphery wall such that the plate protrusions act to set a required minimum separation between the facing cells in adjacent high density rack modules. Each high density spent fuel rack module is supported by at least four pedestals, which are remotely adjustable. Between the high density rack module pedestals and the pool floor liner is a bearing pad, which serves to diffuse the dead load of the loaded high density racks into the reinforced concrete structure of the pool slab.

The high density rack modules are designed as cellular structures such that each fuel assembly has a square opening with conforming lateral support and a flat horizontal-bearing surface. All of the storage locations are constructed with multiple cooling flow holes to ensure that redundant flow paths for the coolant are available.

Additional details, including the principal design criteria, applicable codes, standards, mechanical design and the fabrication of a high density non-flux-trap rack module, are provided in Section 2.0 of Enclosure B.

3.3 Material Considerations

Section 3.0 of Enclosure B provides a listing of the structural materials utilized in the fabrication of the high density racks, and describes the neutron absorbing material Metamic™ used in the high density racks. Because Metamic™ is a porosity-free material, unlike Boral, there is no capillary path through which spent fuel pool water can penetrate Metamic™ panels and chemically react with aluminum in the interior of the material to generate hydrogen. Thus, the potential of swelling and generation of significant quantities of hydrogen is eliminated.

Based upon accelerated test programs, Metamic™ is considered a satisfactory material for reactivity control in spent fuel storage racks and is fully expected to fulfill its design function over the lifetime of the high density racks. Nevertheless, as a defense-in-depth measure, a Metamic™ surveillance program will be implemented for the spent fuel pool in order to monitor the integrity and performance of Metamic™. The surveillance program is described in Section 3.0 of Enclosure B.

3.4 Criticality Safety Analysis

Section 4.0 of Enclosure B documents the criticality analysis for the storage of fresh and spent fuel assemblies with an initial enrichment of up to 5.0 wt% U-235 in a Mixed-Zone Three Region (MZTR) storage arrangement in the BVPS Unit No. 2 spent fuel pool. The analysis demonstrates that the effective neutron multiplication factor (k_{eff}) is less than 1.0 with the storage racks fully loaded with fuel of the highest anticipated reactivity and the pool flooded with unborated water at a temperature corresponding to the highest reactivity. In addition, it demonstrates that k_{eff} is less than or equal to 0.95 with the storage racks fully loaded with fuel of the highest anticipated reactivity and the pool flooded with borated water at a temperature corresponding to the highest reactivity. The maximum calculated reactivity includes a margin for uncertainty in reactivity calculations including manufacturing tolerances and is shown to be less than 0.95 with a 95% probability at a 95% confidence level. Additionally, reactivity effects of abnormal and accident conditions have also been evaluated. The section provides a summary of the types of accidents analyzed and the soluble boron required ensuring that the maximum k_{eff} remains below 0.95. The analysis documents that the most limiting accident is a misloaded fresh fuel assembly in the outer row of the rack in a Region 2 location. A minimum soluble boron requirement must be maintained in the spent fuel pool to ensure that the maximum k_{eff} is less than 0.95 under accident conditions.

The high density BVPS Unit No. 2 storage racks have storage cells that are regionalized for loading purposes into three distinct regions, with independent criteria defining each region. The fuel storage defining criteria are presented in Section 4.0 of Enclosure B and are specified in the Technical Specifications.

The criticality analysis addresses the high density rack temporarily placed in the fuel cask area and the neutronic decoupling of the Boraflex and Metamic™ racks in the spent fuel pool during the installation phase of the reracking project. The analysis determines the spent fuel pool boron concentration requirement for accidents, including a boron dilution event. Neither of these concentrations is in jeopardy of being violated because the BVPS Unit No. 2 spent fuel pool minimum boron concentration of 2000 ppm, controlled by Technical Specification 3.7.16, is not being changed.

As a result of the neutronic decoupling of the Boraflex and Metamic™ racks described in the previous paragraph, the criticality analysis of the BVPS Unit No. 2 spent fuel pool with the existing racks is not affected by the changes proposed in this license amendment request.

The criticality analysis for the Metamic™ racks does not result in an erosion of criticality safety margin. The criticality analysis demonstrates that all of the necessary k_{eff} criteria, described previously, will continue to be met for the Metamic™ racks in the BVPS Unit No. 2 spent fuel pool.

The NRC has raised concerns regarding spent fuel pool criticality analyses during recent public meetings. The following points specifically address those concerns:

- The allowable enrichment of the fuel assemblies being stored in the Metamic™ racks (5 wt% U-235) is no greater than that allowed for the existing Boraflex racks.

- The amount of burnup credit being considered for the Metamic™ racks is not greater than that already used in the existing Boraflex racks. The maximum amount of burnup credited in the Metamic™ racks (55,270 MWD/MTU) is less than the amount of burnup credit in the Boraflex racks for fuel assemblies stored in the "3x3" configuration with no decay time (55,821 MWD/MTU).

- The amount of soluble boron credited to maintain $k_{eff} < 0.95$ under normal conditions in the Metamic™ racks (472 ppm) is only slightly greater than that credited in the existing Boraflex racks (450 ppm). Note that the BVPS Unit No. 2 Technical Specification requirement for spent fuel pool soluble boron concentration is 2000 ppm. Further, there exists no credible spent fuel pool dilution scenario that challenge the amount of boron credited in the criticality analysis for the Metamic™ racks.

- The number of parameters that govern storage of spent fuel in the Metamic™ racks is reduced relative to the existing Boraflex racks. For the Metamic™ racks, only initial fuel assembly enrichment and fuel assembly burnup are used to fully characterize the fuel for storage. For the existing Boraflex racks, fuel is characterized using enrichment, burnup, initial burnable absorber loading and decay time. No credit is being taken in the criticality analysis for the Metamic™ racks for initial burnable absorber loading or decay time.

- The complexity of the storage configurations for the Metamic™ racks is reduced relative to the existing Boraflex racks. The Metamic™ racks utilize a single mixed-zone three-region configuration that applies to all fuel assemblies and all Metamic™ racks. The Boraflex racks utilize four different storage configurations, each of which have separate requirements for enrichment, burnup, and, in some cases, burnable absorber loading and decay time. Combined with the reduced number of parameters needed to fully characterize fuel assemblies for storage in the Metamic™ racks, the probability of a fuel assembly misloading in the Metamic™ racks is lower, relative to the existing Boraflex racks.

- The Metamic™ racks do utilize a more closely spaced array relative to the existing Boraflex racks. However, this is a fixed geometry and allowable variations in the design and manufacture of the rack geometry have been accounted for in the criticality analysis.

- Unlike the existing Boraflex racks, the new Metamic™ racks do utilize and credit a neutron absorber in the rack design. A surveillance program will be established to verify the long term integrity of the neutron absorber.

3.5 Structural/Seismic Considerations

Section 5.0 of Enclosure B provides information on the required structural performance characteristics of the high density fuel storage racks. Included in this section is a description of the acceptance criteria the high density racks must meet, the loads and load combinations considered in the seismic analysis of the high density racks, the structural analysis methodology, the structural evaluation of the high density racks, the mechanical evaluation of the high density racks, the cask pit high density rack platform analysis, the rack bearing pad analysis and an evaluation of the interface loads on the spent fuel pool structure. The evaluations and analyses demonstrate that all acceptance criteria are met.

3.6 Thermal-Hydraulic Evaluation

Section 6.0 of Enclosure B discusses the following specific thermal-hydraulic analyses performed for the BVPS Unit No. 2 spent fuel pool.

1. Calculation of the spent fuel decay heat. The decay heat contributions from both previously stored fuel assemblies and recently discharged fuel assemblies are considered.

2. Determination of the spent fuel bulk thermal response versus time in accordance with each discharge scenario.

3. Calculation of the time-to-boil during a postulated loss of forced cooling event for each discharge scenario.

4. A rigorous Computational Fluid Dynamics (CFD) based study to conservatively quantify the peak local water temperature in the spent fuel pool.

5. Determination of a bounding maximum fuel cladding temperature.

The analysis documented in Section 6.0 assumes that fuel is not discharged from the core until after it has decayed for at least 100 hours and that assemblies are not transferred to the spent fuel pool at a rate greater than 6 assemblies per hour. The decay time assumption is controlled by Licensing Requirement 3.9.3, Decay Time, and the transfer rate is controlled by procedure. Fuel assembly loading into the fuel pool is limited to 6 freshly unloaded assemblies per hour if the offload starts at 100 hours after shutdown and continues at a rate of 6 assemblies per hour. The intent of the 6 assemblies per hour rate is to limit the cumulative number of freshly unloaded assemblies transferred to the fuel pool as a function of time to maintain the fuel pool heat load within that assumed in the analysis. If the offload starts later than 100 hours after shutdown, or offload progress is delayed, the fuel assembly offload rate may exceed 6 per hour as long as the per hour cumulative loading in the fuel pool does not exceed that assumed in the analysis.

The analyses results presented in Section 6.0 of Enclosure B demonstrates that the BVPS Unit No. 2 spent fuel pool meets the thermal-hydraulic requirements for the safe storage of spent fuel when utilizing the high density racks.

3.7 Mechanical Accidents Considerations

Section 7.0 of Enclosure B discusses the analyses carried out to demonstrate the regulatory compliance of the high density racks under postulated accidental drop events germane to the fuel pools; namely, that of a fuel assembly, a high density fuel storage rack and a pool gate. Several categories of accidental drop events are considered. Fuel drop evaluations are performed to evaluate the high density racks subsequent to a fuel assembly impact. The pool structure is evaluated for the drop of a high density fuel rack during installation. A pool gate drop is also evaluated to assess damage to a high density rack. The section also documents evaluations of damage to a fuel assembly as a result of dropping a fuel assembly on top of a stored fuel assembly in the high density rack, and the ability of the high density rack to withstand the uplift force from a stuck fuel assembly.

For all these drop events, other than the dropping of an existing rack during its removal or the dropping of the pool gate onto an existing rack, the current design and licensing basis evaluations applicable to the existing racks remain valid. The drop of an existing rack during its removal is bounded by the evaluation documented in Section 7 of Enclosure B since a new rack is significantly heavier than an existing rack. The dropping of the pool gate onto an existing rack is beyond the current licensing basis because the movement of the pool gate over the fuel is prohibited by plant procedures and Licensing Requirement 3.9.1, "Crane Travel – Spent Fuel Storage Pool Building,' in the BVPS Unit No. 2 Licensing Requirement Manual.

The supporting evaluation also considered dropping items into the fuel cask area or onto the cover that will be placed over the cask pit area during the installation of the new racks. All of the items to be installed in or over the fuel cask area weigh much less than a spent fuel cask, for which the fuel cask area was designed. As such, the drop of any of these items onto the floor of the fuel cask area would be bounded by a spent fuel cask drop. With respect to drops onto the fuel that will temporarily be stored in the fuel cask area, the fuel cask area cover is designed to withstand the load imposed by a rack striking it from above. Since the fuel cask area cover would not fail due to this event, there cannot be any impact on the fuel assemblies in the rack below it. The evaluation also produced acceptable results for dropping any of the three parts of the fuel cask area cover onto the fuel loaded into the rack in the fuel cask area.

The section concludes that the high density spent fuel racks for the BVPS Unit No. 2 posses acceptable margins of safety under the postulated mechanical accidents.

3.8 Radiological Evaluation

Section 8.0 of Enclosure B provides a summary of the radiological evaluations undertaken in support of the use of the high density storage racks at BVPS Unit No. 2. The high density fuel storage racks for BVPS Unit No. 2 are capable of storing a greater number of spent fuel assemblies than the racks that are to be replaced. Consequently, an evaluation of the radiological effect of the increased number of fuel assemblies on the gamma dose rate at the surface of the fuel pool water was conducted and is documented in Section 8.0 of Enclosure B. In addition, the radiological consequences of a fuel-handling accident and the person-rem exposure resulting from the removal of the existing racks and the installation of the high density racks are addressed in Section 8.0 of Enclosure B.

The evaluation concludes that since the factors affecting a fuel-handling accident have not changed due to the installation of high density racks, the doses from this accident remain the same as the current accident analysis.

The evaluations also conclude that the total dose rate at the surface of the pool water following the installation of the high density racks is well below 50 mrem/hour and should not require changes in the radiation zoning of the plant and that the overall personnel (person-rem) dose from the operations necessary for the removal of the existing racks and the installation of the high density racks is low.

3.9 Installation

Section 9.0 of Enclosure B documents that all installation work at BVPS Unit No. 2 will be performed in compliance with NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," and applicable Holtec and plant procedures. A surveillance and inspection program will be maintained throughout the installation phase of the reracking project. A set of inspection points, which have been proven to eliminate any incidence of rework or erroneous installation in previous high density rack projects, will be implemented by the installer, Holtec.

The Holtec procedures cover the scope of activities for the rack removal and installation effort. Similar procedures have been utilized and successfully implemented on many previous reracking projects. These procedures are written to include ALARA practices and provide requirements to assure equipment, personnel, and plant safety. Use of these procedures at BVPS requires review and approval in accordance with plant administrative procedures.

3.10 Human Performance

This section describes the process used to preclude human performance errors associated with the placement of fresh and spent fuel in the spent fuel pool. The process described in this section covers the repositioning of spent fuel during the installation of the high density racks, the placement of fresh fuel into the spent fuel pool in preparation for a refueling outage, and the offloading and reloading of the fuel during a refueling outage.

In order to be consistent with the criticality analysis supporting this submittal, and to preclude the mis-loading of a fuel assembly at anytime, proper placement of fresh and spent fuel in the spent fuel pool must be achieved. The proper characterization of each assembly is required. For assemblies that are to be placed in the high density racks, characterization of an assembly is based solely on enrichment and burnup. For assemblies that are to be placed in the existing racks, characterization of an assembly is based on decay time, enrichment, burnup and number of Integral Fuel Burnable Absorbers (IFBA). Once an assembly is properly characterized, the Technical Specifications dictate into which configuration of an existing rack, or which region of a high density rack, the assembly may be placed. Identifying the correct storage location with the high density racks will be less complex than it is now because the need for the existing multiple storage configurations will be reduced with the installation of the high density racks.

Ensuring that an assembly is loaded into a correct location requires that the assembly be characterized correctly. Fuel characterization is performed in accordance with a refueling procedure. Details regarding the storage location requirements are also contained in the same procedure and in the applicable Technical Specifications. The characterization is performed by a qualified individual and then reviewed by a second qualified individual from the responsible group. Administrative control of a fuel assembly's storage location is accomplished through the use of a fuel movement computer program such as ShuffleWorks. The ShuffleWorks Administrator enters the necessary data into ShuffleWorks. Fuel movement sheets are developed in ShuffleWorks that identify which assemblies are to be moved and where they are to be moved to and from. The fuel movement sheets are verified by two individuals. Actual fuel movement is controlled by refueling procedures in accordance with the fuel movement sheets. During the movement of the fuel the "to" and "from" locations are visually verified by at least two separate individuals.

In order to ensure that an assembly is not mis-loaded, the locations of all fuel assemblies in the spent fuel pool are verified yearly. While the assembly identification numbers are not checked during the verification, passing the verification with mis-loaded assemblies would require multiple misplacements that happened to result in the same expected pool configuration. If a fresh fuel assembly is misplaced, it would be found on the offload if it was placed in a location designated for an offload assembly. If it was not in a location designated for an offload assembly, it would be found prior to reload when the tops of the reload assemblies are visually examined to ensure there is no debris. If an offloaded assembly is misplaced, it would be found on the reload, as with the fresh assembly, if it was to be reloaded. If it was to be discharged, it would be found during the yearly pool verification.

For the movement of fresh fuel into the spent fuel pool and for movement of fuel within the spent fuel pool, including during the installation phase of the reracking project, dependent errors are prevented by the use of fuel movement sheets. The fuel movement sheets contain a single line for each fuel move. This line contains the assembly identification number, the "from" location, the "to" location, and has a sign-off for the move. If a step was inadvertently not signed off, attempting to perform the step again would identify that the "from" location was empty. If a step was inadvertently skipped, subsequent steps would be unaffected because they each contain their own "to" and "from" locations. Similarly, if an assembly is placed in the wrong location or taken from the wrong location, subsequent steps would be unaffected unless a subsequent "to" location coincided with the misplaced assembly or mistaken location. In each case there are no dependent errors.

Offloads and reloads are also controlled by move sheets, but are different in that half of a step is performed in containment while the other half is performed in the spent fuel pool. This provides the opportunity for a different type error than described previously. If a step is skipped, dependent misplacements are possible. To preclude this possibility, the offload and reload are controlled by a Fuel Movement Coordinator (FMC). The FMC communicates via headsets with both the reactor crane operator and the spent fuel pool upender operator who then communicates with the spent fuel pool crane operator. The FMC directs the movement of the fuel in accordance with the fuel movement sheets, which identify the specific locations in both the core and spent fuel pool. The FMC uses a hardcopy of the fuel movement sheets as well as the computer program ShuffleWorks to monitor and document fuel movement. Additionally, the locations for each move are verified by two additional personnel in the field using a hardcopy of the fuel movement sheets. Using the FMC to control fuel movement serves to ensure that the "from" locations in the reactor are synchronized to the correct "to" locations in the spent fuel pool during the offload and that the "from" locations in the spent fuel pool are synchronized to the correct "to" locations in the reactor during the reload.

In summary, it is through the independent verification of an assembly's characterization and resultant storage location determination, and the multiple verification of the "from" and "to" locations used during actual fuel movement, that the occurrence of human performance errors associated with the placement of fresh or spent fuel in the spent fuel pool is reduced.

3.11 Transitioning to High Density Racks

Following issuance of the requested license amendment, the installation of the high density racks will begin. However, since the spent fuel pool will contain both the existing racks and high density racks during the installation phase of the project, the BVPS Technical Specifications will need to address both types of racks. This will be achieved by the proposed Technical Specification changes being in place during the installation phase of the project. In the proposed changes, the type of rack (Boraflex or Metamic) will be identified in the applicable Technical Specifications.

It is noted that the fuel cask area will be used to temporarily store some fuel assemblies during the installation of the high density racks. The criticality analysis, described in Section 4.0 of Enclosure B, includes the temporary storage of fuel in the fuel cask area. The Technical Specifications do not need to be revised to reflect the temporary storage of fuel in the fuel cask area because the criticality analysis addresses the temporary placement of fuel in the fuel cask area and the loading of a rack with fuel is controlled by the Technical Specifications applicable to the high density (Metamic) racks, regardless of whether the rack is located in the fuel cask area or the spent fuel pool.

The Metamic™ rack to rack interfaces have been addressed in the criticality analysis and are physically controlled by the base plate extensions of the high density racks. The proposed Technical Specifications contain a requirement to have two empty rows of storage locations between the fuel assemblies in the different types of racks in the spent fuel pool during the installation phase of the reracking project. The two empty rows of storage cells may both be in one type of rack or the other, or they may be an empty row in each rack. This requirement will ensure neutronic decoupling between adjacent Boraflex and Metamic™ racks during the installation phase of the project. This requirement does not need to be imposed on fuel in racks adjacent to the same type of rack, since rack to rack interfaces are addressed in this criticality analysis for the high density racks, and the analysis of record for the existing racks.

3.12 Compliance with B.5.b

On June 27, 2007 the NRC issued conforming amendments to incorporate the mitigation strategies required by Section B.5.b of Commission Order EA-02-026 for BVPS Unit Nos. 1 and 2. The amendments were implemented on July 18, 2007. Issuance of these amendments resulted in spent fuel pool mitigation strategies becoming a License Condition for BVPS Unit Nos. 1 and 2. As stated in the June 27, 2007 NRC Safety Evaluation, the details of the spent fuel pool mitigation strategies are to be treated as commitments, which will become part of the plant's licensing basis. The NRC Safety Evaluation also states that any changes to these strategies will be managed in accordance with the licensee's commitment management program. The reracking of the BVPS Unit No. 2 spent fuel pool may result in a change to some of the spent fuel pool mitigation strategies. Due to safeguards concerns associated with these strategies, the details cannot be discussed in this submittal. The spent fuel pool mitigation strategy may require modification to address the reracking of the BVPS Unit No. 2 spent fuel pool. If a strategy change is required, it will be needed following the reracking. As required by the June 27, 2007 NRC Safety Evaluation, any required strategy change will be controlled by the FENOC commitment management program.

4.0 REGULATORY EVALUATION

FirstEnergy Nuclear Operating Company (FENOC) intends to expand the Beaver Valley Power Station (BVPS) Unit No. 2 spent fuel storage capacity through the use of high density fuel storage racks. This license amendment request will revise the Technical Specifications to reflect the total replacement of the existing racks with high density fuel storage racks. This action will increase the capacity of the BVPS Unit No. 2 spent fuel pool from 1,088 to 1,690 total storage locations.

During the installation of the high density fuel storage racks, the BVPS Unit No. 2 spent fuel pool will contain a combination of the existing and the high density racks. Once the installation has been completed, the BVPS Unit No. 2 spent fuel pool will contain only the high density racks. In order to provide adequate control of the fuel storage requirements associated with each type of rack, the BVPS Unit No. 2 Technical Specifications will need to address both types of racks during the installation phase of the reracking project. This will be accomplished by the issuance of an amendment referencing both the existing (Boraflex) racks and the high density (Metamic) racks. *This license amendment will be implemented prior to the start of the installation phase* of the reracking project.

Since the design and licensing bases associated with the storage of fuel in the existing racks are not changed from what was approved by Amendment 165 for BVPS Unit No. 2 issued on March 27, 2008, fuel storage in the existing racks is not discussed in detail in the following significant hazards consideration. In addition, since no characteristics of the existing racks are altered by the changes proposed in this license amendment request, the design and licensing basis for the existing racks remain valid while they are present in the spent fuel pool. Therefore design and licensing bases of the existing racks are not discussed in detail in the following significant hazards consideration. The impact of the existing racks is not discussed in detail because the changes proposed to the Technical Specifications applicable to the existing racks are editorial and do not impact the responses to the significant hazards consideration.

4.1 Significant Hazards Consideration

FirstEnergy Nuclear Operating Company (FENOC) has evaluated whether or not a significant hazards consideration is involved with the proposed amendment 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.

The fuel storage racks are not a design basis accident initiator. The potential contribution to the applicable design basis accident (a fuel handling accident) has been evaluated by considering three types of fuel assembly drop scenarios. The three types of scenarios are a shallow drop, a deep drop and a fuel to fuel drop. The shallow drop postulates that the fuel assembly drops vertically and hits the top of a rack. The deep drop postulates that the fuel assembly falls through an empty storage cell impacting the rack baseplate. The fuel to fuel drop postulates that a fuel assembly drops on top of a stored fuel assembly in a rack. The structural damage to the impacted target is primarily dependent on the mass of the falling fuel assembly and the drop height. Since the fuel assembly mass and drop height are not significantly changed by the installation of the high density racks, the postulated structural damage to impacted targets are also not significantly changed due to the installation of the high density racks.

The physical limitations of the racks and the administrative and operational controls used to load fuel assemblies into the spent fuel pool ensure that fuel assemblies are stored in compliance with the applicable fuel storage requirements, both during and following the installation phase of the reracking project. These controls will remain in effect and will continue to protect against criticality and fuel handling accidents during and following the installation phase of the reracking project. Therefore, there is no significant impact on the probability of fuel handling or criticality accidents.

The criticality analysis applicable to the existing racks has not changed from what was approved by Amendment 165 for BVPS Unit No. 2 issued on March 27, 2008. The new criticality analysis defines new spent fuel storage requirements based on enrichment and burnup limits. The new analysis demonstrates that k_{eff} remains below 1.0 with zero soluble boron in the spent fuel pool, 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. As a result potential consequences of accidents previously evaluated remain unchanged for either type of rack.

The proposed installation of the high density racks, and the coexistence of the existing and high density racks in the spent fuel pool during the installation phase, does not result in changes to the spent fuel pool cooling system and therefore the probability of a loss of spent fuel pool cooling is not increased. The consequences of a loss of spent fuel pool cooling were evaluated and found to not involve a significant increase as a result of the proposed changes. A thermal-hydraulic evaluation for the loss of spent fuel pool cooling was performed. The analysis determined that the minimum time to boil provides sufficient time for the operators to restore cooling or establish an alternate means of cooling following a complete loss of forced cooling. Therefore, the proposed change represents no significant increase in the consequences of loss of spent fuel pool cooling for either type of rack.

Therefore, the proposed installation of high density fuel storage racks and the resulting proposed Technical Specifications 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 increase the maximum storage capacity, implementation of fuel loading requirements and fuel handling activities will continue to be performed under administrative and operational controls. The utilization of the additional storage capacity within the allowances of the revised analysis will not create the possibility of a new or different kind of accident from any accident previously evaluated.

Other than the removal of the existing racks and installation of the high density racks, no new or different activities are introduced as a result of the proposed changes. The drop of a high density rack during the installation phase has been described and evaluated as part of this submittal. This evaluation produced acceptable results. The drop of an existing rack during its removal is bounded by this evaluation because a new rack is heavier than an existing rack. The supporting evaluation also considered dropping items into the fuel cask area or onto the cover that will be placed over the cask pit area during the installation of the new racks. All of the items to be installed in or over the fuel cask area weigh much less than a spent fuel cask, for which the fuel cask area was designed. As such, the drop of any of these items onto the floor of the fuel cask area would be bounded by a spent fuel cask drop. With respect to drops onto the fuel that will temporarily be stored in the fuel cask area, the fuel cask area cover is designed to withstand the load imposed by a rack striking it from above. Since the fuel cask area cover would not fail due to this event, there cannot be any impact on the fuel assemblies in the rack below it. The evaluation also produced acceptable results for dropping any of the three parts of the fuel cask area cover onto the fuel loaded into the rack in the fuel cask area.

Therefore the new activities introduced because of the reracking have been evaluated and been found to not create the possibility of a new or different kind of accident from any accident previously evaluated.

No changes are proposed to the spent fuel pool cooling system or makeup systems and therefore no new accidents are considered related to the loss of spent fuel pool cooling or makeup capability.

Therefore, the proposed installation of high density fuel storage racks and the resulting proposed Technical Specifications changes do not create the possibility of a new or different kind of accident from any previously evaluated for either type of rack.

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 requirements and boron concentration controls in the spent fuel pool. The new criticality analysis demonstrates that k_{eff} remains below 1.0 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. This is consistent with the current licensing basis of the BVPS Unit No. 2 spent fuel pool.

The Technical Specifications controlling the water level or boron concentration of the spent fuel pool are not being changed by this license amendment request. Therefore, there is no significant change to the margin of safety attributed to the water level or the boron required when the spent fuel pool is fully flooded with borated water or the boron concentration required for accident or a boron dilution event for either type of rack.

One of the proposed changes to the Technical Specifications is being made to assure that the existing (Boraflex) racks and the high density (Metamic) racks are neutronically decoupled during the installation phase of the reracking project. This temporary requirement results in the existing and new criticality analyses both being valid during the installation phase. Following the completion of the installation of the high density racks, the new criticality analysis becomes the licensing basis of the BVPS Unit No. 2 spent fuel pool.

The structural analysis of the high density racks, along with the evaluation of the spent fuel pool structure, indicates that the integrity of these structures will be maintained during and following installation of the high density racks. The previously performed structural analysis of the existing racks resulted in the same conclusion. Since the structural requirements are satisfied, the applicable safety margins are not significantly reduced for either type of rack.

The proposed change includes a coupon sampling program that will monitor the physical properties of the Metamic absorber material. The monitoring program provides a method of verifying that the neutron absorber assumptions used in the spent fuel pool criticality analyses remain valid.

Therefore, the proposed installation of high density fuel storage racks and the resulting proposed Technical Specifications changes do not involve a significant reduction in margin of safety for either type of rack.

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.

4.2 Applicable Regulatory Requirements/Criteria

A review of 10 CFR 50, Appendix A, "for Nuclear Power Plants," was conducted to determine the impact associated with the proposed changes. 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 design of the BVPS Unit No. 2 spent fuel storage facilities follow the guidance of the following Regulatory Guides with the alternatives and clarifications described in the BVPS Unit No. 2 Updated Final Safety Analysis Report.

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

Additional codes, standards and practices applicable to the design, construction, and assembly of the high density racks are listed in Section 2.0 of Enclosure B.

Assessment

No change to the Updated Final Safety Analysis Report description of conformance to the GDCs or the listed Regulatory Guides is required as a result of the changes proposed in this license amendment request.

4.3 Precedent

References 1 through 9 are license amendments that approved changes to the utility's spent fuel pool storage racks that were supported by analyses conducted by Holtec. In some cases this involved the reconfiguring of the existing spent fuel pool, expanding the capacity to store spent fuel by including the fuel cask area, while in others it involved adding high density racks. For those submittals that involved the addition of high density racks, the racks were designed, built and analyzed by Holtec.

None of the referenced submittals involved a complete reracking of the spent fuel pool as proposed in this submittal. The Cooper, Shearon Harris and Arkansas submittals added Holtec designed high density racks to the spent fuel pool. The Clinton submittal added 16 Holtec designed high density racks and retained the existing racks resulting in the Clinton spent fuel pool containing two different types of racks. The Turkey Point submittal used a combination of Metamic inserts, rod cluster control assemblies and the mixing of higher and lower reactivity fuel to meet criticality requirements. The St. Lucie and Crystal River submittals involved the use of Boral instead of Metamic as the neutron absorber, but the supporting analyses were conducted by Holtec.

All of the referenced submittals, except Shearon Harris and Turkey Point, used the CASMO-4, KENO5a and MCNP4a codes in the supporting criticality analyses. Turkey Point used only the CASMO-4 and MCNP4a codes. The Shearon Harris submittal did not reference the CASMO-4, KENO5a and MCNP4a codes because this submittal referenced a criticality analysis approved in a previous amendment. All of the referenced submittals, except Shearon Harris, Turkey Point and Crystal River, used ORIGEN2 in the decay heat load calculation. All of the referenced submittals except Arkansas Unit 1, St. Lucie and Shearon Harris used DYNARACK in the rack structural analysis. All of these codes, CASMO-4, KENO5a, MCNP4a, ORIGEN2 and DYNARACK, were used in the analyses performed to support the installation of the high density racks at BVPS Unit No. 2.

The Arkansas, Clinton, Turkey Point, Cooper and Shearon Harris submittals involved some reracking of the respective spent fuel pools with the Holtec high density racks that use Metamic as the neutron absorbing material. These submittals, for the most part, also used the same methodologies supporting this submittal. The use of Metamic inserts in the BVPS Unit No. 2 high density racks does not require any changes to the existing racks because all of them are to be replaced with the high density racks. Therefore, these submittals are the most similar to this submittal, even though this submittal involves a complete reracking of the BVPS Unit No. 2 spent fuel pool.

4.4 Conclusions

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.

5.0 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 effluents 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.

6.0 REFERENCES

1. U.S. Nuclear Regulatory Commission letter to Mr. J. A. Stall, Senior Vice President, Nuclear and Chief Nuclear Officer, Florida Power and Light Company, "St. Lucie Units 1 and 2 - Correction/Clarification to NRC Safety Evaluation Regarding Cask Pit Rack Amendments (TAC Nos. MB6627 and MB6628)," dated August 16, 2004.

2. U.S. Nuclear Regulatory Commission letter to Mr. Christopher M. Crane, President and Chief Executive Officer, AmerGen Energy Company, LLC, "Clinton Power Station, Unit 1 - Issuance of an Amendment - RE: Onsite Spent Fuel Storage Expansion (TAC No. MC4202)," dated October 31, 2005.

3. U.S. Nuclear Regulatory Commission letter to Mr. John T. Conway, Site Vice President, Monticello Nuclear Generating Plant, "Monticello Nuclear Generating Plant - Issuance of Amendment RE: Contingent Installation of a Temporary Spent Fuel Storage Rack (TAC No. MD0302)," dated March 9, 2007.

4. U.S. Nuclear Regulatory Commission letter to Mr. Dale E. Young, Vice President, Crystal River Nuclear Plant, "Crystal River, Unit 3 - Issuance of Amendment Regarding Fuel Storage Patterns in the Spent Fuel Pool (TAC No. MD3308)," dated October 25, 2007.

5. U.S. Nuclear Regulatory Commission letter to Mr. Jeffrey S. Forbes, Site Vice President, Arkansas Nuclear One, Entergy Operations, Inc., "Arkansas Nuclear One, Unit No. 1 - Issuance of Amendment for Use of Metamic® Poison Insert Assemblies in the Spent Fuel Pool (TAC No. MD2674)," dated January 26, 2007.

6. U.S. Nuclear Regulatory Commission letter to Mr. J.A. Stall, Senior Vice President, Nuclear and Chief Nuclear Officer, Florida Power and Light Company, "Turkey Point Plant, Units 3 and 4 - Issuance of Amendments Regarding Spent Fuel Pool Boraflex Remedy (TAC No. MC9740 and MC9741)," dated July 17, 2007.

7. U.S. Nuclear Regulatory Commission letter to Mr. Stewart B. Minahan, Vice President-Nuclear and CNO, Nebraska Public Power District, "Cooper Nuclear Station – Issuance of Amendment RE: Onsite Spent Fuel Storage Expansion (TAC No. MD3349)," dated September 6, 2007.

8. U.S. Nuclear Regulatory Commission letter to Mr. Timothy G. Mitchell, Vice President, Operations, Arkansas Nuclear One, Entergy Operations, Inc., "Arkansas Nuclear One, Unit No. 2 - Issuance of Amendment RE: Revisions to Technical Specifications to Support Partial Re-rack and Revised Loading Patterns in the Spent Fuel Pool (TAC No. MD4994)," dated September 28, 2007.

9. U.S. Nuclear Regulatory Commission letter to Mr. Chris L. Burton, Vice President, Shearon Harris Nuclear Power Plant, Carolina Power & Light Company, " Shearon Harris Nuclear Power Plant, Unit 1 - Issuance of Amendment Regarding the Use of Metamic as a Neutron Absorbing Material and Revised Loading Patterns in the Spent Fuel Pool (TAC No. MD8508)," dated January 29, 2009.

Attachment 1

Beaver Valley Power Station, Unit No. 2
Proposed Technical Specification Changes

License Amendment Request No. 08-027

The following is a list of the affected pages:

3.7.12 – 1 *
3.7.12 – 2 *
3.7.14 – 1
3.7.14 – 2 *
3.7.14 – 3
3.7.14 – 4 New page
3.7.15 – 1 *
3.7.16-1 *
3.7.16-2 *
4.0 – 1 *
4.0 – 2
4.0 – 3

* No Change. Page provided for context only.

3.7 PLANT SYSTEMS

3.7.12 Supplemental Leak Collection and Release System (SLCRS)

LCO 3.7.12 One SLCRS train shall be OPERABLE and in operation.

- NOTE -
The fuel building boundary may be opened intermittently under administrative control.

APPLICABILITY: When required in accordance with LCO 3.9.3.c.3 (Unit 1 only),
During movement of recently irradiated fuel assemblies within the fuel storage pool,
During movement of fuel assemblies over recently irradiated fuel assemblies within the fuel storage pool.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. **- NOTE -** Only applicable to Unit 1.		
Requirements of LCO not met when required in accordance with LCO 3.9.3.c.3.	A.1 Enter applicable Conditions and Required Actions of LCO 3.9.3, "Containment Penetrations."	Immediately
B. Requirements of LCO not met during fuel movement involving recently irradiated fuel assemblies within fuel storage pool.	**- NOTE -** LCO 3.0.3 is not applicable.	
	B.1 Suspend movement of recently irradiated fuel assemblies within the fuel storage pool.	Immediately
	<u>AND</u>	
	B.2 Suspend movement of fuel assemblies over recently irradiated fuel assemblies within the fuel storage pool.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.12.1	Verify required SLCRS train is in operation.	12 hours
SR 3.7.12.2	Perform required SLCRS filter testing in accordance with the Ventilation Filter Testing Program (VFTP).	In accordance with the VFTP
SR 3.7.12.3	----- **- NOTE -** Only required to be met during movement of recently irradiated fuel assemblies within the fuel storage pool and during movement of fuel assemblies over recently irradiated fuel assemblies within the fuel storage pool. ----- Verify the required SLCRS train can maintain the fuel storage pool area at a negative pressure of $\geq$ 0.125 (Unit 1), $\geq$ 0.05 (Unit 2) inches water gauge relative to atmospheric pressure during system operation.	18 months

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), for Unit 2:

Table 3.7.14-1B (Unit 2), or in accordance with Specification 4.3.1.1.e. (Unit 2) for the fuel assemblies stored in a Boraflex rack, and

Table 3.7.14-1C and in accordance with Specification 4.3.1.1.e. for the fuel assemblies stored in a Metamic rack.

- NOTE -

For Unit 2 only, the Technical Specification requirements applicable to the fuel storage pool are also applicable to the fuel cask area when a fuel assembly is in the fuel cask area during the installation phase of the Unit 2 reracking project.

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)the LCO (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), the LCO (Unit 2).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

No change. Page included for context only.

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 - Boraflex Rack)

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 ($E \leq 5\%$)

Table 3.7.14-1C (page 1 of 1)
(Unit 2 Spent Fuel Pool Storage - Metamic Rack)
Fuel Assembly Minimum Burnup versus U-235 Initial Enrichment for
Storage in Unit 2 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	8830	0
2.5	6420	16940	0
3.0	14390	24890	0
3.5	23430	32710	0
4.0	32560	40370	0
4.5	40800	47890	0
5.0	47170	55270	0

NOTES:

Region 2: The equation below can be used to determine intermediate burnup limits.

Minimum Burnup, MWD/MTU = $-291.6(E\%)^2 + 17521(E\%) - 25045$

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

Region 3: The equation below can be used to determine intermediate burnup limits.

Minimum Burnup, MWD/MTU = $-1311.8(E\%)^3 + 13957(E\%)^2 - 30989(E\%) + 17163$

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

3.7 PLANT SYSTEMS

3.7.15 Fuel Storage Pool Water Level

LCO 3.7.15 The fuel storage pool water level shall be ≥ 23 ft over the top of irradiated fuel assemblies seated in the storage racks.

APPLICABILITY: During movement of irradiated fuel assemblies in the fuel storage pool,
During movement of fuel assemblies over irradiated fuel assemblies in the fuel storage pool.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Fuel storage pool water level not within limit.	**- NOTE -** LCO 3.0.3 is not applicable.	
	A.1 Suspend movement of irradiated fuel assemblies in the fuel storage pool.	Immediately
	AND	
	A.2 Suspend movement of fuel assemblies over irradiated fuel assemblies in the fuel storage pool.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.15.1	Verify the fuel storage pool water level is ≥ 23 ft above the top of the irradiated fuel assemblies seated in the storage racks.	7 days

3.7 PLANT SYSTEMS

3.7.16 Fuel Storage Pool Boron Concentration

LCO 3.7.16 The fuel storage pool boron concentration shall be ≥ 1050 ppm (Unit 1), ≥ 2000 ppm (Unit 2).

APPLICABILITY: When fuel assemblies are stored in the fuel storage pool and a fuel storage pool verification has not been performed since the last movement of fuel assemblies in the fuel storage pool (Unit 1),
When fuel assemblies are stored in the fuel storage pool (Unit 2).

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Fuel storage pool boron concentration not within limit.	---------- **- NOTE -** LCO 3.0.3 is not applicable. ----------	
	A.1 Suspend movement of fuel assemblies in the fuel storage pool.	Immediately
	AND	
	A.2.1 Initiate action to restore fuel storage pool boron concentration to within limit.	Immediately
	OR	
	A.2.2 ---------- **- NOTE -** Required Action A.2.2 is only applicable for Unit 1. ----------	
	Initiate action to perform a fuel storage pool verification.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.16.1	Verify the fuel storage pool boron concentration is within limit.	7 days

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. $K_{eff} \le 0.95$ if fully flooded with water borated to 450 472 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 (Boraflex rack), 9.03 inches (Metamic rack), and

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

Unit 2
Boraflex Rack
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.

Unit 2
Metamic Rack
New or partially spent fuel assemblies within the limits of Table 3.7.14-1C are allowed storage in the fuel storage racks, provided

Region 1 storage cells are located on the periphery of each rack (outer row only) and are therefore separated from other Region 1 cells in adjacent racks by the gap between the racks. Region 1 cells are additionally separated from other Region 1 cells within the same rack by Region 2 cells (including a Region 2 cell in the diagonal direction). Since Region 1 cells are qualified for the storage of fresh fuel, any fuel assembly (fresh or burned) meeting the maximum enrichment requirement may be stored in a Region 1 location, Region 2 cells are located on the rack periphery (outer row) interspaced with (separating) Region 1 cells and are also located in the second row of cells (from the outside of the rack) separating the Region 1 cells from the Region 3 cells,

Region 3 cells are located on the interior of the rack (at least three rows in from the rack periphery) and are prohibited from being located in the outer two rows of the rack, and

Two empty rows of storage locations shall exist between the fuel assemblies in a Boraflex rack and the fuel assemblies in the adjacent Metamic rack in the spent fuel pool.

4.0 DESIGN FEATURES

4.3 Fuel Storage (continued)

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 (Boraflex racks), 1690 fuel assemblies (Metamic racks).

Attachment 2

Beaver Valley Power Station, Unit No. 2
Retyped Technical Specification Changes

License Amendment Request No. 08-027

The following is a list of the replaced pages:

3.7.14 – 1
3.7.14 – 3
3.7.14 – 4 New page
4.0 – 2
4.0 – 3
4.0 – 4 New page

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), for Unit 2:

Table 3.7.14-1B or in accordance with Specification 4.3.1.1.e, for the fuel assemblies stored in a Boraflex rack, and

Table 3.7.14-1C and in accordance with Specification 4.3.1.1.e, for the fuel assemblies stored in a Metamic rack.

- NOTE -

For Unit 2 only, the Technical Specification requirements applicable to the fuel storage pool are also applicable to the fuel cask area when a fuel assembly is in the fuel cask area during the installation phase of the Unit 2 reracking project.

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), the LCO (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), the LCO (Unit 2).	Prior to storing the fuel assembly in the spent fuel storage pool

Unofficial

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

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 ($E \leq 5\%$)

Table 3.7.14-1C (page 1 of 1)
(Unit 2 Spent Fuel Pool Storage - Metamic Rack)
Fuel Assembly Minimum Burnup versus U-235 Initial Enrichment for
Storage in Unit 2 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	8830	0
2.5	6420	16940	0
3.0	14390	24890	0
3.5	23430	32710	0
4.0	32560	40370	0
4.5	40800	47890	0
5.0	47170	55270	0

NOTES:

Region 2: The equation below can be used to determine intermediate burnup limits.

Minimum Burnup, MWD/MTU = $- 291.6(E\%)^2 + 17521(E\%) - 25045$

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

Region 3: The equation below can be used to determine intermediate burnup limits.

Minimum Burnup, MWD/MTU = $- 1311.8(E\%)^3 + 13957(E\%)^2 - 30989(E\%) + 17163$

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

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 472 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 (Boraflex rack), 9.03 inches (Metamic rack), and

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

Unit 2
Boraflex Rack
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.

Unit 2
Metamic Rack
New or partially spent fuel assemblies within the limits of Table 3.7.14-1C are allowed storage in the fuel storage racks, provided

Region 1 storage cells are located on the periphery of each rack (outer row only) and are therefore separated from other Region 1 cells in adjacent racks by the gap between the racks. Region 1 cells are additionally separated from other Region 1 cells within the same rack by Region 2 cells (including a Region 2 cell in the diagonal direction). Since Region 1 cells are qualified for the storage of fresh fuel, any fuel assembly (fresh or burned) meeting the maximum enrichment requirement may be stored in a Region 1 location,

4.0 DESIGN FEATURES

4.3 Fuel Storage (continued)

Region 2 cells are located on the rack periphery (outer row) interspaced with (separating) Region 1 cells and are also located in the second row of cells (from the outside of the rack) separating the Region 1 cells from the Region 3 cells,

Region 3 cells are located on the interior of the rack (at least three rows in from the rack periphery) and are prohibited from being located in the outer two rows of the rack, and

Two empty rows of storage locations shall exist between the fuel assemblies in a Boraflex rack and the fuel assemblies in the adjacent Metamic rack in the spent fuel pool.

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 Fuel Storage (continued)

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 (Boraflex racks), 1690 fuel assemblies (Metamic racks).

Attachment 3

Beaver Valley Power Station, Unit No. 2
Proposed Technical Specification Bases Changes

License Amendment Request No. 08-027

Technical Specification Bases changes are provided for Information Only

The following is a list of the affected pages:

B 3.7.12 – 2*
B 3.7.12 – 3
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
B 3.7.14 – 6
B 3.7.15 – 2
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 provided for context only.

No change. Page included for context only.

APPLICABLE SAFETY ANALYSES (continued)

The water level requirements of LCO 3.7.15, "Fuel Storage Pool Water Level," in conjunction with a minimum decay time of 100 hours prior to irradiated fuel movement, ensure the resulting offsite and control room dose from the limiting fuel handling accident is within the limits required by 10 CFR 50.67 and within the acceptance criteria of Reference 5 without the need for containment and fuel building closure or filtration. Therefore, the SLCRS requirements contained in LCO 3.7.12 are only applicable during refueling operations involving recently irradiated fuel (i.e., fuel that has occupied part of a critical reactor core within the previous 100 hours). Current requirements based on the decay time of the fuel prevent the movement of recently irradiated fuel. However, the requirements for SLCRS are retained in the Technical Specifications in case these requirements are necessary to support fuel movement involving recently irradiated fuel consistent with the guidance of NUREG-1431 (Ref. 7).

The SLCRS satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

This LCO limits the consequences of a fuel handling accident involving recently irradiated fuel in the containment (Unit 1 only) and the fuel storage pool (both units) by limiting the potential escape paths for fission product radioactivity. One train of the SLCRS exhausting from the fuel building and/or for Unit 1, the containment is required to be OPERABLE and in operation during fuel movement involving recently irradiated fuel with the required area exhaust flow discharging through the SLCRS HEPA filters and charcoal adsorbers. This ensures that air, prior to release to the environment, is being filtered during fuel movement within the fuel storage pool and/or, for Unit 1 only, during fuel movement within the containment when required in accordance with LCO 3.9.3.c.3. System failure could result in the atmospheric release from SLCRS exceeding 10 CFR 50.67 limits in the event of a fuel handling accident involving recently irradiated fuel. The SLCRS is considered OPERABLE when individual components ensure the radioactivity released in the areas of the containment (Unit 1 only) and the fuel building is filtered through the SLCRS and that fuel building doors are closed.

A SLCRS train is considered OPERABLE when its associated:

a. Fan is OPERABLE,

b. HEPA filter and charcoal adsorbers are not excessively restricting flow, and are capable of performing their filtration functions, and

c. Heater (Unit 2 only), demister (Unit 2 only), ductwork, valves, and dampers are OPERABLE and air flow can be maintained.

BASES

LCO (continued)

The SLCRS is considered in operation whenever the required area(s) exhaust flow is discharging through at least one train of the SLCRS HEPA filters and charcoal adsorbers. The LCO is modified by a Note allowing the fuel building boundary to be opened intermittently under administrative controls. For entry and exit through doors, the administrative control of the opening is performed by the person(s) entering or exiting the area. For other openings, these controls consist of stationing a dedicated individual at the opening who is in continuous communication with the control room. This individual will have a method to rapidly close the opening when fuel building isolation is required to support SLCRS operation.

The LCO 3.7.14 Note, applicable to Unit 2 only, applies to the accompanying LCO when a fuel assembly is in the fuel cask area during the installation phase of the Unit 2 reracking project.

APPLICABILITY

When required in accordance with LCO 3.9.3.c.3 (for Unit 1), one train of SLCRS is required to be OPERABLE and in operation to alleviate the consequences of a fuel handling accident inside containment. This Applicability applies only to Unit 1 in accordance with the provisions of LCO 3.9.3, "Containment Penetrations" when the Containment Purge and Exhaust System penetrations are open coincident with fuel movement involving recently irradiated fuel assemblies (i.e., fuel that has occupied part of a critical reactor core within the previous 100 hours) within containment.

During movement of recently irradiated fuel assemblies (i.e., fuel that has occupied part of a critical reactor core within the previous 100 hours) within the fuel storage pool or during movement of fuel assemblies over recently irradiated fuel assemblies within the fuel storage pool, one train of SLCRS is required to be OPERABLE and in operation to alleviate the consequences of a potential fuel handling accident.

Since SLCRS is not credited in any existing DBA analysis applicable in MODES 1, 2, 3, 4, 5, and 6 the SLCRS is not required to be OPERABLE in these MODES (except as required to support fuel movement involving recently irradiated fuel assemblies described above).

ACTIONS

A.1

A Note modifies Condition A since this Condition is only applicable to Unit 1. Only Unit 1 relies on SLCRS to filter the exhaust from the containment building to mitigate a fuel handling accident involving the movement of recently irradiated fuel.

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 when the spent fuel pool contains only Boraflex racks or 1690 fuel assemblies when the spent fuel pool contains only Metamic racks (Unit 2). The racks are designed to store Westinghouse 17X17 fuel assemblies with nominal enrichment up to 5.0 weight percent.

For Unit 1, the 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.

Boraflex Racks

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.

No change. Page included for context only.

BACKGROUND (continued)

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.

In the second Unit 2 configuration, designated as "3x3", Westinghouse 17x17 standard fuel assemblies can be stored in a repeating 3x3 matrix of storage cells 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 locations 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

BACKGROUND (continued)

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.

For Unit 2, spent fuel racks have been analyzed in accordance with the methodology contained and documented in Reference 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. ~~5~~6). 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 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} is maintained < 1.0, including uncertainties and tolerances on a 95/95 probability/confidence level, without crediting soluble boron.

Metamic Racks

For Unit 2, the spent fuel storage racks are constructed, in part, from a boron carbide and aluminum-composite material with the trade name "Metamic." The Metamic material provides a neutron absorbing function to maintain the stored fuel in a subcritical condition. The criticality analysis, documented in Holtec Report HI-2084175 (Ref. 5), demonstrates that the effective neutron multiplication factor (k_{eff}) is less than 1.0 with the storage racks fully loaded with fuel of the highest anticipated reactivity and the pool flooded with unborated water at a temperature corresponding to the highest reactivity. The criticality analysis also demonstrates that k_{eff} is less than or equal to 0.95 with the storage racks fully loaded with fuel of the highest anticipated reactivity and the pool flooded with borated water at a temperature corresponding to the highest reactivity. In addition, soluble boron is required in the Unit 2 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 the April 1978 NRC letter (Ref. 3) and

ANSI/ANS-57.2-1983 (Ref. 6).

For Unit 2, spent fuel racks have been analyzed in accordance with the methodology contained and documented in Reference 5. This methodology ensures that, with soluble boron credit, 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. 6). The codes, methods, and techniques contained in the methodology are used to satisfy this k_{eff} criterion.

Therefore, with either type of rack, 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.

BASES

APPLICABLE SAFETY ANALYSES

The hypothetical accidents can only take place during or as a result of the movement of an assembly (Ref. ~~6~~7). 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 the 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.

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 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 requirements of the accompanying LCO with no soluble boron in the Unit 2 spent fuel pool 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 of the Boraflex racks are maintained such that only the depleted assemblies are at the boundary. In accordance with Reference 5, this restriction is not applicable to the assemblies stored in the Metamic racks.

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.

Boraflex Racks

For Unit 2, operation within the storage requirements specified in Table 3.7.14-1B of the accompanying LCO or Specification 4.3.1.1.e, 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 storage requirements of the accompanying LCO, in order to meet the requirement to maintain $k_{eff} \leq 0.95$.~~

Metamic Racks

For Unit 2, operation within the storage requirements specified in Table 3.7.14-1C of the accompanying LCO and Specification 4.3.1.1.e, 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, with either type of rack, 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 storage requirements of the accompanying LCO, in order to meet the requirement to maintain $k_{eff} \leq 0.95$.

For Unit 2, Specification 4.3.1.1.e contains a requirement that two empty rows of storage cells shall exist between the fuel assemblies stored in a Boraflex rack and the fuel assemblies stored in an adjacent Metamic rack in the spent fuel pool during the installation phase of the reracking project. The two empty rows of storage cells may both be in one type of rack or the other, or they may consist of an empty row in each type of rack. The need for the two empty rows is to ensure that the fuel in the two types of racks is neutronically decoupled during the installation phase of the reracking project.

The LCO is modified by a Note, applicable to Unit 2 only, stating that the Technical Specification requirements applicable to the fuel storage pool are also applicable to the fuel cask area when a fuel assembly is in the fuel cask area during the installation phase of the Unit 2 reracking project.

BASES

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 for (Unit 1) and the LCO for Table 3.7.14-1B (Unit 2) or Specification 4.3.1.1 (Unit 2), 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 (for Unit 1) and the LCO for Table 3.7.14-1B (Unit 2) or Specification 4.3.1.1 (Unit 2).

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 analyses.

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

5. Holtec Report HI-2084175, Rev. 3, "Licensing Report for Beaver Valley Unit 2 Rerack," as submitted to the NRC by License Amendment Request No. 08-027, Unit 2 Spent Fuel Pool Rerack.

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

67. UFSAR Section 14 (Unit 1) and UFSAR Section 15 (Unit 2).

BASES

LCO

The fuel storage pool water level is required to be ≥ 23 ft over the top of irradiated fuel assemblies seated in the storage racks. The specified water level preserves the assumptions of the fuel handling accident analysis (Ref. 3). As such, it is the minimum required for fuel movement within the fuel storage pool.

The LCO 3.7.14 Note, applicable to Unit 2 only, applies to the accompanying LCO when a fuel assembly is in the fuel cask area during the installation phase of the Unit 2 reracking project.

APPLICABILITY

This LCO applies during movement of irradiated fuel assemblies in the fuel storage pool and during movement of fuel assemblies over irradiated fuel assemblies in the fuel storage pool, since the potential for a release of fission products exists.

ACTIONS

Condition A is modified by a Note indicating that LCO 3.0.3 does not apply. If moving irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODES 1, 2, 3, and 4, the fuel movement is independent of reactor operations. Therefore, inability to suspend movement of irradiated fuel assemblies is not sufficient reason to require a reactor shutdown.

A.1

When the initial conditions for prevention of an accident cannot be met, steps should be taken to preclude the accident from occurring. When the fuel storage pool water level is lower than the required level, the movement of irradiated fuel assemblies in the fuel storage pool is immediately suspended to a safe position. This action effectively precludes the occurrence of a fuel handling accident. This does not preclude movement of a fuel assembly to a safe position.

A.2

When the fuel storage pool water level is lower than the required level, the movement of non-irradiated fuel assemblies over irradiated fuel assemblies in the fuel storage pool is immediately suspended to a safe position. This action effectively precludes the occurrence of a fuel handling accident. This does not preclude movement of a fuel assembly to a safe position.

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 when the spent fuel pool contains only Boraflex racks or 1690 fuel assemblies when the spent fuel pool contains only Metamic racks (Unit 2). The racks are designed to store Westinghouse 17X17 fuel assemblies with nominal enrichment up to 5.0 weight percent.

For Unit 1, the 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}, $\leq$ 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}, $\leq$ 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)

Boraflex Racks

For Unit 2, the Boraflex spent fuel racks have been analyzed in accordance with the methodology contained and documented in Reference 4. This methodology ensures the spent fuel rack multiplication factor, k_{eff} is $\leq$ 0.95, as recommended by the April 1978 NRC letter (Ref. 3) and ANSI/ANS-57.2-1983 (Ref. ~~5~~6). 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 Boraflex spent fuel storage racks are analyzed for a range of initial assembly enrichment up to 5.0 w/o utilizing credit for burnup, burnable absorbers, decay time and soluble boron, to ensure k_{eff} is maintained $\leq$ 0.95, including uncertainties, tolerances, and accident conditions.

Metamic Racks

For Unit 2, the Metamic spent fuel racks have been analyzed in accordance with the methodology contained and documented in Reference 5. This methodology ensures the spent fuel rack multiplication factor, k_{eff} is $\leq$ 0.95, as recommended by the April 1978 NRC letter (Ref. 3) and ANSI/ANS-57.2-1983 (Ref. 6). The codes, methods, and techniques contained in the methodology are used to satisfy this k_{eff} criterion.

The three storage regions for the Unit 2 Metamic spent fuel storage racks are analyzed for a range of initial assembly enrichment up to 5.0 w/o utilizing credit for burnup, to ensure k_{eff} is maintained $\leq$ 0.95, including uncertainties, tolerances, and accident conditions.

The soluble boron concentration required to maintain $k_{eff} \leq 0.95$ in the Unit 2 spent fuel pool under normal conditions ~~is 450 ppm.~~ has been determined for when the spent fuel pool contains only Boraflex racks (Ref. 4) and when the spent fuel pool contains only Metamic racks (Ref. 5). When the spent fuel pool contains only Boraflex racks the required concentration is 450 ppm. When the spent fuel pool contains only Metamic racks the required concentration is 472 ppm. For conservatism, 472 ppm is specified in Specification 4.3.1.1.c.

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 with either type of rack 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 with either type of rack.

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 $\geq$ 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)

Boraflex Racks

For Unit 2, with only Boraflex racks, 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 ≥ 837 ppm.

Metamic Racks

For Unit 2, with only Metamic racks the amount of soluble boron required to maintain the spent fuel storage rack multiplication factor, k_{eff}, ≤ 0.95 with the worst case, i.e., a misplaced new fuel assembly in the outer row of the rack in a Region 2 location, is ≥ 1192 ppm.

When the spent fuel contains a combination of racks, 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 conservatively specified as ≥ 1192 ppm.

For either type of rack, tThe ≥ 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 450 472 ppm required during normal non-accident conditions to maintain k_{eff} ≤ 0.95 for either type of rack.

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. 67). 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.

The LCO 3.7.14 Note, applicable to Unit 2 only, applies to the accompanying LCO when a fuel assembly is in the fuel cask area during the installation phase of the Unit 2 reracking project.

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

5. Holtec Report HI-2084175, Rev. 3, "Licensing Report for Beaver Valley Unit 2 Rerack," as submitted to the NRC by License Amendment Request No. 08-027, Unit 2 Spent Fuel Pool Rerack.

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

67. 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).