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10 CFR 50.90

June 25, 2008

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

Peach Bottom Atomic Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-44 and DPR-56
NRC Docket Nos. 50-277 and 50-278

Subject: *License Amendment Request – Revision to Technical Specification 4.3.1.1.a Concerning k-infinity*

Pursuant to 10 CFR 50.90, Exelon Generation Company, LLC (Exelon) hereby requests an amendment to Appendix A, Technical Specifications, of the Renewed Facility Operating Licenses DPR-44 and DPR-56. The proposed change would revise the maximum k-infinity value contained in Technical Specification 4.3.1.1.a for the storage of fuel assemblies in the spent fuel storage racks. The proposed maximum k-infinity value is 1.318.

Exelon requests approval of the proposed changes by June 25, 2009. Once approved, the amendment shall be implemented within 60 days. The proposed changes have been reviewed by the Plant Operations Review Committee and approved by the Nuclear Safety Review Board. No new regulatory commitments are established by this submittal.

Enclosures 3 and 5 contain information proprietary to Northeast Technology Corporation (Enclosure 3) and Global Nuclear Fuel (Enclosure 5), respectively. Northeast Technology Corporation and Global Nuclear Fuel request that the documents be withheld from public disclosure in accordance with 10 CFR 2.390(a)(4). An affidavit supporting this request is also contained in Enclosures 3 and 5. Enclosures 4 and 6 contain a non-proprietary version of the Northeast Technology Corporation and Global Nuclear Fuel documents, respectively.

Enclosures 3 and 5 transmitted herewith contain Proprietary Information.
When separated from enclosures, this transmittal document is decontrolled.

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NRR

We are notifying the Commonwealth of Pennsylvania of this application for changes to the Technical Specifications by transmitting a copy of this letter and its attachments to the designated State Official.

If any additional information is needed, please contact Tom Loomis at (610) 765-5510.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 25th of June, 2008.

Respectfully,

Pamela B. Cowan
Director, Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Enclosures:
(1) Evaluation of Proposed Change
(2) Markup of Proposed Technical Specification Page Changes
(3) Criticality Analysis of the Peach Bottom Spent Fuel Racks for GNF 2 Fuel with Boraflex Panel Degradation Projected to May 2012 (Affidavit and Proprietary Version)
(4) Criticality Analysis of the Peach Bottom Spent Fuel Racks for GNF 2 Fuel with Boraflex Panel Degradation Projected to May 2012 (Non-Proprietary Version)
(5) GNF2 Spent Fuel Storage Rack Criticality Analysis for Peach Bottom Atomic Power Station Units 2 & 3 (Affidavit and Proprietary Version)
(6) GNF2 Spent Fuel Storage Rack Criticality Analysis for Peach Bottom Atomic Power Station Units 2 & 3 (Non-Proprietary Version)

cc:
S. J. Collins, Regional Administrator, Region I, USNRC
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J. Hughey, Project Manager [PBAPS] USNRC
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ENCLOSURE 1

Evaluation of Proposed Change

ENCLOSURE 1

CONTENTS

SUBJECT: Revision to Technical Specification 4.3.1.1.a Concerning k-infinity

1.0 SUMMARY DESCRIPTION

This letter is a request to amend Renewed Facility Operating Licenses Nos. DPR-44 and DPR-56. The proposed change would revise the maximum k-infinity value contained in Technical Specification 4.3.1.1.a for the storage of fuel assemblies in the spent fuel storage racks. The proposed maximum k-infinity value is 1.318.

Exelon Generation Company, LLC (Exelon) requests approval of the proposed changes by June 18, 2009. Once approved, the amendment shall be implemented within 60 days.

2.0 DETAILED DESCRIPTION

Design Feature TS 4.3.1.1.a currently requires that the spent fuel storage racks be loaded with fuel assemblies having a maximum k-infinity of 1.362 in the normal reactor core configuration at cold conditions. The proposed change is to revise the k-infinity value contained in TS 4.3.1.1.a. The proposed maximum k-infinity value is 1.318. This change is necessary as a result of the ongoing degradation of the Boraflex neutron absorbing material in the Peach Bottom Atomic Power Station (PBAPS) Spent Fuel Pool (SFP) storage racks.

The in-core k-infinity is the neutron multiplication factor for an infinite array of fuel configured in the standard, uncontrolled, reactor geometry at cold conditions. The value of k-infinity is readily evaluated by fuel designers using 2-dimensional transport theory methods as part of the fuel assembly design process. The in-rack k-effective value is the neutron multiplication factor for a finite spent fuel pool rack geometry at cold conditions. In-rack k-effective is calculated using more complex Monte Carlo methods that explicitly model rack composition and geometry, neutron leakage at rack boundaries, etc. As discussed in the PBAPS, Units 2 and 3, Updated Final Safety Analysis Report (UFSAR), Section 10.3, "Spent Fuel Storage," the fundamental design parameter of merit is the in-rack k-effective value. K-effective must remain less than or equal to 0.95. The basic regulatory requirements for assuring margin to criticality for spent fuel storage at PBAPS are defined in the USNRC Regulatory Guide 1.13 (Reference 1), with design basis and criticality specifications defined in ANSI/ANS-57.2-1983 (Reference 2).

In License Amendment Nos. 175 and 178 for PBAPS, Units 2 and 3, respectively, dated May 28, 1993 (Reference 3), the U. S. Nuclear Regulatory Commission (U. S. NRC) approved the use of the maximum in-core k-infinity as an alternative method of demonstrating compliance with fuel storage criticality limits. The in-core k-infinity value was approved as ≤ 1.362. Previously, fuel storage criticality limits were comprised of initial U-235 loading/enrichment restrictions in conjunction with the existing in-rack k-effective criteria of 0.95. The conversion from the U-235 loading approach to the in-core k-infinity parameter was undertaken because k-infinity is a more appropriate parameter than enrichment loading to demonstrate compliance with the fuel storage k-effective criteria in that it accounts for the major fuel parameters, including geometry, enrichment, enrichment distribution, exposure, burnable poisons, water rods, fuel density, etc, and is calculated as part of the standard core design process. The intent of the change was to simplify the process of demonstrating compliance with the fundamental figure of merit, in-rack k-effective ≤ 0.95. As referred to in License Amendment Nos.175 and 178, the fuel vendor (GE) performed an explicit Monte Carlo analysis of the PBAPS, Units 2 and 3 racks in accordance with ANSI/ANS-57.2 to determine a limiting fuel lattice that would meet the 4.3.1.1.b k-effective ≤ 0.95 criteria, with margin. That limiting lattice was then evaluated using NRC approved infinite lattice methods to establish an equivalent in-core k-infinity limit. The k-infinity criterion alternative approach was subsequently carried over as part of the improved Technical Specifications conversion (Reference 4) into TS 4.3.1.1.a.

The proposed amendment revises the in-core k-infinity fuel storage criticality parameter discussed in Technical Specification 4.3, "Fuel Storage." The proposed maximum k-infinity value is 1.318.

The proposed change to revise the in-core k-infinity value is necessary at this time due to the ongoing degradation of the Boraflex neutron absorbing material in the PBAPS, Units 2 and 3 SFP storage racks. A program was established in the mid-1990's to monitor the degradation of the Boraflex material in the PBAPS racks, as discussed in our response to Generic Letter 96-04 for PBAPS, Units 2 and 3 (Reference 5). Surveillance activities now project that average Boraflex B-10 density loss in the PBAPS, Unit 2 SFP racks will exceed 10% in the fall of 2008. When the 10% B-10 loss value is exceeded, the maximum in-core k-infinity parameter currently specified in TS 4.3.1.1.a (≤ 1.362) will become non-conservative. Compliance with a k-infinity limit of ≤ 1.362 will no longer provide an acceptable alternative means of assuring that the in-rack k-effective limit of 0.95 is not exceeded. This proposed change would revise the k-infinity limit to a more conservative value based on calculations provided in Enclosures 3 and 5.

The TS 4.3.1.1.a k-infinity value of 1.362 was developed based on a fuel assembly design that resulted in an in-rack k-effective of slightly less than 0.95. This hypothetical fuel design was conservatively assumed to be significantly more reactive than fuel designs actually stored and operated at PBAPS, Units 2 and 3. Due to the continuing degradation of the Boraflex neutron absorber material in the PBAPS SFP racks, a fuel design of lower reactivity must now be evaluated in an updated criticality analysis. The new, lower, in-core k-infinity value that will ensure future compliance with the TS 4.3.1.1.b in-rack criteria of k-effective ≤ 0.95 is 1.318. The in-rack k-effective limit of 0.95 will continue to be enforced by TS 4.3.1.1.b.

3.0 TECHNICAL EVALUATION

The PBAPS, Units 2 and 3 spent fuel rack design basis requires that the in-rack criticality criteria (k-effective ≤ 0.95) be met when the racks are fully loaded with the design basis bundle and flooded with full-density, un-borated water, for all normal and credible abnormal conditions. Credit may be taken for neutron-absorbing materials (such as Boraflex), and allowance must be included for all relevant uncertainties and tolerances. The basic regulatory requirements for assuring margin to criticality for spent fuel storage at PBAPS are defined in the USNRC Regulatory Guide 1.13 (Reference 1), with design basis and criticality specifications defined in ANSI/ANS-57.2-1983 (Reference 2).

The PBAPS, Units 2 and 3 spent fuel racks utilize the Boraflex material for neutron absorption. The current PBAPS, Units 2 and 3 fuel rack design basis allows for up to 10% average Boron-10 (B-10) density loss and up to 10 cm random gapping of the Boraflex panels. Due to the ongoing degradation of the Boraflex material, the maximum allowable in-core k-infinity parameter specified in TS 4.3.1.1.a will become non-conservative when the Boraflex average Boron-10 density loss exceeds 10% in the fall of 2008. When the 10% B-10 loss limit is exceeded, maintaining fuel assembly in-core k-infinity values less than 1.362 will no longer assure an in-rack k-effective of less than 0.95. Therefore, a reduced k-infinity limit is required.

In order to compensate for the positive reactivity affects associated with the ongoing degradation of the boron carbide neutron absorbing material in the PBAPS SFP storage racks, Global Nuclear Fuels (GNF) has performed an updated analysis (Enclosure 5) that evaluates a less reactive fuel assembly than assumed in earlier analyses. Specifically, the new analysis is based on the GNF2 10X10 mechanical design, uniformly loaded with 4.90 wt% U-235 and 13 rods loaded with 2 wt% Gadolinium. GNF has applied qualified Monte Carlo methods to demonstrate that, when uniformly loaded with this less reactive design basis fuel assembly, the PBAPS SFPs will maintain at least 5% margin to criticality (K-effective $\leq$ 0.95).

Critical to this GNF analysis is the reactivity penalty associated with the projected degradation of the Boraflex panels in the PBAPS SFP storage racks. This reactivity penalty was developed by Northeast Technology Corporation (NETCo) as documented in the Enclosure 3 report. The NETCo analysis is premised on the identical GNF2 design basis fuel bundle and employs a methodology that was previously submitted and approved (References 6 and 7) for Indian Point 2. The methodology conservatively projects future rack conditions, accounting for actual current PBAPS SFP rack Boraflex conditions, as measured using the qualified NETCo Badger methodology. The NETCo analysis culminates in a Boraflex degradation reactivity penalty of 0.02581 delta-K. This penalty is premised upon a theoretical 35.0% pool average B-10 aerial density loss. Conservatively accounting for uncertainties, this value is consistent with a 15.2% pool average B-10 aerial density loss, as evaluated by the qualified NETCo RACKLIFE methodology. The RACKLIFE methodology has further been demonstrated to perform a bounding assessment of BORAFLEX degradation based upon multiple benchmarks to PBAPS, Units 2 and 3 BADGER empirical data. The 15.2% B-10 density loss value, as evaluated by the NETCo RACKLIFE/BADGER methodologies, will constitute the revised design basis criteria for future PBAPS Boraflex surveillances.

Having demonstrated via explicit Monte Carlo analysis that the PBAPS racks can be maintained greater than 5% sub-critical when fully loaded with the new design basis assembly under 35% B-10 Boraflex depletion conditions, the GNF analysis then goes on to evaluate the revised design basis assembly in a cold, uncontrolled, in-reactor geometry. This evaluation is performed using the same qualified infinite-lattice transport methodology that is used by GNF in the fuel/core design process. This evaluation produced the revised k-infinity value of 1.318 that will be incorporated into the PBAPS, Units 2 and 3 TS 4.3.1.1.a. The GNF evaluation further goes on to confirm that, from a SFP criticality perspective, the new design basis 10X10 assembly still conservatively bounds all previous fuel designs operated and stored in the PBAPS SFP racks.

Confirmation that future fuel designs loaded in the PBAPS SFP storage racks have a k-infinity of less than 1.318, consistent with the proposed TS 4.3.1.1.a restriction, will provide high confidence that SFP neutron multiplication will remain ≤ 0.95 under normal and postulated accident conditions.

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

10 CFR 50.36, "Technical specifications," provides the regulatory requirements for the content required in a licensee's Technical Specifications. 10 CFR 50.36(d) delineates the items to be included in the Technical Specifications. 10 CFR 50.36(d)(4) requires that the design features include those features of the facility such as materials of construction and geometric arrangements, which, if altered or modified, would have a significant effect on safety and are not covered in categories described in paragraphs (1), (2), and (3) of this section. Based on the above, the controls and analytical methods used for the fuel storage racks are included in Sections 4 and 5 of the Technical Specifications. The basic regulatory requirements for assuring margin to criticality for spent fuel storage at PBAPS are defined in the USNRC Regulatory Guide 1.13 (Reference 1), with design basis and criticality specifications defined in ANSI/ANS-57.2-1983 (Reference 2). As discussed in the PBAPS, Units 2 and 3, Updated Final Safety Analysis Report (UFSAR), Section 10.3, "Spent Fuel Storage," the fundamental design parameter of merit is the in-rack k-effective value. K-effective must remain less than or equal to 0.95. Although this license amendment request does not propose to eliminate the k-infinity value, other licensees have deleted k-infinity based on the use of different fuel vendors (References 8 and 9). The k-infinity value is neither a material of construction nor a geometric arrangement, but rather a simplified parameter which can be used to demonstrate compliance with the fundamental figure of merit, in-rack k-effective ≤ 0.95. Therefore, this value can be revised. As demonstrated through the Global Nuclear Fuels analysis, the PBAPS spent fuel storage racks satisfy the reactivity requirements for all storage conditions with GNF2 fuel having an associated in-core peak k-infinity of no greater than 1.318. Controls and analytical methods will continue to be employed to ensure criticality in the fuel storage racks will be prevented.

4.2 Precedent

As a related item, but not the same request, prior precedence for this change has demonstrated that the k-infinity value can be deleted from the TS, but as a result of a change in vendor fuel suppliers (References 8 and 9). The k-infinity value was also deleted for the Dresden Nuclear Power Station, Units 1 and 2 (Reference 10) Technical Specifications. The k-infinity values were also revised to allow for storage of nuclear fuel assemblies with new designs (Reference 11).

4.3 No Significant Hazards Consideration

Exelon 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 amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No

The proposed change is to revise the k-infinity value contained in TS 4.3.1.1.a. The k-infinity value will be revised to 1.318. This change is necessary as a result of the ongoing degradation of the Boraflex neutron absorbing material. As demonstrated through the Global Nuclear Fuels analysis, the PBAPS spent fuel storage racks satisfy the reactivity requirements for all storage conditions with GNF2 fuel having an associated in-core peak k-infinity of no greater than 1.318 inserted. The basic regulatory requirements for assuring margin to criticality for spent fuel storage at PBAPS are defined in the USNRC Regulatory Guide 1.13, with design basis and criticality specifications defined in ANSI/ANS-57.2-1983. This change does not involve any plant modifications or operational changes that could affect system reliability, performance, or the possibility of an operator error. The fuel storage k-effective subcriticality design limit of 0.95 will continue to be required by TS 4.3.1.1.b. Therefore, the k-infinity parameter may be revised without impacting the probability or consequences of a previously evaluated accident. Additionally, a program has been established to monitor Boraflex degradation. The PBAPS, Units 2 and 3 Boraflex monitoring program discussed in our response to Generic Letter 96-04 for PBAPS, Units 2 and 3 will ensure that the spent fuel pool racks remain capable of performing their intended safety function. This change does not affect any postulated accident precursors and does not affect the performance of any accident mitigation systems that could increase the probability or consequences of an accident. Additionally, this change does not introduce any new accident initiation mechanisms.

Therefore, the proposed change does not involve an increase in the probability or consequences of an accident previously evaluated.

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

Response: No

The proposed change is to revise the k-infinity value contained in TS 4.3.1.1.a. The design basis for preventing fuel criticality in fuel storage facilities is not impacted by this change. This design function of the spent fuel racks will be maintained. The criticality analysis criteria being retained in TS 4.3.1.1 and 4.3.1.2, will preserve existing criticality margins associated with the storage of new and irradiated fuel. The fuel storage k-effective subcriticality design limit of 0.95 will continue to be required by TS 4.3.1.1.b. This change does not involve any plant modifications or operational changes that could affect system reliability or performance. No new failure mechanisms, malfunctions, or accident initiators will be introduced as a result of this change.

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

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

Response: No

The proposed change is to revise the k-infinity value contained in TS 4.3.1.1.a. The k-infinity value will be revised to 1.318. This change is necessary as a result of the ongoing degradation of the Boraflex neutron absorbing material. Since the existing in-rack k-effective criteria remains consistent with fuel storage criticality design criteria, the k-infinity parameter may be revised without impacting nuclear safety. As demonstrated through the Global Nuclear Fuels analysis, the PBAPS spent fuel storage racks satisfy the reactivity requirements for all storage conditions with GNF2 fuel having an associated in-core peak k-infinity of no greater than 1.318. The criticality analysis criteria being retained in Technical Specifications 4.3.1.1 and 4.3.1.2 will preserve required criticality margins associated with the storage of new and irradiated fuel.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based upon the above, Exelon Generation Company, LLC 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.

4.4 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, "Standards for Protection Against Radiation," or would change an inspection or surveillance requirement. However, the proposed amendment does not involve: (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 REFERENCES

1. Regulatory Guide 1.13, "Spent Fuel Storage Design Basis," March 2007, Revision 2.

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

3. Letter from J. W. Shea (U. S. NRC) to G. A. Hunger (Philadelphia Electric Company), "Fuel Storage Criticality Criteria, Peach Bottom Atomic Power Station, Units 2 and 3 (TAC NOS. M85756 and M85757)," dated May 28, 1993.

4. Letter from J. W. Shea (U. S. NRC) to G. A. Hunger (PECO Energy Company), "Issuance of Improved Technical Specifications, Peach Bottom Atomic Power Station, Unit Nos. 2 and 3, (TAC NOS. M90746 and M90747)," dated August 30, 1995.

5. Letter from G. A. Hunger (PECO Energy) to U. S. NRC, "Peach Bottom Atomic Power Station, Units 2 and 3, Limerick Generating Station, Units 1 and 2, Response to Generic Letter 96-04, "Boraflex Degradation in Spent Fuel Pool Storage Racks"," dated October 25, 1996.

6. Letter from F. Dacimo (Entergy Nuclear Operations, Inc.) to U. S. NRC, "License Amendment Request (LAR 01-010) for Spent Fuel Storage Pit Rack Criticality Analysis with Soluble Boron Credit," dated September 20, 2001

7. Letter from P. D. Milano (U. S. NRC) to M. R. Kansier (Energy Nuclear Operations, Inc.), "Indian Point Nuclear Generating, Unit No. 2 – Amendment RE: Credit for Soluble Boron and Burnup in Spent Fuel Pit (TAC NO. MB2989)," dated May 29, 2002

8. Letter from K. N. Jabbour (U. S. NRC) to J. A. Scalice (Tennessee Valley Authority), "Browns Ferry Nuclear Plant, Units 1, 2, and 3, RE: Issuance of Amendments (TAC NOS. MB7743, MB7744, AND MB7745) (TS 421)," dated September 5, 2003.

9. Letter from S. N. Bailey (U. S. NRC) to J. Scarola (Progress Energy), "Brunswick Steam Electric Plant, Units 1 and 2 – Issuance of Amendment Storage of AREVA NP Fuel (TAC NOS. MD4061 and MD4062)," dated November 27, 2007.

10. Letter from J. F. Stang (U. S. NRC) to D. L. Farrar (Commonwealth Edison Company), "Issuance of Amendments Related to TUSP Section 5.0," dated June 14, 1995.

11. Letter from B. L. Mozafari (U. S. NRC) to E. Protsch (IES Utilities, Inc.), "Duane Arnold Energy Center – Issuance of Amendment RE: Spent Fuel Racks Storage Update (TAC NO. MA4658)," dated June 8, 1999.

ENCLOSURE 2

MARKUP OF PROPOSED TECHNICAL SPECIFICATION PAGE CHANGES

PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3

Revised TS Pages

Units 2 and 3

4.0-2

4.0 DESIGN FEATURES (continued)

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 k-infinity of ~~1.362~~ 1.318 in the normal reactor core configuration at cold conditions;

b. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 10.3 of the UFSAR; and

c. A nominal 6.280 inch center to center distance between fuel assemblies placed in the storage racks.

4.3.1.2 The new fuel storage racks shall not be used for fuel storage. The new fuel shall be stored in the spent fuel storage racks.

4.3.2 Drainage

The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below plant elevation 219 ft.

4.3.3 Capacity

The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 3819 fuel assemblies.

4.0 DESIGN FEATURES (continued)

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 k-infinity of 1.362 in the normal reactor core configuration at cold conditions;

b. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 10.3 of the UFSAR; and

c. A nominal 6.280 inch center to center distance between fuel assemblies placed in the storage racks.

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