STP Nuclear Operating Company

South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

Attachment 4 should be withheld from public disclosure under 10 CFR 2.390.

June 7, 2006
NOC-AE-06002013
10 CFR 50.90
10 CFR 2.390
D43.02

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
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11555 Rockville Pike
Rockville, MD 20852-2738

South Texas Project
Units 1 and 2
Docket No. STN 50-498 and STN 50-499
License Amendment Request -
Proposed Amendment to Technical Specifications:
Revision of the Spent Fuel Pool and In-Containment Storage Area Criticality Analysis

Pursuant to 10 CFR 50.90, STP Nuclear Operating Company (STPNOC) proposes to amend South Texas Project Operating Licenses NPF-76 and NPF-80 by incorporating the attached changes into the Technical Specifications (TS). The proposed changes reflect a revision of the criticality analysis and the rack utilization schemes for the spent fuel racks as described in Section 5.6 of the TS. STPNOC has determined that a finding of "no significant hazards consideration" is justified.

This proposed change is necessary to implement an updated criticality analysis for irradiated fuel storage in the spent fuel pool racks and the In-Containment Storage Area racks. The existing criticality analysis is based on the Westinghouse two-dimensional KENO methodology with an axial burnup shape reactivity bias. The revised analysis is based on a three-dimensional KENO model. The new methodology has been approved previously by the NRC for use at other nuclear power plants.

Attachment 1 provides the No Significant Hazards Determination and Attachment 2 provides the TS pages with the proposed revisions incorporated. Attachment 4 (proprietary) provides the revised criticality analysis. Classification of this information as proprietary to the Westinghouse Electric Company LLC is supported by the affidavit in Attachment 3 signed by Westinghouse, the owner of the information. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the NRC and addresses with specificity the considerations in 10 CFR 2.390(b)(4). Accordingly, STPNOC requests that Attachment 4 be withheld in its entirety from public disclosure. A non-proprietary version does not exist.

A001

STI: 32006066

The Plant Operations Review Committee has recommended approval of the proposed change. STPNOC has notified the State of Texas in accordance with 10 CFR 50.91(b).

STPNOC requests approval of the proposed amendment by May 15, 2007. Once approved, the amendment shall be implemented within 120 days.

Correspondence with respect to the proprietary aspects of the revised criticality analysis or the supporting Westinghouse affidavit should reference CAW-06-2136 and should be addressed to B. F. Maurer, Acting Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

If there are any questions regarding this license amendment request, please contact John Conly at (361) 972-7336 or me at (361) 972-7867.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on June 7, 2006

David W. Rencurrel
Vice President, Engineering

jtc

Attachments:

1. Licensee Evaluation
2. Proposed Changes to the Technical Specifications
3. Westinghouse Affidavit
4. South Texas Project Spent Fuel Pool and In-Containment Storage Rack Criticality Analysis, WCAP-16513-P, Rev. 1 (Proprietary)
5. Table of Commitments

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Attachment 1

Licensee Evaluation

Licensee Evaluation

1.0 DESCRIPTION

This evaluation addresses a request to amend South Texas Project (STP) Operating Licenses NPF-76 and NPF-80 by incorporating the attached changes into the Technical Specifications (TS). The proposed changes reflect revision of the criticality analysis and the rack utilization schemes for Regions 1 and 2 of the spent fuel racks.

In 2000, Westinghouse issued a Nuclear Safety Advisory Letter (Ref. 1) advising clients that the two-dimensional-to-three-dimensional (2D-to-3D) axial burnup biases presented in WCAP-14416-P-A were non-conservative. The 2D KENO analyses did not adequately address the axial reactivity distribution in an irradiated fuel assembly. Subsequently, the NRC decided that future submittals from licensees would no longer be able to reference the methodology in WCAP-14416-P-A (Ref. 2).

Westinghouse re-evaluated the criticality analysis for the spent fuel pool (SFP) racks and the In-Containment Storage Area (ICSA) racks at the request of STP Nuclear Operating Company (STPNOC). The revised analysis is based on the methodology presented in WCAP-14416-P-A, but the 2D-to-3D axial burnup biasing methodology is not used. Instead, the 3D axial burnup distribution effects are explicitly modeled. This 3D axial burnup distribution methodology was previously approved by the NRC for Ginna (Ref. 3). The proposed changes in this license amendment request implement the results of the revised analysis into the TS.

The axial burnup shape bias is not applicable to the new fuel racks because it is analyzed for fresh assemblies only. Therefore, the current analyses for the new fuel racks remain valid and the TS sections addressing the new fuel racks are not modified.

2.0 PROPOSED CHANGES

The changes to the TS proposed in this license amendment request are summarized in the following table:

Section	Proposed Change	Reason for Change
5.6.1	Add sentence.	The sentence provides control over implementation of the change.
5.6.1.1	Add paragraph e.	The proposed change provides for the use of rack cell inserts in Region 2 racks.
5.6.1.2	Change the reactivity category definitions.	The proposed changes redefine the reactivity category designations. Also, the use of numerical fits to the analytical data is proposed to be allowed.

Section	Proposed Change	Reason for Change
5.6.1.3	Change the reactivity categories allowed to be stored in Region 1 racks.	The proposed changes redefine the reactivity category designations.
5.6.1.4	Change the reactivity categories allowed to be stored in Region 2 racks.	The proposed changes redefine the reactivity category designations.
5.6.1.5	Revise the interface requirements for storage configurations.	The proposed changes revise the interface requirements for storage configurations.
5.6.1.8	Revise the maximum enrichment of fuel assemblies stored in the ICSA.	The proposed change increases the maximum fuel enrichment from 4.5 w/o to 5.0 w/o.
5.6.1.8	Delete requirements for IFBA pins in fuel assemblies to be stored in the ICSA.	The proposed change eliminates the need for IFBA pins in assemblies stored in the ICSA.
Tables 5.6-1 through 5.6-18	Add Tables.	The proposed changes redefine the reactivity category designations, the allowable storage configurations, and the interface requirements.
Figures 5.6-1 to 5.6-20	Revise Figures 5.6-1 through 5.6-20. Add Figures 5.6-21 through 5.6-33.	The proposed changes redefine the reactivity category designations, the allowable storage configurations, and the interface requirements.

In addition, the following editorial changes are proposed in this license amendment request:

- Change “center to center distance” to read “center-to-center distance” at three locations in Section 5.6.1.
- Change “provided that: the cells are not face-adjacent to a cell storing a fuel assembly, or an evaluation has been performed...” to read “provided that the cells are not face-adjacent to a cell storing a fuel assembly or an evaluation has been performed...” in Section 5.6.1.3.
- Change “A K_{eff} equivalent to...” to read “k_{eff} equivalent to...” in Sections 5.6.1.7a and 5.6.1.8a.
- Change “In-containment fuel storage racks” to read “in-containment storage area (ICSA) racks” in Section 5.6.1.8.

3.0 BACKGROUND

Each unit at STP has its own separate SFP. The spent fuel storage facility provides storage capacity for 1,969 fuel assemblies in each unit. Two storage regions are provided in each SFP. The Region 1 racks have 10.95-in. nominal center-to-center spacing between the cells. Region 1 storage cells are each bounded on four sides by a water box except on the periphery of the pool. The Region 2 racks have a 9.15-in. nominal center-to-center spacing. A sheet of neutron absorber material (Boraflex) is captured between the side walls of all adjacent boxes. The criticality analysis does not take credit for the presence of the fixed absorber material.

The current STP criticality analysis for storage of irradiated fuel in the SFP racks and in the ICSA racks (Refs. 4 and 5) are based on the Westinghouse methodology described in WCAP-14416-P-A. The analyses are based on 2D KENO analyses using an axial burnup shape reactivity bias and reactivity equivalencing techniques to obtain credit for burnup, Westinghouse Integral Fuel Burnable Absorber (IFBA) pins, and control rod content. The results of the current analysis are presented in TS Section 5.6.

For storage in the SFP racks, each fuel assembly may be designated as one or more of eleven reactivity categories based on initial nominal enrichment, burnup, decay, or number of IFBA pins contained in the assembly. Whether the assembly has a control rod inserted is also a factor in characterization. The TS currently defines three allowable storage configurations in Region 1 racks and five configurations in Region 2 racks. There are twelve figures depicting burnup and/or IFBA requirements. Allowable interfaces between storage configurations are defined.

Storage in the ICSA is governed by the initial enrichment and IFBA content of a fuel assembly.

4.0 TECHNICAL ANALYSIS

The revised analysis is based on the WCAP-14416-P-A methodology with an explicit treatment of the axial burnup distribution for non-blanketed irradiated assemblies. This 3D methodology was previously approved by the NRC staff (Ref. 6). STPNOC also uses fuel with axial blankets. The 3D axial burnup distribution for blanketed fuel is considered and the modeling methodology is described in the revised criticality analysis (Attachment 4 to this license amendment request). The new analysis does not use reactivity biasing, thus avoiding the pitfalls associated with that methodology.

4.1 Methodology Overview

The reactivity analysis of the spent fuel racks is provided in Attachment 4. The methodology employed in the revised analysis for soluble boron credit is analogous to that of Ginna (Ref. 3) and employs analysis criteria consistent with those cited in the WCAP-14416-P-A safety evaluation (Ref. 6). The methodology employed in the revised STP analysis and by Ginna employs axially distributed burnups to represent discharged fuel assemblies.

Credit is taken for the soluble boron present in SFP Region 1 and 2 to provide safety margin in the criticality analysis of the spent fuel racks. This parameter provides significant negative reactivity in the criticality analysis of the spent fuel rack and is used here in conjunction with administrative controls to offset the reactivity increase when ignoring the presence of the spent fuel rack Boraflex poison panels. Soluble boron credit provides sufficient relaxation in the enrichment limits of the spent fuel racks. Reference 7 shows that there is no credible event at STP which would result in a SFP dilution from the required soluble boron concentration (2500 ppm) to the minimum soluble boron concentration that assures $k_{eff} < 0.95$ (700 ppm). This dilution analysis was previously submitted (Ref. 4) and approved by the NRC (Ref. 5). The changes proposed by this license amendment request do not impact the assumptions, analyses, or conclusions of the previous dilution analysis.

The design criteria are consistent with General Design Criterion (GDC) 62 and NRC guidance given regarding criticality analysis (Ref. 8). The revised STP criticality analysis describes the analysis methods including a description of the computer codes used to perform the criticality safety analysis. The design basis for preventing criticality in the SFP is:

1. the effective neutron multiplication factor, k_{eff}, of the fuel rack array will be < 1.00 in pure, unborated water, with a 95% probability at a 95% confidence level, including uncertainties (The actual NRC k_{eff} limit for this condition is unity; therefore, an additional margin equal to 0.005 Δk_{eff} units is included in the analysis results.); and
2. k_{eff} of the fuel rack array will be < 0.95 in the pool containing borated water, with a 95% probability at a 95% confidence level, including uncertainties.

With the simplifying assumptions employed in this analysis (no grids, sleeves, etc.), the various types of 17x17 XL fuel do not contribute to any increase in the basic assembly reactivity. This includes small changes in guide tube and instrumentation tube dimensions. Therefore, future fuel assembly upgrades do not require a criticality analysis if the fuel diameter is the same 0.374 inches.

The most reactive SFP temperature will be employed for each fuel assembly storage configuration such that the analysis results are valid over the nominal spent fuel temperature range of 50°F to 160°F.

The steps in the analysis are:

1. Determine the fresh and spent fuel storage configurations using no soluble boron conditions such that the 95/95 upper tolerance limit value of k_{eff}, including applicable biases and uncertainties, is < 0.995. This is accomplished with infinite arrays of either fresh or spent fuel assembly configurations. Note that actual k_{eff} limit for this condition is unity. Therefore, an additional margin equal to 0.005 Δk_{eff} units is included in the analysis results.
2. Determine the amount of soluble boron (ppm) necessary to reduce the k_{eff} value of all storage configurations by at least 0.05 Δk_{eff} units. This is accomplished by constructing a KENO model for the entire SFP which includes the storage configurations that are least sensitive to changes in soluble boron concentration. As an example, storage

configurations that contain depleted fuel assemblies (and represented by depleted isotopics) are less reactivity-sensitive to changes in soluble boron concentration than an assembly represented by zero burnup and relatively low initial fuel enrichment.

3. Determine the amount of soluble boron necessary to compensate for 5% of the maximum burnup credited in any storage configuration. In addition, determine the amount of soluble boron necessary to account for a reactivity depletion uncertainty equal to 1.0% Δk_{eff} per 30,000 MWD/MTU of credited assembly burnup. This is accomplished by multiplying this derivative by the maximum burnup credited in any storage configuration and converting to soluble boron using the data generated in Step 2.
4. Determine the largest increase in reactivity caused by postulated accidents and the corresponding amount of soluble boron needed to offset this reactivity increase.

An alternative form of expressing the soluble boron requirements is given in Reference 6. The final soluble boron requirement (ppm) is determined from the following summation:

$$SBC_{TOTAL} = SBC_{95/95} + SBC_{RE} + SBC_{PA}$$

where:

SBC_{TOTAL} = total soluble boron credit requirement

$SBC_{95/95}$ = soluble boron requirement for 95/95 $k_{eff} \leq 0.95$

SBC_{RE} = soluble boron required to account for burnup and reactivity uncertainties

SBC_{PA} = soluble boron required to maintain $k_{eff} \leq 0.95$ under accident conditions

For purposes of the analysis, minimum burnup limits established for fuel assemblies to be stored in the storage configuration racks include burnup credit established in a manner that takes into account approximations to the operating history of the fuel assemblies. Variables such as axial burnup profile and axial profile of moderator and fuel temperatures have been factored into the analysis. The axial reactivity effects associated with the "cut-back" of the IFBA at both ends of the fuel assembly and reduced IFBA poison loadings were directly included in this analysis.

The reactivity characteristics of the storage racks were evaluated using infinite lattice analyses. This environment was employed in the evaluation of the burnup limits versus initial enrichment as well as the evaluation of physical tolerances and uncertainties. A full SFP model was also employed to evaluate soluble boron worth, the reactivity worth of postulated accidents, and the multiplication factor for the zero soluble boron condition. Furthermore, a full ICSA was employed to analyze the criticality of a fresh 5.0 w/o (weight %) U^{235} fuel assembly array.

The analysis methodology employs SCALE-PC, a personal computer version of the SCALE-4.4 code system (Ref. 9) with the updated SCALE-4.4 version of the 44 group ENDF/B-V neutron cross section library, and the two-dimensional integral transport code DIT (Ref. 10), with an ENDF/B-VI neutron cross section library.

SCALE-PC was used for calculations involving infinite arrays for all the storage configurations in SFP Regions 1 and 2. In addition, it was employed in a full-pool and ICSA representation of the storage racks to evaluate soluble boron worth and postulated accidents. SCALE-PC, used in both the benchmarking and the fuel assembly storage configurations, includes the control module CSAS25 and functional modules BONAMI, NITAWL-II, and KENO V.a.

The DIT code is used for simulation of in-reactor fuel assembly depletion.

The fuel rod, guide tube, and instrumentation tube claddings are modeled with zircaloy in this analysis. This is conservative with respect to the Westinghouse ZIRLO product, which is a zirconium alloy containing additional elements including niobium. Niobium has a small absorption cross section, which causes more neutron capture in the cladding regions resulting in a lower reactivity. Therefore, this analysis is conservative with respect to fuel assemblies containing ZIRLO cladding in fuel rods, guide tubes, and the instrumentation tube.

Empty water cells may be substituted for fresh or burned fuel assemblies at any location. Any positive reactivity effect due to the additional water in the 2x2 analytical cell is offset by the absence of uranium.

This analysis also includes provision for the use of rack cell inserts (referred to as "poison inserts" in the attached criticality analysis) to close-pack the Region 2 racks to maximize storage. One storage configuration ("All-Cell" with Cell Inserts) is modeled to take advantage of rack cell inserts that are on the market. In this configuration, an L-shaped insert is assumed to be placed in each cell. The dimensions, materials, and manufacturing tolerances of the insert are specified in the analysis. These values will be used as purchase specifications for such inserts in the future.

The licensing basis for the racks is met by the combination of the physical design and center-to-center spacing of the storage cells, the required presence of soluble boron, and the use of administrative procedures to guide the placement of fuel assemblies, cell inserts, Pyrex Burnable Poison Absorber Rods (BPRAs), and rod cluster control assemblies (RCCAs).

When storing fuel with an initial nominal enrichment greater than the maximum all-cell enrichment for the respective rack region, a rack k_{eff} of ≤ 0.95 is ensured by maintaining a minimum amount of soluble boron and using administrative procedures to control the placement of burned fuel, fresh fuel, cell inserts, BPRAs, and RCCAs. A rack k_{eff} of < 0.995 in pure, unborated water is ensured by using administrative procedures to control the placement of burned fuel, fresh fuel, cell inserts, BPRAs, and RCCAs.

The boron concentration of the water in the SFP is maintained at or above the minimum value needed to ensure that the rack k_{eff} is ≤ 0.95 in the event of a single misplaced assembly.

4.2 Basis for Determining Analyzed Storage Configurations

Because the number of possible storage configurations of existing and expected fuel assemblies would be overwhelming, a strategy was developed to determine those combinations that would have the best possibility of maximizing the pool utilization. Sixteen 2x2 storage configurations were predefined for analysis in the SFP racks. Three configurations were chosen for the Region 1 racks and thirteen for the Region 2 racks.

In preparation for a refueling outage, fresh feed fuel may be pre-staged in the Region 1 racks prior to loading in the core. The core is routinely discharged into the Region 1 racks during the outage. Decay credit in the Region 1 racks is not needed because discharged fuel is routinely allowed to decay in the Region 1 racks and then is moved to the Region 2 racks. These considerations govern the choices of storage configurations. For Region 1, the configurations are:

- "All-Cell" or close-packed storage
- Checkerboard #1 - storage of burned fuel or burned fuel with fresh feed fuel
- Checkerboard #2 - storage of burned fuel with fresh feed fuel

All of the configurations allow burnup credit. Checkerboard #1 allows credit for the number of Westinghouse IFBA pins.

The Region 2 racks are used for long-term storage of fuel assemblies. Burnup credit and decay time credit are used extensively in the Region 2 configurations. However, as for Region 1, the Region 2 racks may also be used to pre-stage fresh fuel assemblies in preparation for a refueling outage. Also, accommodations are needed to store once-burned assemblies, and those with minimal burnup, in case they cannot be reused in the core. These considerations, and the desire to maximize the use of storage locations for existing fuel and for planned discharge batches, govern the choices of storage configurations.

Most of the existing discharged fuel assemblies do not have axial blankets. However, recent fuel cycles and future planned cycles utilize assemblies with top and bottom axial blankets with reduced enrichment (2.6 w/o U^{235}) and/or annular pellets. The criticality analysis makes use of this axial feature to lower the reactivity of the top and bottom regions of the assemblies.

For Region 2, the configurations are:

- "All-Cell," non-blanketed
- 4-out-of-4 with Westinghouse BPRA insert, non-blanketed
- 1-out-of-4 blanketed
- 2-out-of-4 blanketed
- 1-out-of-4 with RCCA
- 2-out-of-4 with RCCA
- 3-out-of-4 Checkerboard

- 4-out-of-4 blanketed
- 4-out-of-4 blanketed, 1 RCCA and decay credit

The following configurations are for pre-staging fresh feed fuel in Region 2 racks:

- 2-out-of-4 5.0 w/o, sixteen 1.5x IFBA (where "1.5x" designates the B^{10} loading on the fuel pellet. "1.0x" corresponds to a loading of 1.57 mg/in. of B^{10}.)
- 1-out-of-4 5.0 w/o with no IFBA (This configuration provides storage for last-minute replacement assemblies of any enrichment and minimal IFBA content.)
- 2-out-of-4 4.768 w/o with no IFBA (This configuration provides more efficient storage for last-minute replacement assemblies of most enrichments and minimal IFBA content.)

In the future, STPNOC will probably use RCCAs and some type of rack cell inserts to close-pack the Region 2 racks to maximize storage capacity. Use of RCCAs is included in the configurations above. One final configuration ("All-Cell" with Cell Inserts) is modeled to take advantage of rack cell inserts that are on the market. In this configuration, an L-shaped insert is assumed to be placed in each cell. The dimensions, materials, and manufacturing tolerances of the insert are specified in the analysis. These values will be used as purchase specifications for such inserts in the future.

Actual implementation and usage of rack inserts will be evaluated in accordance with 10 CFR 50.59. This proposed change will provide the criticality basis and fuel storage guidance for the use of cell inserts.

4.3 Results

The detailed results of the analysis are presented in Attachment 4. Only a brief overview of the analysis results is presented in this evaluation.

Twenty-four reactivity categories were defined from the definitions of the storage configurations. Six odd-numbered categories are used in Region 1 configurations. Eighteen even-numbered categories are used in Region 2 racks. The fuel assembly characteristics of the categories are given in Attachment 4.

As discussed in Section 4.1 above, soluble boron in the SFP coolant is used in this analysis to offset the reactivity allowances for calculational uncertainties in modeling, storage rack fabrication tolerances, fuel assembly design tolerances, and postulated accidents. The total soluble boron requirement is defined above.

The magnitude of each soluble boron requirement is as follows with the individual terms as defined in Section 4.1, above:

$SBC_{95/95}$	=	373.1 ppm
SBC_{RE}	=	293.1 ppm
SBC_{PA}	=	789.3 ppm
SBC_{TOTAL}	=	1455.5 ppm

Therefore, a total of 1455.5 ppm of soluble boron (with 19.9% B^{10} abundance) is required to maintain $k_{eff} \leq$ to 0.95 (including all biases and uncertainties) assuming the most limiting single accident.

The existing boron dilution analysis (Ref. 7) is based on the current criticality analysis finding that a soluble boron concentration of 700 ppm is needed to account for the 95/95 confidence level and burnup and reactivity uncertainties. Per the revised analysis (Section 3.6.4 of Attachment 4), only 666 ppm boron is needed (373 ppm for 95/95 confidence + 293 ppm for uncertainties). Therefore, the current dilution analysis described in Reference 7 remains bounding.

To aid in the practical application of the required minimum burnup as a function of initial nominal enrichment, decay time, and IFBA content, n-degree polynomials were developed as curve fits on most of the result sets for the reactivity categories in the analyzed storage configurations. Interpolations between analyzed decay times to determine the required burnup as a function of initial nominal enrichment may be performed using at least a second degree polynomial. Extrapolation beyond the 30-year time limit is not allowed.

A surface fit polynomial may also be developed to directly determine the required minimum burnup as a function of initial enrichment and decay time for a particular category. Since the analysis was performed using four enrichment values and seven time points, a polynomial of third degree in x (enrichment) and sixth degree in y (time), will fit the analytical data. Such a surface fit will match the analytical results "exactly" at the data point. However, before implementation, interior points at intermediate enrichment and time values will be analyzed to ensure the polynomials chosen for the surface fit yield results within 1% of the results obtained by interpolation between the 2D polynomial fits generated in the criticality analysis.

Interface requirements between storage configurations within a rack region and between configurations in Region 1 adjacent to configurations in Region 2 have been analyzed and are defined in Attachment 4.

4.4 Relevant NRC Guidance Documents

- NRC Information Notice 91-26, "Potential Nonconservative Errors in the Working Format Hansen-Roach Cross-Section Set Provided with the KENO and SCALE Codes"

  The revised analysis uses the newer version of SCALE package (Version 4.4a as opposed to Version 3, to which this error pertains) and the 44-group library rather than the 16-group Hansen-Roach library.

- NRC Information Notice 92-21, "Spent Fuel Pool Reactivity Calculations" (including Supplement 1)

  The modeling problems cited by this Notice concerned methodologies with flaws that were not detected due to the lack of analytical benchmark data sets containing strong neutron absorbers such as Boraflex. However, no credit is taken in the revised analysis for Boraflex. Therefore, the problem of selecting representative benchmarks does not arise.

- NRC Information Notice 95-38, "Degradation of Boraflex Neutron Absorber in Spent Fuel Storage Racks"

  The spent fuel racks at STP were originally designed with Boraflex. However, the Boraflex was removed from the Region 1 racks in 2000. Because of the construction of the Region 2 racks, it is not practical to remove the Boraflex from those racks. Neither the current nor the revised analysis credits Boraflex as a neutron absorber.

- NRC Regulatory Issue Summary 2001-12, "Nonconservatism in Pressurized Water Reactor Spent Fuel Storage Pool Reactivity Equivalencing Calculations"

  The revised analysis does not use reactivity equivalencing, so the nonconservatisms identified in this Summary have been avoided.

- NRC Information Notice 2005-13, "Potential Non-Conservative Error in Modeling Geometric Regions in the KENO-V.A Criticality Code"

  None of the input models involve cylindrical holes with shared boundaries in the STP analysis, so the revised analysis is not affected by this error.

5.0 REGULATORY ANALYSIS

5.1 No Significant Hazards Determination

STPNOC has evaluated whether a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92:

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

   Response: No

   There is no increase in the probability of an accident. The proposed change does allow a greater number of fuel storage configurations in the SFP. While this could increase the probability of a fuel misloading, the presence of sufficient soluble boron in the SFP precludes criticality as a result of the misloading. Fuel assembly placement will continue to be controlled pursuant to approved fuel handling procedures and will be in accordance with the TS and the spent fuel rack storage configuration limitations of UFSAR Chapter 9.1.2.

Reactivity changes due to SFP temperature changes have been evaluated. The base case criticality analysis covers a "normal" SFP temperature range of 50°F to 160°F. Spent fuel pool temperature accidents are considered outside the normal temperature range extending from 50°F to 240°F. In all SFP temperature accident cases, sufficient reactivity margin is available to the 0.95 k_{eff} limit without requiring additional soluble boron above the base case level. Because adequate soluble boron will be maintained in the SFP water to maintain $k_{eff} < 0.95$, the consequences of a loss of normal cooling to the SFP will not be increased.

There is no increase in the consequences of the accidental misloading of spent fuel assemblies into the SFP racks. The criticality analysis demonstrates that the pool k_{eff} will remain ≤ 0.95 following an accidental misloading due to the boron concentration of the pool. The current TS limitation will ensure that an adequate SFP boron concentration is maintained.

The criticality analysis shows the consequences of a fuel assembly drop accident in the SFP are not affected when considering the presence of soluble boron. The rack k_{eff} remains ≤ 0.95.

The editorial changes proposed in this license amendment request do not impact the probability or consequences of an accident.

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

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

   Response: No

   Spent fuel handling accidents are not new or different types of accidents; they have been analyzed in Section 15.7.4 of the UFSAR.

   Criticality accidents in the SFP are not new or different types of accidents. They have been analyzed in the UFSAR and in Criticality Analysis Reports associated with specific licensing amendments for fuel enrichments that are assumed for the proposed change. Because the proposed SFP storage configuration limitations will be similar to the current ones, the new limitations will not have any significant effect on normal SFP operations and maintenance, and will not create any possibility of a new or different kind of accident. Verifications will continue to be performed to ensure that the SFP loading configuration meets specified requirements.

The misloading of a fuel assembly in the required storage configuration has been evaluated. In all cases, the rack k_{eff} remains ≤ 0.95. Removal of an RCCA from a checkerboard storage configuration has been analyzed and found to be bounded by the misloading of a fuel assembly.

As discussed above, the proposed changes will not create the possibility of a new or different kind of accident. There is no significant change in plant configuration, equipment design, or equipment.

The editorial changes proposed in this license amendment request do not impact the design basis accidents of STP.

Under the proposed amendment, no changes are being made to the racks themselves, to any other systems, or to the physical structures of the Fuel Handling Building.

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 change involve a significant reduction in a margin of safety?

   Response: No

   The proposed TS changes and the resulting spent fuel storage operation limits will provide adequate safety margin to ensure that the stored fuel assembly array always remains subcritical. Those limits are based on a plant-specific criticality analysis performed in accordance with Westinghouse spent fuel rack criticality analysis methodology.

   While the criticality analysis utilized credit for soluble boron, storage configurations have been defined using 95/95 k_{eff} calculations to ensure that the spent fuel rack k_{eff} is < 1.0 with no soluble boron. Soluble boron credit is used to offset uncertainties, tolerances, and off-normal conditions, and to provide subcritical margin such that the SFP k_{eff} is maintained ≤ 0.95.

   The loss of substantial amounts of soluble boron from the SFP that could lead to k_{eff} exceeding 0.95 has been previously evaluated and approved (Ref. 4 and 5) and shown to be not credible. A safety evaluation has been performed which shows that dilution of the SFP boron concentration from 2500 ppm to 700 ppm is not credible. Also, the spent fuel rack k_{eff} will remain < 1.0 (with a 95/95 confidence level) with the SFP flooded with unborated water. These safety analyses demonstrate a level of safety comparable to the conservative criticality analysis methodology required by Westinghouse WCAP-14416-P-A.

The editorial changes proposed in this license amendment request do not affect the margin of safety.

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

Based on the above, STPNOC concludes that the proposed amendment involves no significant hazards consideration under the standards set forth in 10CFR50.92 and a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements/Criteria

10 CFR 50, Appendix A, GDC 62 states;

> Criticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations.

Implementation of the proposed changes in the required fuel storage configurations and the associated assembly reactivity requirements will continue to satisfy the requirements of GDC 62. Specifically, the design basis for preventing criticality in the SFP and the ICSA is:

1. the k_{eff} of the fuel rack array shall be < 1.00 in pure, unborated water, with a 95% probability at a 95% confidence level, including uncertainties; and
2. the k_{eff} of the fuel rack array shall be < 0.95 in the pool containing borated water, with a 95% probability at a 95% confidence level, including uncertainties.

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

6.0 ENVIRONMENTAL CONSIDERATION

STPNOC has evaluated the proposed changes and determined that (i) the proposed amendment involves no significant hazards considerations, (ii) there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite, and (iii) there is no significant increase in the individual or cumulative occupational exposure. Accordingly, the proposed changes meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9), and an environmental assessment of the proposed changes is not required.

7.0 IMPLEMENTATION

The proposed TS changes do not modify the basic design objectives in TS 5.6.1.1 concerning the SFP rack storage criticality. However, the proposed changes to the allowed storage configurations and associated fuel assembly characteristics (e.g., required fuel assembly burnup, decay time, etc.) are generally more restrictive than the current TS. Therefore, it is very probable that storage configurations allowed by the current TS are not allowed by the proposed TS.

STPNOC proposes to perform the following to allow for an implementation period for fuel stored in the SFP:

- Move the current requirements in TS 5.6 to Technical Requirements Manual (TRM) Section 5.6.1.
- Add the following paragraph to TRM Section 5.6.1:

    "Fuel shall be stored in compliance with the requirements below OR in accordance with the requirements of Technical Specification 5.6.1 during the implementation period of May 15, 2007 to September 15, 2007. After September 15, 2007, fuel shall be stored in compliance with the requirements of Technical Specification 5.6.1 only."
- Add the following paragraph to TS Section 5.6.1:

    "Fuel shall be stored in compliance with the requirements below or in accordance with the requirements of Technical Requirements Manual (TRM) 5.6.1 during the implementation period as specified in TRM 5.6.1."
- Update the TS with the proposed storage configurations and fuel assembly requirements

After the implementation period, all configuration requirements in TRM 5.6.1 wll be removed and replaced by the statement:

"Fuel shall be stored in compliance with the requirements of Technical Specification 5.6.1."

This ensures that all fuel is stored in an analyzed configuration during the implementation period, either in the currently approved configuration moved to the TRM or in the configuration approved by the NRC as the new TS section. After the implementation period, all fuel will be stored in accordance with the proposed TS.

Because fuel is not normally stored in the ICSA, changes in the fuel storage requirements for the ICSA will be implemented in the normal manner.

8.0 REFERENCES AND PRECEDENTS

8.1 References

1. Westinghouse Nuclear Safety Advisory Letter, "Axial Burnup Shape Reactivity Bias," NSAL-00-015, November 2, 2000
2. Letter, S. Dembek to H.A. Sepp, "Non-conservatisms in Axial Burnup Biases for Spent Fuel Rack Criticality Analysis Methodology," July 27, 2001 (ML012080337)
3. Letter, G. S. Vissing to R. C. Mecredy, "R. E. Ginna Nuclear Plant – Amendment re: Revision to the Storage Configuration Requirements within the Existing Storage Racking and Taking Credit for a Limited Amount of Soluble Boron (TAC No. MA8443)," December 7, 2000 (ML003761578)
4. Letter, T.H. Cloninger to Document Control Desk, "Proposed Amendment to Technical Specifications for Spent Fuel Storage Pool Rack Criticality Analysis with Soluble Boron Credit," July 7, 1998 (NOC-AE-000178) (TAC Nos. MA2296 and MA2297)
5. Letter, T. W. Alexion to W. T. Cottle, "South Texas Project Units 1 and 2 – Amendment Nos. 104 and 91 to Facility Operating License Nos. NPF-76 and NPF-80 (TAC Nos. MA2296 and MA2297)," March 3, 1999
6. Letter, T. E. Collins to T. Greene, "Acceptance for Referencing of Licensing Topical Report WCAP-14416-P, 'Westinghouse Spent Fuel Rack Methodology' (TAC No. M93254)," October 25, 1996
7. Corpora, G. J., "South Texas Units 1 and 2 Spent Fuel Pool Dilution Analysis," Westinghouse Electric Co., February 25, 1998 (submitted as an attachment to Ref. 4 above)
8. L. Kopp, "Guidance on the Regulatory Requirements for Criticality Analysis of Fuel Storage at Light-Water Reactor Power Plants," February 1998
9. "SCALE 4.4a – Modular Code System for Performing Standardized Computer Analyses for Licensing Evaluation for Workstations and Personal Computers," RSICC Code Package CCC-545, Oak Ridge National Laboratory, 2000
10. "DIT: Discrete Integral Transport Assembly Design Code," CE-CES-11, Revision 4-P, April 1994

8.2 Precedents

Three-Dimensional Methodology

Letter, T. E. Collins to T. Greene, "Acceptance for Referencing of Licensing Topical Report WCAP-14416-P, Westinghouse Spent Fuel Rack Methodology (TAC No. M93254)," October 25, 1996

Letter, B. Benney to G. M. Rueger, "Diablo Canyon Nuclear Power Plant, Unit Nos. 1 and 2 - Issuance of Amendment re: Credit for Soluble Boron in the Spent Fuel Pool Criticality Analysis (TAC Nos. MB2982 and MB2984)," September 25, 2002 (ML022610080)

Letter, R. B. Ennis to J. A. Price, "Millstone Power Station, Unit 2 - Issuance of Amendment re: Spent Fuel Pool Requirements (TAC No. MB3386)," April 1, 2003 (ML030910485)

Letter, R. E. Martin to L. M. Stinson, "Joseph M. Farley Nuclear Plant, Units 1 and 2 re: Issuance of Amendments (TAC Nos. MC6987 and MC6988)," June 28, 2005 (ML051860200)

Specific Application at Ginna

Letter, G. S. Vissing to R. C. Mecredy, "R. E. Ginna Nuclear Plant - Amendment re: Revision to the Storage Configuration Requirements within the Existing Storage Racking and Taking Credit for a Limited Amount of Soluble Boron (TAC No. MA8443)," December 7, 2000 (ML003761578)

Attachment 2

Proposed Changes to the Technical Specifications

SECTION PAGE

SECTION PAGE

5.3 REACTOR CORE

FUEL ASSEMBLIES

5.3.1 The reactor core shall contain 193 fuel assemblies. Each fuel assembly shall consist of a matrix of zircaloy or ZIRLO clad fuel rods with an initial composition of natural or slightly enriched uranium dioxide as fuel material. Limited substitutions of zirconium alloy, ZIRLO or stainless steel filler rods for fuel rods, in accordance with NRC-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 non-limiting core regions.

CONTROL ROD ASSEMBLIES

5.3.2 The core shall contain 57 full-length control rod assemblies. The full-length control rod assemblies shall contain a nominal 158.9 inches of absorber material. The absorber material within each assembly shall be silver-indium-cadmium or hafnium. Mixtures of hafnium and silver-indium-cadmium are not permitted within a bank. All control rods shall be clad with stainless steel tubing.

5.4 (NOT USED)

5.5 METEOROLOGICAL TOWER LOCATION

5.5.1 The meteorological towers shall be located as shown on Figure 5.1-1.

5.6 FUEL STORAGE

5.6.1 CRITICALITY

Fuel shall be stored in compliance with the requirements below or in accordance with the requirements of Technical Requirements Manual (TRM) 5.6.1 during the implementation period as specified in TRM 5.6.1.

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

a. k_{eff} less than 1.0 when flooded with unborated water, which includes an allowance for uncertainties as described in WCAP-14416-NP-A.

b. k_{eff} less than or equal to 0.95 when flooded with water borated to 700 ppm, which includes an allowance for uncertainties as described in WCAP-14416-NP-A.

c. These requirements (a and b above) shall be met by storing fuel in the spent fuel storage racks according to Specifications 5.6.1.3, 5.6.1.4, and 5.6.1.5. Additionally, credit may be taken for the presence of soluble boron in the spent fuel pool water, per Specification 3.9.13, to mitigate the misloading of one or more fuel assemblies, as described in Specification 5.6.1.6.

d. A nominal 10.95 inches center-to-center distance between fuel assemblies in Region 1 of the storage racks and a nominal 9.15 inches center-to-center distance between fuel assemblies in Region 2 of the storage racks.

e. Rack cell inserts of appropriate material may be used to provide reactivity holddown in all or portions of the Region 2 racks.

5.6.1.2 *Prior to insertion into the spent fuel storage racks,* each fuel assembly shall be categorized by reactivity, as discussed below, or be designated as a Category 11 (for storage in Region 1) or Category 32 (for storage in Region 2) fuel assembly. All fuel enrichment values are initial nominal U^{235} enrichments. The reactivity categories are:

CATEGORY 1:

Fuel in Category 1 shall meet at least one of the following criteria:

1) an initial enrichment of less than or equal to 2.452 w/o; OR
2) a minimum burnup requirement as a function of initial enrichment as presented in Table 5.6-1 and Figure 5.6-17.

CATEGORY 2:

Fuel in Category 2 shall meet at least one of the following criteria:

1) an initial nominal enrichment of less than or equal to 1.169 w/o; OR
2) a minimum burnup as a function of initial enrichment and decay time as presented in Table 5.6-2 and Figure 5.6-18.

CATEGORY 3:

Fuel in Category 3 shall meet at least one of the following criteria:

1) an initial nominal enrichment of less than or equal to 2.961 w/o; OR
2) a minimum burnup as a function of initial enrichment as presented in Table 5.6-3 and Figure 5.6-19; OR
3) a minimum number of 140-inch Integral Fuel Burnable Absorber (IFBA) pins, as a function of IFBA B^{10} loading and initial enrichment as presented in Table 5.6-4 and Figure 5.6-20. Coefficients for the polynomial fits for the IFBA requirements as a function of enrichment are given in Table 5.6-4.

CATEGORY 4:

Fuel in Category 4 shall meet the following criteria:

1) a Burnable Poison Rod Assembly (BPRA of the Pyrex design) insert with at least 20 rodlets; AND EITHER
2) an initial enrichment of less than or equal to 1.240 w/o; OR
3) a minimum burnup as a function of initial enrichment and decay time as presented in Table 5.6-5 and Figure 5.6-21.

CATEGORY 5:

Fuel in Category 5 shall meet at least one of the following criteria:

1) an initial nominal enrichment of less than or equal to 1.695 w/o; OR
2) a minimum burnup as a function of initial enrichment as presented in Table 5.6-6 and Figure 5.6-22.

CATEGORY 6:

Fuel in Category 6 shall meet the following criteria:

1) a 7-inch axial blanket on each end of the fuel assembly with an enrichment less than or equal to 2.60 w/o U^{235}; AND EITHER
2) an initial enrichment of less than or equal to 1.172 w/o U^{235}; OR
3) a minimum burnup as a function of initial enrichment as presented in Table 5.6-7 and Figure 5.6-23.

Decay time credit may not be taken for Category 6 fuel (i.e., only the "0 yr decay" curve on Figure 5.6-23 may be used).

CATEGORY 7:

Fuel in Category 7 shall meet at least one of the following criteria:

1) an initial nominal enrichment of less than or equal to 3.860 w/o; OR
2) a minimum burnup as a function of initial enrichment as presented in Table 5.6-8 and Figure 5.6-24; OR
3) a minimum number of 140-inch IFBA pins as a function of IFBA B^{10} loading and initial enrichment as determined in Table 5.6-9 and Figure 5.6-25. Coefficients for the polynomial fits for the IFBA requirements as a function of enrichment are presented in Table 5.6-9.

CATEGORY 8:

A fuel assembly that does not meet the Blanketed criteria for Category 6 may be considered to be in Category 8. Specifically, fuel in Category 8 is a non-blanketed fuel assembly meeting the following criteria:

1) an initial enrichment of less than or equal to 1.172 w/o; OR
2) a burnup greater than the minimum burnup as a function of initial enrichment and decay time as presented in Table 5.6-7 and Figure 5.6-23.

CATEGORY 9:

Fuel in Category 9 shall meet at least one of the following criteria:

1) an initial nominal enrichment of less than or equal to 1.606 w/o; OR
2) a minimum burnup as a function of initial enrichment as presented in Table 5.6-10 and Figure 5.6-26.

CATEGORY 10:

Fuel in Category 10 shall meet the following criteria:

1) a 7-inch axial blanket on each end of the fuel assembly with an enrichment less than or equal to 2.60 w/o U^{235}; AND EITHER
2) an initial enrichment of less than or equal to 1.159 w/o; OR
3) a minimum burnup as a function of initial enrichment as presented in Table 5.6-11 and Figure 5.6-27.

Decay time credit may not be taken for Category 10 fuel (i.e., only the "0 yr decay" curve on Figure 5.6-27 may be used).

CATEGORY 11:

Fuel in Category 11 shall have an initial enrichment of less than or equal to 5.0 w/o.

CATEGORY 12

A fuel assembly that does not meet the Blanketed criteria for Category 10 may be considered to be in Category 12. Specifically, fuel in Category 12 is a non-blanketed fuel assembly that shall meet the following criteria:

1) an initial enrichment of less than or equal to 1.159 w/o; OR,
2) a minimum burnup as a function of initial enrichment and decay time as presented in Table 5.6-11 and Figure 5.6-27.

CATEGORY 14

Fuel in Category 14 shall meet the following criteria:

1) a rod cluster control assembly (RCCA) insert; AND EITHER
2) an initial enrichment of less than or equal to 1.379 w/o; OR
3) a minimum burnup as a function of initial enrichment and decay time as presented in Table 5.6-12 and Figure 5.6-28.

CATEGORY 16

Fuel in Category 16 shall meet the following criteria:

1) an initial enrichment of less than or equal to 1.379 w/o; OR
2) a minimum burnup as a function of initial enrichment and decay time as presented in Table 5.6-12 and Figure 5.6-28.

CATEGORY 18

Fuel in Category 18 shall meet the following criteria:

1) an RCCA insert; AND EITHER
2) an initial enrichment of less than or equal to 1.665 w/o; OR
3) a minimum burnup as a function of initial enrichment and decay time as presented in Table 5.6-13 and Figure 5.6-29.

CATEGORY 20

Fuel in Category 20 shall meet the following criteria:

1) an initial enrichment of less than or equal to 1.665 w/o; OR
2) a minimum burnup as a function of initial enrichment and decay time as presented in Table 5.6-13 and Figure 5.6-29.

CATEGORY 22

Fuel in Category 22 shall meet the following criteria:

1) an initial enrichment of less than or equal to 1.696 w/o; OR
2) a minimum burnup as a function of initial enrichment and decay time as presented in Table 5.6-14 and Figure 5.6-30.

CATEGORY 24

Fuel in Category 24 shall meet the following criteria:

1) a 7-inch axial blanket on each end of the fuel assembly with an enrichment less than or equal to 2.60 w/o; AND EITHER
2) an initial enrichment of less than or equal to 1.153 w/o; OR
3) a minimum burnup as a function of initial enrichment and decay time as presented in Table 5.6-15 and Figure 5.6-31.

CATEGORY 26

Fuel in Category 26 shall meet the following criteria:

1) a 7-inch axial blanket on each end of the fuel assembly with an enrichment less than or equal to 2.60 w/o; AND
2) an RCCA insert; AND EITHER
3) an initial enrichment of less than or equal to 1.369 w/o; OR
4) a minimum burnup as a function of initial enrichment and decay time as presented in Table 5.6-16 and Figure 5.6-32.

CATEGORY 28

Fuel in Category 28 shall meet the following criteria:

1) a 7-inch axial blanket on each end of the fuel assembly with an enrichment less than or equal to 2.60 w/o; AND EITHER
2) an initial enrichment of less than or equal to 1.369 w/o; OR
3) a minimum burnup as a function of initial enrichment and decay time as presented in Table 5.6-16 and Figure 5.6-32.

CATEGORY 30

Fuel in Category 30 shall meet the following criteria:

1) an initial enrichment of less than or equal to 5.0 w/o; AND
2) at least 16, 140-inch IFBA pins with a ^{10}B loading greater than or equal to 2.355 mg/in (1.5X).

CATEGORY 32

Fuel in Category 32 shall have an initial enrichment of less than or equal to 5.0 w/o.

CATEGORY 34

Fuel in Category 34 shall have an initial enrichment of less than or equal to 4.768 w/o.

CATEGORY 36

Fuel in Category 36 shall meet at least one of the following criteria:

1) an initial enrichment of less than or equal to 2.049 w/o; OR
2) a minimum burnup as a function of initial enrichment and decay time as presented in Table 5.6-17 and Figure 5.6-33.

The cell in which a Category 36 fuel assembly is placed SHALL contain a rack insert.

Data points for the curves presented in Figures 5.6-17 through 5.6-33 are presented in Tables 5.6-1 through 5.6-17. The tables also provide polynomial curve fits which may be used in lieu of the figures. Interpolations between analyzed decay times to determine the required burnup as a function of initial nominal enrichment may be performed using at least a second-degree polynomial. Extrapolation beyond the 30 year time limits is not allowed.

A surface fit polynomial may be used to directly determine the required minimum burnup as a function of initial enrichment and decay time for a particular category.

5.6.1.3 Region 1 racks may be used to store odd-numbered Category fuel. The fuel in Region 1 shall be stored in accordance with Figures 5.6-1 through 5.6-3.

Empty water cells may be substituted for fuel assemblies in all cases.

Empty water cells may be used to store non-fissile items provided that the cells are not face-adjacent to a cell storing a fuel assembly or an evaluation has been performed that supports storage of the non-fissile item.

5.6.1.4 Region 2 racks may be used to store even-numbered Category fuel. The fuel in Region 2 shall be stored in accordance with Figures 5.6-4 through 5.6-16.

Empty water cells may be substituted for fuel assemblies in all cases. Non-fissile items may be stored in empty water cells per the provisions of Specification 5.6.1.3.

Fuel Rod Storage Canisters (or Racks) filled with fuel pins with a maximum enrichment of 5.0 w/o U^{235} with no burnable absorbers may be stored in the Region 2 "All-Cell" storage configuration (Figure 5.6-4).

5.6.1.5 Storage Configuration Interface Requirements. Fuel storage configurations used within each region and at the interface between Region 1 and Region 2 racks shall comply with the assembly loading requirements at the interface provided in Table 5.6-18. The interface boundaries of three or four different storage configurations are acceptable only if the storage cells on the boundary between the groups satisfy the interface requirements of the corresponding storage configurations as shown in Figures 5.6-34 and 5.6-35 and the assembly configurations along the border satisfy Table 5.6-18.

5.6.1.6 The minimum boron concentration of 2500 ppm specified by Specification 3.9.13, "Spent Fuel Pool Minimum Boron Concentration" bounds the boron concentration of 1456 ppm required for the most limiting fuel misloading and also assures that the rack k_{eff} limit in Specification 5.6.1.1a will not be violated.

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

a. k_{eff} equivalent to less than or equal to 0.95 when flooded with unborated water and less than or equal to 0.98 when filled with aqueous foam moderation (low density water). This requirement shall be met by limiting the fuel assembly nominal enrichments to 5.0 w/o or less.

b. A nominal 21 inches center-to-center distance between fuel assemblies.

5.6.1.8 The in-containment fuel storage area (ICSA) racks are designed and shall be maintained with:

a. k_{eff} equivalent to less than or equal to 0.95 when flooded with unborated water. This requirement shall be met by limiting the fuel assembly nominal enrichments to 5.0 w/o or less.

b. A nominal 16 inches center-to-center distance between fuel assemblies.

In the ICSA, empty water cells may be substituted for fuel assemblies in all cases.

Empty water cells may be used to store non-fissile items provided that the cells are not face-adjacent to a cell storing a fuel assembly or an evaluation has been performed that supports storage of the non-fissile item.

DRAINAGE

5.6.2 The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 62 feet-6 inches.

CAPACITY

5.6.3 The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1969 fuel assemblies.

TABLE 5.6-1

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 1 FUEL

Initial Enrichment (w/o ^{235}U)	Limiting Burnup (MWD/MTU)
2.452	0
3.000	4,466.43
4.000	13,056.25
5.000	20,787.51

Note that the required assembly burnup as a function of initial enrichment (e) is described by the following polynomial:

Required Assembly Burnup = $-281.156e^3 + 2944.097e^2 - 1616.095e - 9590.945$

This data represents the curves in Figure 5.6-17.

TABLE 5.6-2

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 2 FUEL

Initial Enrichment (w/o ^{235}U)	Limiting Burnup (MWD/MTU)						
	0 yr decay	5 yr decay	10 yr decay	15 yr decay	20 yr decay	25 yr decay	30 yr decay
1.169	0	0	0	0	0	0	0
3.000	34,181.37	31,739.93	30,016.00	28,707.44	27,899.89	27,201.13	26,828.89
4.000	49,896.73	46,448.45	43,861.01	42,370.86	40,980.96	40,274.66	39,689.32
5.000	65,006.18	60,688.97	57,628.51	55,503.59	54,010.68	53,081.69	52,120.75

Note that the required assembly burnups as a function of initial enrichment (e) for each decay period is described by the following polynomials:

Required Assembly Burnup (@0 yr decay) $= 193.82e^3 - 2628.80e^2 + 26945.60e - 28229.39$
Required Assembly Burnup (@5 yr decay) $= 181.66e^3 - 2413.97e^2 + 24884.71e - 26093.42$
Required Assembly Burnup (@10 yr decay) $= 225.41e^3 - 2743.71e^2 + 24710.68e - 25508.80$
Required Assembly Burnup (@15 yr decay) $= 117.06e^3 - 1670.11e^2 + 21022.85e - 22490.81$
Required Assembly Burnup (@20 yr decay) $= 192.66e^3 - 2337.54e^2 + 22315.60e - 23210.74$
Required Assembly Burnup (@25 yr decay) $= 130.06e^3 - 1693.93e^2 + 20118.91e - 21421.79$
Required Assembly Burnup (@30 yr decay) $= 109.74e^3 - 1531.41e^2 + 19519.81e - 20910.89$

This data represents the curves in Figure 5.6-18.

TABLE 5.6-3

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 3 FUEL

Initial Enrichment (w/o ^{235}U)	Limiting Burnup (MWD/MTU)
2.961	0
4.000	7,233.97
5.000	14,519.63

Note that the required assembly burnup as a function of initial enrichment (e) is described by the following polynomial:

Required Assembly Burnup = $158.729e^2 + 5857.101e - 18734.103$

These data represent the curves in Figure 5.6-19.

TABLE 5.6-4

IFBA CREDIT REQUIREMENTS FOR CATEGORY 3 FUEL

IFBA Loading (mg ^{10}B per inch)	Initial Enrichment (w/o ^{235}U)	Number of IFBAs
N/A	2.961	0
1.0x*	4.000	46.16
1.0x	5.000	96.02
1.5x	4.000	30.70
1.5x	5.000	68.34
2.0x	4.000	27.12
2.0x	5.000	53.33

* "1.0x" corresponds to an IFBA B^{10} loading of 1.57 mg/in. Accordingly, "1.5x" and "2.0x" corresponds to 1.5x and 2x an IFBA B^{10} loading of 1.57 mg/in.

Note that the required number of IFBA as a function of initial enrichment (e) is described by the following polynomials:

Required Number of 1.0x IFBA = $2.662e^2 + 25.895e - 100.014$
Required Number of 1.5x IFBA = $3.964e^2 + 1.958e - 40.548$
Required Number of 2.0x IFBA = $0.052e^2 + 25.744e - 76.680$

This data represents the curves in Figure 5.6-20.

TABLE 5.6-5

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 4 FUEL

Initial Enrichment (w/o ^{235}U)	Limiting Burnup (MWD/MTU)						
	0 yr decay	5 yr decay	10 yr decay	15 yr decay	20 yr decay	25 yr decay	30 yr decay
1.240	0	0	0	0	0	0	0
3.000	31,005.51	28,911.05	27,181.32	26,214.57	25,577.34	24,902.21	24,411.30
4.000	45,943.04	42,781.39	40,567.87	39,204.86	38,151.31	37,284.43	36,815.21
5.000	60,361.64	56,489.33	53,864.06	51,947.13	50,680.02	49,485.61	48,865.60

Note that the required assembly burnups as a function of initial enrichment (e) for each decay period is described by the following polynomials:

Required Assembly Burnup (@0 yr decay) $= 189.37e^3 - 2531.89e^2 + 25654.14e - 28282.82$
Required Assembly Burnup (@5 yr decay) $= 224.93e^3 - 2780.39e^2 + 25010.58e - 27170.32$
Required Assembly Burnup (@10 yr decay) $= 186.41e^3 - 2282.12e^2 + 22464.17e - 24705.21$
Required Assembly Burnup (@15 yr decay) $= 150.69e^3 - 1932.33e^2 + 20940.94e - 23285.99$
Required Assembly Burnup (@20 yr decay) $= 182.88e^3 - 2217.24e^2 + 21327.90e - 23389.09$
Required Assembly Burnup (@25 yr decay) $= 146.33e^3 - 1846.50e^2 + 19893.47e - 22110.62$
Required Assembly Burnup (@30 yr decay) $= 94.42e^3 - 1309.83e^2 + 18079.07e - 20586.85$

This data represents the curves in Figure 5.6-21.

TABLE 5.6-6

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 5 FUEL

Initial Enrichment (w/o ^{235}U)	Limiting Burnup (MWD/MTU)
1.695	0
3.000	17,449.52
4.000	27,331.22
5.000	37,696.66

Note that the required assembly burnup as a function of initial enrichment (e) is described by the following polynomial:

Required Assembly Burnup $= 531.223e^3 - 6132.815e^2 + 33156.150e - 41166.623$

This data represents the curves in Figure 5.6-22.

TABLE 5.6-7

BURNUP CREDIT REQUIREMENTS FOR THE CATEGORY 6 AND 8 FUEL

Initial Enrichment (w/o ^{235}U)	Limiting Burnup (MWD/MTU)						
	0 yr decay	5 yr decay	10 yr decay	15 yr decay	20 yr decay	25 yr decay	30 yr decay
1.172	0	0	0	0	0	0	0
3.000	31,962.27	30,134.91	28,763.65	27,930.20	27,344.72	26,914.24	26,612.28
4.000	45,626.99	43,422.99	41,479.85	40,504.05	39,735.24	38,786.33	38,460.32
5.000	58,634.68	55,880.90	53,972.48	52,665.53	51,286.08	50,659.00	50,147.32

Note that the required assembly burnups as a function of initial enrichment (e) for each decay period is described by the following polynomials:

Required Assembly Burnup (@0 yr decay) = $266.80e^3 - 3530.16e^2 + 28504.12e - 28982.31$
Required Assembly Burnup (@5 yr decay) = $186.66e^3 - 2654.99e^2 + 24966.68e - 25909.96$*
Required Assembly Burnup (@10 yr decay) = $249.43e^3 - 3104.96e^2 + 25221.98e - 25692.29$*
Required Assembly Burnup (@15 yr decay) = $195.82e^3 - 2555.99e^2 + 23220.53e - 24014.56$*
Required Assembly Burnup (@20 yr decay) = $127.36e^3 - 1948.18e^2 + 21315.40e - 22506.60$*
Required Assembly Burnup (@25 yr decay) = $263.24e^3 - 3158.60e^2 + 24242.37e - 24492.99$*
Required Assembly Burnup (@30 yr decay) = $229.10e^3 - 2829.72e^2 + 23179.35e - 23644.02$*

* Decay time credit may not be taken for Category 6 fuel (i.e., only the "0 yr decay" column may be used).

This data represents the curves in Figure 5.6-23.

TABLE 5.6-8

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 7 FUEL

Initial Enrichment (w/o ^{235}U)	Limiting Burnup (MWD/MTU)
3.860	0
5.000	4,366.45

Note that the required assembly burnup as a function of initial enrichment (e) is described by the following polynomial:

Required Assembly Burnup = $3829.871e - 14782.907$

This data represents the curves in Figure 5.6-24.

TABLE 5.6-9

IFBA CREDIT REQUIREMENTS FOR CATEGORY 7 FUEL

IFBA Loading (mg ^{10}B per inch)	Initial Enrichment (w/o ^{235}U)	Number of IFBAs
N/A	3.860	0
1.0x *	5.000	42.97
1.5x	5.000	30.19
2.0x	5.000	25.04

* "1.0x" corresponds to an IFBA B^{10} loading of 1.57 mg/in. Accordingly, "1.5x" and "2.0x" corresponds to 1.5x and 2x an IFBA B^{10} loading of 1.57 mg/in.

Note that the required number of IFBA as a function of initial enrichment (e) is described by the following polynomials:

Required Number of 1.0x IFBA = $37.691e - 145.483$
Required Number of 1.5x IFBA = $26.477e - 102.198$
Required Number of 2.0x IFBA = $21.692e - 84.770$

This data represents the curves in Figure 5.6-25

TABLE 5.6-10

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 9 FUEL

Initial Enrichment (w/o ^{235}U)	Limiting Burnup (MWD/MTU)
1.606	0
3.000	19,884.59
4.000	30,202.66
5.000	40,475.25

Note that the required assembly burnup as a function of initial enrichment (e) is described by the following polynomial:

Required Assembly Burnup = $478.565e^3 - 5765.516e^2 + 32969.784e - 400956.362$

This data represents the curve in Figure 5.6-26.

TABLE 5.6-11

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 10 AND 12 FUEL

Initial Enrichment (w/o ^{235}U)	Limiting Burnup (MWD/MTU)						
	0 yr decay	5 yr decay	10 yr decay	15 yr decay	20 yr decay	25 yr decay	30 yr decay
1.159	0	0	0	0	0	0	0
3.000	31,521.17	30,182.28	29,181.14	28,564.51	28,131.83	27,780.08	27,480.99
4.000	43,590.11	41,980.08	41,050.96	40,020.70	39,623.29	39,071.36	38,768.59
5.000	55,371.82	53,783.15	52,247.98	51,474.09	50,582.97	50,246.64	49,941.13

Note that the required assembly burnups as a function of initial enrichment (e) for each decay period is described by the following polynomials:

Required Assembly Burnup (@0 yr decay) $= 425.49e^3 - 5249.45e^2 + 33072.07e - 31938.15$
Required Assembly Burnup (@5 yr decay) $= 421.77e^3 - 5058.57e^2 + 31602.46e - 30485.63$*
Required Assembly Burnup (@10 yr decay) $= 277.08e^3 - 3661.38e^2 + 27247.46e - 27090.00$*
Required Assembly Burnup (@15 yr decay) $= 371.51e^3 - 4459.49e^2 + 28926.85e - 28111.30$*
Required Assembly Burnup (@20 yr decay) $= 277.88e^3 - 3600.49e^2 + 26413.23e - 26206.27$*
Required Assembly Burnup (@25 yr decay) $= 332.84e^3 - 4052.11e^2 + 27340.89e - 26760.32$*
Required Assembly Burnup (@30 yr decay) $= 318.42e^3 - 3878.55e^2 + 26655.95e - 26177.21$*

* Decay time credit may not be taken for Category 10 fuel (i.e., only the "0 yr decay" column may be used).

This data represents the curves in Figure 5.6-27.

TABLE 5.6-12

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 14 AND 16 FUEL

Initial Enrichment (w/o ^{235}U)	Limiting Burnup (MWD/MTU)						
	0 yr decay	5 yr decay	10 yr decay	15 yr decay	20 yr decay	25 yr decay	30 yr decay
1.379	0	0	0	0	0	0	0
3.000	26,324.70	24,510.31	23,293.43	22,355.96	21,841.95	21,318.38	21,045.43
4.000	40,552.13	37,872.29	35,977.77	34,847.67	33,978.83	33,197.02	32,857.48
5.000	54,120.03	51,210.59	48,740.61	47,176.78	45,874.18	45,225.90	44,385.90

Note that the required assembly burnups as a function of initial enrichment (e) for each decay period is described by the following polynomials:

Required Assembly Burnup (@0 yr decay) $= 121.12e^3 - 1783.27e^2 + 22228.68e - 27582.31$
Required Assembly Burnup (@5 yr decay) $= 182.17e^3 - 2197.86e^2 + 22006.79e - 26647.85$
Required Assembly Burnup (@10 yr decay) $= 188.58e^3 - 2223.67e^2 + 21272.66e - 25603.11$
Required Assembly Burnup (@15 yr decay) $= 114.63e^3 - 1456.89e^2 + 18448.52e - 22972.71$
Required Assembly Burnup (@20 yr decay) $= 107.71e^3 - 1413.26e^2 + 18044.48e - 22480.30$
Required Assembly Burnup (@25 yr decay) $= 154.98e^3 - 1784.63e^2 + 18636.83e - 22714.86$
Required Assembly Burnup (@30 yr decay) $= 84.34e^3 - 1153.89e^2 + 16768.69e - 21152.84$

This data represents the curves in Figure 5.6-28.

TABLE 5.6-13

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 18 AND 20 FUEL

Initial Enrichment (w/o ^{235}U)	Limiting Burnup (MWD/MTU)						
	0 yr decay	5 yr decay	10 yr decay	15 yr decay	20 yr decay	25 yr decay	30 yr decay
1.665	0	0	0	0	0	0	0
3.000	19,854.57	18,768.74	17,956.96	17,428.60	17,023.73	16,655.44	16,368.60
4.000	31,877.43	30,055.14	28,752.30	27,947.64	27,254.34	26,851.19	26,497.38
5.000	42,753.09	40,507.61	39,097.96	37,839.29	37,230.89	36,462.46	36,152.70

Note that the required assembly burnups as a function of initial enrichment (e) for each decay period is described by the following polynomials:

Required Assembly Burnup (@0 yr decay) $= 193.48e^3 - 2895.33e^2 + 25131.51e - 34705.87$
Required Assembly Burnup (@5 yr decay) $= 230.59e^3 - 3184.01e^2 + 25042.79e - 33929.34$
Required Assembly Burnup (@10 yr decay) $= 273.18e^3 - 3503.04e^2 + 25208.86e - 33518.20$
Required Assembly Burnup (@15 yr decay) $= 231.22e^3 - 3088.28e^2 + 23582.01e - 31765.77$
Required Assembly Burnup (@20 yr decay) $= 285.28e^3 - 3550.43e^2 + 24528.14e - 32309.48$
Required Assembly Burnup (@25 yr decay) $= 204.81e^3 - 2750.00e^2 + 21867.68e - 29727.52$
Required Assembly Burnup (@30 yr decay) $= 202.48e^3 - 2666.43e^2 + 21302.33e - 29007.01$

This data represents the curves in Figure 5.6-29.

TABLE 5.6-14

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 22 FUEL

Initial Enrichment (w/o ^{235}U)	Limiting Burnup (MWD/MTU)						
	0 yr decay	5 yr decay	10 yr decay	15 yr decay	20 yr decay	25 yr decay	30 yr decay
1.696	0	0	0	0	0	0	0
3.000	15,443.94	14,682.92	14,147.18	13,784.66	13,374.76	13,092.76	12,948.70
4.000	26,269.52	24,965.41	23,860.31	23,340.38	22,882.39	22,469.93	22,348.49
5.000	36,948.53	34,752.92	33,568.91	32,651.58	32,037.58	31,531.37	31,175.27

Note that the required assembly burnups as a function of initial enrichment (e) for each decay period is described by the following polynomials:

Required Assembly Burnup (@0 yr decay) $= 111.07e^3 - 1406.13e^2 + 16558.88e - 24576.43$
Required Assembly Burnup (@5 yr decay) $= 53.05e^3 - 884.09e^2 + 14508.27e - 22317.44$
Required Assembly Burnup (@10 yr decay) $= 148.10e^3 - 1779.46e^2 + 16689.63e - 23905.27$
Required Assembly Burnup (@15 yr decay) $= 95.96e^3 - 1273.72e^2 + 14921.44e - 22106.93$
Required Assembly Burnup (@20 yr decay) $= 44.67e^3 - 712.27e^2 + 12840.68e - 19942.99$
Required Assembly Burnup (@25 yr decay) $= 38.96e^3 - 625.41e^2 + 12313.46e - 19270.92$
Required Assembly Burnup (@30 yr decay) $= -17.44e^3 - 77.24e^2 + 10585.68e - 17642.36$

This data represents the curves in Figure 5.6-30.

TABLE 5.6-15

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 24 FUEL

Initial Enrichment (w/o ^{235}U)	Limiting Burnup (MWD/MTU)						
	0 yr decay	5 yr decay	10 yr decay	15 yr decay	20 yr decay	25 yr decay	30 yr decay
1.153	0	0	0	0	0	0	0
3.000	32,196.93	29,606.82	27,947.14	26,663.96	25,932.39	25,259.09	24,884.07
4.000	44,231.10	40,927.90	38,757.70	37,326.28	36,223.83	35,511.98	34,891.94
5.000	55,546.33	51,810.19	49,187.88	47,443.64	46,091.89	45,123.86	44,426.31

Note that the required assembly burnups as a function of initial enrichment (e) for each decay period is described by the following polynomials:

Required Assembly Burnup (@0 yr decay) $= 399.01e^3 - 5147.63e^2 + 33304.09e - 32160.03$
Required Assembly Burnup (@5 yr decay) $= 372.53e^3 - 4689.72e^2 + 30365.62e - 29340.81$
Required Assembly Burnup (@10 yr decay) $= 344.71e^3 - 4326.72e^2 + 28343.29e - 27449.44$
Required Assembly Burnup (@15 yr decay) $= 273.45e^3 - 3553.83e^2 + 25421.62e - 24999.51$
Required Assembly Burnup (@20 yr decay) $= 286.95e^3 - 3655.10e^2 + 25259.98e - 24699.31$
Required Assembly Burnup (@25 yr decay) $= 228.92e^3 - 3067.53e^2 + 23255.60e - 23080.73$
Required Assembly Burnup (@30 yr decay) $= 254.52e^3 - 3291.02e^2 + 23627.67e - 23251.88$

This data represents the curves in Figure 5.6-31.

TABLE 5.6-16

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 26 AND 28 FUEL

Initial Enrichment (w/o ^{235}U)	Limiting Burnup (MWD/MTU)						
	0 yr decay	5 yr decay	10 yr decay	15 yr decay	20 yr decay	25 yr decay	30 yr decay
1.369	0	0	0	0	0	0	0
3.000	25,928.30	24,078.04	22,788.97	21,931.60	21,398.03	20,834.48	20,440.03
4.000	37,542.07	35,109.98	33,443.17	32,163.04	31,311.84	30,617.11	30,180.08
5.000	48,372.80	45,418.12	43,304.49	41,861.29	40,661.75	39,838.23	39,312.95

Note that the required assembly burnups as a function of initial enrichment (e) for each decay period is described by the following polynomials:

Required Assembly Burnup (@0 yr decay) $= 340.06e^3 - 4472.21e^2 + 30337.12e - 34014.74$
Required Assembly Burnup (@5 yr decay) $= 290.41e^3 - 3846.85e^2 + 27214.65e - 30785.36$
Required Assembly Burnup (@10 yr decay) $= 237.74e^3 - 3249.32e^2 + 24603.07e - 28195.32$
Required Assembly Burnup (@15 yr decay) $= 262.74e^3 - 3419.44e^2 + 24446.28e - 27726.17$
Required Assembly Burnup (@20 yr decay) $= 257.52e^3 - 3372.24e^2 + 23991.10e - 27178.24$
Required Assembly Burnup (@25 yr decay) $= 235.43e^3 - 3105.92e^2 + 22813.12e - 26008.26$
Required Assembly Burnup (@30 yr decay) $= 208.29e^3 - 2803.09e^2 + 21654.92e - 24920.78$

This data represents the curves in Figure 5.6-32.

TABLE 5.6-17

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 36 FUEL

Initial Enrichment (w/o ^{235}U)	Limiting Burnup (MWD/MTU)						
	0 yr decay	5 yr decay	10 yr decay	15 yr decay	20 yr decay	25 yr decay	30 yr decay
2.049	0	0	0	0	0	0	0
3.000	10,489.63	9,924.78	9,500.65	9,480.05	9,127.01	9,025.86	8,933.94
4.000	20,728.17	19,881.06	19,180.16	18,677.80	18,167.33	18,116.47	18,034.30
5.000	30,841.66	29,420.10	28,380.30	27,501.48	27,042.47	26,541.63	26,296.65

Note that the required assembly burnups as a function of initial enrichment (e) for each decay period is described by the following polynomials:

Required Assembly Burnup (@0 yr decay) $= 116.95e^3 - 1465.93e^2 + 16172.89e - 27993.31$
Required Assembly Burnup (@5 yr decay) $= 13.25e^3 - 367.64e^2 + 12039.45e - 23242.60$
Required Assembly Burnup (@10 yr decay) $= -26.70e^3 + 80.68e^2 + 10102.53e - 20812.24$
Required Assembly Burnup (@15 yr decay) $= 71.08e^3 - 1039.95e^2 + 13847.60e - 24622.23$
Required Assembly Burnup (@20 yr decay) $= 69.31e^3 - 914.32e^2 + 12876.05e - 23143.65$
Required Assembly Burnup (@25 yr decay) $= -42.69e^3 + 179.50e^2 + 9413.49e - 19677.57$
Required Assembly Burnup (@30 yr decay) $= -90.41e^3 + 665.96e^2 + 7783.94e - 17970.33$

This data represents the curves in Figure 5.6-33.

TABLE 5.6-18

ASSEMBLY LOADING REQUIREMENTS AT THE INTERFACE BETWEEN DIFFERENT STORAGE CONFIGURATIONS[1]

Configuration	Assembly that Must be Loaded at the Interface with Another Configuration[2]
Region 1	
All-Cell	Any
Checkerboard #1	Only Category 3 and Category 5
Checkerboard #2	Only Category 9
Region 2	
All-Cell	Any
4-out-of-4 BPRA	Any
1-out-of-4 Blanketed	Category 6
2-out-of-4 Blanketed	Any
1-out-of-4 RCCA	Category 14
2-out-of-4 RCCA	Any
3-out-of-4 Checkerboard	Leave empty location at interface
4-out-of-4 Blanketed	Any
4-out-of-4 Blanketed with 1 RCCA	Category 26
2-out-of-4 5.0 w/o with 16 1.5x IFBA	See footnote[3]
1-out-of-4 5.0 w/o Fresh, No IFBA	See footnote[3]
2-out-of-4 4.768 w/o Fresh No IFBA	See footnote[3]
All-Cell with Poison Inserts	Any

Instructions:

1. Identify which storage configurations will be interfaced.
2. Look up the assembly loading requirements for both storage configurations.

[1] These interface requirements apply within Region 1 and Region 2 and at the interface between Region 1 and Region 2.

[2] An empty storage location is always permitted.

[3] A fresh fuel assembly from these configurations must be surrounded by empty locations on all four sides of the assembly.

FIGURE 5.6-1

REGION 1: ALL-CELL STORAGE

Position 1: CATEGORY 1	Position 2: CATEGORY 1
Position 3: CATEGORY 1	Position 4: CATEGORY 1

FIGURE 5.6-2

REGION 1: CHECKERBOARD #1

Position 1: CATEGORY 3	Position 2: CATEGORY 5
Position 3: CATEGORY 5	Position 4: CATEGORY 7

FIGURE 5.6-3

REGION 1: CHECKERBOARD #2

Position 1: CATEGORY 9	Position 2: CATEGORY 9
Position 3: CATEGORY 11	Position 4: CATEGORY 9

FIGURE 5.6-4

REGION 2: ALL-CELL, NON-BLANKETED

Position 1: CATEGORY 2	Position 2: CATEGORY 2
Position 3: CATEGORY 2	Position 4: CATEGORY 2

FIGURE 5.6-5

REGION 2: 4-OUT-OF-4 BPRA, NON-BLANKETED

Position 1: CATEGORY 4	Position 2: CATEGORY 4
Position 3: CATEGORY 4	Position 4: CATEGORY 4

FIGURE 5.6-6

REGION 2: 1-OUT-OF-4 BLANKETED

Position 1: CATEGORY 8	Position 2: CATEGORY 6
Position 3: CATEGORY 8	Position 4: CATEGORY 8

FIGURE 5.6-7

REGION 2: 2-OUT-OF-4 BLANKETED

Position 1: CATEGORY 10	Position 2: CATEGORY 12
Position 3: CATEGORY 12	Position 4: CATEGORY 10

FIGURE 5.6-8

REGION 2: 1-OUT-OF-4 WITH RCCA

Position 1: CATEGORY 16	Position 2: CATEGORY 14
Position 3: CATEGORY 16	Position 4: CATEGORY 16

FIGURE 5.6-9

REGION 2: 2-OUT-OF-4 WITH RCCA

Position 1: CATEGORY 18	Position 2: CATEGORY 20
Position 3: CATEGORY 20	Position 4: CATEGORY 18

FIGURE 5.6-10

REGION 2: 3-OUT-OF-4 CHECKERBOARD

Position 1: CATEGORY 22	Position 2: CATEGORY 22
Position 3: CATEGORY 22	Position 4: WATER

FIGURE 5.6-11

REGION 2: 4-OUT-OF-4 BLANKETED

Position 1: CATEGORY 24	Position 2: CATEGORY 24
Position 3: CATEGORY 24	Position 4: CATEGORY 24

FIGURE 5.6-12

REGION 2: 4-OUT-OF-4 BLANKETED, 1 RCCA AND DECAY CREDIT

Position 1: CATEGORY 28	Position 2: CATEGORY 26
Position 3: CATEGORY 28	Position 4: CATEGORY 28

FIGURE 5.6-13

REGION 2: 2-OUT-OF-4, 5.0 W/O, 16 1.5X IFBA

Position 1: CATEGORY 30	Position 2: WATER
Position 3: WATER	Position 4: CATEGORY 30

FIGURE 5.6-14

REGION 2: 1-OUT-OF-4, 5.0 W/O WITH NO IFBA

Position 1: CATEGORY 32	Position 2: WATER
Position 3: WATER	Position 4: WATER

FIGURE 5.6-15

REGION 2: 2-OUT-OF-4 4.768 W/O WITH NO IFBA

Position 1: CATEGORY 34	Position 2: WATER
Position 3: WATER	Position 4: CATEGORY 34

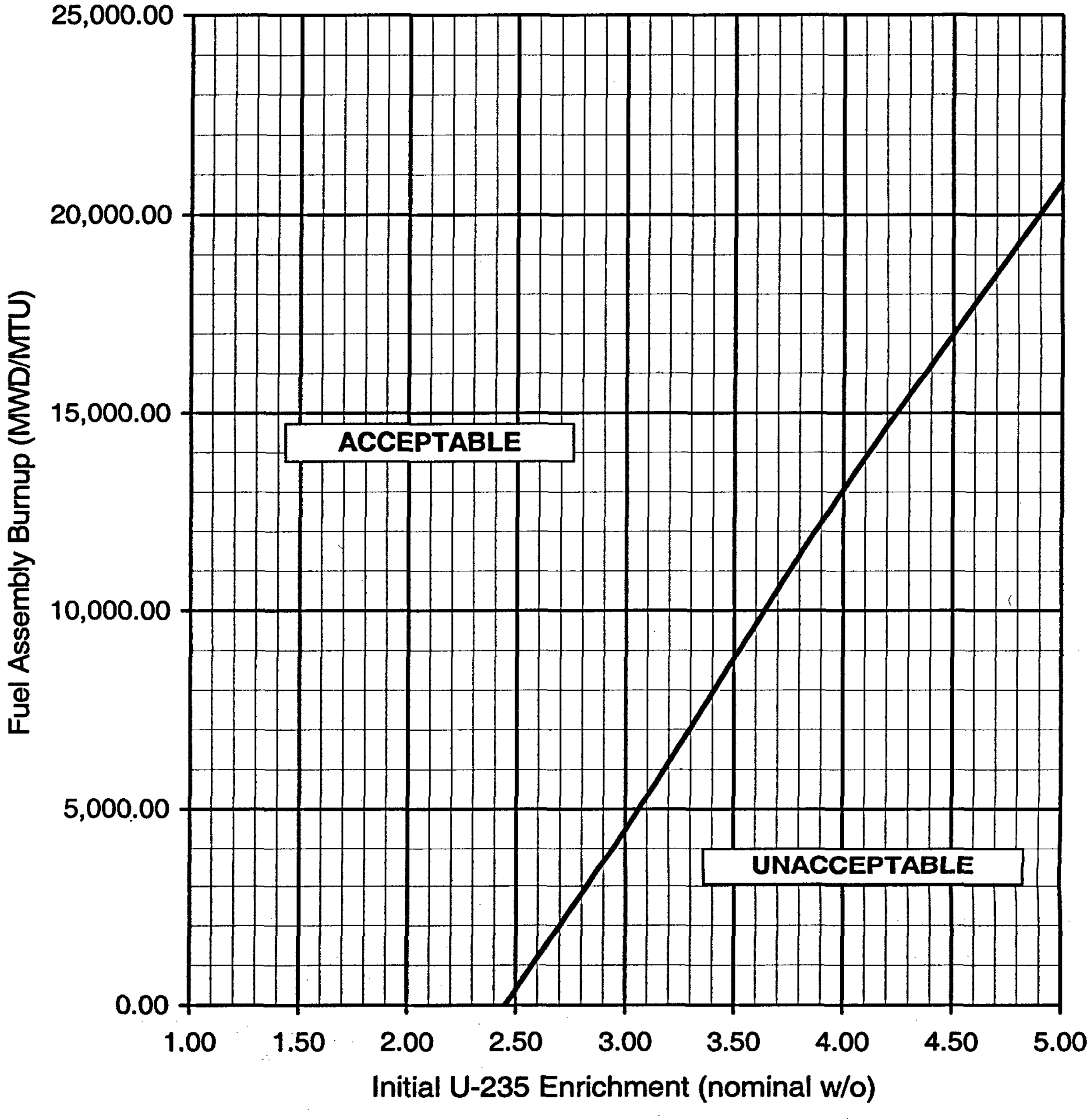
FIGURE 5.6-16

REGION 2: ALL-CELL WITH CELL INSERTS

Position 1: CATEGORY 36	Position 2: CATEGORY 36
Position 3: CATEGORY 36	Position 4: CATEGORY 36

FIGURE 5.6-17

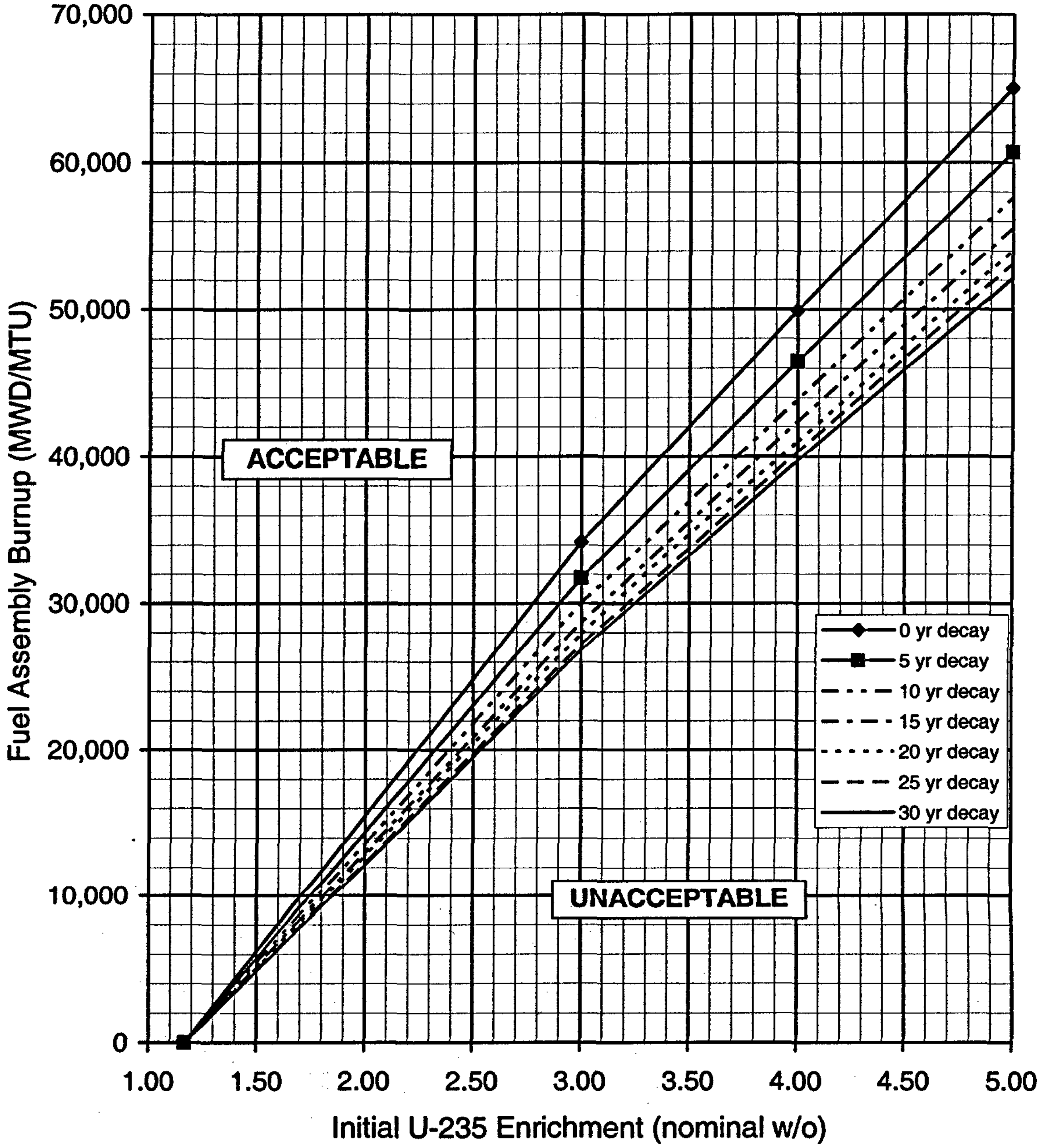
BURNUP CREDIT REQUIREMENTS FOR CATEGORY 1 FUEL



The data for this curve is given in Table 5.6-1.

FIGURE 5.6-18

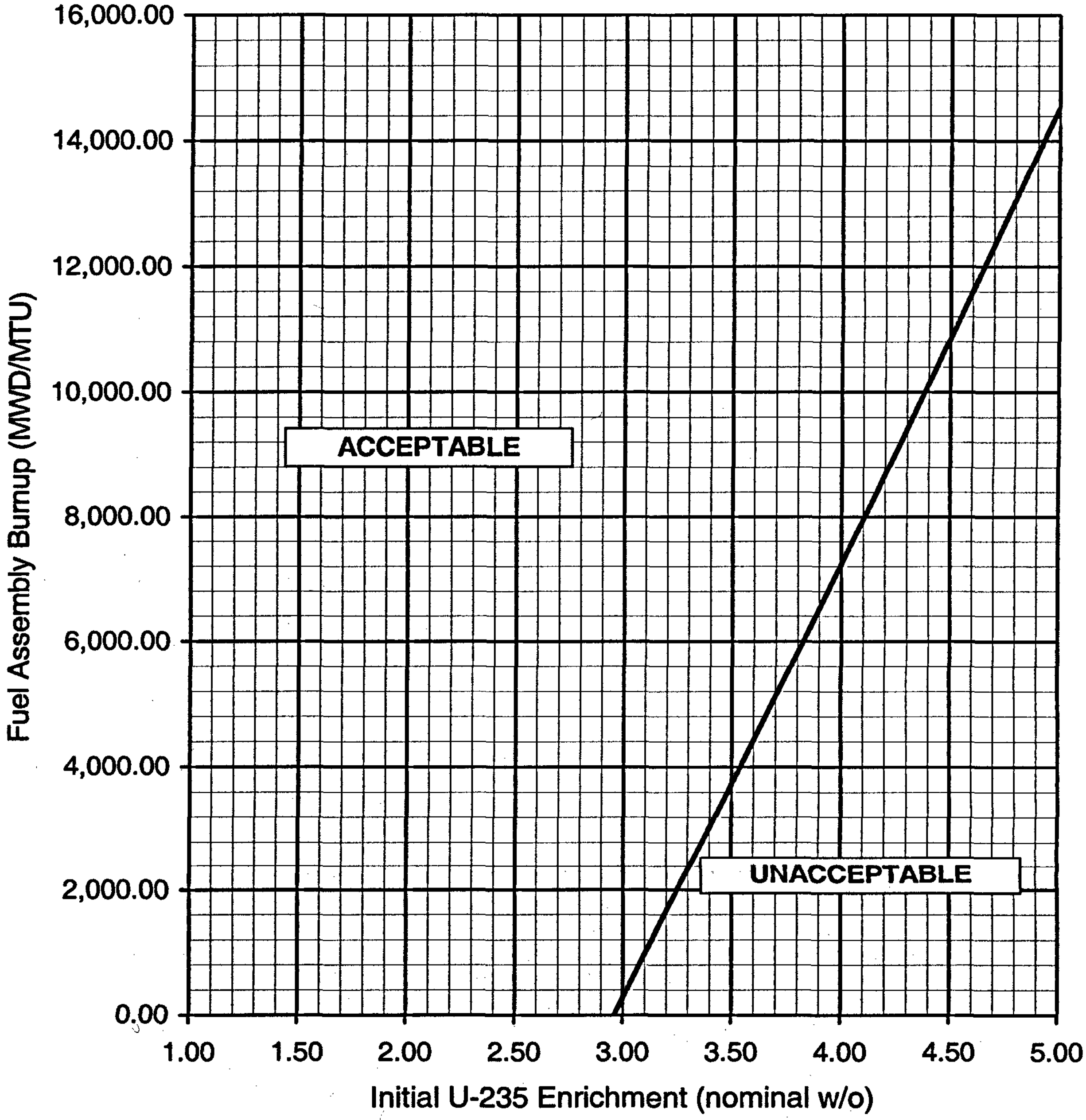
BURNUP CREDIT REQUIREMENTS FOR CATEGORY 2 FUEL



The data for these curves is given in Table 5.6-2.

FIGURE 5.6-19

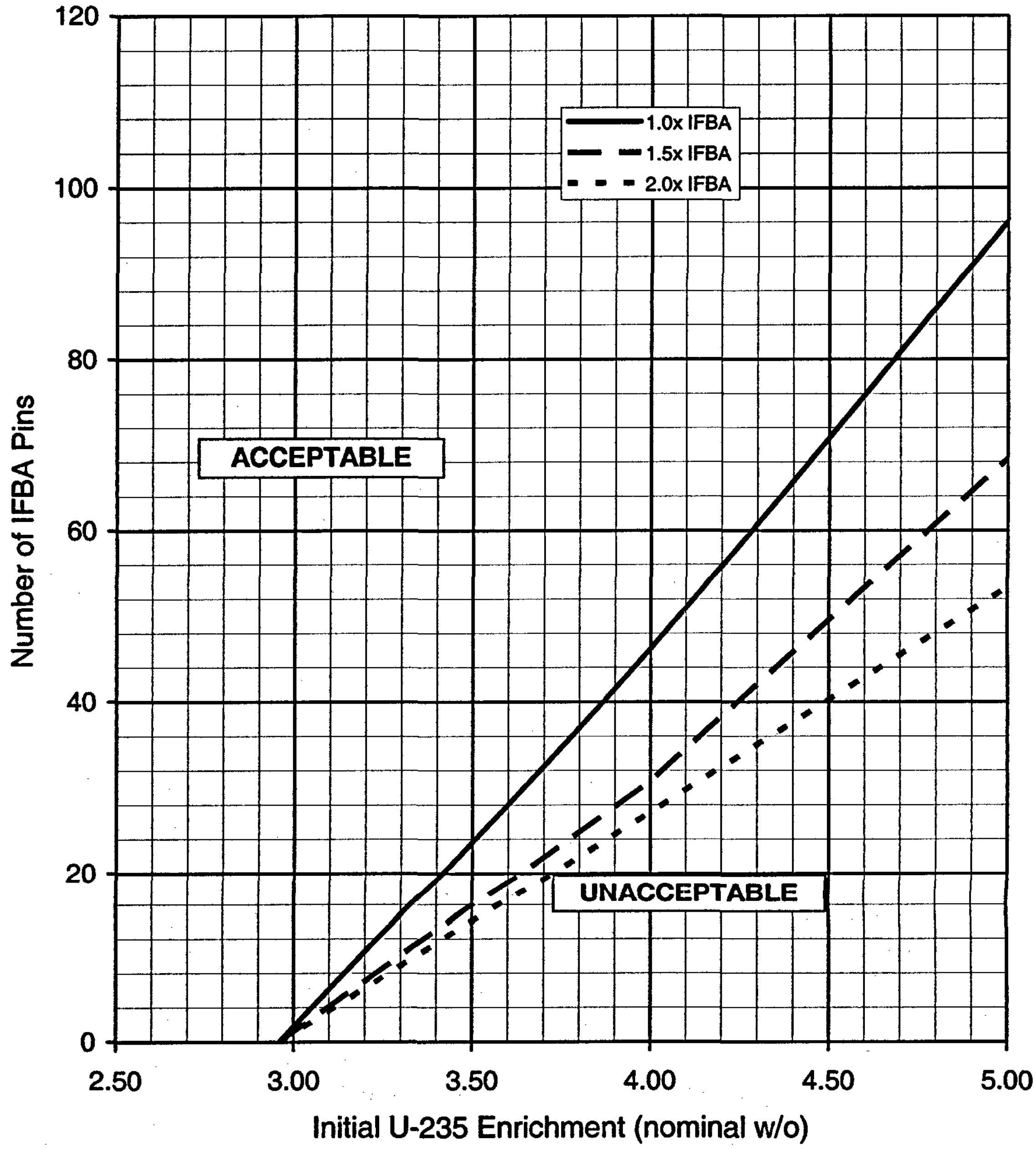
BURNUP CREDIT REQUIREMENTS FOR CATEGORY 3 FUEL



The data for this curve is given in Table 5.6-3.

FIGURE 5.6-20

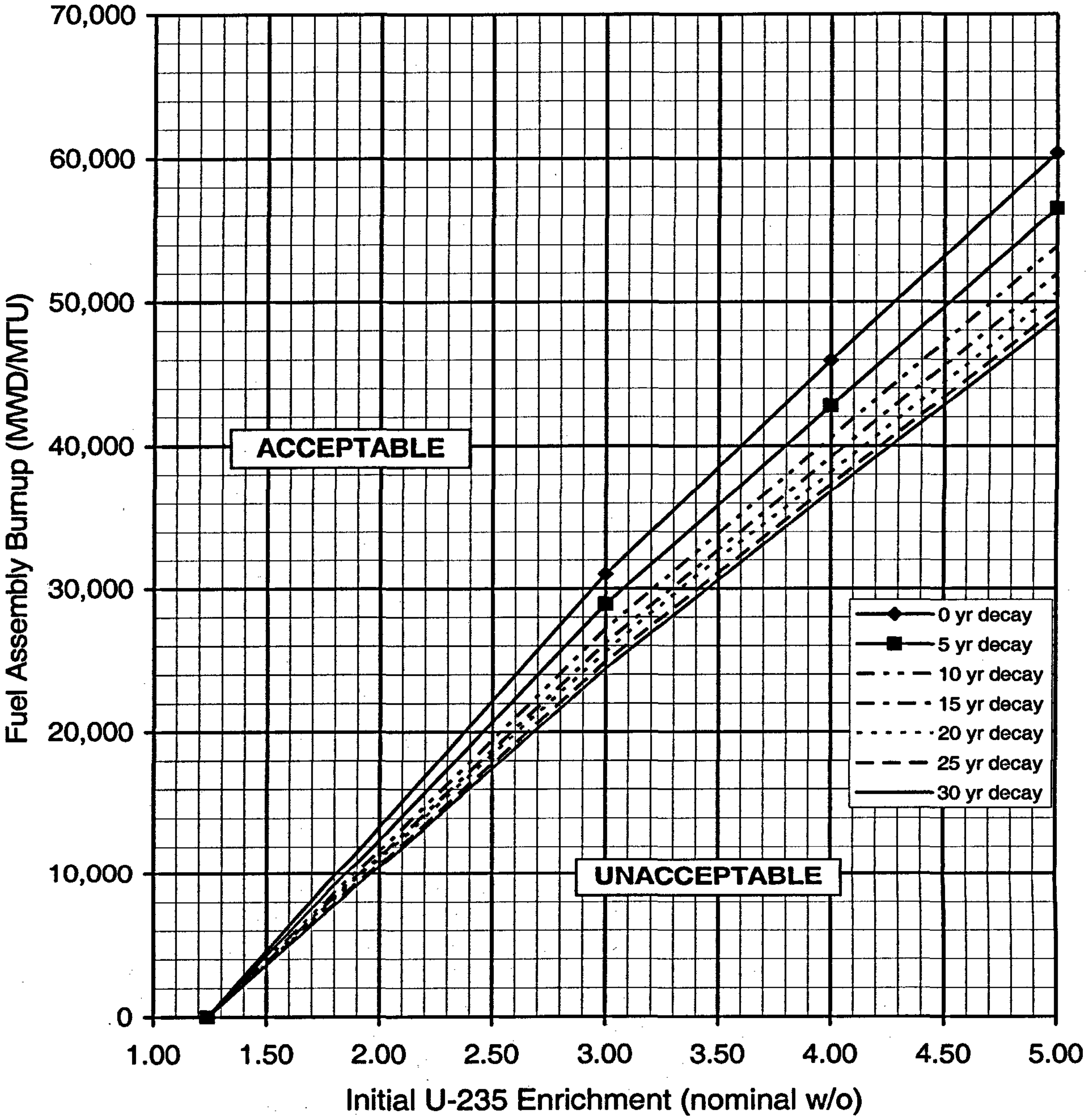
IFBA CREDIT REQUIREMENTS FOR CATEGORY 3 FUEL



The data for these curves is given in Table 5.6-4.

FIGURE 5.6-21

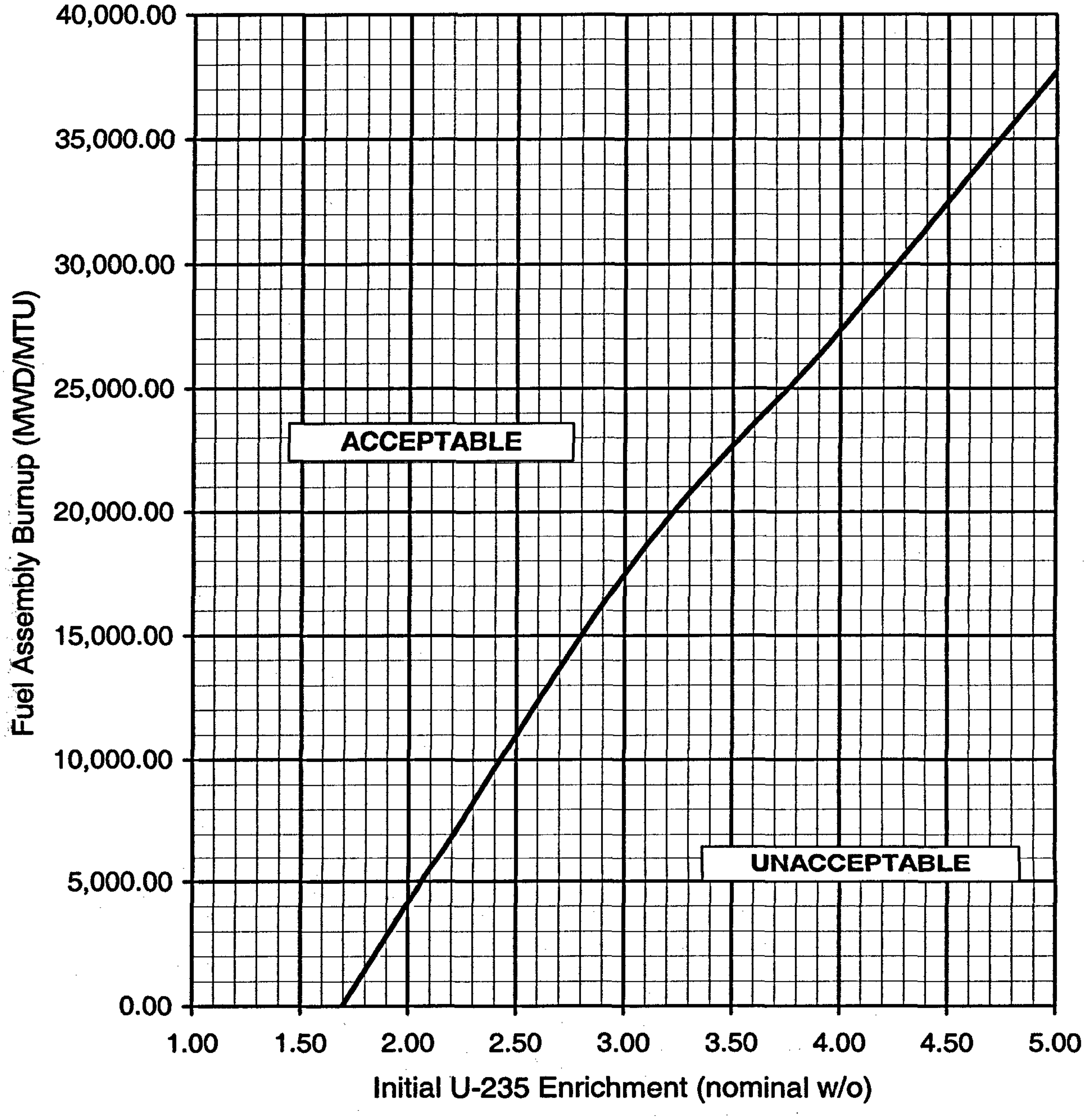
BURNUP CREDIT REQUIREMENTS FOR CATEGORY 4 FUEL



The data for these curves is given in Table 5.6-5.

FIGURE 5.6-22

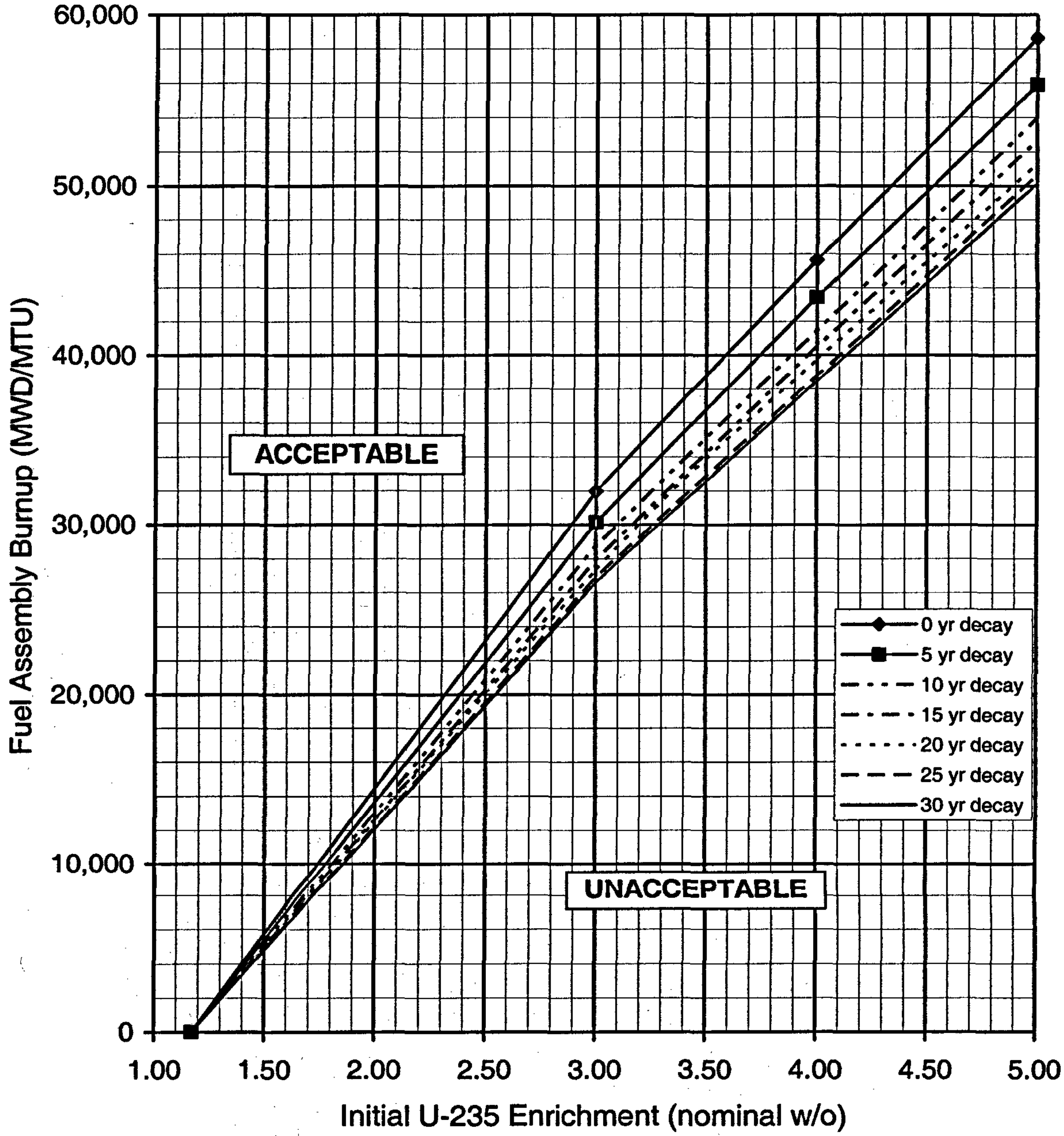
BURNUP CREDIT REQUIREMENTS FOR CATEGORY 5 FUEL



The data for this curve is given in Table 5.6-6.

FIGURE 5.6-23

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 6 AND 8 FUEL

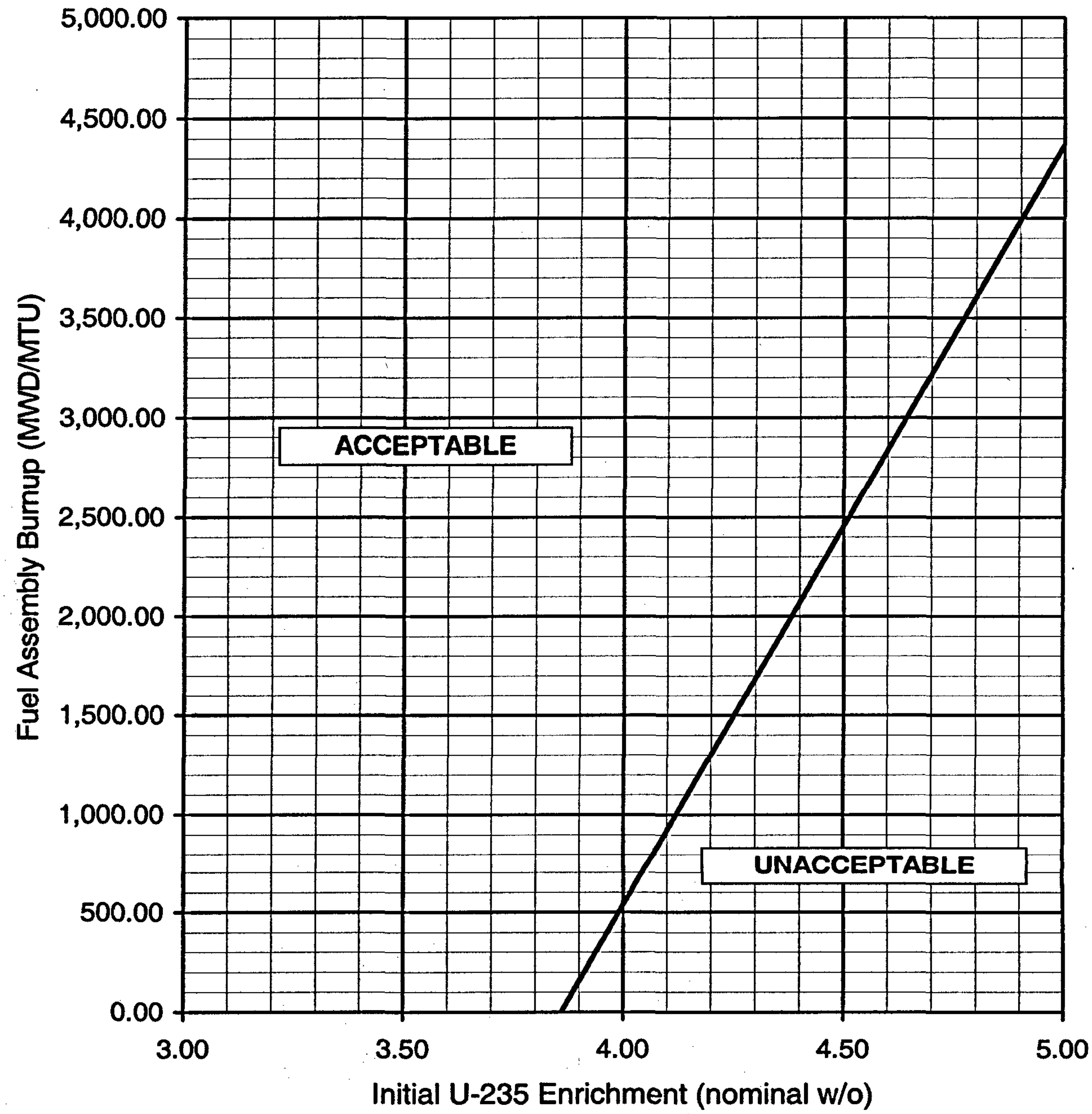


Category 6 fuel may ONLY use the "0yr decay" curve.

The data for these curves is given in Table 5.6-7.

FIGURE 5.6-24

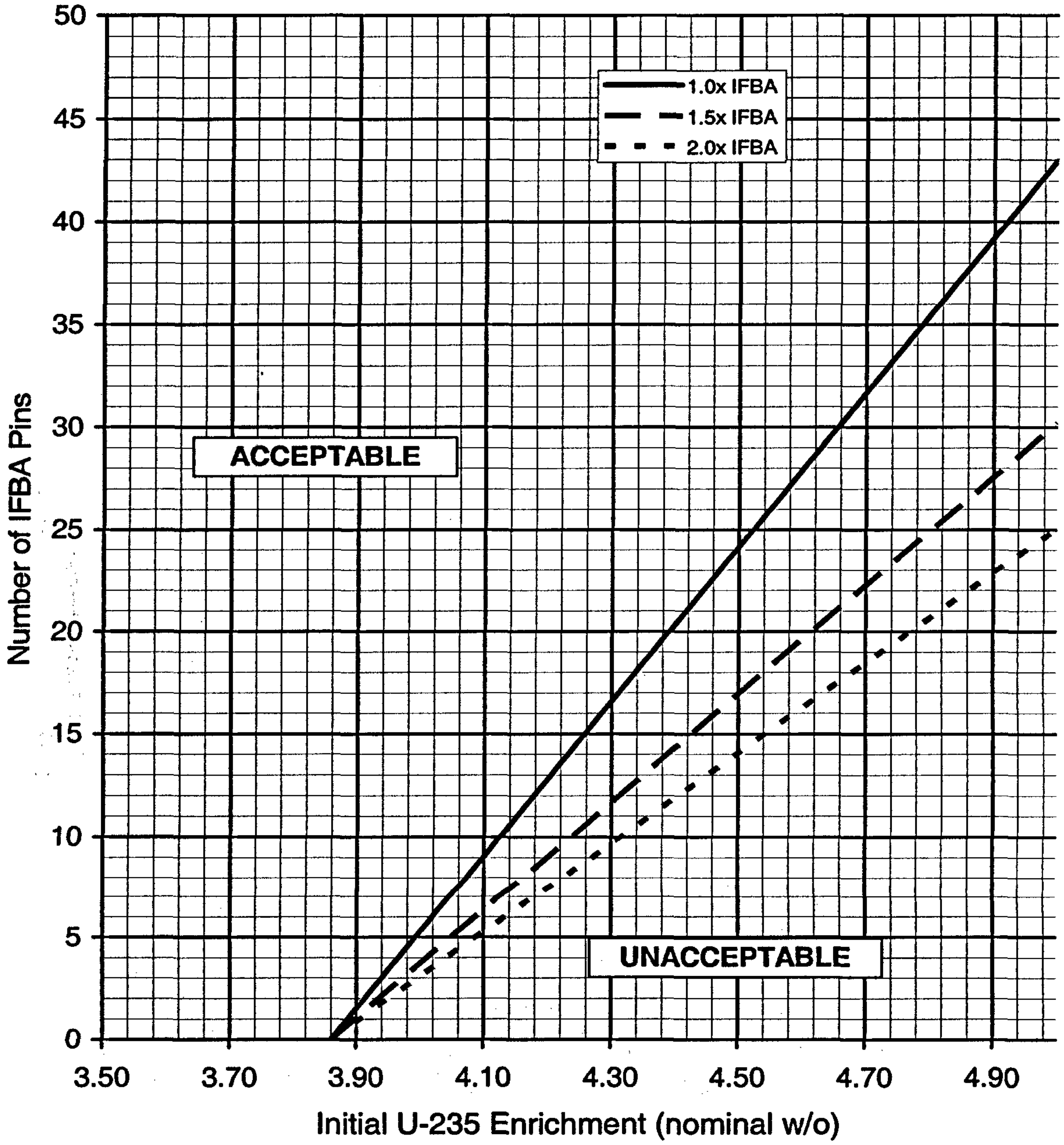
BURNUP CREDIT REQUIREMENTS FOR CATEGORY 7 FUEL



The data for this curve is given in Table 5.6-8.

FIGURE 5.6-25

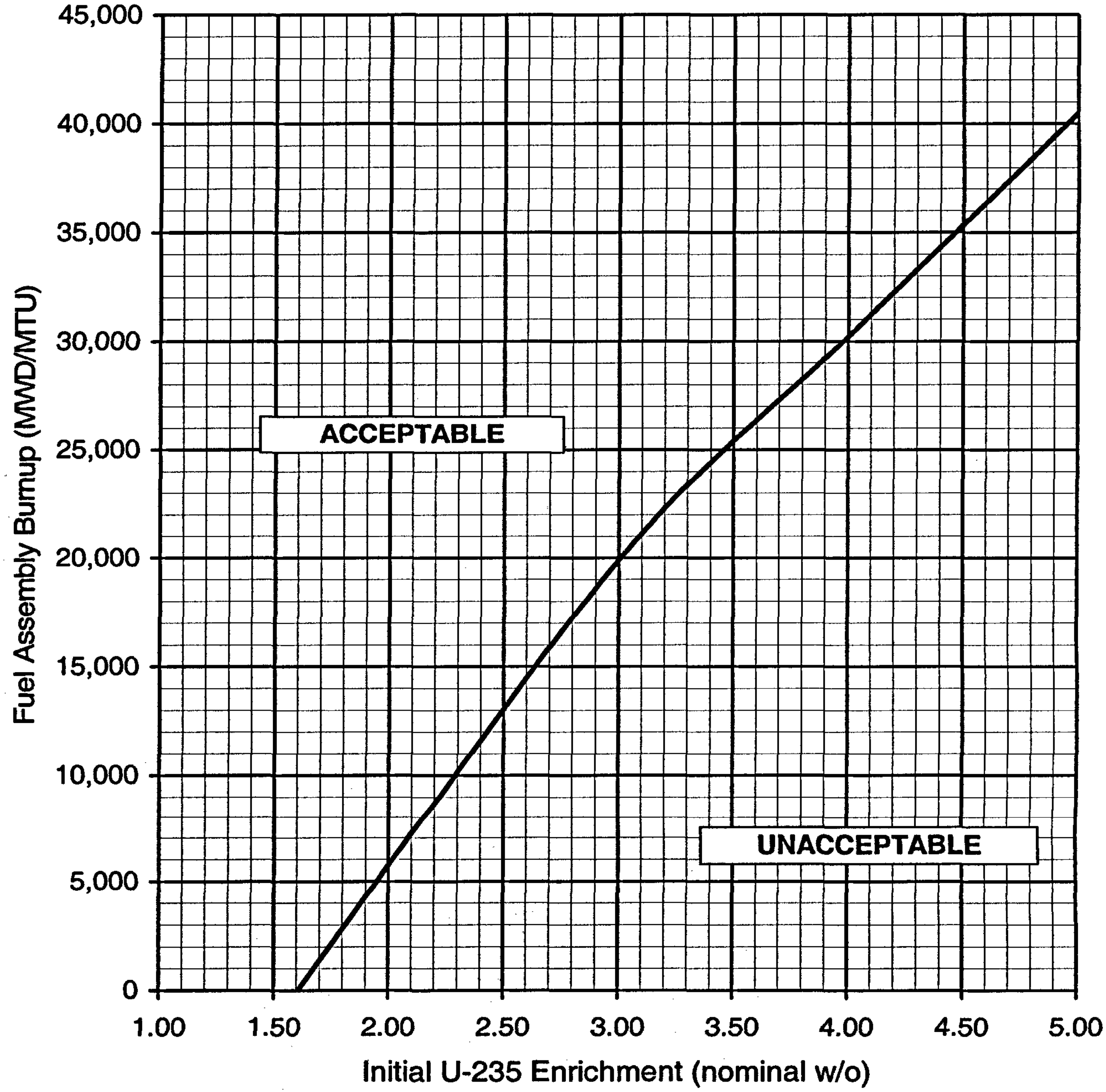
IFBA CREDIT REQUIREMENTS FOR CATEGORY 7 FUEL



The data for these curves is given in Table 5.6-9.

FIGURE 5.6-26

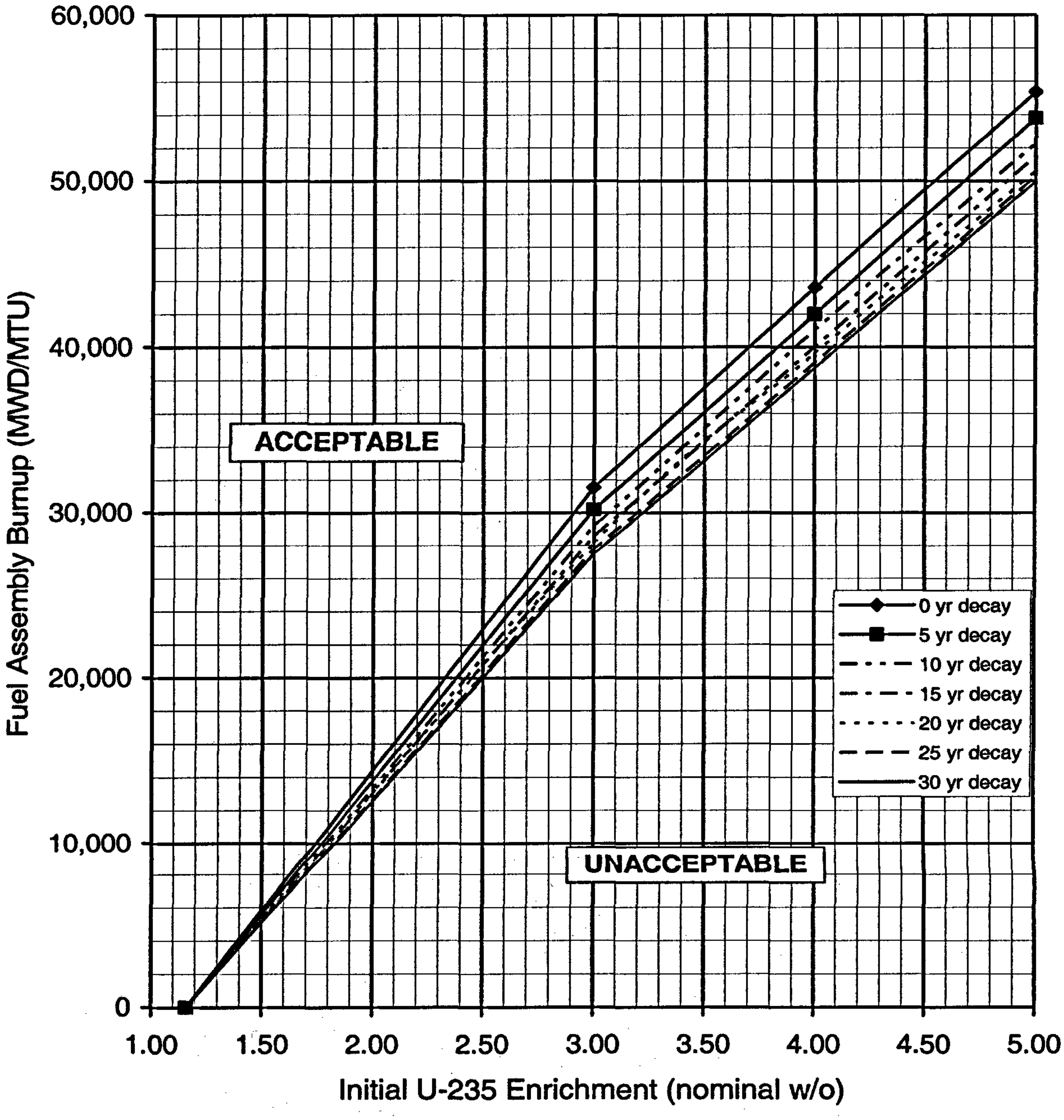
BURNUP CREDIT REQUIREMENTS FOR CATEGORY 9 FUEL



The data for this curve is given in Table 5.6-10.

FIGURE 5.6-27

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 10 AND 12 FUEL

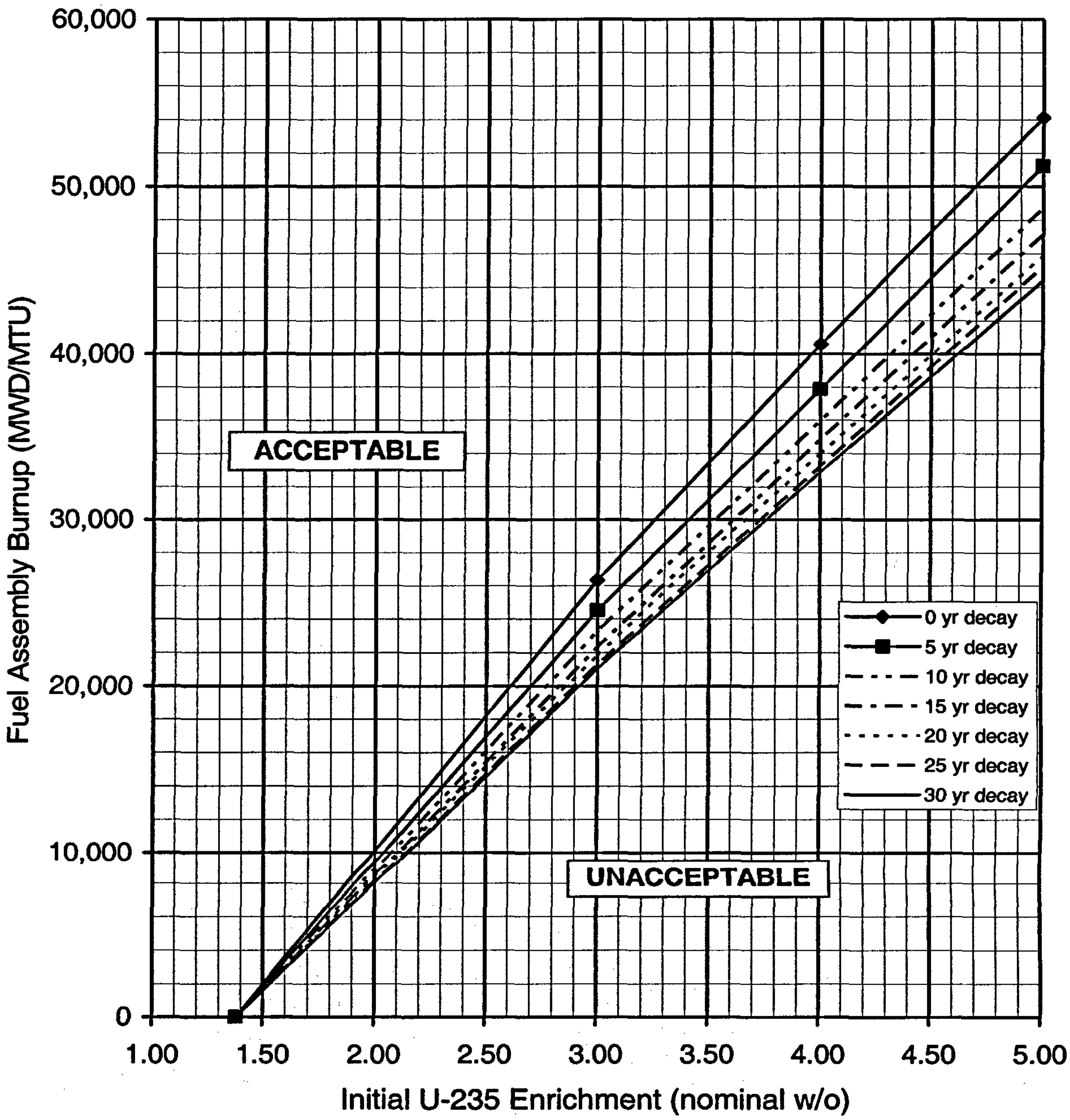


Category 10 fuel may ONLY use the "0yr decay" curve.

The data for these curves is given in Table 5.6-11.

FIGURE 5.6-28

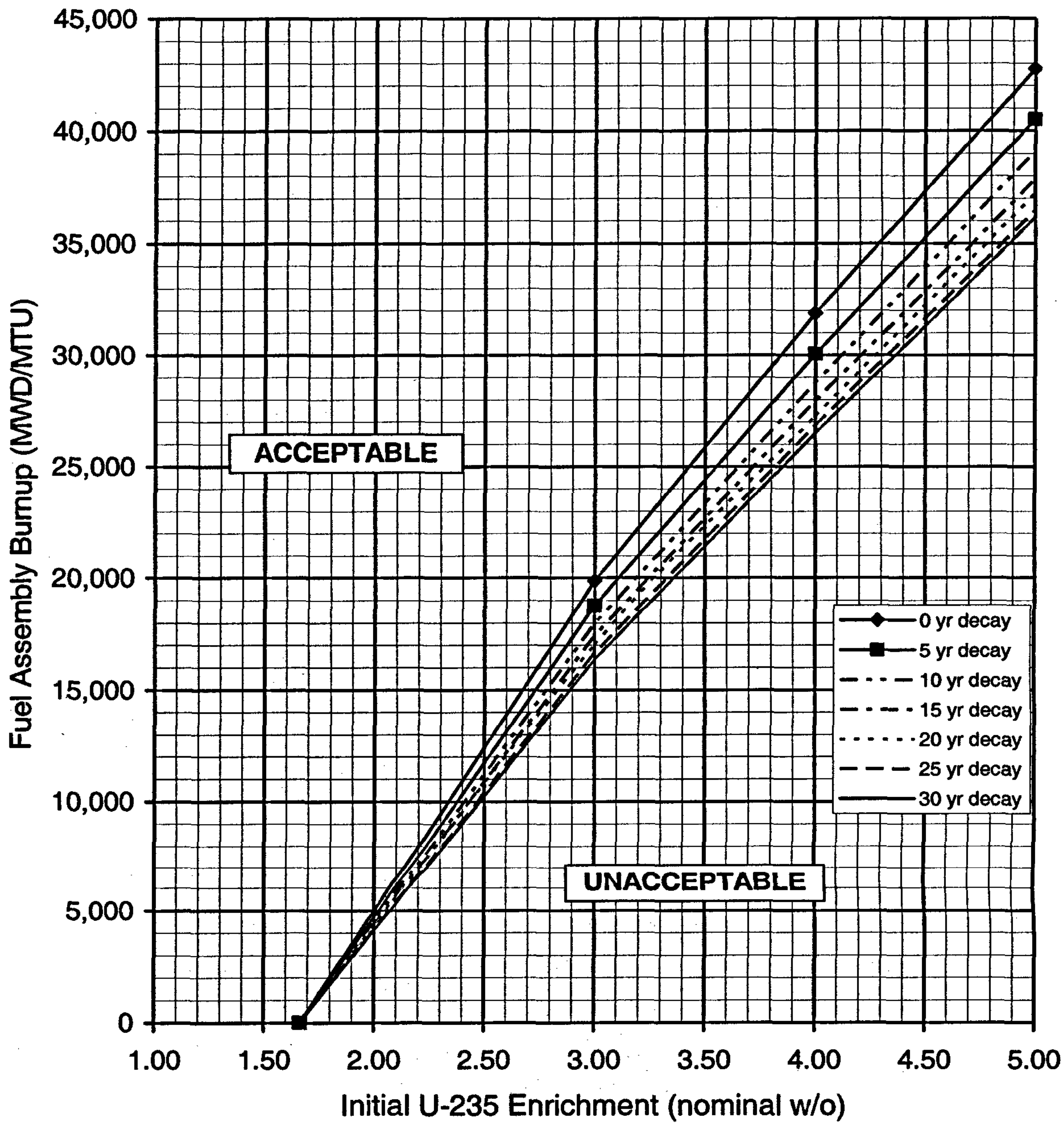
BURNUP CREDIT REQUIREMENTS FOR CATEGORY 14 AND 16 FUEL



The data for these curves is given in Table 5.6-12.

FIGURE 5.6-29

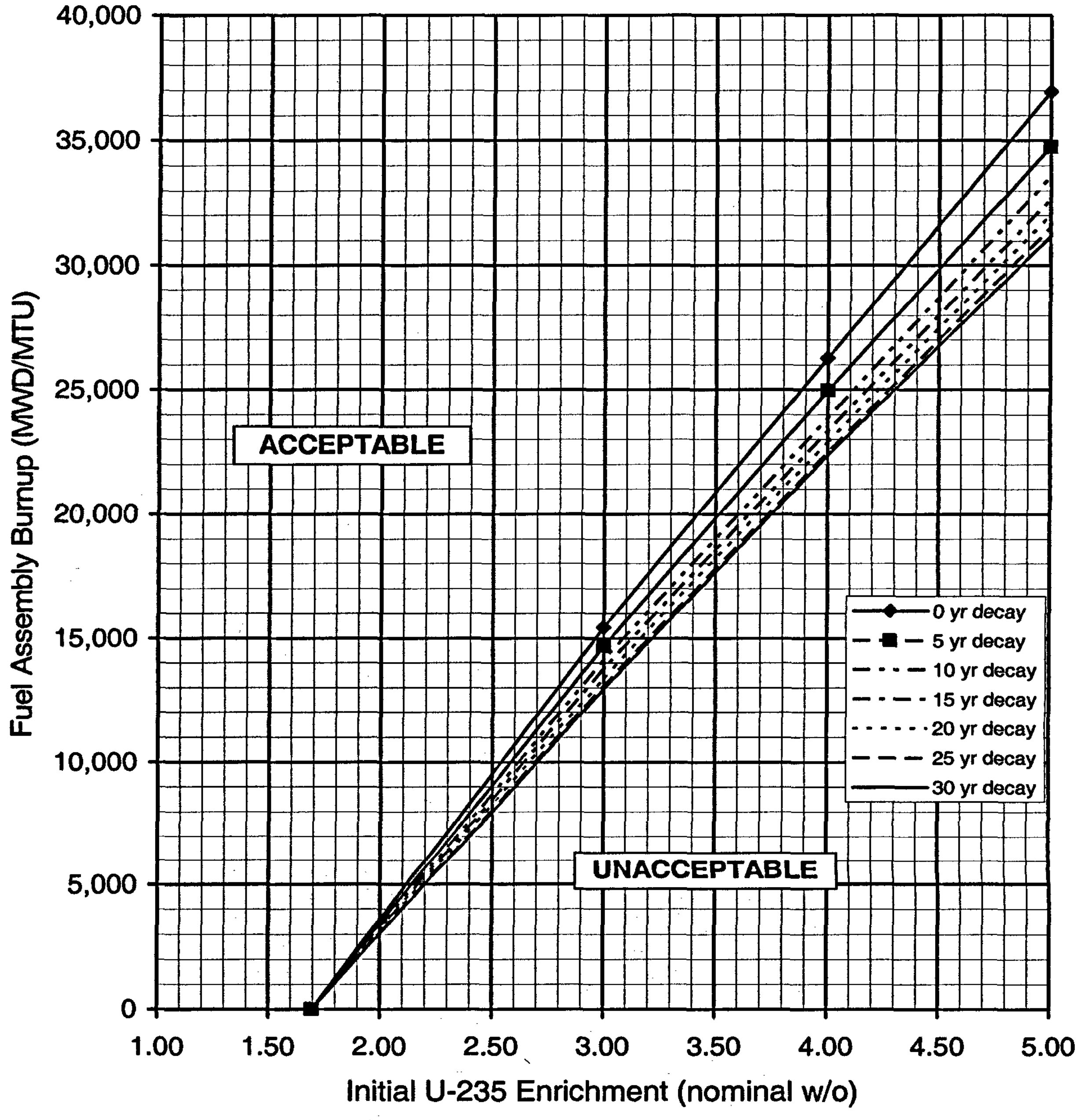
BURNUP CREDIT REQUIREMENTS FOR CATEGORY 18 AND 20 FUEL



The data for these curves is given in Table 5.6-13.

FIGURE 5.6-30

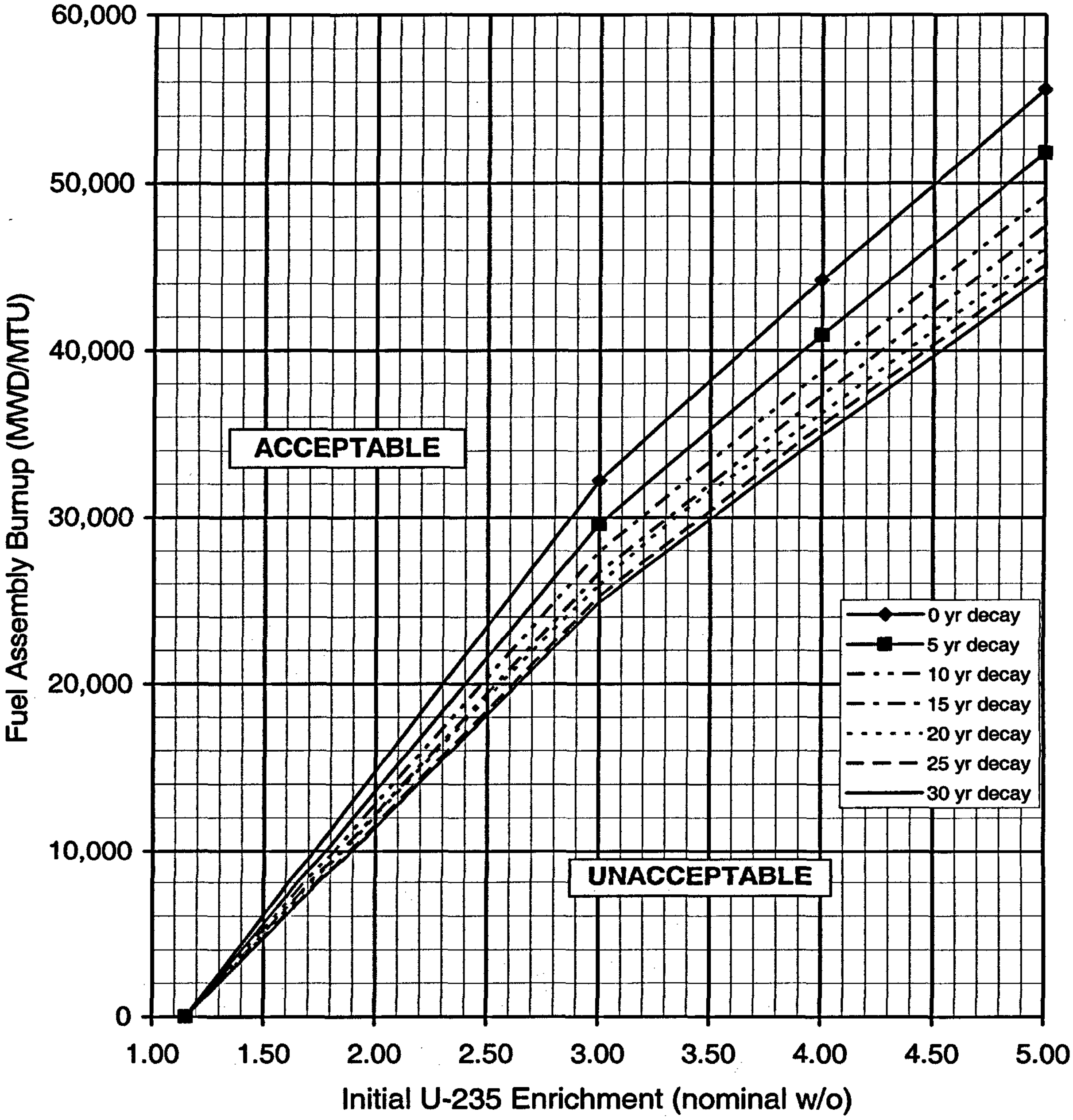
BURNUP CREDIT REQUIREMENTS FOR CATEGORY 22 FUEL



The data for these curves is given in Table 5.6-14.

FIGURE 5.6-31

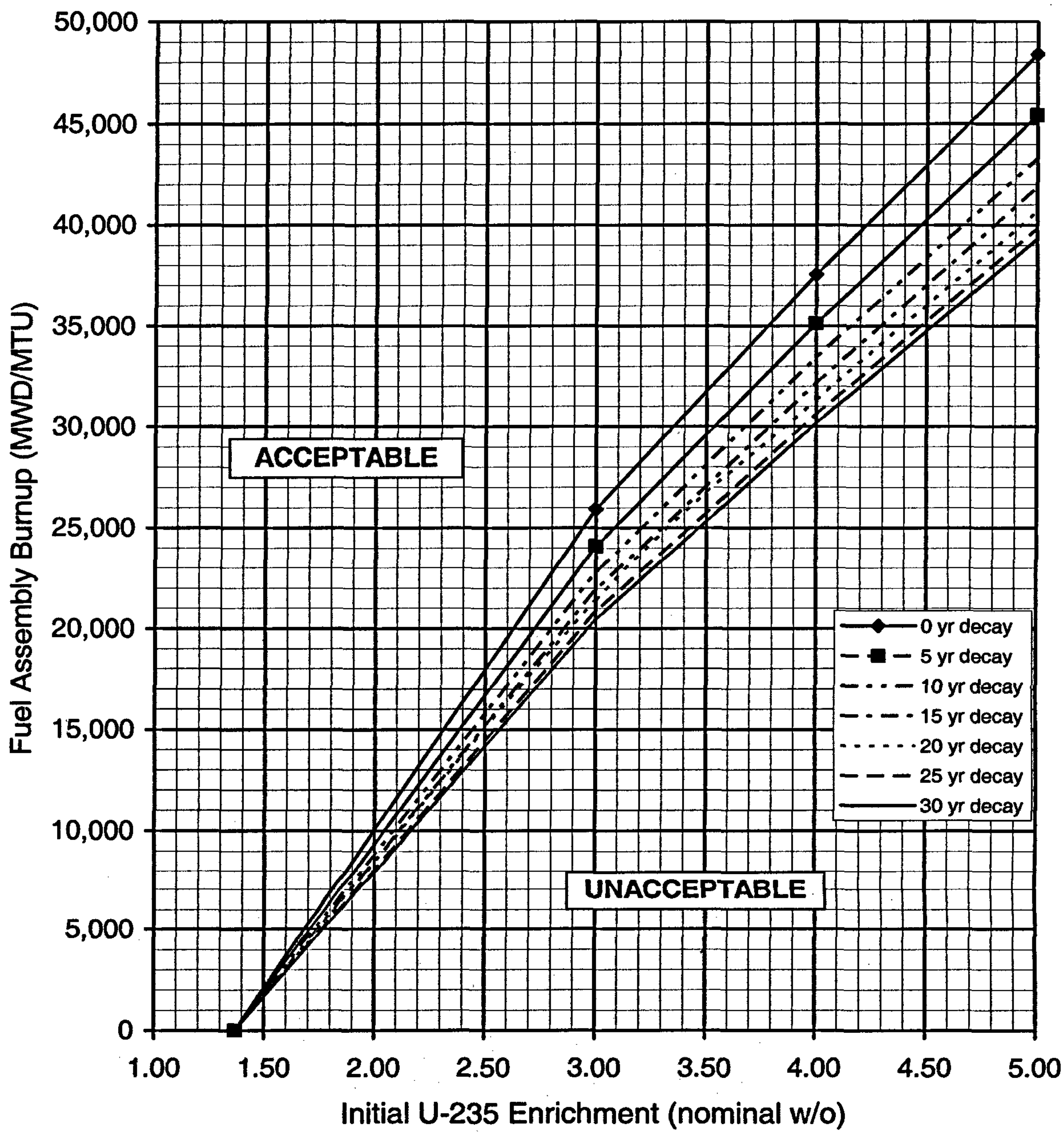
BURNUP CREDIT REQUIREMENTS FOR CATEGORY 24 FUEL



The data for these curves is given in Table 5.6-15.

FIGURE 5.6-32

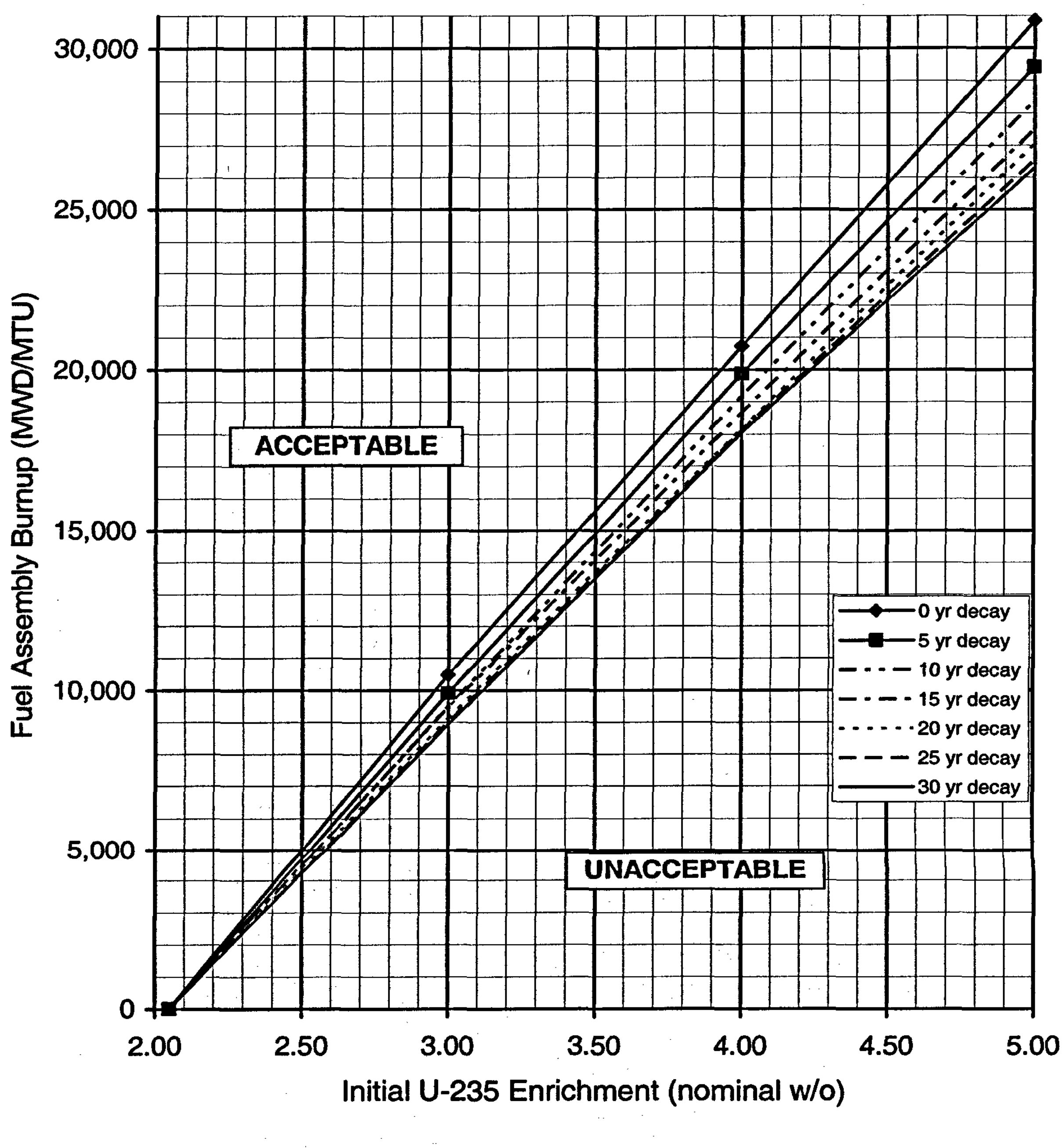
BURNUP CREDIT REQUIREMENTS FOR CATEGORY 26 AND 28 FUEL



The data for these curves is given in Table 5.6-16.

FIGURE 5.6-33

BURNUP CREDIT REQUIREMENTS FOR CATEGORY 36 FUEL



The data for these curves is given in Table 5.6-17.

FIGURE 5.6-34

BOUNDARY BETWEEN THREE STORAGE CONFIGURATIONS

G1	G1	G1	G1	G1	G1	G1	G1
G1	G1	G1	G1	G1	G1	G1	G1
G1	G1	G1	G1	G1	G1	G1	G1
G1	G1	G1	G1	G1	G1	G1	G1
G2	G2	G2	G2	G3	G3	G3	G3
G2	G2	G2	G2	G3	G3	G3	G3
G2	G2	G2	G2	G3	G3	G3	G3
G2	G2	G2	G2	G3	G3	G3	G3

- G1, G2, and G3 represent groups of storage configurations.
- The interface between G1 and G2, G1 and G3, and G2 and G3 must satisfy the requirements of Table 5.6-18.

FIGURE 5.6-35

BOUNDARY BETWEEN FOUR STORAGE CONFIGURATIONS

G1	G1	G1	G1	G2	G2	G2	G2
G1	G1	G1	G1	G2	G2	G2	G2
G1	G1	G1	G1	G2	G2	G2	G2
G1	G1	G1	G1	G2	G2	G2	G2
G3	G3	G3	G3	G4	G4	G4	G4
G3	G3	G3	G3	G4	G4	G4	G4
G3	G3	G3	G3	G4	G4	G4	G4
G3	G3	G3	G3	G4	G4	G4	G4

- G1, G2, G3, and G4 represent groups of storage configurations.
- The interface between G1 and G2, G1 and G3, and G2 and G4, G3 and G4 must satisfy the requirements of Table 5.6-18.

5.7 COMPONENT CYCLIC OR TRANSIENT LIMIT

5.7.1 The components of the reactor coolant system are designed and shall be maintained within limits addressed in the Component Cyclic and Transient Limit Program as required by specification 6.8.3f.

Attachment 3

Westinghouse Affidavit

Westinghouse

Westinghouse Electric Company
Nuclear Services
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355
USA

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

Direct tel: (412) 374-4419
Direct fax: (412) 374-4011
e-mail: maurerbf@westinghouse.com

Our ref: CAW-06-2136

May 2, 2006

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: WCAP-16513-P Revision 1 "South Texas Project Spent Fuel Pool and In-Containment Storage Racks Criticality Analysis," January 2006 (Proprietary)

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-06-2136 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.390 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying affidavit by South Texas Project Nuclear Operating Company.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-06-2136 and should be addressed to B. F. Maurer, Acting Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

Very truly yours,

B. F. Maurer, Acting Manager
Regulatory Compliance and Plant Licensing

Enclosures

cc: D. H. Jaffe/NRR
F. M. Akstulewicz/NRR
G. S. Shukla/NRR

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared B. F. Maurer, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

B. F. Maurer, Acting Manager
Regulatory Compliance and Plant Licensing

Sworn to and subscribed
before me this 2nd day
of May, 2006

Notary Public

Notarial Seal
Sharon L. Fiori, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires January 29, 2007
Member, Pennsylvania Association Of Notaries

(1) I am Acting Manager, Regulatory Compliance and Plant Licensing, in Nuclear Services, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse application for withholding accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in WCAP-16513-P Revision 1, "South Texas Project Spent Fuel Pool and In-Containment Storage Racks Criticality Analysis," January 2006 (Proprietary), for review and approval, being transmitted by the South Texas Nuclear Operating Company letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse for South Texas Nuclear Generating Station Units 1 and 2 is for review and approval. Note that a non-proprietary version of the report has not been included since the entire report is deemed proprietary by Westinghouse and a non-proprietary version would be essentially all blank pages.

This information is part of that which will enable Westinghouse to:

(a) Provide technical information in support of spent fuel pool and in-containment storage rack criticality analysis licensing.

(b) Assist customer to obtain license change.

Further this information has substantial commercial value as follows:

(a) Westinghouse can use this information to further enhance their licensing position with their competitors.

(b) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar analyses and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

Proprietary Information Notice

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

Copyright Notice

Attachment 5

Table of Commitments

Table of Commitments

The following table identifies the actions in this document to which the STP Nuclear Operating Company has committed. Statements in this submittal with the exception of those in the table below are provided for information purposes and are not considered commitments. Please direct questions regarding this commitment to John Conly at (361) 972-7336.

Commitment	Expected Completion Date	CR Action No.
Add the following paragraph to TRM Section 5.6.1: "Fuel shall be stored in compliance with the requirements below OR in accordance with the requirements of Technical Specification 5.6.1 during the implementation period of May 15, 2007 to September 15, 2007. After September 15, 2007, fuel shall be stored in compliance with the requirements of Technical Specification 5.6.1 only."	05/21/2007	04-12271-6