Mr. William T. Cottle
President and Chief Executive Officer
STP Nuclear Operating Company
South Texas Project Electric
Generating Station
P. O. Box 289
Wadsworth, TX 77483

March 3, 1999

SUBJECT: 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)

Dear Mr. Cottle:

The Commission has issued the enclosed Amendment Nos. 104 and 91 to Facility Operating License Nos. NPF-76 and NPF-80 for the South Texas Project, Units 1 and 2 (STP). The amendments consist of changes to the Technical Specifications (TSs) in response to your application dated July 7, 1998, as supplemented by letters dated October 15 and October 26, 1998, and February 16, 1999.

The amendments revise the spent fuel pool criticality analysis and rack utilization schemes by allowing credit for spent fuel pool soluble boron.

The Nuclear Regulatory Commission (NRC) staff found that the technical content of the application was exceptionally thorough, especially when considering its volume and complexity. The first two supplements only clarified minor points and were promptly submitted by your staff upon learning of NRC's need for clarification. However, the NRC staff found administrative errors in the TSs proposed with the initial application, which resulted in the February 16, 1999, supplement. This supplement would not have been necessary if your staff had paid greater attention to detail when preparing the initial application.

A copy of our related Safety Evaluation is enclosed. The Notice of Issuance will be included in the Commission's next biweekly Federal Register notice.

Sincerely,

ORIGINAL SIGNED BY:
Thomas W. Alexion, Project Manager
Project Directorate IV-1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-498 and 50-499

Enclosures:
1. Amendment No. 104 to NPF-76
2. Amendment No. 91 to NPF-80
3. Safety Evaluation

NRC FILE CENTER COPY

cc w/encls: See next page

DISTRIBUTION:

Docket File	GHill (4)	PUBLIC	OGC	L. Kopp
CHawes	TAlexion (2)	WBeckner	PDIV-1 r/f	D. Jackson
ACRS	LHurley, RIV	JKilcrease, RIV f/r	GHubbard	EWeiss
JZwolinski	CNorsworthy (RCN)	KBrockman, RIV	SBlack	

Document Name: G:\STPFINAL\AMDA2296.WPD *See previous conconcurrence

OFC	PM/PD4-1	LA/PD4-1	SL/SRXB*	SL/SPLB*	OGC	PD/PD4-1
NAME	TAlexion	CHawes	EWeiss	GHubbard	AHH	JHannon
DATE	2/26/99	2/26/99	01/12/99	01/08/99	3/01/99	3/2/99
COPY	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO

OFFICIAL RECORD COPY

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 3, 1999

Mr. William T. Cottle
President and Chief Executive Officer
STP Nuclear Operating Company
South Texas Project Electric
Generating Station
P. O. Box 289
Wadsworth, TX 77483

SUBJECT: 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)

Dear Mr. Cottle:

The Commission has issued the enclosed Amendment Nos. 104 and 91 to Facility Operating License Nos. NPF-76 and NPF-80 for the South Texas Project, Units 1 and 2 (STP). The amendments consist of changes to the Technical Specifications (TSs) in response to your application dated July 7, 1998, as supplemented by letters dated October 15 and October 26, 1998, and February 16, 1999.

The amendments revise the spent fuel pool criticality analysis and rack utilization schemes by allowing credit for spent fuel pool soluble boron.

The Nuclear Regulatory Commission (NRC) staff found that the technical content of the application was exceptionally thorough, especially when considering its volume and complexity. The first two supplements only clarified minor points and were promptly submitted by your staff upon learning of NRC's need for clarification. However, the NRC staff found administrative errors in the TSs proposed with the initial application, which resulted in the February 16, 1999, supplement. This supplement would not have been necessary if your staff had paid greater attention to detail when preparing the initial application.

A copy of our related Safety Evaluation is enclosed. The Notice of Issuance will be included in the Commission's next biweekly Federal Register notice.

Sincerely,

Thomas W. Alexion

Thomas W. Alexion, Project Manager
Project Directorate IV-1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-498 and 50-499

Enclosures:
1. Amendment No. 104 to NPF-76
2. Amendment No. 91 to NPF-80
3. Safety Evaluation

cc w/encls: See next page

cc:

Mr. Cornelius F. O'Keefe
Senior Resident Inspector
U.S. Nuclear Regulatory Commission
P. O. Box 910
Bay City, TX 77414

A. Ramirez/C. M. Canady
City of Austin
Electric Utility Department
721 Barton Springs Road
Austin, TX 78704

Mr. M. T. Hardt
Mr. W. C. Gunst
City Public Service Board
P. O. Box 1771
San Antonio, TX 78296

Mr. G. E. Vaughn/C. A. Johnson
Central Power and Light Company
P. O. Box 289
Mail Code: N5012
Wadsworth, TX 74483

INPO
Records Center
700 Galleria Parkway
Atlanta, GA 30339-3064

Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011

D. G. Tees/R. L. Balcom
Houston Lighting & Power Co.
P. O. Box 1700
Houston, TX 77251

Judge, Matagorda County
Matagorda County Courthouse
1700 Seventh Street
Bay City, TX 77414

Jack R. Newman, Esq.
Morgan, Lewis & Bockius
1800 M Street, N.W.
Washington, DC 20036-5869

Mr. T. H. Cloninger
Vice President
Engineering & Technical Services
STP Nuclear Operating Company
P. O. Box 289
Wadsworth, TX 77483

Office of the Governor
ATTN: John Howard, Director
Environmental and Natural
Resources Policy
P. O. Box 12428
Austin, TX 78711

Jon C. Wood
Matthews & Branscomb
One Alamo Center
106 S. St. Mary's Street, Suite 700
San Antonio, TX 78205-3692

Arthur C. Tate, Director
Division of Compliance & Inspection
Bureau of Radiation Control
Texas Department of Health
1100 West 49th Street
Austin, TX 78756

Jim Calloway
Public Utility Commission of Texas
Electric Industry Analysis
P. O. Box 13326
Austin, TX 78711-3326

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

STP NUCLEAR OPERATING COMPANY

DOCKET NO. 50-498

SOUTH TEXAS PROJECT, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 104
License No. NPF-76

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

   A. The application for amendment by STP Nuclear Operating Company* acting on behalf of itself and for Houston Lighting & Power Company (HL&P), the City Public Service Board of San Antonio (CPS), Central Power and Light Company (CPL), and City of Austin, Texas (COA) (the licensees), dated July 7, 1998, as supplemented by letters dated October 15 and October 26, 1998, and February 16, 1999, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

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

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

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

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

---

*STP Nuclear Operating Company is authorized to act for Houston Lighting & Power Company (HL&P), the City Public Service Board of San Antonio, Central Power and Light Company and City of Austin, Texas and has exclusive responsibility and control over the physical construction, operation and maintenance of the facility.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and Paragraph 2.C.(2) of Facility Operating License No. NPF-76 is hereby amended to read as follows:

   2. <u>Technical Specifications</u>

      The Technical Specifications contained in Appendix A, as revised through Amendment No. **104** , and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. The license amendment is effective as of its date of issuance and shall be implemented within 90 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Thomas W. Alexion

Thomas W. Alexion, Project Manager
Project Directorate IV-1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: **March 3, 1999**

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

STP NUCLEAR OPERATING COMPANY

DOCKET NO. 50-499

SOUTH TEXAS PROJECT, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 91
License No. NPF-80

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

   A. The application for amendment by STP Nuclear Operating Company* acting on behalf of itself and for Houston Lighting & Power Company (HL&P), the City Public Service Board of San Antonio (CPS), Central Power and Light Company (CPL), and City of Austin, Texas (COA) (the licensees), dated July 7, 1998, as supplemented by letters dated October 15 and October 26, 1998, and February 16, 1999, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

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

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

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

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

---

*STP Nuclear Operating Company is authorized to act for Houston Lighting & Power Company (HL&P), the City Public Service Board of San Antonio, Central Power and Light Company and City of Austin, Texas and has exclusive responsibility and control over the physical construction, operation and maintenance of the facility.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and Paragraph 2.C.(2) of Facility Operating License No. NPF-80 is hereby amended to read as follows:

   2. Technical Specifications

      The Technical Specifications contained in Appendix A, as revised through Amendment No. 91 , and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. The license amendment is effective as of its date of issuance and shall be implemented within 90 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Thomas W. Alexion

Thomas W. Alexion, Project Manager
Project Directorate IV-1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: March 3, 1999

ATTACHMENT TO LICENSE AMENDMENT NOS. 104 AND 91

FACILITY OPERATING LICENSE NOS. NPF-76 AND NPF-80

DOCKET NOS. 50-498 AND 50-499

Replace the following pages of the Appendix A Technical Specifications with the attached pages. The revised pages are identified by Amendment number and contain marginal lines indicating the areas of change. The corresponding overleaf pages are also provided to maintain document completeness.

REMOVE	INSERT
xvii	xvii
-	xviia
3/4 9-17	3/4 9-17
B 3/4 9-4	B 3/4 9-4
5-6	5-6
5-7	5-7
5-8	5-8
5-9	5-9
5-9a	5-9a
5-10	5-10
5-11	5-11
5-12	5-12
5-13	5-13
5-14	5-14
5-15	5-15
-	5-16
-	5-17
-	5-18
-	5-19
-	5-20
-	5-21
-	5-22
-	5-23
-	5-24
-	5-25
-	5-26
-	5-27
-	5-28
5-16	5-29
5-17	5-30

SECTION PAGE

5.1 SITE
5.1.1 EXCLUSION AREA 5-1
5.1.2 LOW POPULATION ZONE 5-1
5.1.3 MAP DEFINING UNRESTRICTED AREAS AND SITE BOUNDARY FOR RADIOACTIVE GASEOUS AND LIQUID EFFLUENTS 5-1

5.2 CONTAINMENT
5.2.1 CONFIGURATION 5-1
5.2.2 DESIGN PRESSURE AND TEMPERATURE 5-1
FIGURE 5.1-1 EXCLUSION AREA 5-2
FIGURE 5.1-2 LOW POPULATION ZONE 5-3
FIGURE 5.1-3 UNRESTRICTED AREA AND SITE BOUNDARY FOR RADIOACTIVE GASEOUS EFFLUENTS 5-4

FIGURE 5.1-4 UNRESTRICTED AREA AND SITE BOUNDARY FOR RADIOACTIVE LIQUID EFFLUENTS 5-5

5.3 REACTOR CORE
5.3.1 FUEL ASSEMBLIES 5-6
5.3.2 CONTROL ROD ASSEMBLIES 5-6
5.4 (NOT USED)
5.5 METEOROLOGICAL TOWER LOCATION 5-6
5.6 FUEL STORAGE
5.6.1 CRITICALITY 5-6
5.6.2 DRAINAGE 5-9
5.6.3 CAPACITY 5-9
FIGURE 5.6-1 MINIMUM BURNUP FOR CATEGORY 2 FUEL REGION 2 5-10
FIGURE 5.6-2 MINIMUM BURNUP FOR CATEGORY 3 FUEL REGION 1 5-11
FIGURE 5.6-3 MINIMUM IFBA FOR CATEGORY 3 FUEL REGION 1 5-12
FIGURE 5.6-4 MINIMUM BURNUP FOR CATEGORY 4 FUEL REGION 1 5-13
FIGURE 5.6-5 MINIMUM IFBA FOR CATEGORY 4 FUEL REGION 1 5-14
FIGURE 5.6-6 MINIMUM BURNUP FOR CATEGORY 5 FUEL REGION 2 5-15
FIGURE 5.6-7 MINIMUM BURNUP FOR CATEGORY 6 FUEL REGION 1 5-16
FIGURE 5.6-8 MINIMUM BURNUP FOR CATEGORY 7 FUEL REGION 2 5-17
FIGURE 5.6-9 MINIMUM BURNUP FOR CATEGORY 8 FUEL REGION 2 5-18
FIGURE 5.6-10 MINIMUM BURNUP FOR CATEGORY 9 FUEL REGION 2 5-19

INDEX

DESIGN FEATURES

FIGURE 5.6-11 MINIMUM BURNUP FOR CATEGORY 10 FUEL REGION 1 ... 5-20

FIGURE 5.6-12 MINIMUM BURNUP FOR CATEGORY 11 FUEL REGION 2 ... 5-21

FIGURE 5.6-13 ALLOWABLE FUEL CATEGORIES FOR REGION 1 CONFIGURATIONS ... 5-22

FIGURE 5.6-14 ALLOWABLE FUEL CATEGORIES FOR REGION 2 CONFIGURATIONS ... 5-23

FIGURE 5.6-15 REGION 1 BOUNDARY BETWEEN ALL CELL STORAGE AND CHECKERBOARD #2 and REGION 1 BOUNDARY BETWEEN ALL CELL STORAGE AND CHECKERBOARD #1 ... 5-24

FIGURE 5.6-16 REGION 1 BOUNDARY BETWEEN CHECKERBOARD #1 AND CHECKERBOARD #2 and REGION 1 BOUNDARY BETWEEN CHECKERBOARD #2 AND CHECKERBOARD #1 ... 5-25

FIGURE 5.6-17 REGION 2 BOUNDARY BETWEEN ALL CELL STORAGE AND 3-OUT-OF-4 STORAGE and REGION 2 BOUNDARY BETWEEN ALL CELL STORAGE AND 2-OUT-OF-4 STORAGE ... 5-26

FIGURE 5.6-18 REGION 2 BOUNDARY BETWEEN ALL CELL STORAGE AND RCCA CHECKERBOARD #1 and REGION 2 BOUNDARY BETWEEN ALL CELL STORAGE AND RCCA CHECKERBOARD #2 ... 5-27

FIGURE 5.6-19 REGION 2 BOUNDARY BETWEEN 2-OUT-OF-4 AND 3-OUT-OF-4 STORAGE and REGION 2 BOUNDARY BETWEEN RCCA AND CHECKERBOARD STORAGE PATTERNS ... 5-28

FIGURE 5.6-20 MINIMUM IFBA CONTENT FOR IN-CONTAINMENT RACK FUEL STORAGE ... 5-29

5.7 COMPONENT CYCLIC OR TRANSIENT LIMIT ... 5-30

INDEX

ADMINISTRATIVE CONTROLS

SECTION	PAGE
6.1 RESPONSIBILITY	6-1
6.2 ORGANIZATION	
6.2.1 OFFSITE AND ONSITE ORGANIZATIONS	6-1
6.2.2 UNIT STAFF	6-1
TABLE 6.2-1 MINIMUM SHIFT CREW COMPOSITION-TWO UNITS WITH TWO SEPARATE CONTROL ROOMS	6-4
6.2.3 INDEPENDENT SAFETY ENGINEERING GROUP (ISEG)	
Function	6-6
Composition	6-6
Responsibilities	6-6
Records	6-6
6.2.4 SHIFT TECHNICAL ADVISOR	6-6
6.3 (Not Used)	
6.4 TRAINING	6-7
6.5 REVIEW AND AUDIT	6-7
6.5.1 PLANT OPERATIONS REVIEW COMMITTEE (PORC)	
Function	6-7
Composition	6-7
Alternates	6-7
Meeting Frequency	6-7
Quorum	6-7
Responsibilities	6-8
Records	6-9

3/4.9.13 SPENT FUEL POOL MINIMUM BORON CONCENTRATION

LIMITING CONDITION FOR OPERATION

3.9.13 The boron concentration of the spent fuel pool water shall be maintained greater than or equal to 2500 ppm.

APPLICABILITY: Whenever one or more fuel assemblies are stored in the spent fuel pool racks.

ACTION:

a. With the requirements of the above specification not satisfied, immediately suspend all operations involving movement of fuel assemblies in the spent fuel storage pool and initiate action to restore the boron concentration in the spent fuel pool to greater than or equal to 2500 ppm.

b. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.13 The boron concentration of the spent fuel pool shall be determined by chemical analysis at least once per 7 days.

3/4.9.12 FUEL HANDLING BUILDING EXHAUST AIR SYSTEM - BASES

Examples of onsite emergency power sources that satisfy this requirement are: In all MODES/CONDITIONS, (a) OPERABLE ESF diesel generator for the associated required components; IN MODES/CONDITIONS below MODE 4, (b) OPERABLE ESF diesel generator capable of supplying the required components via cross tied trains, allowing one diesel generator to supply all required components, (c) an approved non-safety related diesel generator, capable of supplying the requried filter train loads in conjunction with an ESF diesel.

3/4.9.13 SPENT FUEL POOL MINIMUM BORON CONCENTRATION

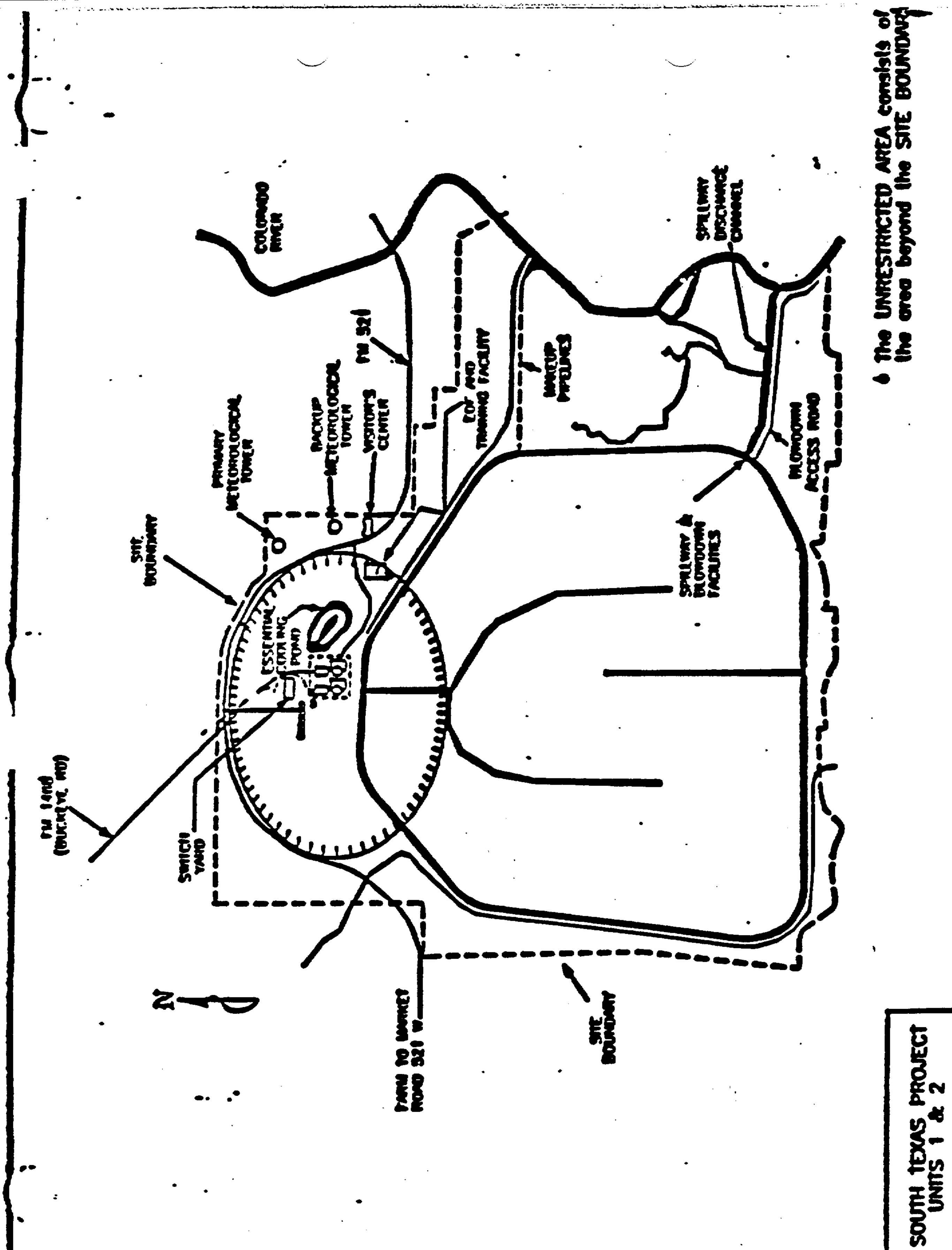
The spent fuel racks have been analyzed in accordance with the methodology contained in WCAP-14416-NP-A, "Westinghouse Spent Fuel Rack Criticality Analysis Methodology", Revision 1, November, 1996. This methodology ensures that the spent fuel rack multiplication factor, k_{eff} is less than or equal to 0.95, as recommended by ANSI 57.2-1983 and the guidance contained in NRC Letter to All Power Reactor Licensees from B. K. Grimes, "OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications," April 14, 1978. The codes, methods, and techniques contained in the methodology are used to satisfy this k_{eff} criterion. The spent fuel storage racks are analyzed to allow storage of 17X17XL fuel assemblies with nominal enrichments up to 4.95 w/o U-235 utilizing credit for checkerboard configurations, burnup, Integral Fuel Burnable Absorbers, decay time, RCCAs, and soluble boron, to ensure that k_{eff} is maintained $\leq$ 0.95, including uncertainties, tolerances, and accident conditions. In addition, the spent fuel pool k_{eff} is maintained < 1.0 including uncertainties and tolerances on a 95/95 basis without soluble boron. The inadvertent withdrawal of an RCCA from a required location in a Region 2 checkerboard is bounded by the misloading of a 4.95 w/o fuel assembly in the same checkerboard pattern at the location of the assembly with the inadvertently withdrawn RCCA.

The soluble boron concentration required to maintain $k_{eff} \leq$ 0.95 under normal conditions is 700 ppm.

Specifications 5.6.1.3 and 5.6.1.4 ensure that fuel assemblies are stored in the spent fuel racks in accordance with the configurations assumed in the spent fuel rack criticality analysis.

The most limiting accident with respect to the storage configurations assumed in the spent fuel rack criticality analysis is the misplacement of a nominal 4.95 w/o U-235 fuel assembly into a storage cell location in the Region 2 RCCA checkerboard #2 storage arrangement. The amount of soluble boron required to maintain k_{eff} less than or equal to 0.95 due to this fuel misload accident is 2200 ppm. The 2500 ppm limit specified in the LCO bounds the 2200 ppm required for a fuel misload accident.

A spent fuel pool boron dilution analysis was performed to determine that sufficient time is available to detect and mitigate dilution of the spent fuel pool prior to exceeding the k_{eff} design basis limit of 0.95. The spent fuel pool boron dilution analysis concluded that an inadvertent or unplanned event that would result in a dilution of the spent fuel pool boron concentration from 2500 ppm to 700 ppm is not a credible event.



* The UNRESTRICTED AREA consists of the area beyond the SITE BOUNDARY

FIGURE 5.1-4
UNRESTRICTED AREA* AND SITE BOUNDARY FOR RADIOACTIVE LIQUID EFFLUENTS

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

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.

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 1 fuel assembly. All fuel enrichment values are initial nominal uranium-235 enrichments. The reactivity categories are:

CATEGORY 1:
Fuel in Category 1 shall have an initial nominal enrichment of less than or equal to 4.95 w/o.

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 4.85 w/o; or,
2) a minimum burnup as shown on Figure 5.6-1.

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 3.55 w/o; or,
2) a minimum burnup as shown on Figure 5.6-2; or,
3) a minimum number of Integral Fuel Burnable Absorber (IFBA) pins, as shown on Figure 5.6-3.

The IFBA pin requirements shown in Figure 5.6-3 are based on nominal IFBA linear B^{10} loading of 1.57 mg-B^{10}/inch (1.0X). For higher IFBA loadings up to 2.35 mg-B^{10}/inch (1.5X), the required number of IFBA pins per assembly may be reduced by the ratio of the increased B^{10} loading to the nominal 1.57 mg-B^{10}/inch loading. A full length IFBA is 168 inches long, and a part length IFBA is greater than 120 inches long.

CATEGORY 4:

Fuel in Category 4 shall meet at least one of the following criteria:

1) an initial nominal enrichment of less than or equal to 2.50 w/o; or,
2) an minimum burnup as shown in Figure 5.6-4; or,
3) a minimum number of IFBA pins, as shown on Figure 5.6-5.

The IFBA pin requirements shown in Figure 5.6-5 are based on nominal IFBA linear B^{10} loading of 1.57 mg-B^{10}/inch (1.0X). For higher IFBA loadings up to 2.35 mg-B^{10}/inch (1.5X), the required number of IFBA pins per assembly may be reduced by the ratio of the increased B^{10} loading to the nominal 1.57 mg-B^{10}/inch loading. A full length IFBA is 168 inches long, and a part length IFBA is greater than 120 inches long.

CATEGORY 5:

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

1) an initial nominal enrichment of less than or equal to 1.70 w/o; or
2) a minimum burnup as shown on Figure 5.6-6.

CATEGORY 6:

Fuel in Category 6 shall meet at least one of the following criteria:

1) an initial nominal enrichment of less than or equal to 1.70 w/o; or
2) a minimum burnup as shown on Figure 5.6-7.

CATEGORY 7:

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

1) an initial nominal enrichment of less than or equal to 1.65 w/o; or
2) a minimum burnup as shown on Figure 5.6-8.

CATEGORY 8:

Fuel in Category 8 shall meet at least one of the following criteria:

1) an initial nominal enrichment of less than or equal to 1.40 w/o; or
2) a minimum burnup as shown on Figure 5.6-9.

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 1.40 w/o; or
2) a minimum burnup as shown on Figure 5.6-10.

CATEGORY 10:

Fuel in Category 10 shall meet a least one of the following criteria:

1) an initial nominal enrichment of less than or equal to 1.40 w/o; or
2) a minimum burnup as shown on Figure 5.6-11.

CATEGORY 11:

Fuel in Category 11 shall meet at least one of the following criteria:

1) an initial nominal enrichment of less than or equal to 1.20 w/o; or
2) a minimum burnup and decay time since shutdown as shown on Figure 5.6-12.

Data points for the curves presented in Figures 5.6-1 through 5.6-12 are presented in tables on the respective figures. Linear interpolation between table values may be used for intermediate points.

5.6.1.3 Region 1 racks may be used to store Category 1, 3, 4, 6, and 10 fuel. The fuel in Region 1 shall be stored in accordance with Figures 5.6-13, 5.6-15, and 5.6-16.

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 Category 2, 5, 7, 8, 9, and 11 fuel. The fuel in Region 2 shall be stored in accordance with Figures 5.6-14, 5.6-17, 5.6-18, and 5.6-19.

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.

5.6.1.5 Storage Configuration Interface Requirements. Fuel storage patterns used within Region 1 shall comply with the interface requirements shown in Figures 5.6-15 and 5.6-16. Fuel storage patterns used within Region 2 shall comply with the interface requirements shown in Figures 5.6-17 through 5.6-19. At the interface between Region 1 and Region 2 one row of empty water cells shall be maintained between the Regions. The empty water cell row can be positioned in either Region. Non-fissile items can be stored in the empty water cells per the provisions of Specification 5.6.1.3.

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 2200 ppm required for the most limiting fuel misloading and also assures that the rack K_{eff} limit in Specification 5.6.1.1.a will not be violated.

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

a. 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 racks are designed and shall be maintained with:

a. A K_{eff} equivalent to less than or equal to 0.95 when flooded with unborated water. This requirement shall be met by satisfying at least one of the following criteria:

1) a maximum initial fuel assembly nominal enrichment to 4.5 w/o or less; or,

2) a minimum number of Integral Fuel Burnable Absorbers (IFBA), as a function of initial nominal assembly enrichment, as shown on Figure 5.6-20, or a K_{inf} of less than or equal to 1.484. The fuel assembly K_{inf} shall be based on a unit assembly configuration (infinite in the lateral and axial extent) in the reactor core geometry, assuming unborated water at 68°F.

The IFBA pin requirements shown in Figure 5.6-20 are based on a nominal IFBA linear B^{10} loading of 1.57 mg-B^{10}/inch. For higher IFBA linear B^{10} loadings, the required number of IFBA pins per assembly may be reduced by the ratio of the increased B^{10} loading to the nominal 1.57 mg-B^{10}/inch loading.

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

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.

Minimum Burnup for Category 2 Fuel
Region 2

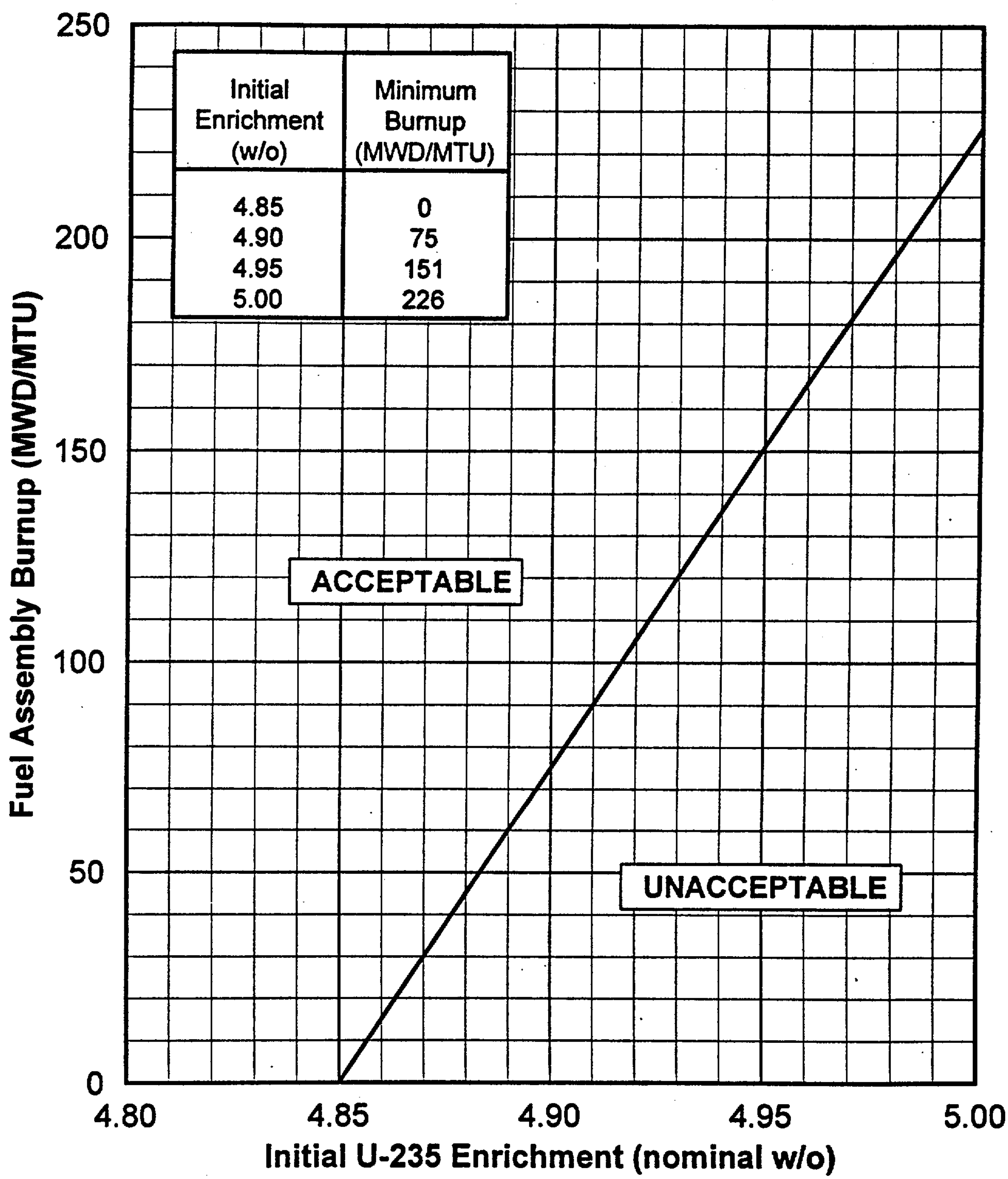
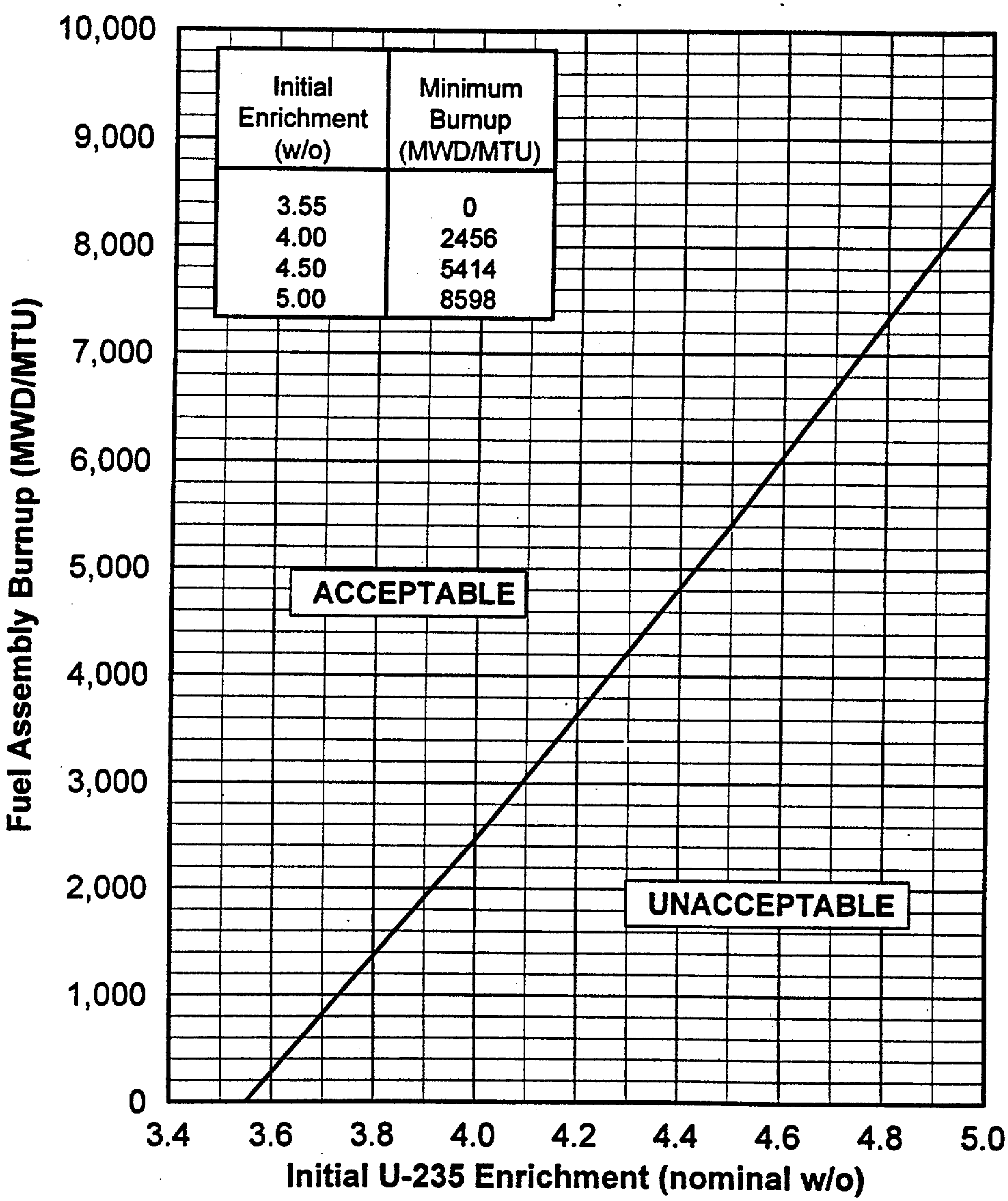


Figure 5.6-1

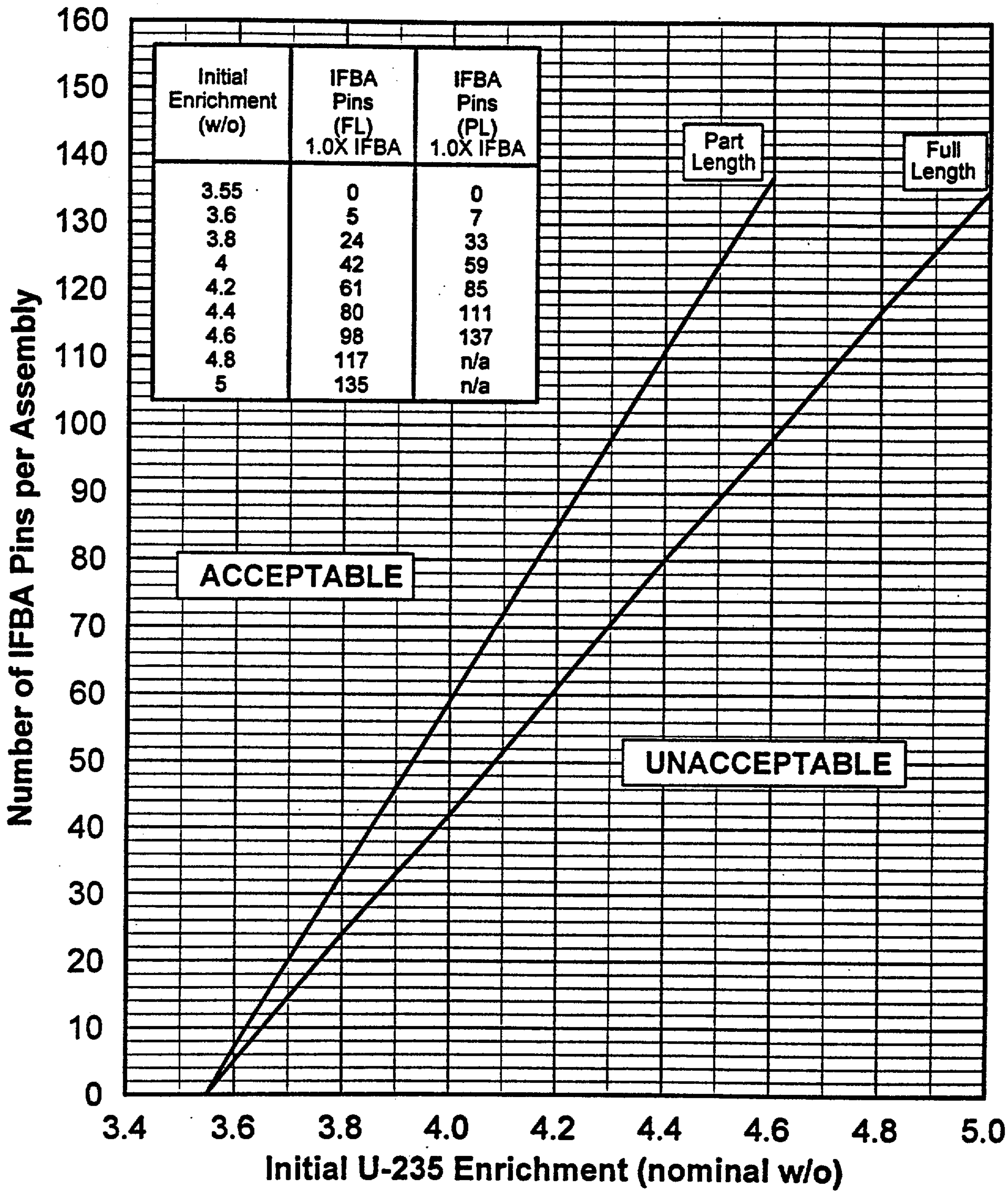
Minimum Burnup for Category 3 Fuel
Region 1



Initial Enrichment (w/o)	Minimum Burnup (MWD/MTU)
3.55	0
4.00	2456
4.50	5414
5.00	8598

Figure 5.6-2

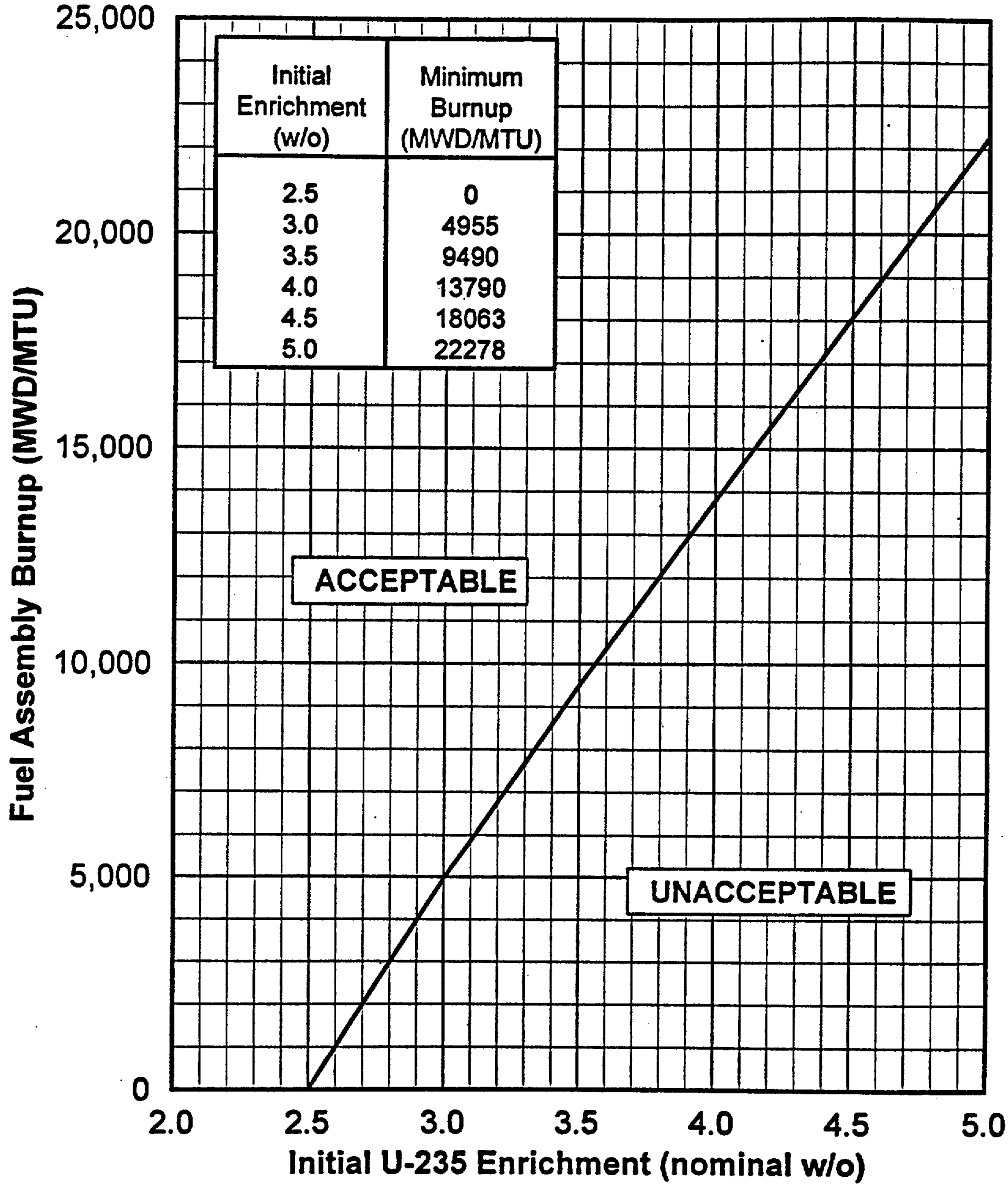
Minimum IFBA for Category 3 Fuel
Region 1



Initial Enrichment (w/o)	IFBA Pins (FL) 1.0X IFBA	IFBA Pins (PL) 1.0X IFBA
3.55	0	0
3.6	5	7
3.8	24	33
4	42	59
4.2	61	85
4.4	80	111
4.6	98	137
4.8	117	n/a
5	135	n/a

Figure 5.6-3

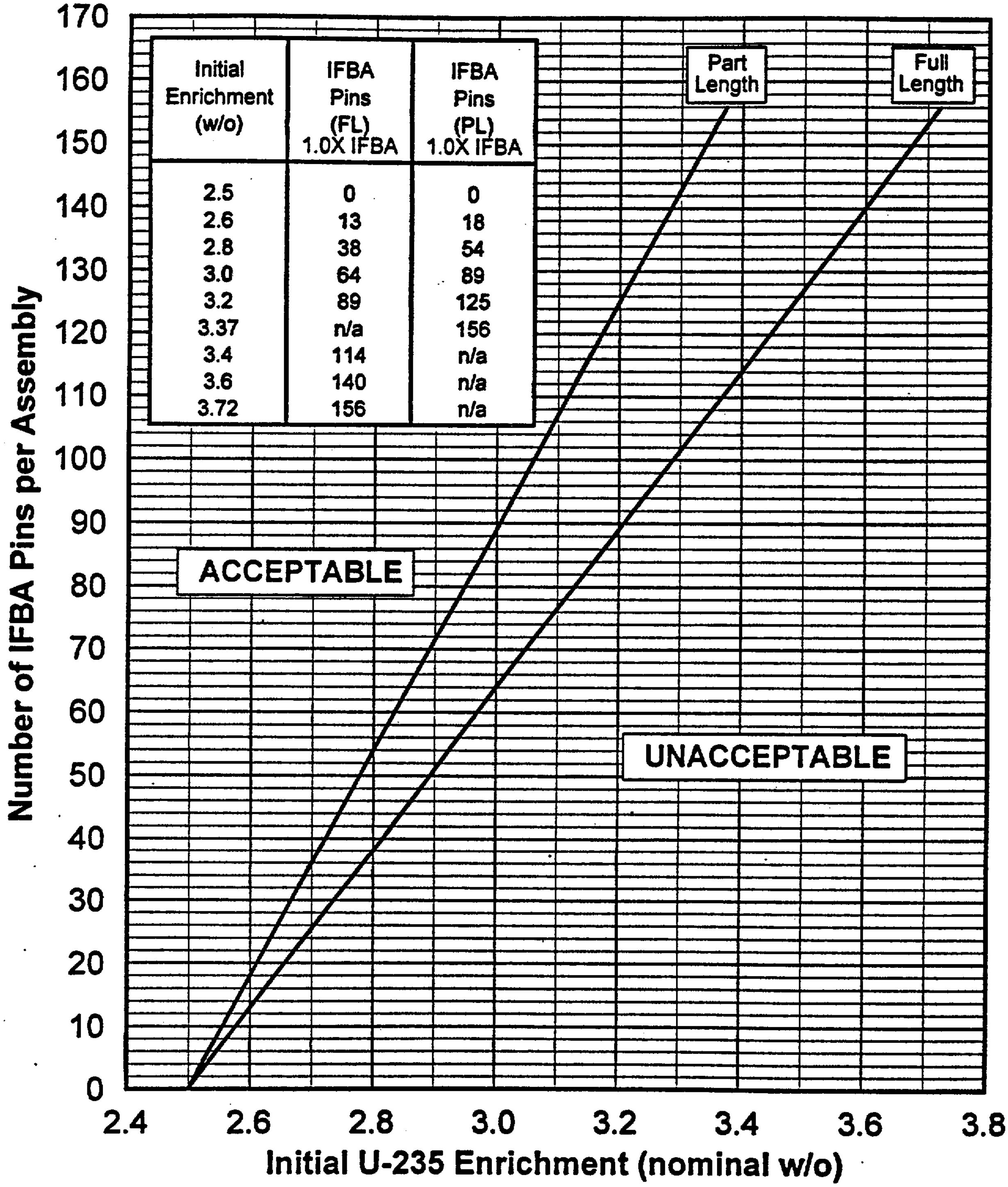
Minimum Burnup for Category 4 Fuel
Region 1



Initial Enrichment (w/o)	Minimum Burnup (MWD/MTU)
2.5	0
3.0	4955
3.5	9490
4.0	13790
4.5	18063
5.0	22278

Figure 5.6-4

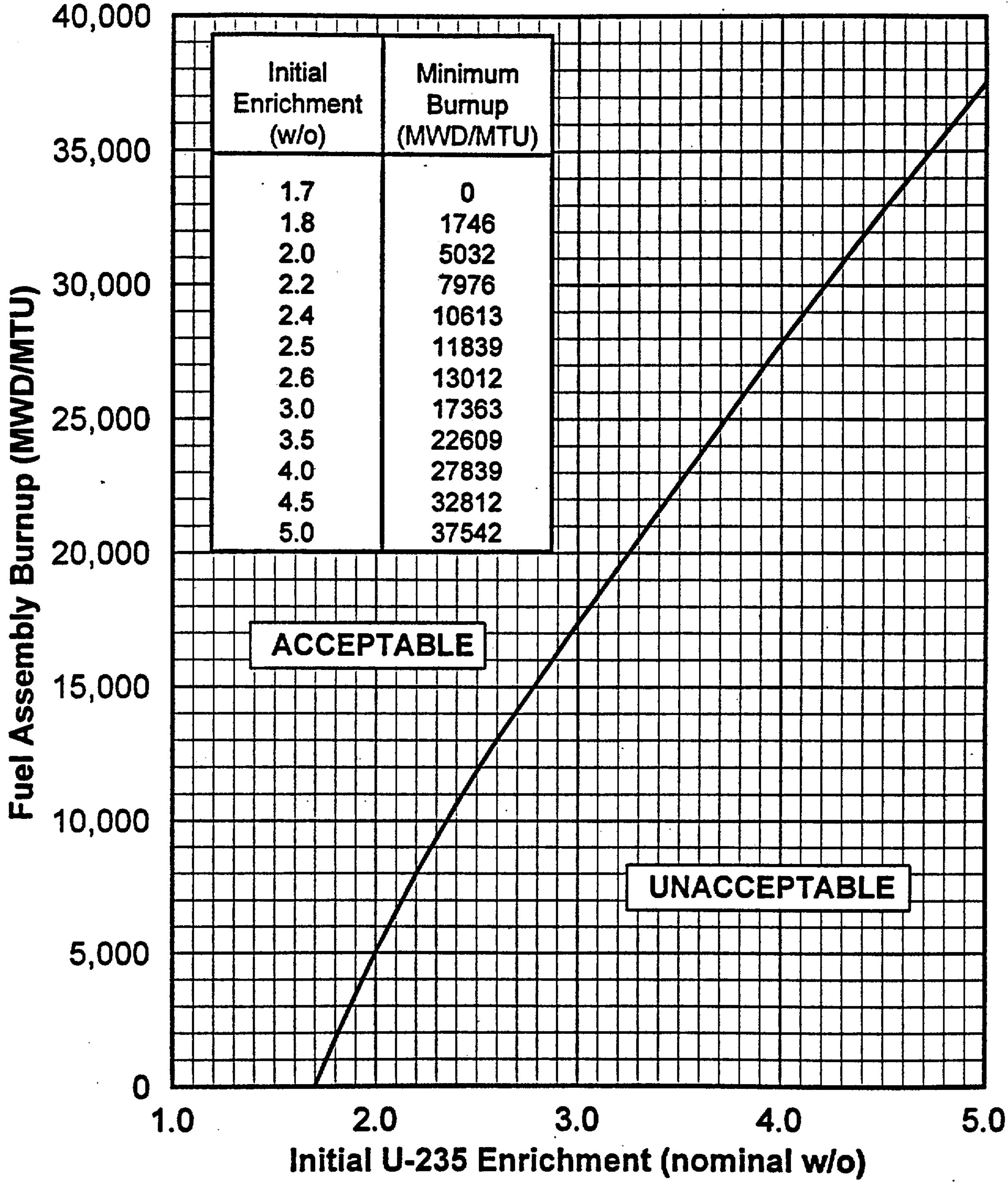
Minimum IFBA for Category 4 Fuel
Region 1



Initial Enrichment (w/o)	IFBA Pins (FL) 1.0X IFBA	IFBA Pins (PL) 1.0X IFBA
2.5	0	0
2.6	13	18
2.8	38	54
3.0	64	89
3.2	89	125
3.37	n/a	156
3.4	114	n/a
3.6	140	n/a
3.72	156	n/a

Figure 5.6-5

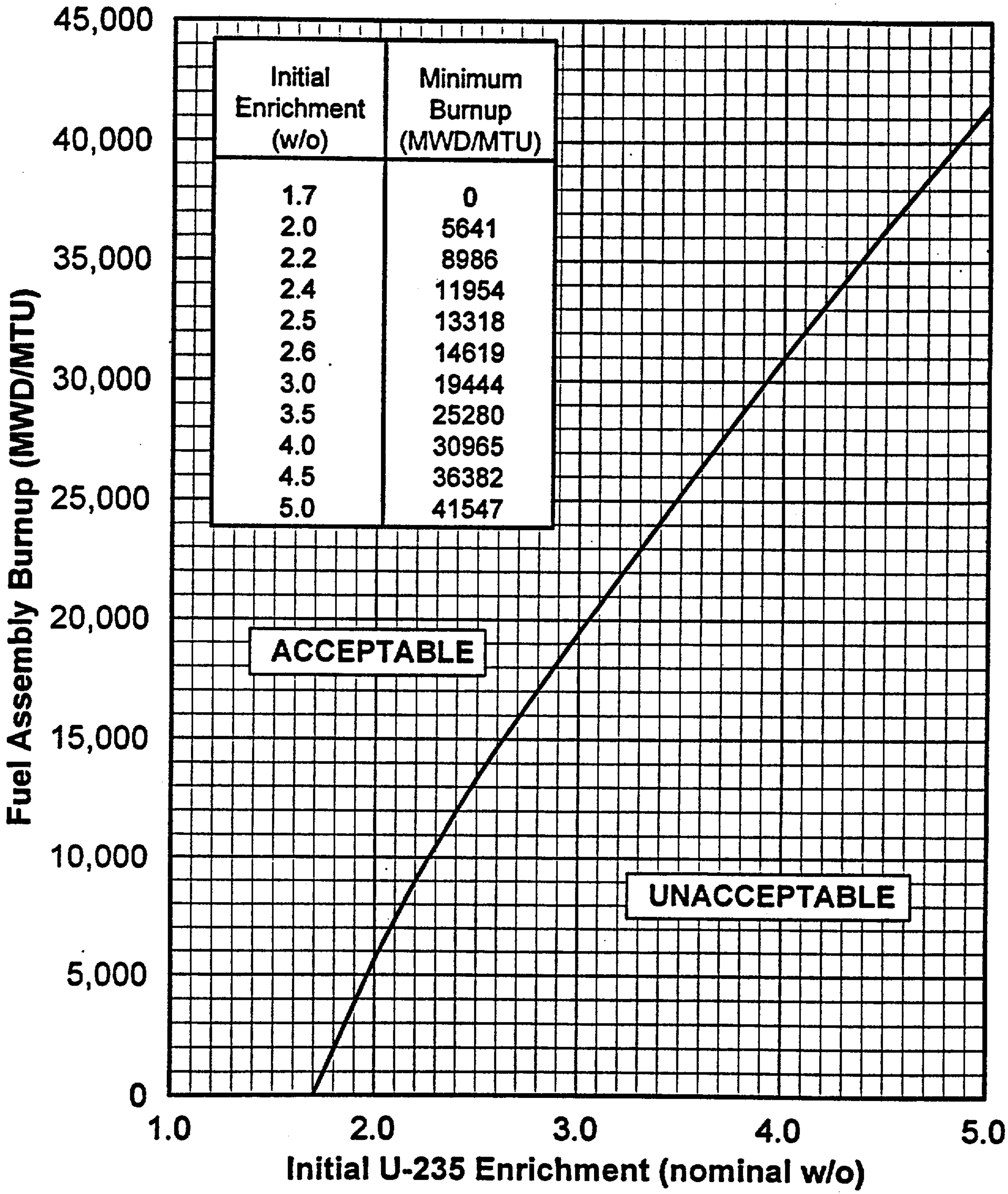
Minimum Burnup for Category 5 Fuel
Region 2



Initial Enrichment (w/o)	Minimum Burnup (MWD/MTU)
1.7	0
1.8	1746
2.0	5032
2.2	7976
2.4	10613
2.5	11839
2.6	13012
3.0	17363
3.5	22609
4.0	27839
4.5	32812
5.0	37542

Figure 5.6-6

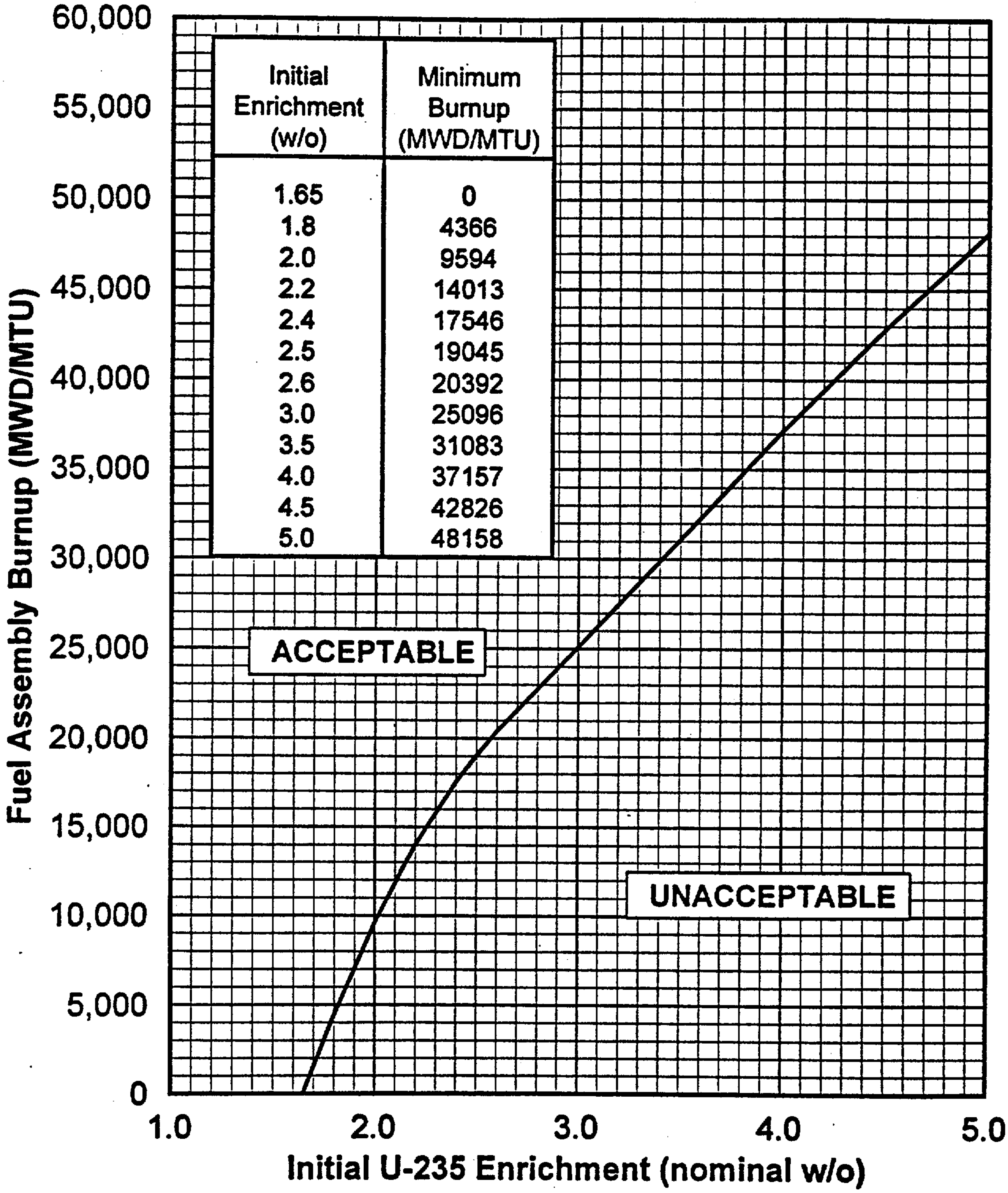
Minimum Burnup for Category 6 Fuel
Region 1



Initial Enrichment (w/o)	Minimum Burnup (MWD/MTU)
1.7	0
2.0	5641
2.2	8986
2.4	11954
2.5	13318
2.6	14619
3.0	19444
3.5	25280
4.0	30965
4.5	36382
5.0	41547

Figure 5.6-7

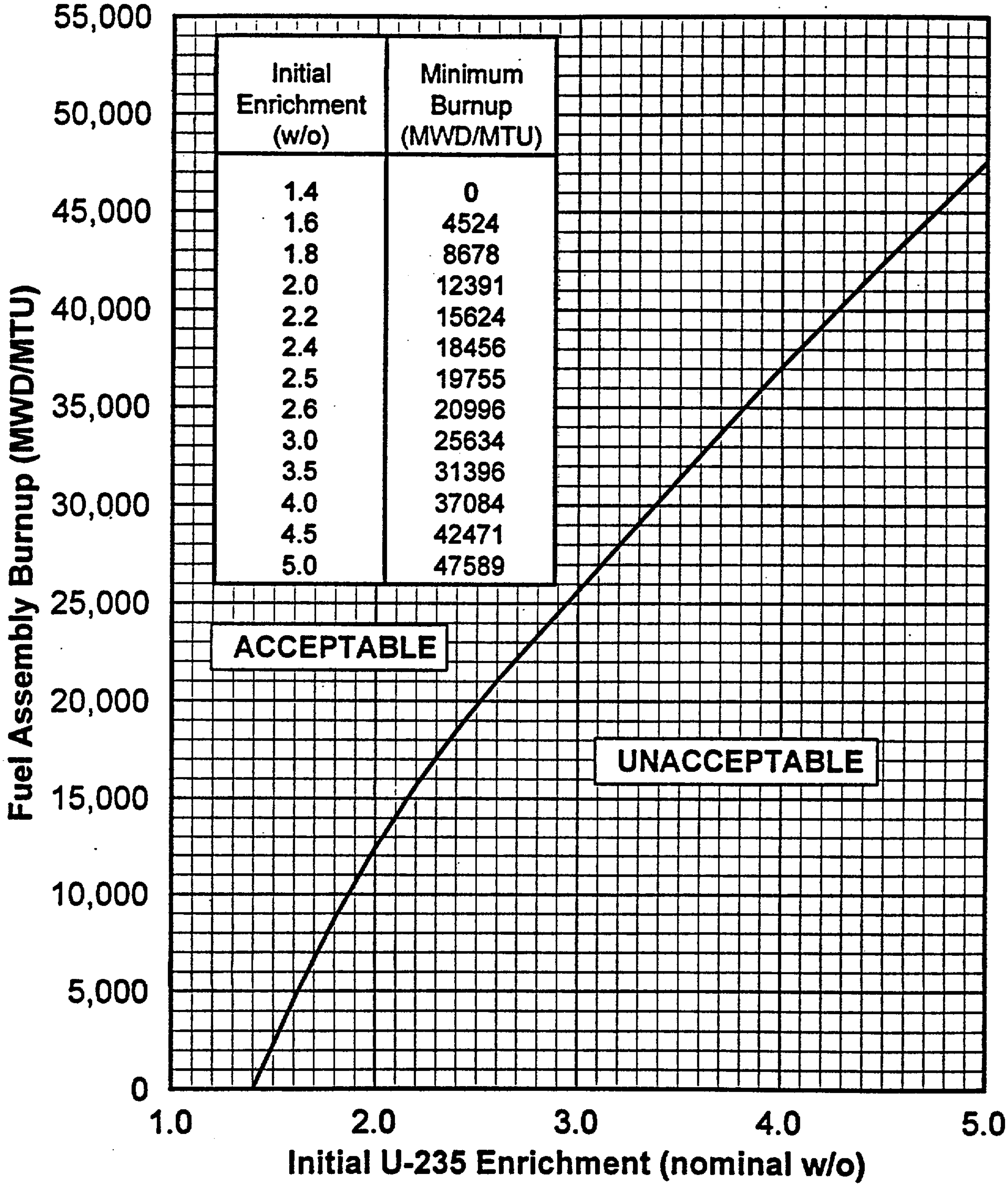
Minimum Burnup for Category 7 Fuel
Region 2



Initial Enrichment (w/o)	Minimum Burnup (MWD/MTU)
1.65	0
1.8	4366
2.0	9594
2.2	14013
2.4	17546
2.5	19045
2.6	20392
3.0	25096
3.5	31083
4.0	37157
4.5	42826
5.0	48158

Figure 5.6-8

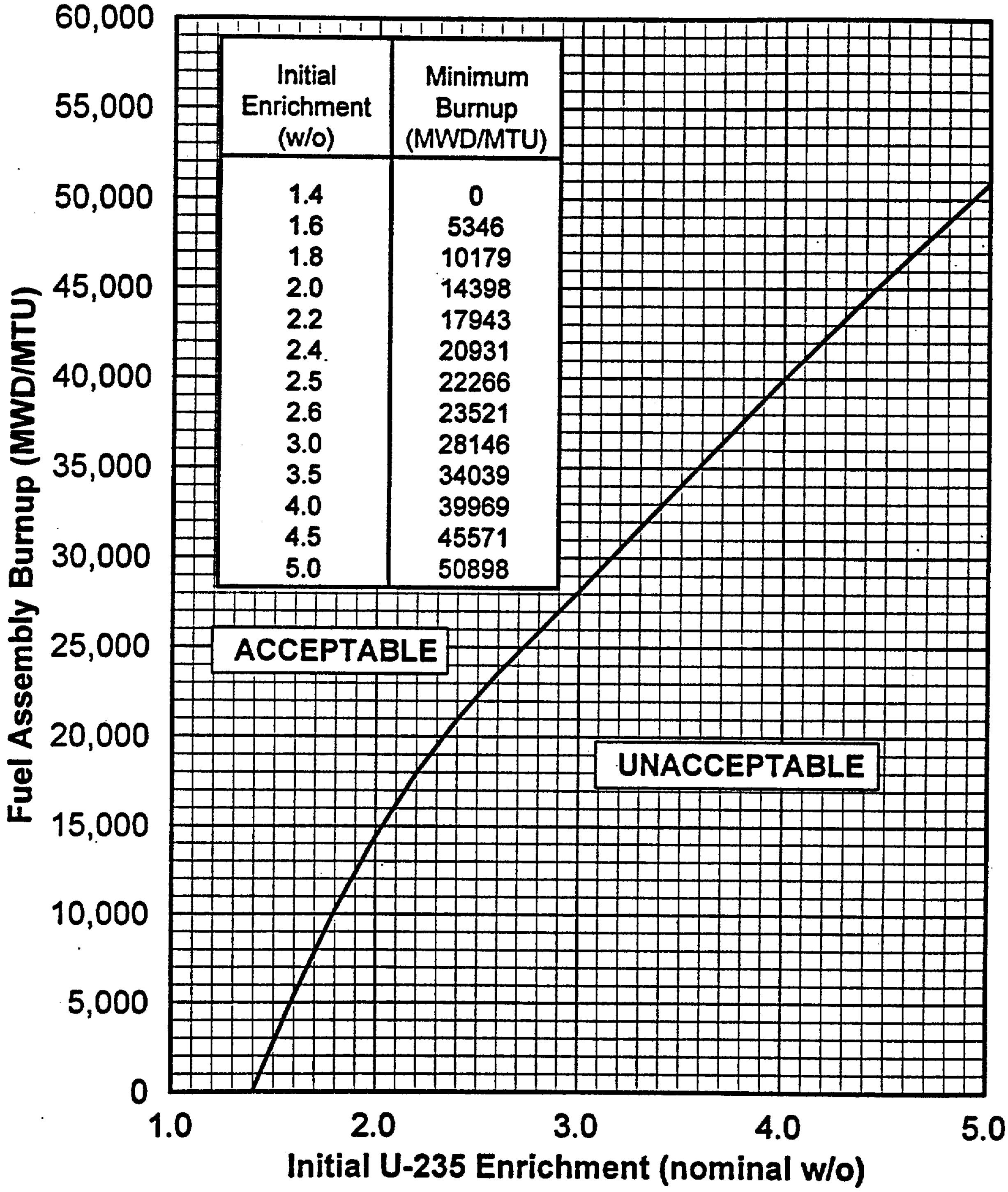
Minimum Burnup for Category 8 Fuel
Region 2



Initial Enrichment (w/o)	Minimum Burnup (MWD/MTU)
1.4	0
1.6	4524
1.8	8678
2.0	12391
2.2	15624
2.4	18456
2.5	19755
2.6	20996
3.0	25634
3.5	31396
4.0	37084
4.5	42471
5.0	47589

Figure 5.6-9

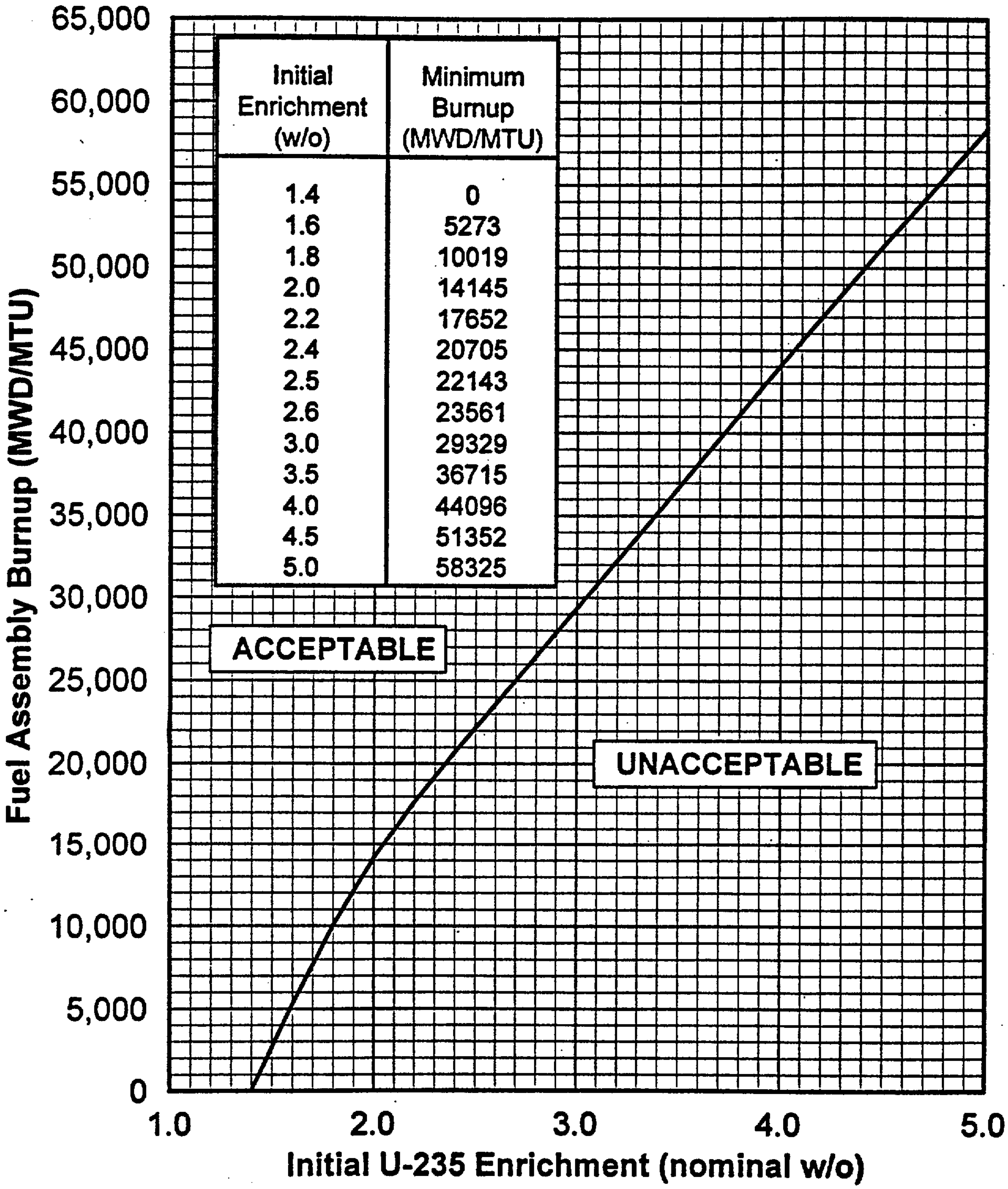
Minimum Burnup for Category 9 Fuel
Region 2



Initial Enrichment (w/o)	Minimum Burnup (MWD/MTU)
1.4	0
1.6	5346
1.8	10179
2.0	14398
2.2	17943
2.4	20931
2.5	22266
2.6	23521
3.0	28146
3.5	34039
4.0	39969
4.5	45571
5.0	50898

Figure 5.6-10

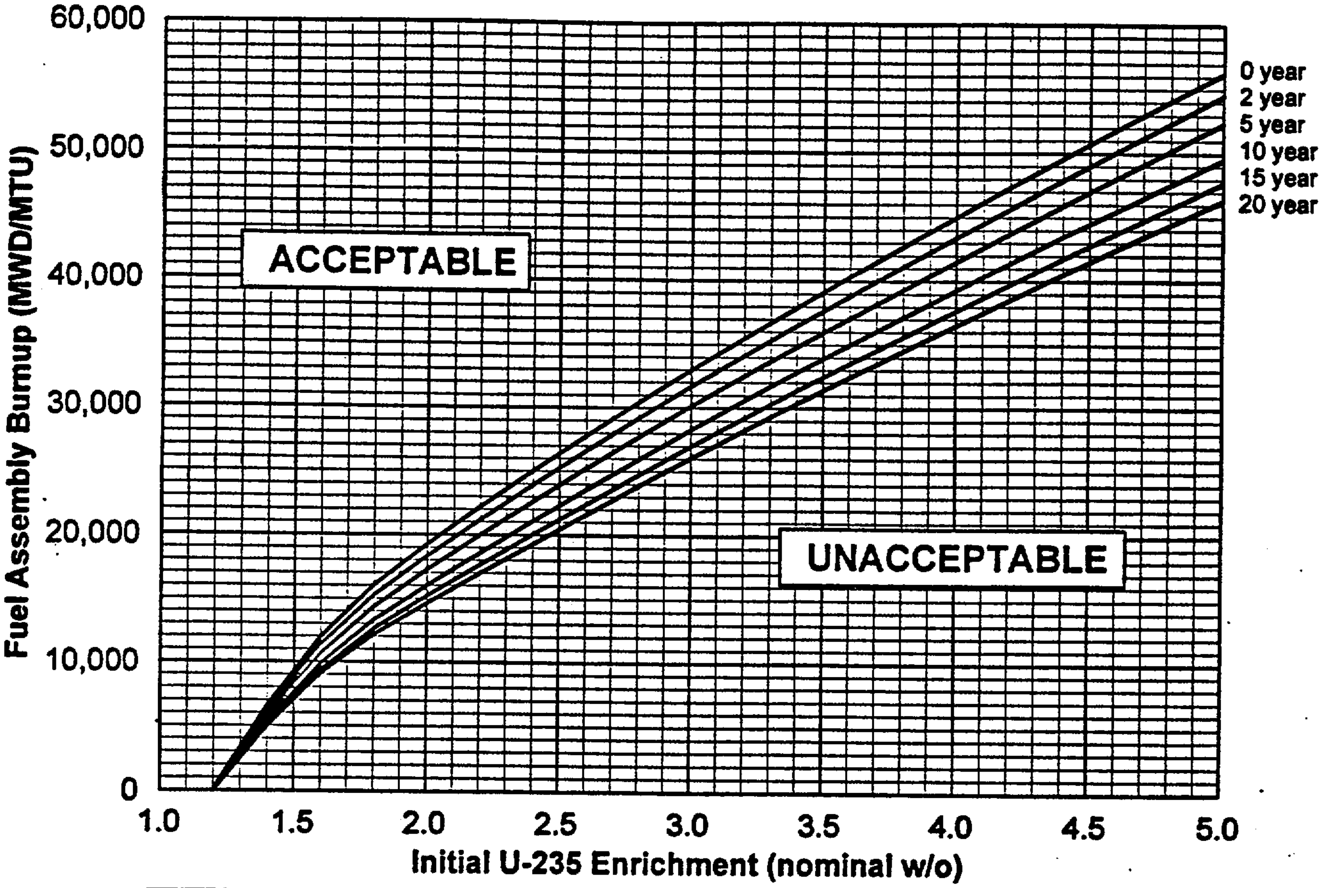
Minimum Burnup for Category 10 Fuel
Region 1



Initial Enrichment (w/o)	Minimum Burnup (MWD/MTU)
1.4	0
1.6	5273
1.8	10019
2.0	14145
2.2	17652
2.4	20705
2.5	22143
2.6	23561
3.0	29329
3.5	36715
4.0	44096
4.5	51352
5.0	58325

Figure 5.6-11

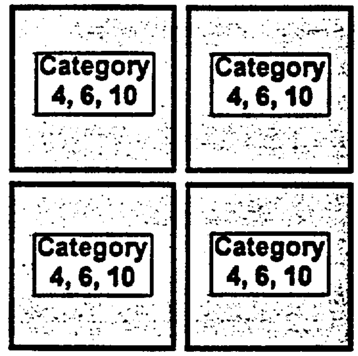
Minimum Burnup for Category 11 Fuel
Region 2



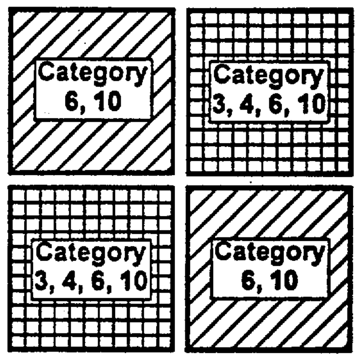
Initial Enrichment (w/o)	Minimum Burnup (MWD/MTU)					
	0 year	2 year	5 year	10 year	15 year	20 year
1.2	0	0	0	0	0	0
1.4	6533	6188	5807	5384	5113	4937
1.6	11912	11298	10613	9843	9347	9018
1.8	16021	15221	14313	13282	12606	12149
2.0	19209	18285	17221	15992	15177	14611
2.2	22150	21130	19939	18543	17609	16952
2.4	24988	23888	22590	21050	20012	19276
2.6	27732	26563	25173	23507	22377	21574
2.8	30389	29156	27686	25912	24700	23838
3.0	32967	31669	30126	28260	26973	26057
3.2	35474	34107	32495	30550	29192	28226
3.4	37919	36481	34803	32787	31363	30348
3.6	40314	38807	37064	34981	33493	32432
3.8	42669	41098	39291	37138	35591	34485
4.0	44995	43368	41499	39267	37664	36514
4.2	47300	45629	43697	41374	39718	38525
4.4	49582	47878	45885	43459	41753	40518
4.6	51838	50112	48056	45519	43765	42489
4.8	54065	52325	50208	47550	45753	44437
5.0	56259	54513	52336	49551	47713	46358

Figure 5.6-12

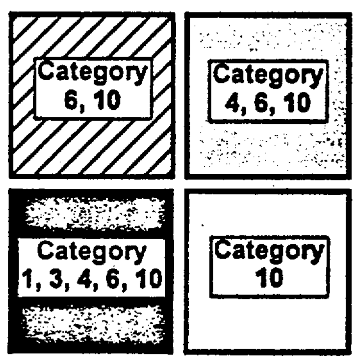
Region 1 All Cell



Region 1 Checkerboard #1



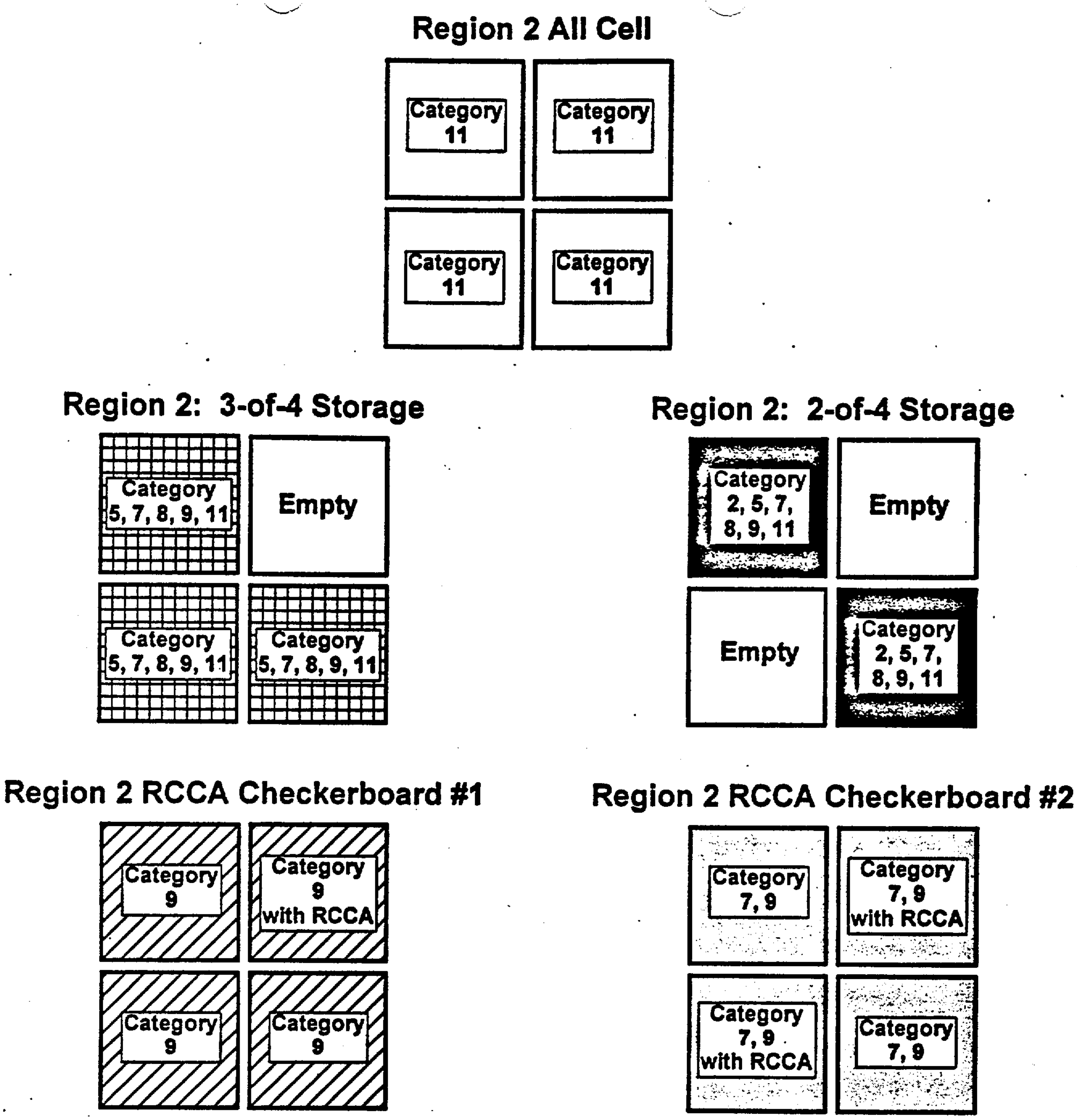
Region 1 Checkerboard #2



Note: These configurations can be rotated (90°, 180°, 270°) provided that configuration interface requirements are satisfied.

Allowable Fuel Categories for Region 1 Configurations

Figure 5.6-13



Note 1: Category 8 and 9 fuel can be substituted for any and all Category 11 fuel at the periphery of region 2. The periphery includes: cell locations next to the spent fuel pool wall, or cell locations separated from Region 1 by one row of empty cells.

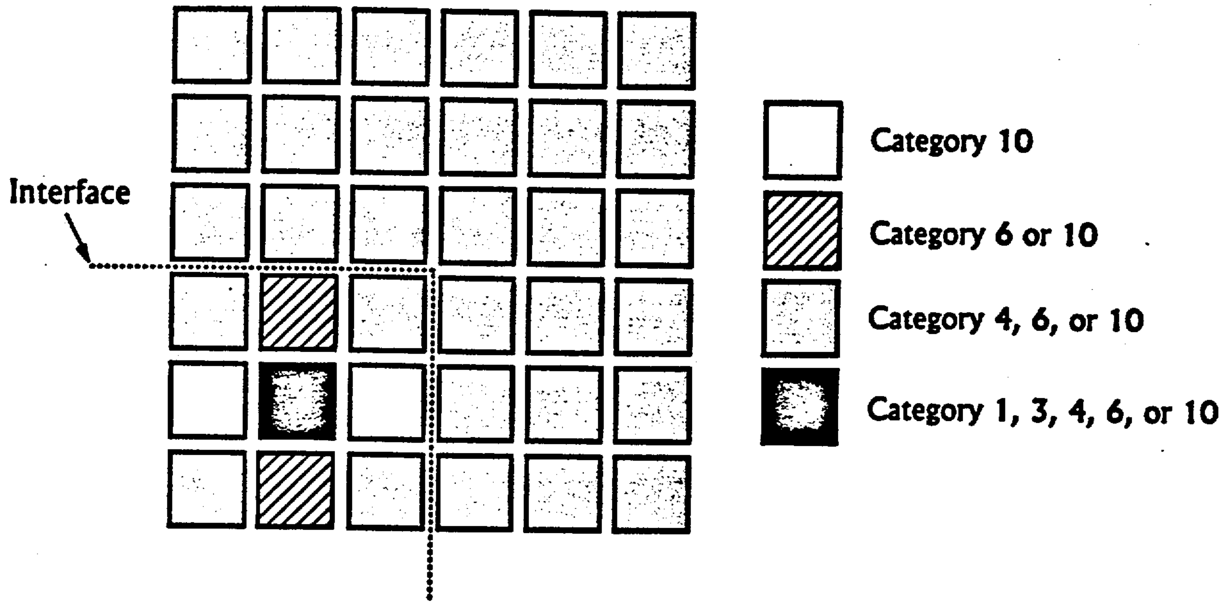
Note 2: See Technical Specification 5.6.1.4 for provisions for storing non-fissile items in empty cells.

Note 3: These configurations can be rotated (90°, 180°, 270°) provided that configuration interface requirements are satisfied.

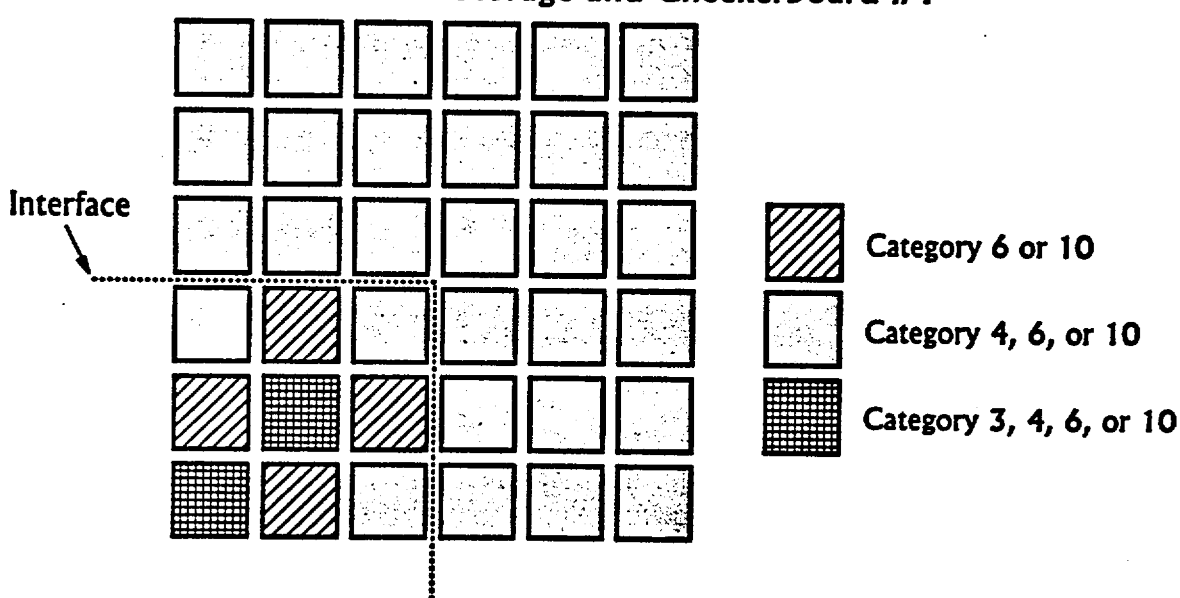
Allowable Fuel Categories for Region 2 Configurations

Figure 5.6-14

Region 1 Boundary Between All Cell Storage and Checkerboard #2



Region 1 Boundary Between All Cell Storage and Checkerboard #1

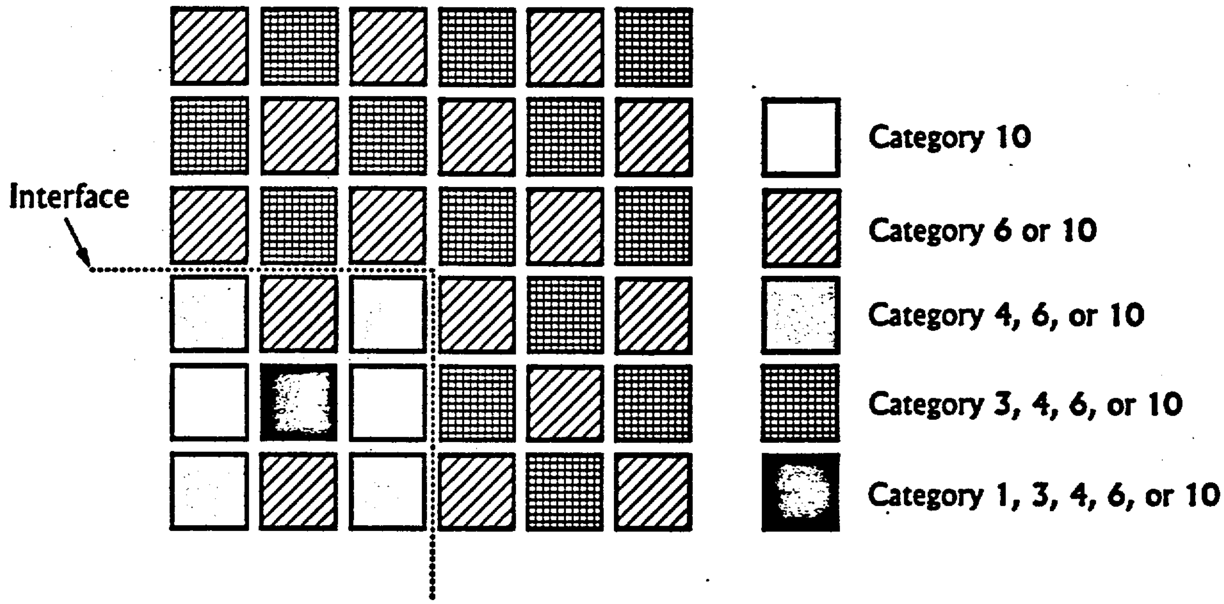


Note:

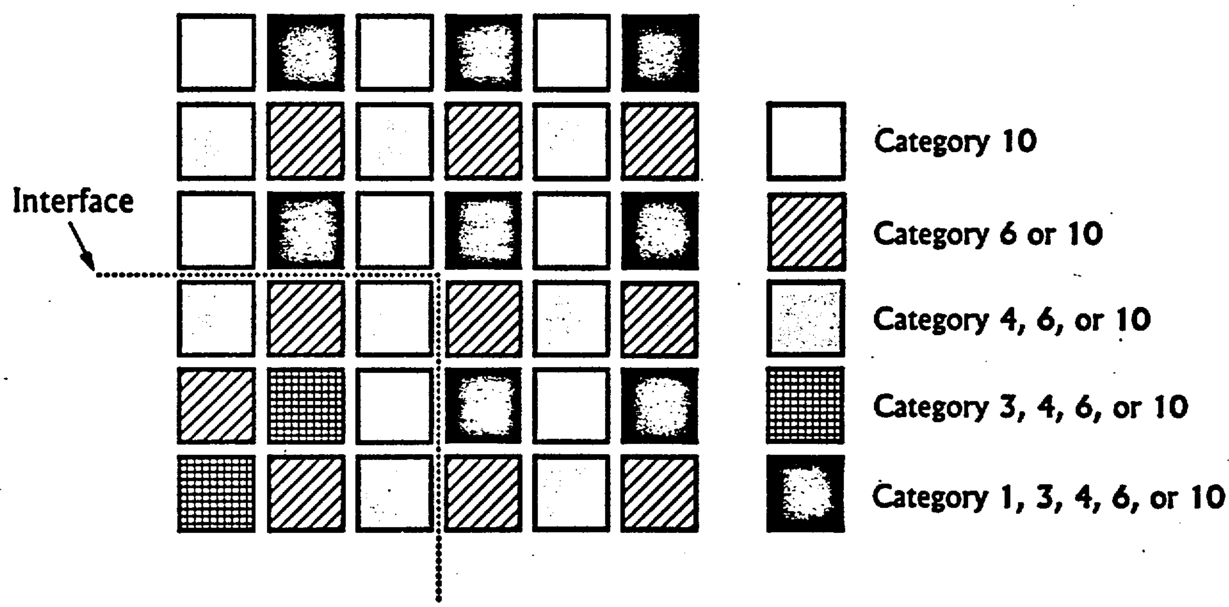
1. A row of empty cells can be used at the interface to seperate the configurations.
2. It is acceptable to replace an assembly with an empty cell.
3. See Specification 5.6.1.3 for provisions for storing non-fissile material in empty cells.

Figure 5.6-15

Region 1 Boundary Between Checkerboard #1 and Checkerboard #2



Region 1 Boundary Between Checkerboard #2 and Checkerboard #1

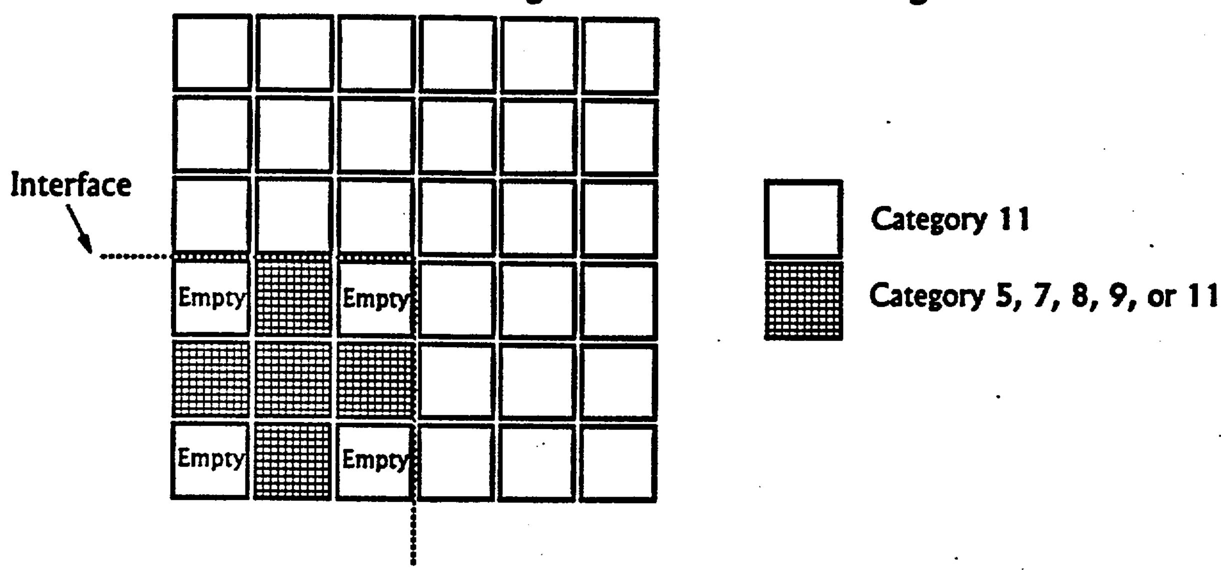


Note:

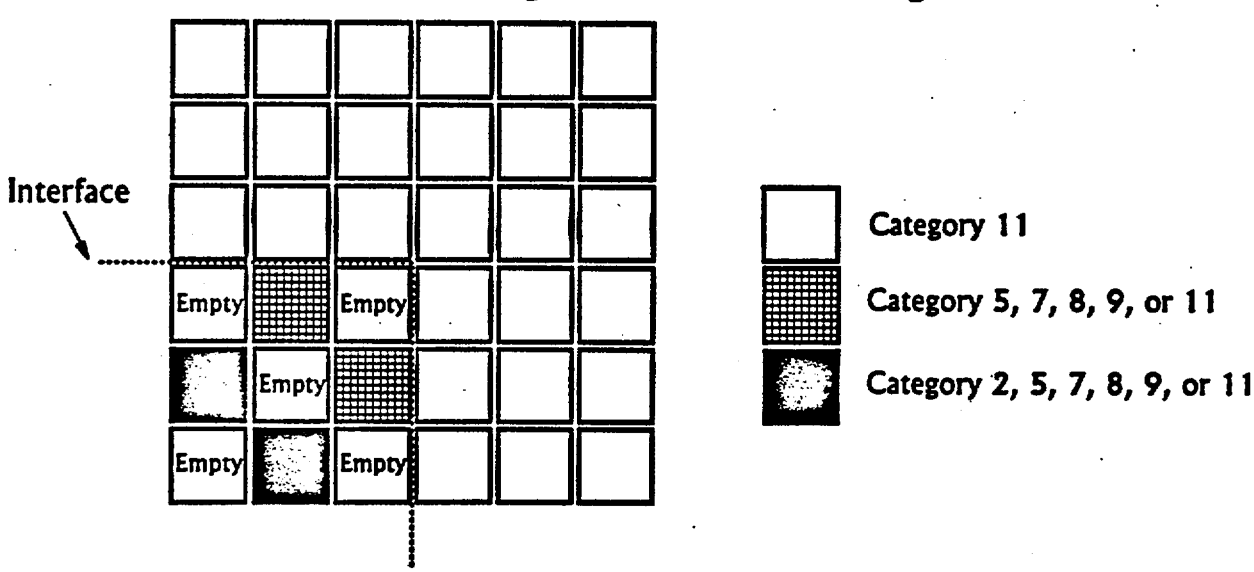
1. A row of empty cells can be used at the interface to seperate the configurations.
2. It is acceptable to replace an assembly with an empty cell.
3. See Specification 5.6.1.3 for provisions for storing non-fissile material in empty cells.

Figure 5.6-16

Region 2 Boundary Between All Cell Storage and 3-out-of-4 Storage



Region 2 Boundary Between All Cell Storage and 2-out-of-4 Storage

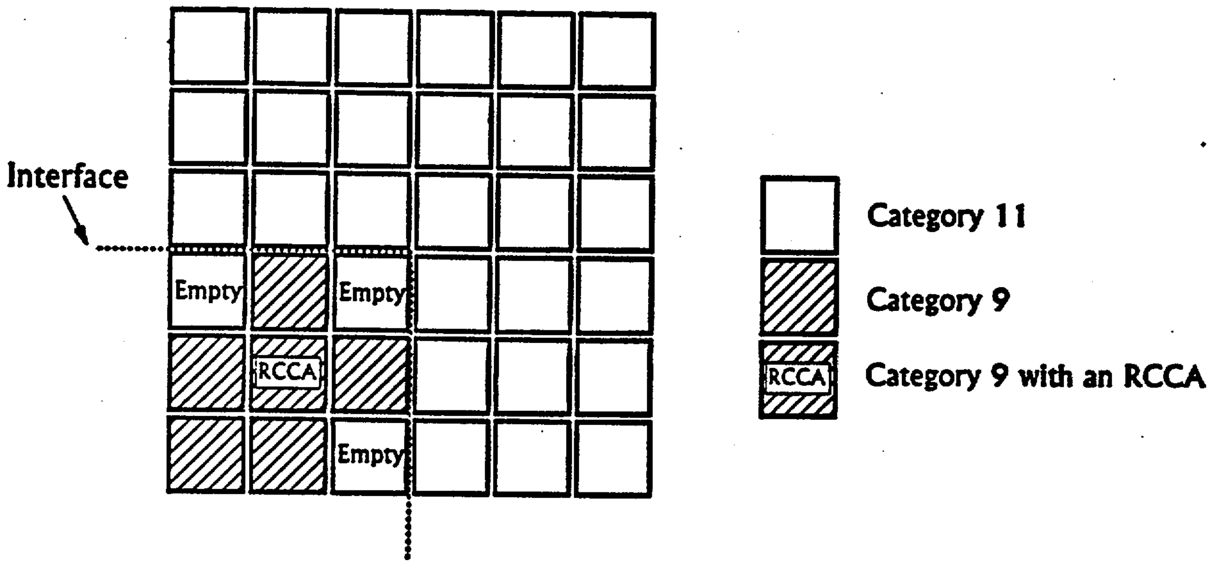


Note:

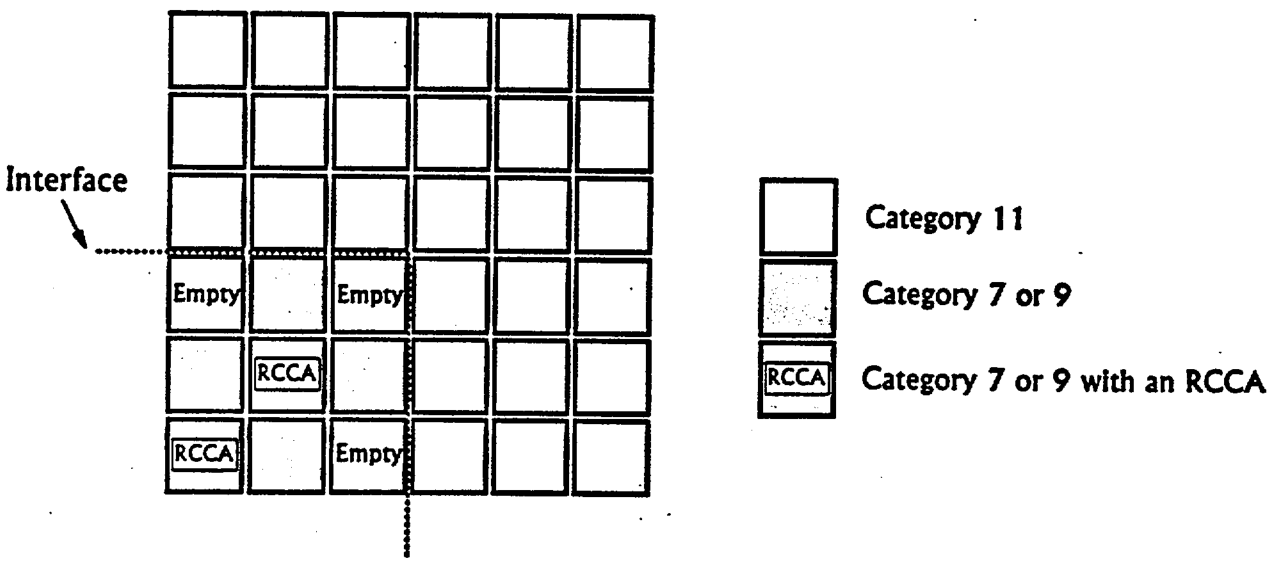
1. A row of empty cells can be used at the interface to seperate the configurations.
2. It is acceptable to replace an assembly with an empty cell.
3. See Specification 5.6.1.4 for provisions for storing non-fissile material in empty cells.

Figure 5.6-17

Region 2 Boundary Between All Cell Storage and RCCA Checkerboard #1



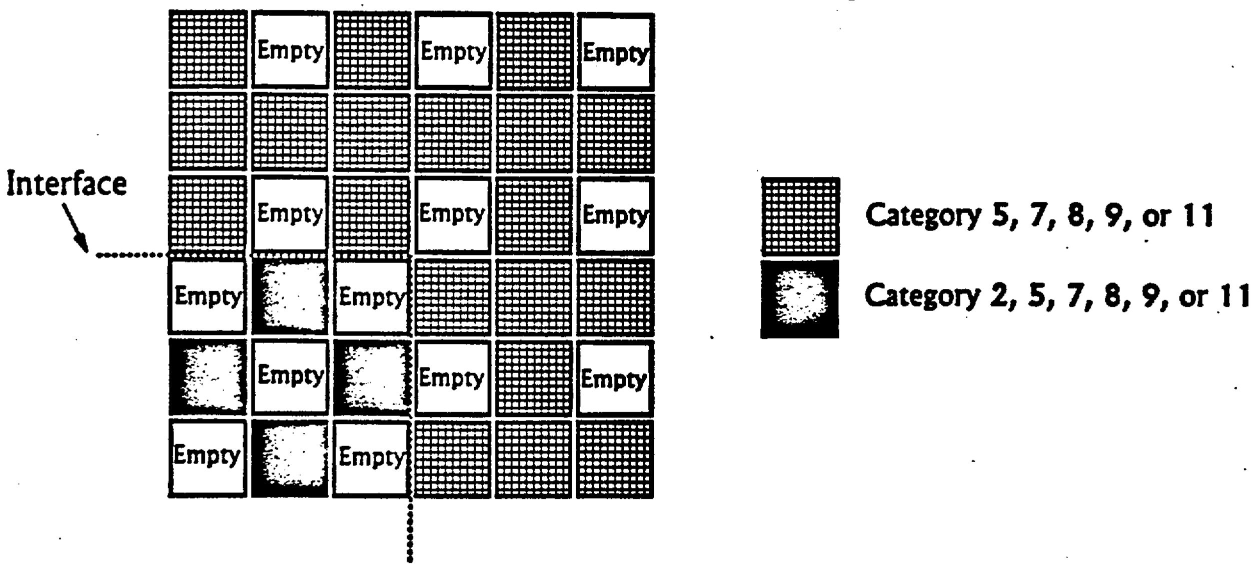
Region 2 Boundary Between All Cell Storage and RCCA Checkerboard #2



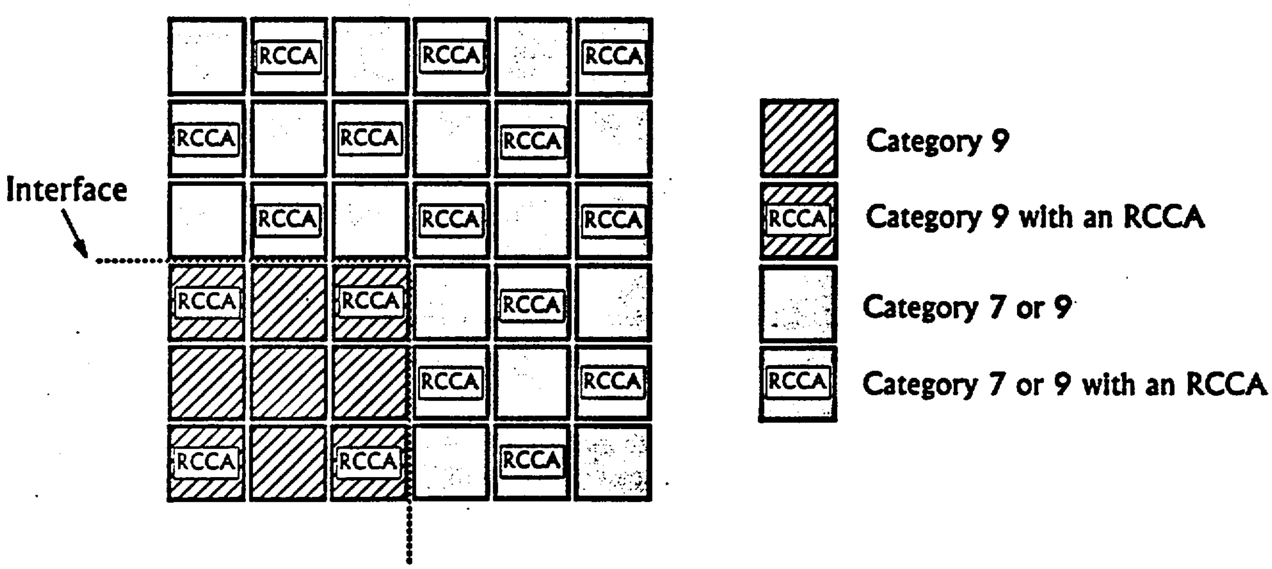
Note:
1. A row of empty cells can be used at the interface to seperate the configurations.
2. It is acceptable to replace an assembly with an empty cell.
3. See Specification 5.6.1.4 for provisions for storing non-fissile material in empty cells.

Figure 5.6-18

Region 2 Boundary Between 2-out-of-4 and 3-out-of-4 Storage



Region 2 Boundary Between RCCA Checkerboard Storage Patterns

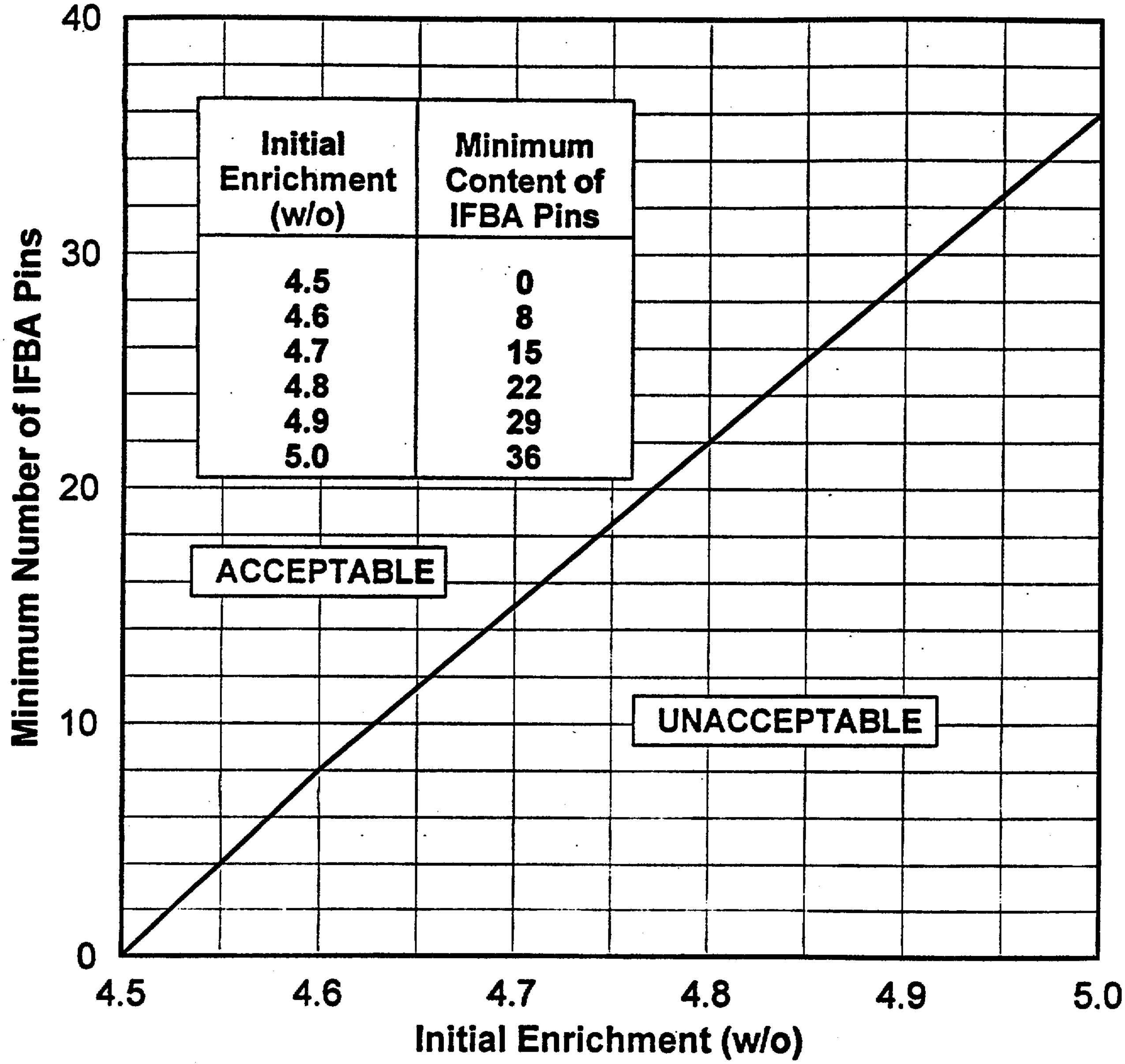


Note:

1. A row of empty cells can be used at the interface to seperate the configurations.
2. It is acceptable to replace an assembly with an empty cell.
3. See Specification 5.6.1.4 for provisions for storing non-fissile material in empty cells.

Figure 5.6-19

Minimum IFBA Content for In-Containment Rack Fuel Storage



Assemblies with an initial enrichment less than 4.5 w/o are ACCEPTABLE

Figure 5.6-20

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.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 104 AND 91 TO

FACILITY OPERATING LICENSE NOS. NPF-76 AND NPF-80

STP NUCLEAR OPERATING COMPANY

DOCKET NOS. 50-498 AND 50-499

SOUTH TEXAS PROJECT, UNITS 1 AND 2

1.0 INTRODUCTION

By application dated July 7, 1998, as supplemented by letters dated October 15 and October 26, 1998, STP Nuclear Operating Company, et al., (STPNOC, the licensee) requested changes to the Technical Specifications (TSs) (Appendix A to Facility Operating License Nos. NPF-76 and NPF-80) for the South Texas Project, Units 1 and 2 (STP). The proposed changes would revise the spent fuel pool criticality analysis and rack utilization schemes by allowing credit for spent fuel pool soluble boron.

The October 15 and October 26, 1998, and February 16, 1999, supplements provide clarifying information and corrected administrative errors, and did not change the initial no significant hazards consideration determination.

2.0 CRITICALITY ANALYSIS

2.1 Discussion

In a letter of July 7, 1998 (Ref. 1), supplemented by letter of October 15, 1998 (Ref. 2), STPNOC requested changes to the STP TSs to allow the use of credit for soluble boron in the spent fuel pool criticality analyses. These criticality analyses were performed using the methodology developed by the Westinghouse Owners Group (WOG) and described in WCAP-14416-NP-A, "Westinghouse Spent Fuel Rack Criticality Analysis Methodology," (Ref. 3).

The staff's evaluation of the criticality aspects of the proposed TS changes follows.

2.2 Evaluation

The STP spent fuel storage racks were analyzed using the Westinghouse methodology, which has been reviewed and approved by the Nuclear Regulatory Commission (NRC) (Ref. 3). This methodology takes partial credit for soluble boron in the fuel storage pool criticality analyses and requires conformance with the following NRC acceptance criteria for preventing criticality outside the reactor:

1) k_{eff} shall be less than 1.0 if fully flooded with unborated water, which includes an allowance for uncertainties at a 95% probability, 95% confidence (95/95) level as described in WCAP-14416-NP-A; and

2) k_{eff} shall be less than or equal to 0.95 if fully flooded with borated water, which includes an allowance for uncertainties at a 95/95 level as described in WCAP-14416-NP-A.

The analysis of the reactivity effects of fuel storage in the STP spent fuel racks was performed with the three-dimensional Monte Carlo code, KENO-Va, with neutron cross sections generated with the NITAWL-II and XSDRNPM-S codes using the 227 group ENDF/B-V cross-section data. Since the KENO-Va code package does not have burnup capability, depletion analyses and the determination of small reactivity increments due to manufacturing tolerances were made with the two-dimensional transport theory code, PHOENIX-P, which uses a 42 energy group nuclear data library from ENDF/B-V data. The analytical methods and models used in the reactivity analysis have been benchmarked against experimental data for fuel assemblies similar to those for which the STP racks are designed and have been found to adequately reproduce the critical values. This experimental data is sufficiently diverse to establish that the method bias and uncertainty will apply to rack conditions which include close proximity storage and strong neutron absorbers. The staff concludes that the analysis methods used are acceptable and capable of predicting the reactivity of the STP storage racks with a high degree of confidence.

The STP spent fuel pool contains two types of storage racks. The Region 1 racks were designed to use Boraflex panels in a removable stainless steel box to absorb neutrons. The Region 2 racks were fabricated by trapping Boraflex panels between the cell walls. The STP spent fuel storage racks have previously been qualified for storage of various Westinghouse 17x17XL fuel assembly types with maximum enrichments up to 5.0 weight percent (w/o) U-235. The maximum enrichment is based on a nominal value of 4.95 w/o U-235 plus a manufacturing tolerance of 0.05. The spent fuel rack Boraflex absorber panels were considered in this previous analysis. Because of concerns with the Boraflex deterioration that has been observed in many spent fuel pools, the STP spent fuel storage racks in Regions 1 and 2 have been reanalyzed neglecting the presence of Boraflex to allow storage of all 17x17XL fuel assemblies with nominal enrichments up to 4.95 w/o U-235 using credit for checkerboarding, burnup, burnable absorbers, and soluble boron. Also, because of concerns with the spent fuel pool silica levels resulting from Boraflex degradation, STPNOC has stated that they may decide to physically remove the Boraflex, and the stainless steel water box inserts upon which the Boraflex panels are mounted, from the Region 1 racks. Therefore, the criticality analysis has been performed for the Region 1 racks both with and without the steel water box insert. Since removal of the water box insert would decrease the amount of neutron capture in this area and therefore increase the reactivity, the results from these cases bound the results from the cases with the water boxes included and were used in the TS revisions, thereby allowing either configuration.

The moderator was assumed to be pure water at a temperature of 68°F and a density of 1.0 gm/cc and the array was assumed to be infinite in lateral (x and y) extent. Uncertainties due to tolerances in fuel enrichment and density, storage cell inner diameter, storage cell pitch, stainless steel thickness, assembly position, calculational uncertainty, and methodology bias uncertainty were accounted for. These uncertainties were appropriately determined at the 95/95 probability/confidence level. A methodology bias (determined from benchmark calculations) as well as a reactivity bias to account for the effect of the normal range of spent fuel pool water temperatures (50°F to 160°F) were included. These biases and uncertainties meet the previously stated NRC requirements and are, therefore, acceptable.

For Region 1, the nominal enrichment required to maintain k_{eff} less than 1.0 with all cells filled with Westinghouse 17x17XL fuel assemblies and no soluble boron in the pool water was found to be 2.50 w/o U-235 (Category 4 fuel as defined by TS 5.6.1.2). This resulted in a nominal k_{eff} of 0.97070. The 95/95 k_{eff} was then determined by adding the temperature and methodology biases and the statistical sum of independent tolerances and uncertainties to the nominal k_{eff} values, as described in Reference 2. This resulted in a 95/95 k_{eff} of 0.99660. Since this value is less than 1.0 and was determined at a 95/95 probability/confidence level, it meets the NRC criterion for precluding criticality with no credit for soluble boron and is acceptable.

Soluble boron credit is used to provide safety margin by maintaining k_{eff} less than or equal to 0.95 including 95/95 uncertainties. The soluble boron credit calculations assumed the all cell storage configuration moderated by water borated to 200 ppm. As previously described, the individual tolerances and uncertainties, and the temperature and methodology biases, were added to the calculated nominal k_{eff} to obtain a 95/95 value. The resulting 95/95 k_{eff} was 0.94579 for fuel enriched to 2.50 w/o U-235. Since k_{eff} is less than 0.95 with 200 ppm of boron and uncertainties at a 95/95 probability/confidence level, the NRC acceptance criterion for precluding criticality is satisfied. The required amount of soluble boron is well below the minimum spent fuel pool boron concentration value of 2500 ppm required by TS 3.9.13 and is, therefore, acceptable.

The concept of reactivity equivalencing due to fuel burnup was used to achieve the storage of fuel assemblies with enrichments higher than 2.50 w/o U-235 for the all cell storage configuration. The NRC has previously accepted the use of reactivity equivalencing predicated upon the reactivity decrease associated with fuel depletion. To determine the amount of soluble boron required to maintain $k_{eff} \leq 0.95$ for storage of fuel assemblies with maximum enrichments up to 5.0 w/o U-235, a series of reactivity calculations were performed to generate a set of enrichment versus fuel assembly discharge burnup ordered pairs which all yield an equivalent k_{eff} when stored in the STP spent fuel storage racks. These are shown in TS Figure 5.6-4 and represent combinations of fuel enrichment and discharge burnup which yield the same rack k_{eff} as the rack loaded with 2.50 w/o fuel (at zero burnup). Uncertainties associated with burnup credit include a reactivity uncertainty of 0.01 Δk at 30,000 MWD/MTU applied linearly to the burnup credit requirement to account for calculational and depletion uncertainties and 5% on the calculated burnup to account for burnup measurement uncertainty. The NRC staff concludes that these uncertainties conservatively reflect the uncertainties associated with burnup calculations and are acceptable. The amount of additional soluble boron, above the 200 ppm value required above, that is needed to account for these uncertainties is 300 ppm. This results in a total soluble boron credit of 500 ppm for the all cell configuration. This is well below the minimum spent fuel pool boron concentration value of 2500 ppm required by TS 3.9.13 and is, therefore, acceptable.

Storage of assemblies with enrichments higher than 2.50 w/o U-235 in the all cell storage configuration was also determined by crediting the reactivity decrease associated with the addition of integral fuel burnable absorbers (IFBAs). IFBAs consist of neutron absorbing material applied as a thin ZrB_2 coating on the outside of the UO_2 pellet. As with burnup credit, for IFBA credit reactivity equivalencing, a series of reactivity calculations are performed to generate a set of IFBA rod number versus initial enrichment ordered pairs which all yield the equivalent k_{eff} when the fuel is stored in the all cell configuration analyzed for the STP spent fuel racks as shown in TS Figure 5.6-5. Uncertainties associated with IFBA credit include a 5% manufacturing tolerance and a 10% calculational uncertainty on the B-10 loading of the IFBA rods. The staff finds these uncertainties adequately conservative and acceptable. The amount of additional soluble boron needed to account for these uncertainties is the same as the 300 ppm required for burnup credit.

Therefore, with the above reactivity equivalencing, fuel assemblies with maximum enrichments up to 5.0 w/o U-235 can be stored in all Region 1 cell locations by taking credit for a total additional amount of soluble boron of 300 ppm. When added to the 200 ppm required without reactivity equivalencing, this results in a total boron requirement of 500 ppm. This is well below the minimum spent fuel pool boron concentration value of 2500 ppm required by TS 3.9.13 and is, therefore, acceptable.

In a similar fashion, criticality analyses were performed for a two separate Region 1 checkerboard storage configurations. The first configuration (Checkerboard #1) consisted of 17x17XL fuel assemblies in a 2x2 checkerboard arrangement containing fuel assemblies in two diagonally adjacent cells with an initial, nominal enrichment no greater than 1.70 w/o U-235 (Category 6) and fuel assemblies in the two remaining cells with a nominal enrichment no greater than 3.55 w/o U-235 (Category 3). Fuel assemblies with enrichments greater than these values may be stored in the Region 1 Checkerboard #1 arrangement if they satisfy the minimum burnup requirements given in TS Figures 5.6-7 and 5.6-2 for Category 6 and Category 3 fuel, respectively, or if the Category 3 fuel contains a minimum number of IFBAs as given in TS Figure 5.6-3. The soluble boron concentration that results in $k_{eff} \leq 0.95$ was calculated to be 300 ppm.

The second Region 1 checkerboard configuration (Checkerboard #2) consisted of 17x17XL fuel assemblies in a 2x2 checkerboard arrangement containing assemblies in two diagonally adjacent cells with an initial, nominal enrichment no greater than 1.40 w/o U-235 (Category 10) and 1.70 w/o U-235 (Category 6) respectively, an assembly in one remaining cell with an initial, nominal enrichment no greater than 2.50 w/o U-235 (Category 4) and an assembly in the remaining cell with a nominal enrichment no greater than 4.95 w/o U-235 (Category 1). Fuel assemblies with enrichments greater than these values may be stored in the Region 1 Checkerboard #2 configuration if they satisfy the minimum burnup requirements given in TS Figures 5.6-11, 5.6-7, and 5.6-4 for Category 10, 6, or 4 fuel, respectively, or if the Category 4 fuel contains the minimum number of IFBAs given in TS Figure 5.6-5. The soluble boron concentration that results in $k_{eff} \leq 0.95$ was calculated to be 400 ppm.

The criticality analysis for Region 2 fuel storage showed that 17x17XL assemblies with initial nominal enrichments no greater than 1.20 w/o U-235 (Category 11) can be stored in all cell locations. Fuel assemblies with enrichments greater than this may be stored in all cells if they satisfy the minimum burnup requirements of TS Figure 5.6-12. The Figure also credits the time an assembly has been discharged from the core. Decay time credit is an extension of the burnup credit process and results from the radioactive decay of isotopes in the spent fuel to daughter isotopes, which results in reduced reactivity. Although decay of the fission products has the effect of further reducing the reactivity of the spent fuel, in this amendment request, credit is taken only for the decay of actinides. Decay time credit has been previously approved by the NRC (Ref. 4). Calculations were also performed to assess the impact of loading a slightly higher enriched assembly in the peripheral cells (next to the pool wall or separated from Region 1 fuel by an empty row). For fuel assemblies on the periphery of the Region 2 racks, storage of 17x17XL assemblies with an initial nominal enrichment no greater than 1.40 w/o U-235 (Category 2) or which meet the burnup requirements of TS Figure 5.6-9 was found to be acceptable. The soluble boron concentration that results in $k_{eff} \leq 0.95$ was calculated to be 700 ppm.

A 3-out-of-4 checkerboard storage arrangement with an empty cell was analyzed for the Region 2 racks. Three assemblies with initial nominal enrichment no greater than 1.70 w/o

U-235 (Category 5) can occupy any 2x2 matrix with the fourth cell vacant. Higher enriched assemblies must meet the burnup requirements given in TS Figure 5.6-6. The soluble boron concentration that results in $k_{eff} \leq 0.95$ was calculated to be 550 ppm.

A 2-out-of-4 checkerboard storage arrangement with empty cells was analyzed for the Region 2 racks. Two assemblies with initial nominal enrichment no greater than 4.85 w/o U-235 (Category 2) can be stored corner adjacent in a 2x2 matrix with the other two cells vacant. The soluble boron concentration that results in $k_{eff} \leq 0.95$ was calculated to be 300 ppm.

Two additional storage configurations were analyzed for Region 2 taking credit for silver-indium-cadmium (Ag-In-Cd) or hafnium (Hf) rod cluster control assembly (RCCA). STP Units 1 and 2 have used both Ag-In-Cd and Hf RCCA absorber material. Since the Hf RCCAs provide slightly less reactivity holddown than the Ag-In-Cd RCCAs, the Hf RCCAs were used in the criticality analysis for conservatism. In addition, the staff concludes that a conservative allowance for the reactivity worth of the RCCA absorber material was assumed by depleting the full length of the RCCA for 60,000 MWD/MTU exposure. Credit for added absorber (rods, plates, or other configurations) has been allowed by the NRC provided it can be clearly demonstrated that design features prevent such absorbers from being removed, either inadvertently or intentionally, without unusual effort such as the necessity for special equipment maintained under positive administrative control. In response to a staff request for additional information, STPNOC stated that special equipment, i.e., the RCCA Change Tool, is required in order to move RCCAs in the spent fuel pool (Ref. 2). Operation of this tool requires a unique electrical power cord and an instrument air line with regulator. Authorization to use this equipment is controlled by the Core Loading Supervisor during refueling outages, or by the Shift Supervisor at all other times. Based on this, the staff concludes that special equipment, which is maintained under positive administrative control, is necessary in order to remove any inserted RCCAs. Therefore, the use of RCCAs for reactivity holddown in these fuel assemblies is acceptable.

Storage of 17x17XL fuel assemblies with an initial nominal enrichment of no greater than 1.40 w/o U-235 (Category 9) was analyzed for a 2x2 checkerboard where one of the four assemblies contains a Ag-In-Cd or Hf RCCA (RCCA #1 Checkerboard). Higher enriched assemblies must meet the burnup requirements of TS Figure 5.6-10. The soluble boron concentration that results in $k_{eff} \leq 0.95$ was calculated to be 650 ppm.

The final Region 2 analyzed storage configuration was for 17x17XL assemblies with initial nominal enrichment no greater than 1.65 w/o U-235 (Category 7) in a 2x2 checkerboard where two of the diagonally adjacent assemblies contain a Ag-In-Cd or Hf RCCA (RCCA #2 Checkerboard). Higher enriched assemblies must satisfy the burnup requirements of TS Figure 5.6-8. The soluble boron concentration that results in $k_{eff} \leq 0.95$ was calculated to be 700 ppm.

Based on the above analyzed storage configurations, the maximum required total soluble boron (700 ppm) occurs for both the Region 2 all cell storage and the Region 2 RCCA #2 Checkerboard patterns.

Although most accidents will not result in a reactivity increase, three accidents can be postulated for each storage configuration which would increase reactivity beyond the analyzed conditions. The first would be a loss of fuel pool cooling system and a rise in pool water temperature from 160°F to 240°F. The second would be dropping an assembly into an already loaded cell. The third accident would be a misload of an assembly into a cell for which the restrictions on location, enrichment, or burnup are not satisfied.

Calculations have shown that the misload assembly accident for a 2-out-of-4 checkerboard configuration results in the highest reactivity increase. The reactivity increase requires an additional 1800 ppm of soluble boron to maintain $k_{eff} \leq 0.95$. However, for such events, the double contingency principle can be applied. This states that the assumption of two unlikely, independent, concurrent events is not required to ensure protection against a criticality accident. Therefore, the minimum amount of boron required by TS 3.9.13 (2500 ppm) is more than sufficient to cover any accident and the presence of the additional boron above the concentration required for normal conditions and reactivity equivalencing (700 ppm maximum) can be assumed as a realistic initial condition since not assuming its presence would be a second unlikely event.

In order to prevent an undesirable increase in reactivity, the boundaries between the different storage configurations were analyzed. The boundary between checkerboard zones and the boundary between a checkerboard zone and an all cell storage region must be controlled to prevent an undesirable increase in reactivity. The fuel storage patterns used within Region 1 must comply with the interface requirements shown in TS Figures 5.6-15 and 5.6-16. Fuel storage patterns used within Region 2 must comply with the interface requirements shown in TS Figures 5.6-17 through 5.6-19. One row of empty water cells must be maintained at the interface between Region 1 and Region 2, and can be positioned in either Region. Non-fissile items can be stored in these empty water cells per the provisions of TS 5.6.1.3.

The TS changes proposed as a result of the revised criticality analysis are consistent with the NRC-approved methodology given in Westinghouse topical report, WCAP-14416-NP-A, Rev. 1, (Ref. 3). Based on this consistency with the approved methodology and on the above evaluation, the staff finds these TS changes acceptable. The proposed associated Bases changes adequately describe these TS changes and are also acceptable.

2.3 <u>Summary</u>

Based on the review described above, the staff finds the criticality aspects of the proposed STP license amendment request are acceptable and meet the requirements of General Design Criterion 62 for the prevention of criticality in fuel storage and handling. The analysis assumed credit for soluble boron, as allowed by WCAP-14416-NP-A, but no credit for the Boraflex neutron absorber panels. The required amount of soluble boron for each analyzed storage configuration is shown in attached Table 1. The criticality analysis conformed to the NRC guidance on the regulatory requirements for criticality analysis of fuel storage at light-water reactor power plants (Ref. 5).

The following storage configurations and U-235 enrichment limits for Westinghouse 17x17XL fuel assemblies were determined to be acceptable:

<u>Region 1</u>

<u>All Cell Storage</u>
Assemblies with initial nominal enrichments no greater than 2.50 w/o U-235 can be stored in any cell location. Fuel assemblies with initial nominal enrichments greater than this and up to 4.95 w/o U-235 must satisfy the minimum burnup requirements shown in TS Fig. 5.6-4 or contain a minimum number of IFBAs as shown in TS Fig. 5.6-5.

Checkerboard #1 Storage
Assemblies can be stored in a 2x2 checkerboard arrangement consisting of two diagonally adjacent fuel assemblies with initial nominal enrichment no greater than 1.70 w/o U-235 and fuel assemblies in the two remaining cells with initial nominal enrichment no greater than 3.55 w/o U-235. Fuel assemblies with initial enrichments greater than this and up to 4.95 w/o U-235 must satisfy the minimum burnup requirement shown in TS Fig. 5.6-7 (1.70 w/o assemblies) or Fig. 5.6-2 (3.55 w/o assemblies) or must satisfy a minimum IFBA requirement as shown in TS Fig. 5.6-3 (3.55 w/o assemblies).

Checkerboard #2 Storage
Assemblies can be stored in a 2x2 checkerboard arrangement consisting of two diagonally adjacent fuel assemblies with initial nominal enrichment no greater than 1.40 w/o and 1.70 w/o U-235, an assembly in one remaining cell with a nominal enrichment no greater than 2.50 w/o U-235, and a fuel assembly in the remaining cell with a nominal enrichment no greater than 4.95 w/o U-235. Fuel assemblies with initial nominal enrichments greater than these and up to 4.95 w/o U-235 must satisfy the minimum burnup requirement shown in TS Figs. 5.6-11 (1.40 w/o assemblies), Fig. 5.6-7 (1.70 w/o assemblies), or Fig. 5.6-4 (2.50 w/o assemblies) or must satisfy a minimum IFBA requirement as shown in TS Fig. 5.6-5 (2.50 w/o assemblies).

Region 2

All Cell Storage
Assemblies with initial nominal enrichments no greater than 1.20 w/o U-235 can be stored in any cell location. Fuel assemblies with initial nominal enrichments greater than this and up to 4.95 w/o U-235 must satisfy the minimum burnup requirements shown in TS Fig. 5.6-12.

Periphery Location Storage
Assemblies with initial nominal enrichments no greater than 1.40 w/o U-235 can be stored on the periphery of the Region 2 rack modules. Fuel assemblies with initial nominal enrichments greater than this and up to 4.95 w/o U-235 must satisfy the minimum burnup requirements shown in TS Fig. 5.6-9.

3-out-of-4 Checkerboard Storage
Assemblies with initial nominal enrichments no greater than 1.70 w/o U-235 can be stored in a 3-out-of-4 checkerboard arrangement with empty cells. This means that no more than three fuel assemblies can occupy any 2x2 matrix of cells. Fuel assemblies with initial nominal enrichments greater than this and up to 4.95 w/o U-235 must satisfy the minimum burnup requirements shown in TS Fig. 5.6-6.

2-out-of-4 Checkerboard Storage
Assemblies with initial nominal enrichments no greater than 4.85 w/o U-235 can be stored in a 2-out-of-4 checkerboard arrangement with empty cells. This means that no two assemblies may be stored face adjacent but must be stored corner adjacent. Fuel assemblies with initial nominal enrichments greater than this and up to 4.95 w/o U-235 must satisfy the minimum burnup requirements shown in TS Fig. 5.6-1.

RCCA #1 Checkerboard Storage
Assemblies with initial nominal enrichments no greater than 1.40 w/o U-235 can be stored in a 2x2 checkerboard arrangement where one of the four assemblies contains a Ag-In-Cd or Hf RCCA. Fuel assemblies with initial enrichments greater than this and up to 4.95 w/o U-235 must satisfy the minimum burnup requirements shown in TS Fig. 5.6-10.

RCCA #2 Checkerboard Storage
Assemblies with initial nominal enrichments no greater than 1.65 w/o U-235 can be stored in a 2x2 checkerboard arrangement where two diagonally adjacent of the four assemblies contain a Ag-In-Cd or Hf RCCA. Fuel assemblies with initial enrichments greater than this and up to 4.95 w/o U-235 must satisfy the minimum burnup requirements shown in TS Fig. 5.6-8.

3.0 BORON DILUTION ANALYSIS

3.1 Discussion

In accordance with the NRC Safety Evaluation (Ref. 6) of the Westinghouse methodology described in WCAP-14416-A, the licensee performed a boron dilution analysis to ensure that sufficient time is available to detect and mitigate the dilution prior to exceeding the 0.95 k_{eff} design basis. The licensee provided a boron dilution analysis on July 7, 1998 (Ref. 1), and supplemental information on October 26, 1998 (Ref. 7). Potential events were quantified to show that sufficient time is available to enable adequate detection and suppression of any dilution event.

3.2 Evaluation

Deterministic dilution event calculations were performed for STP to define the dilution times and volumes necessary to dilute the spent fuel pool from the minimum TS boron concentration of 2500 ppm to a soluble boron concentration of 700 ppm. Because the Unit 1 and Unit 2 spent fuel pools are essentially identical, the analysis applies to both pools. Each spent fuel pool has a water inventory of 420,000 gallons. Assuming a well-mixed pool, the volume required to dilute the spent fuel pool from the TS limit of 2500 ppm to 700 ppm is 534,600 gallons. The various events that were considered included dilution from the boron recovery system, reactor makeup system, demineralized water system, fire protection system, and other events that may affect the boron concentration of the pool, such as seismic events, pipe break, and loss of offsite power.

There are three water storage sources that could provide the 534,600 gallons of water needed to dilute the spent fuel pool boron concentration to 700 ppm. The reactor makeup water tank has a volume of 153,050 gallons with an automatic makeup source, which would be sufficient with the makeup to dilute the spent fuel pool boron concentration to 700 ppm. The reactor makeup system is directly connected to the spent fuel pool and is isolated by one closed manual valve. However, the largest dilution rate would be 240 gpm, which would take over 37 hours to dilute the spent fuel pool to 700 ppm. The licensee's demineralized water tank (961,000 gallons) also is sufficient to dilute the spent fuel pool boron concentration to 700 ppm. However, the most rapid dilution would occur through the 2-inch makeup line. The dilution event would require over 46 hours at 190 gpm to dilute the pool to 700 ppm. These events would be identified through the high level pool alarm or by operator rounds, which are conducted every 12 hours.

The licensee identified that a random pipe break in the fire protection standpipe and sprinkler manifold piping provided the possible largest flow rate of the dilution sources. Additionally, this pipe is evaluated because the water in the fire protection tanks (600,000 gallons) is sufficient to dilute the spent fuel pool boron concentration to 700 ppm without replenishment. The licensee identified that a break in this 6-inch piping could have a flow rate of 4,000 gpm. If all the water was deposited directly into the spent fuel pool, a break in this fire protection standpipe would take approximately five minutes to fill the pool to the high level alarm actuation level. However, the 6-inch pipe is located below the spent fuel pool deck elevation and branches to smaller two- and three-inch lines prior to penetrating the deck elevation. Therefore, the licensee concluded that a break in the 6-inch line has no effect on the spent fuel pool inventory or boron concentration. The licensee evaluated the smaller lines and determined that it would take at least 35 hours to dilute the pool boron concentration to 700 ppm. Since a dilution due to a break in one of the smaller lines would take longer than 12 hours, it would be identified and terminated by plant personnel during rounds, if not earlier, prior to reaching a boron concentration of 700 ppm in the spent fuel pool.

Other evaluated dilution events take longer than twelve hours to reach the minimum boron concentration. These events would be detected by plant personnel during required rounds every twelve hours. To detect low flow, long term dilution events, the licensee samples its spent fuel pool every seven days. This frequency is consistent with the standard TSs for Westinghouse plants and is considered appropriate for this plant.

The licensee concluded an unplanned or inadvertent event that would dilute the spent fuel pool boron concentration from 2,500 ppm to 700 ppm is not credible for STP. The staff finds that the combination of the large volume of water required for a dilution event, TS-controlled spent fuel pool concentration and 7-day sampling requirement, and plant personnel rounds would adequately detect a dilution event prior to k_{eff} reaching 0.95 (700 ppm); therefore, the analysis and proposed TS controls are acceptable for the boron dilution aspects of the request.

Additionally, the criticality analysis for the spent fuel storage pool show that k_{eff} remains less than 1.0 at a 95/95 probability/confidence level even if the pool were completely filled with unborated water. Therefore, even if the spent fuel storage pool were diluted to zero ppm, the racks are expected to remain subcritical.

3.3 Summary

Based on the review described above, the staff finds the boron dilution aspects of the proposed license amendment request acceptable. The TS boron concentration of 2500 ppm and 7-day surveillance requirements are acceptable to ensure that sufficient time is available to detect and mitigate a dilution event prior to exceeding the design basis k_{eff} of 0.95.

4.0 STATE CONSULTATION

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

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (63 FR 45530). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

6.0 CONCLUSION

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

7.0 REFERENCES

1) T. H. Cloninger, STPNOC, letter to U. S. Nuclear Regulatory Commission, "South Texas Project, Units 1 and 2, Docket Nos. STN 50-498, STN 50-499, Proposed Amendment to Technical Specifications for Spent Fuel Storage Pool Rack, Criticality Analysis with Soluble Boron Credit," July 7, 1998.

2) D. A. Leazar, STPNOC, letter to U. S. Nuclear Regulatory Commission, "South Texas Project, Units 1 and 2, Docket Nos. STN 50-498, STN 50-499, Response to Staff Questions on Proposed Amendment to Technical Specifications for Spent Fuel Storage Pool Rack Criticality Analysis with Soluble Boron Credit," October 15, 1998.

3) W. D. Newmyer, "Westinghouse Spent Fuel Rack Criticality Analysis Methodology," Westinghouse Electric Corporation, WCAP-14416-NP-A, Rev. 1, November 1996.

4) Prairie Island Nuclear Generating Plant, Unit Nos. 1 and 2, Issuance of Amendment Re: Credit for Soluble Boron in Spent Fuel Pool Criticality Analysis," June 12, 1997.

5) L. Kopp, Guidance on the Regulatory Requirements for Criticality Analysis of Fuel Storage at Light-Water Reactor Power Plants, NRC Memorandum to T. Collins, August 19, 1998.

6) NRC letter to Mr. T. Greene, Westinghouse Owners Group, dated October 25, 1996, Enclosure: NRC Safety Evaluation of WCAP-14416-P.

7) T.J. Jordan, STPNOC, letter to U.S. Nuclear Regulatory Commission, "Response to NRC Staff Questions on Fire Protection System with regard to the Proposed Amendment to the Technical Specifications for Spent Fuel Storage Pool Rack Criticality Analysis with Soluble Boron Credit," dated October 26, 1998.

Principal Contributors: L. Kopp
D. Jackson

Date: **March 3, 1999**

Attachment: Table 1

TABLE 1

Summary of Soluble Boron Credit Requirements for South Texas Units 1 and 2

Storage Configuration	Soluble Boron Required for $k_{eff} \leq 0.95$ (ppm)	Soluble Boron Required for Reactivity Equivalencing (ppm)	Total Soluble Boron Credit Required Without Accidents (ppm)
Region 1			
All Cells	200	300	500
Checkerboard #1	200	100	300
Checkerboard #2	250	150	400
Region 2			
All Cells	200	500	700
3-out-of-4 Checkerboard	200	350	550
2-out-of-4 Checkerboard	250	50	300
RCCA #1 Checkerboard	200	450	650
RCCA #2 Checkerboard	250	450	700

ATTACHMENT