Docket

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

August 25, 1992

Docket Nos. 50-498
and 50-499

Mr. Donald P. Hall
Group Vice-President, Nuclear
Houston Lighting & Power Company
P. O. Box 1700
Houston, Texas 77251

Dear Mr. Hall:

SUBJECT: ISSUANCE OF AMENDMENT NOS. 43 AND 32 TO FACILITY OPERATING LICENSE NOS. NPF-76 AND NPF-80 - SOUTH TEXAS PROJECT, UNITS 1 AND 2 (TAC NOS. M83416 AND M83417)

The Commission has issued the enclosed Amendment Nos. 43 and 32 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 May 26, 1992, as supplemented by letter dated June 3, 1992.

The amendments change the Appendix A Technical Specifications in Sections 3/4.9 and 5.6 related to the prevention of criticality in the spent fuel pool. The revised specifications introduce a required boron concentration in the spent fuel pool during refueling operations and define categories of fuel assemblies based upon enrichment, burnup, and presence of burnable poisons. The allowable arrangement of assemblies within the spent fuel pool is determined as a function of the defined categories.

The staff also reviewed the proposed changes to the Updated Final Safety Analysis Report which were developed based on the reanalysis of the criticality aspects and the rack utilization schemes for the STP spent fuel storage racks. The staff found the proposed changes to be acceptable.

Based upon conversations with your staff, several editorial changes related to page and section numbers have been incorporated into the amendment which differ slightly from those proposed in your May 26, 1992 submittal.

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

Sincerely,

Original Signed By

George F. Dick, Jr., Senior Project Manager
Project Directorate IV-2
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No. 43 to NPF-76
2. Amendment No. 32 to NPF-80
3. Safety Evaluation

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See next page

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

HOUSTON LIGHTING & POWER COMPANY

CITY PUBLIC SERVICE BOARD OF SAN ANTONIO

CENTRAL POWER AND LIGHT COMPANY

CITY OF AUSTIN, TEXAS

DOCKET NO. 50-498

SOUTH TEXAS PROJECT, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 43
License No. NPF-76

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

   A. The application for amendment by Houston Lighting & Power Company* (HL&P) acting on behalf of itself and for the City Public Service Board of San Antonio (CPS), Central Power and Light Company (CPL), and City of Austin, Texas (COA) (the licensees) dated May 26, 1992, as supplemented by letter dated June 3, 1992, 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.

* Houston Lighting & Power Company is authorized to act for 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.

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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. Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 43, 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 is to be implemented within ten days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Suzanne C. Black

Suzanne C. Black, Director
Project Directorate IV-2
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: August 25, 1992

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

HOUSTON LIGHTING & POWER COMPANY

CITY PUBLIC SERVICE BOARD OF SAN ANTONIO

CENTRAL POWER AND LIGHT COMPANY

CITY OF AUSTIN, TEXAS

DOCKET NO. 50-499

SOUTH TEXAS PROJECT, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 32
License No. NPF-80

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

   A. The application for amendment by Houston Lighting & Power Company* (HL&P) acting on behalf of itself and for the City Public Service Board of San Antonio (CPS), Central Power and Light Company (CPL), and City of Austin, Texas (COA) (the licensees) dated May 26, 1992, as supplemented by letter dated June 3, 1992, 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.

* Houston Lighting & Power Company is authorized to act for 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. 32, 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 is to be implemented within ten days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Suzanne C. Black

Suzanne C. Black, Director
Project Directorate IV-2
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: August 25, 1992

ATTACHMENT TO LICENSE AMENDMENT NOS. 43 AND 32

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 vertical lines indicating the areas of change. The corresponding overleaf pages are also provided to maintain document completeness.

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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 700 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 700 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.

3/4.9.10 and 3/4.9.11 WATER LEVEL - REFUELING CAVITY AND STORAGE POOLS

The restrictions on minimum water level ensure that sufficient water depth is available to remove 99% of the assumed 10% iodine gap activity released from the rupture of an irradiated fuel assembly. The minimum water depth is consistent with the assumptions of the safety analysis.

3/4.9.12 FUEL HANDLING BUILDING EXHAUST AIR SYSTEM

The limitations on the Fuel Handling Building Exhaust Air System ensure that all radioactive material released from an irradiated fuel assembly will be filtered through the HEPA filters and charcoal adsorber prior to discharge to the atmosphere. Operation of the system with the heaters operating for at least 10 continuous hours in a 31-day period is sufficient to reduce the buildup of moisture on the adsorbers and HEPA filters. The OPERABILITY of this system and the resulting iodine removal capacity are consistent with the assumptions of the safety analyses. ANSI N510-1980 will be used as a procedural guide for surveillance testing.

3/4.9.13 SPENT FUEL POOL MINIMUM BORON CONCENTRATION

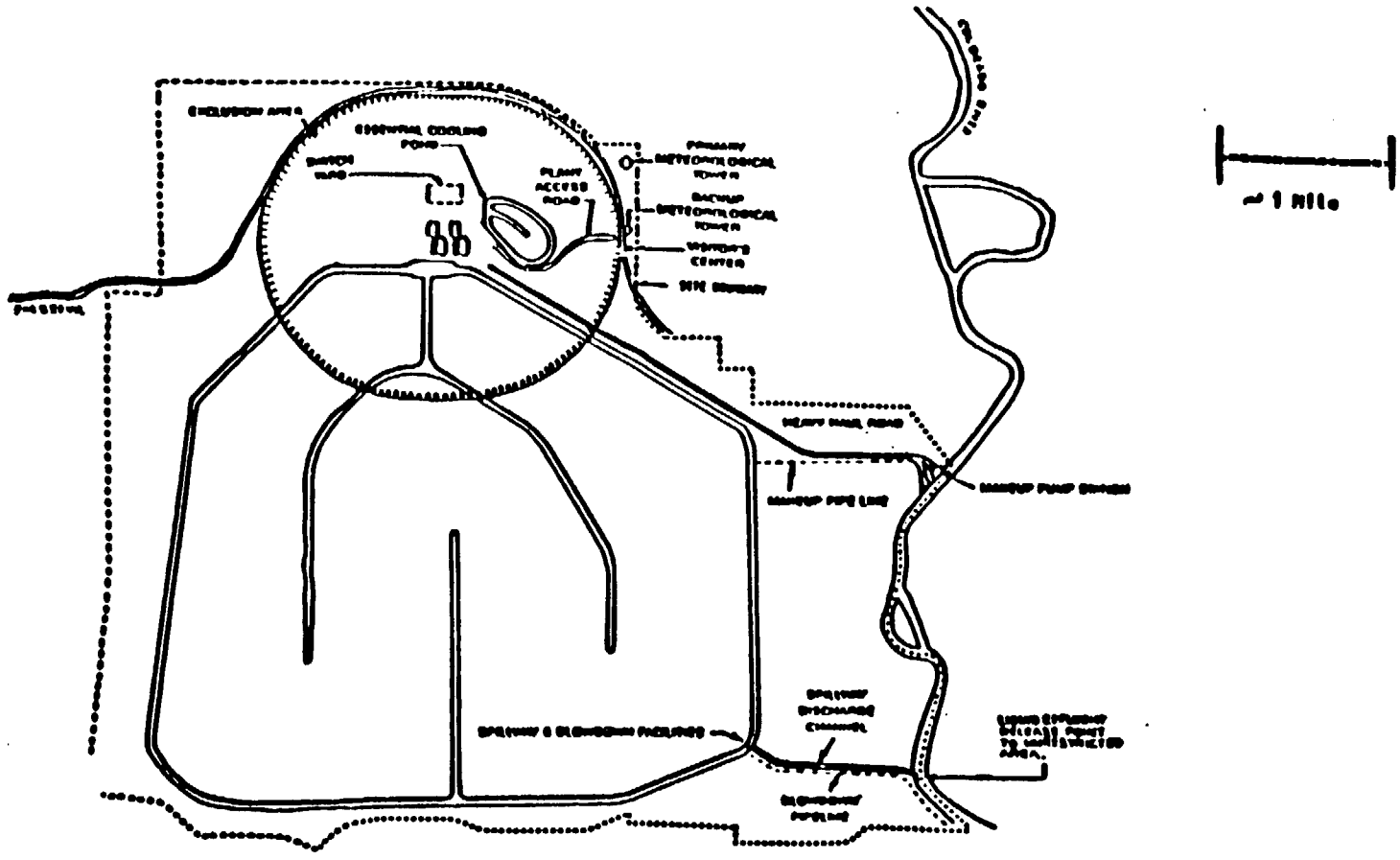
The restrictions on the boron concentration of the spent fuel pool ensures that the rack K_{eff} is maintained less than or equal to 0.95 in the event that one or more fuel assemblies are improperly loaded in the spent fuel pool storage racks (with respect to Specification 5.6). Since the presence of boron is ensured, the rack K_{eff} will be maintained less than or equal to 0.95 in the event of improper loading of fuel assemblies. This boron concentration is more than adequate to ensure the K_{eff} limit of 0.95, specified in Specification 5.6.1.1.a, will not be violated under the following scenarios:

(1) in Region 1, any misloading of Category 1, 2, 3, and 4 assemblies; or

(2) in Region 2, the misloading of one Category 1 assembly into the center of a fully loaded checkerboard area also containing Category 1 assemblies; or,

(3) the misloading of a Category 1 assembly in a Region 1 rack adjacent to a Category 1 assembly in a Region 2 rack.

This boron concentration limit is the value necessary to ensure that the 0.95 K_{eff} limit for rack criticality will not be violated in the event of a Category 1 assembly dropped in the gap between the pool wall and a Region 2 rack module.



*The UNRESTRICTED AREA consists of the FM 521 right-of-way and the area beyond the SITE BOUNDARY.

SOUTH TEXAS PROJECT
UNITS 1 & 2

FIGURE 5.1-4

UNRESTRICTED AREA* AND SITE BOUNDARY FOR RADIOACTIVE LIQUID EFFLUENTS

5.3 REACTOR CORE

FUEL ASSEMBLIES

5.3.1 The core shall contain 193 fuel assemblies with each fuel assembly containing 264 fuel rods clad with Zircaloy-4. Each fuel rod shall have a nominal active fuel length of 168 inches. The initial core loading shall have a maximum enrichment of 3.5 weight percent U-235. Reload fuel shall be similar in physical design to the initial core loading and shall have a maximum enrichment of 4.5 weight percent U-235.

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 REACTOR COOLANT SYSTEM

DESIGN PRESSURE AND TEMPERATURE

5.4.1 The Reactor Coolant System is designed and shall be maintained:

a. In accordance with the Code requirements specified in Section 5.2 of the FSAR, with allowance for normal degradation pursuant to the applicable Surveillance Requirements,

b. For a pressure of 2485 psig, and

c. For a temperature of 650°F, except for the pressurizer which is 680°F.

VOLUME

5.4.2 The total water and steam volume of the Reactor Coolant System is 13,814 ± 100 cubic feet at a nominal T_{avg} of 561°F.

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. A k_{eff} equivalent to less than or equal to 0.95 when flooded with unborated water. This requirement 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.

b. 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.

c. Neutron absorber (Boraflex) installed between spent fuel assemblies in the storage racks in Region 1 and Region 2.

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 5.0 w/o.

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

1) a maximum initial nominal enrichment of 4.0 w/o; or,
2) a minimum burnup as shown on Figure 5.6-1; or,
3) a minimum number of Westinghouse Integral Fuel Burnable Absorber pins, as shown on Figure 5.6-2, or a K_{inf} of less than or equal to 1.445. 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 rod requirements shown in Figure 5.6-2 are based on an IFBA linear B^{10} loading of 1.57 mg-B^{10}/inch. For higher IFBA linear B^{10} loadings, the required number of IFBA rods per assembly may be reduced by the ratio of the increased B^{10} loading to the nominal 1.57 mg-B^{10}/inch loading.

CATEGORY 3:
Fuel in Category 3 shall have the minimum assembly burnup shown on Figure 5.6-3.

CATEGORY 4:
Fuel in Category 4 shall have the minimum assembly burnup shown on Figure 5.6-4.

Data points for the curves presented in Figures 5.6-1 through 5.6-4 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, 2, 3, and 4 fuel. Category 1 fuel shall be stored in a checkerboard pattern configuration with Category 3 or 4 fuel, alternating fuel assemblies as shown in Figure 5.6-5. Category 2, 3, and 4 fuel may be stored in a close packed arrangement.

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

5.6.1.4 Region 2 racks may be used to store Category 1, 2, 3, and 4 fuel. Fuel in Categories 1, 2, and 3, shall be stored in a checkerboard pattern configuration alternating fuel assemblies with empty water cells in a 2 out of 4 pattern, as shown in Figure 5.6-6. Category 4 fuel may be stored either in a close packed arrangement or in the checkerboard pattern described above.

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

5.6.1.5 Storage Configuration Interface Requirements. The transition schemes described below shall be used at the interface of two storage configuration areas in the spent fuel racks. Empty water cells may be substituted for fuel assemblies in all cases.

Internal Interfaces in Region 1 Racks

The interface between a closed packed fuel storage area in Region 1 and a checkerboarded storage area also in Region 1 shall be such that either:

1. Category 3 or 4 fuel assemblies in the checkerboard pattern are carried into the first row of the close packed storage area of fuel, as shown in Figure 5.6-5; or,

2. at least one row of empty water cells separate a close packed fuel storage area and a checkerboarded storage area.

Internal Interfaces in Region 2 Racks

The interface between a close packed fuel storage area in Region 2 and a checkerboarded storage area in Region 2 shall be such that either:

1. there is a one row carryover of alternating empty cells from the checkerboard area into the first row of the close packed area with the remaining cells of the row filled with Category 4 assemblies, as shown in Figure 5.6-6; or,

2. at least one empty row of cells separates the checkerboard pattern area and the close packed storage area.

Region 1 Close Packed Storage Area Adjacent to Region 2 Close Packed Area

There are no restrictions on the interface between Region 1 close packed storage areas and adjacent close packed storage areas in Region 2.

Region 1 Checkerboard Storage Area Adjacent to Region 2

The interface between a checkerboarded storage area in Region 1 and any Region 2 rack storage area shall be such that either:

1. the Region 1 checkerboard pattern is carried to the Region 1 boundary, but the last row at the Region 1 boundary leaves the Category 1 fuel assembly positions vacant; or,

2. at least one row of empty water cells in either Region 1 or Region 2 racks separate the Region 1 checkerboarded storage area and the Region 2 rack storage area.

Region 2 Checkerboard Storage Area Adjacent to Region 1

The interface between a checkerboarded storage area in Region 2 and any Region 1 rack storage area shall be such that at least one row of empty water cells in either Region 1 or Region 2 racks separate the Region 2 checkerboarded storage area and the Region 1 rack storage area.

If checkerboarded storage areas in both Regions 1 and 2 are adjacent, at least one row of empty water cells in either Region 1 or Region 2 racks shall separate the checkerboarded storage areas in the respective racks.

5.6.1.6 The minimum boron concentration specified by Specification 3.9.13, "Spent Fuel Pool Minimum Boron Concentration" ensures that the rack K_{eff} limit in Specification 5.6.1.1.a will not be violated under the following scenarios:

1. in Region 1, any misloading of Category 1, 2, 3, and 4 assemblies; or,

2. in Region 2, the misloading of one Category 1 assembly into the center of a fully loaded checkerboard area also containing Category 1 assemblies; or,

3. the misloading of a Category 1 assembly in a Region 1 rack adjacent to a Category 1 assembly in a Region 2 rack.

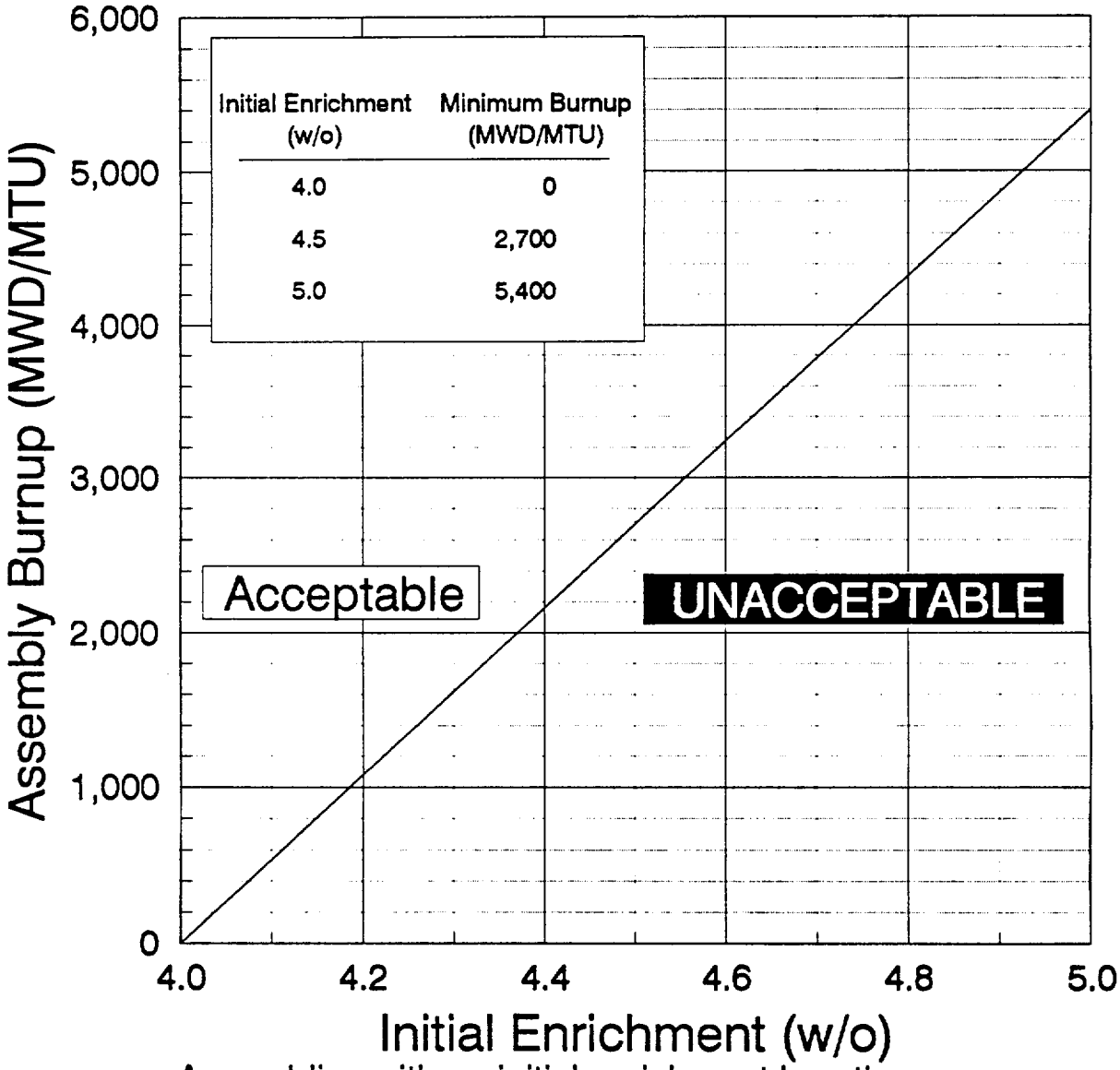
DRAINAGE

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



Assemblies with an initial enrichment less than 4.0 w/o are ACCEPTABLE

Figure 5.6-1

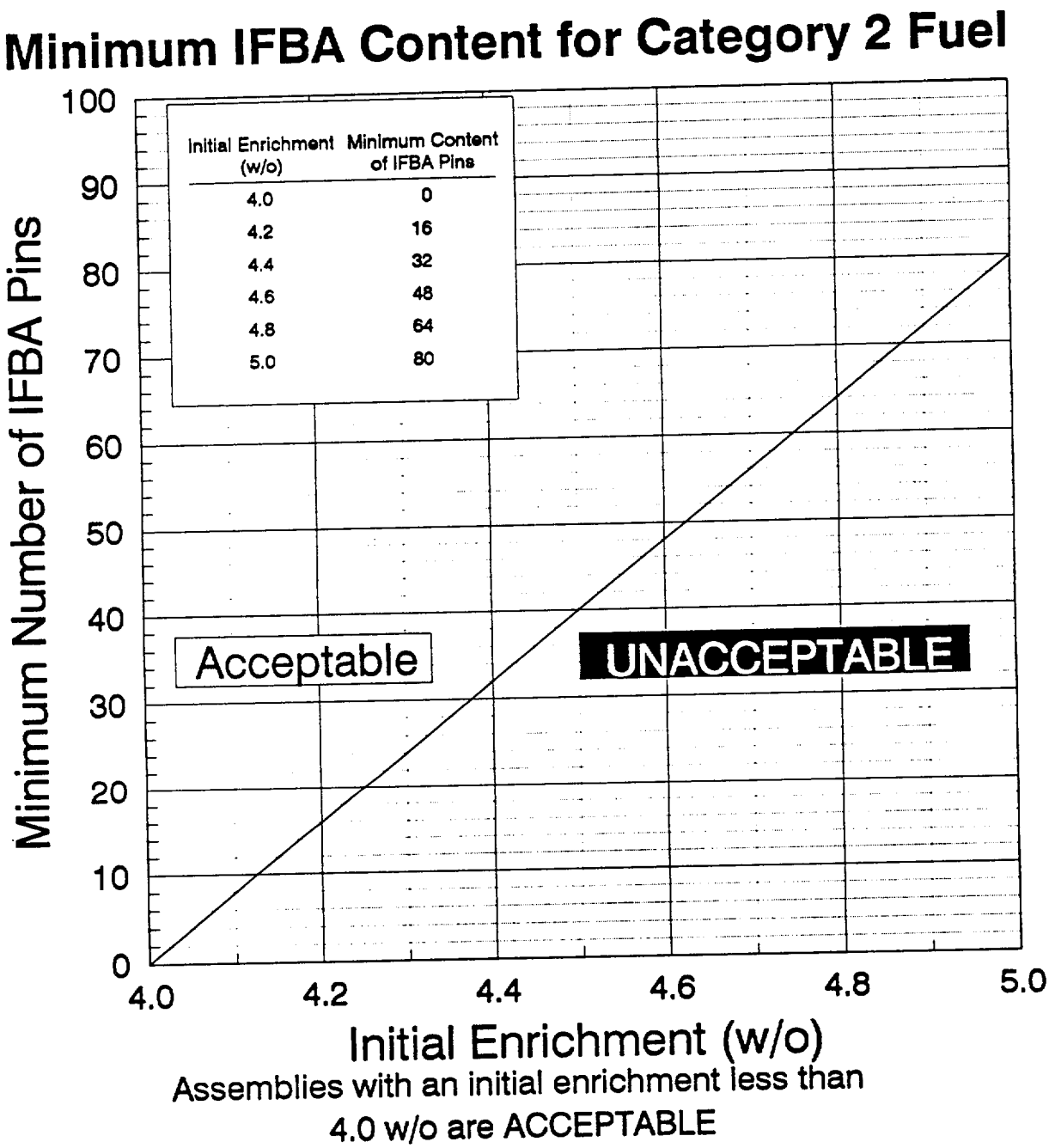
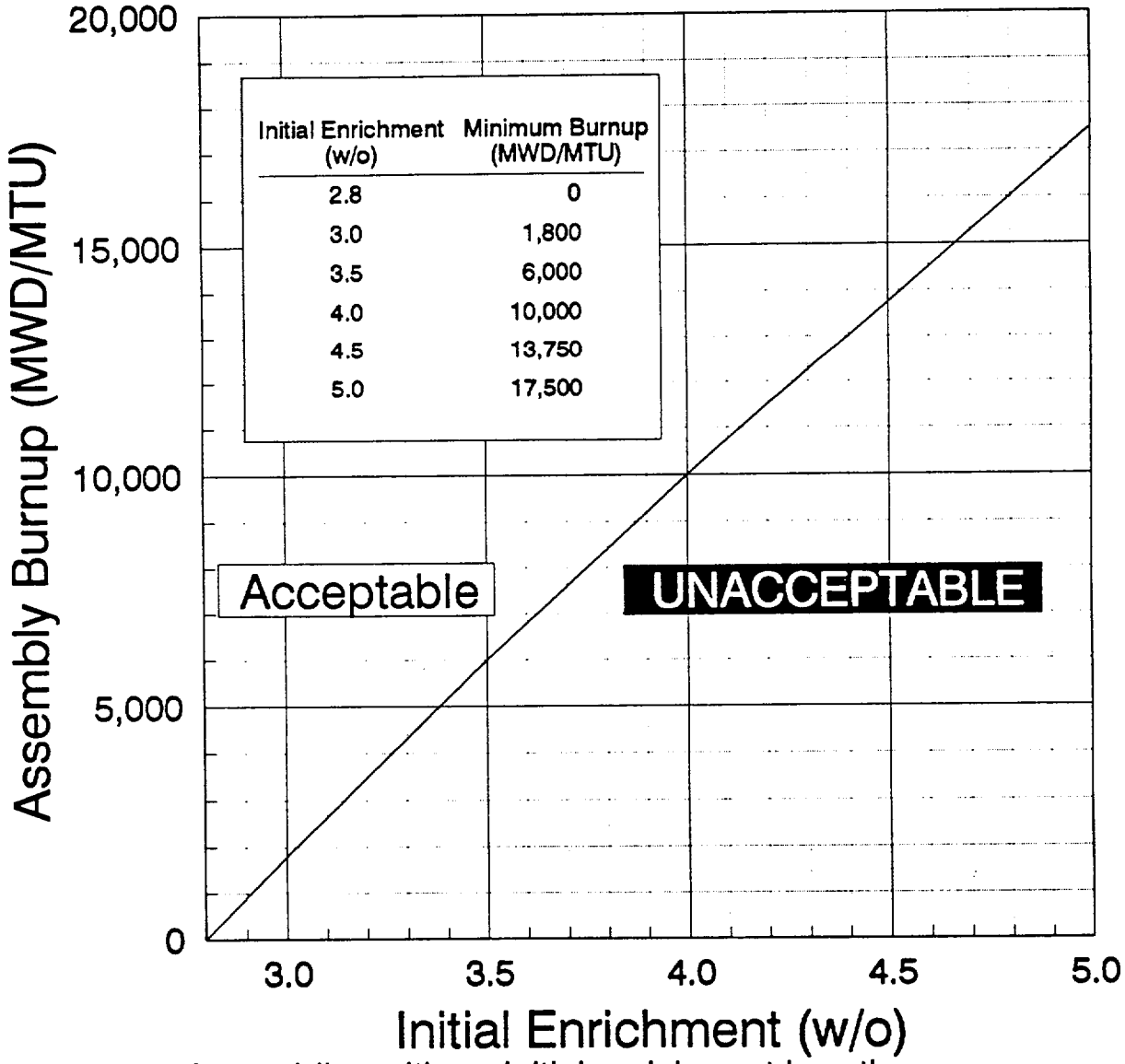

Minimum IFBA Content for Category 2 Fuel
Initial Enrichment (w/o)
Minimum Content of IFBA Pins
4.0 0
4.2 16
4.4 32
4.6 48
4.8 64
5.0 80
Acceptable
UNACCEPTABLE
Minimum Number of IFBA Pins
0
10
20
30
40
50
60
70
80
90
100
4.0
4.2
4.4
4.6
4.8
5.0
Initial Enrichment (w/o)
Assemblies with an initial enrichment less than 4.0 w/o are ACCEPTABLE

Figure 5.6-2

Minimum Burnup for Category 3 Fuel

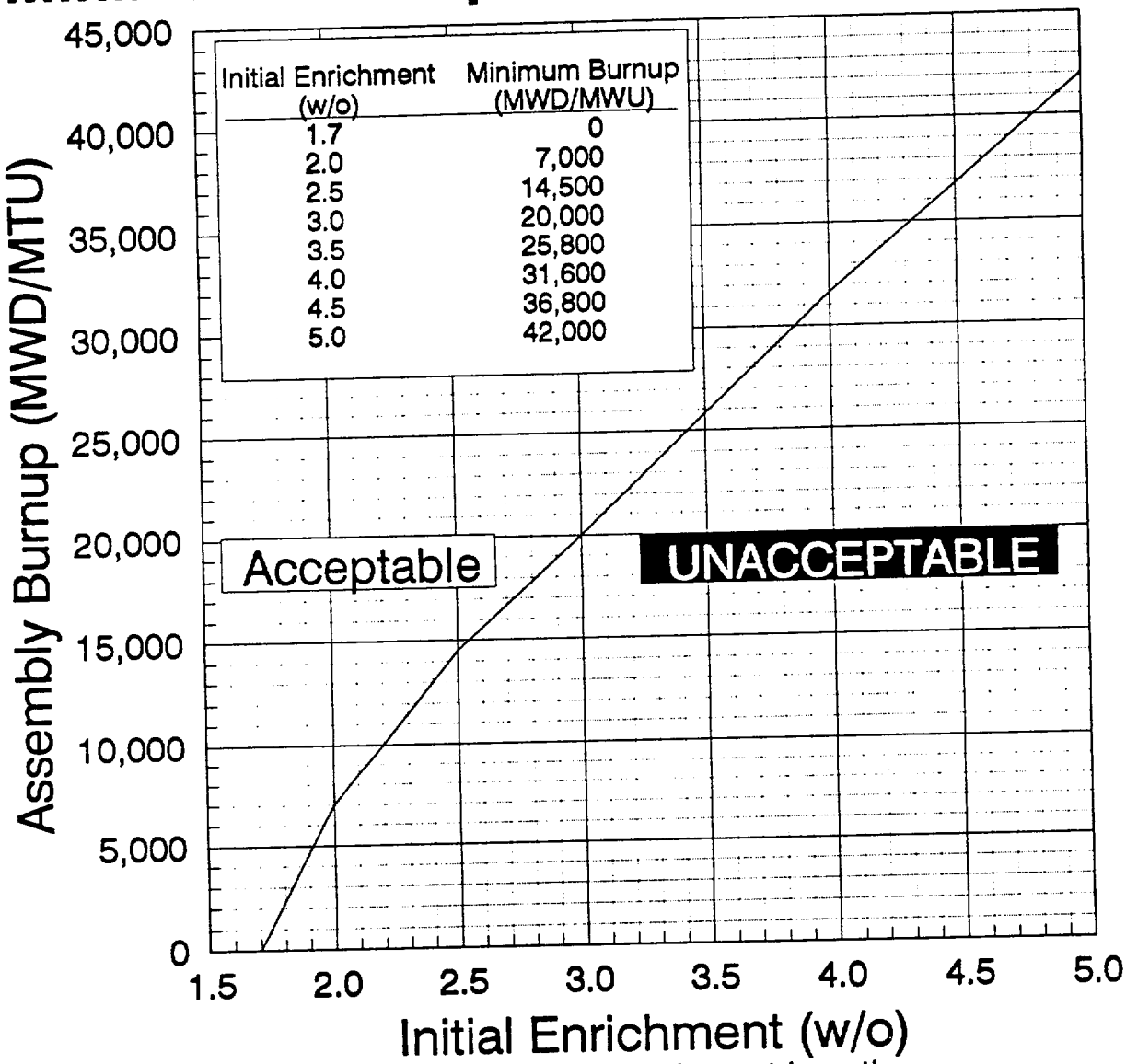


Initial Enrichment (w/o)	Minimum Burnup (MWD/MTU)
2.8	0
3.0	1,800
3.5	6,000
4.0	10,000
4.5	13,750
5.0	17,500

Assemblies with an initial enrichment less than 2.8 w/o are ACCEPTABLE

Figure 5.6-3

Minimum Burnup for Category 4 Fuel



Initial Enrichment (w/o)	Minimum Burnup (MWD/MWU)
1.7	0
2.0	7,000
2.5	14,500
3.0	20,000
3.5	25,800
4.0	31,600
4.5	36,800
5.0	42,000

Assemblies with an initial enrichment less than 1.7 w/o are ACCEPTABLE

Figure 5.6-4

Region 1 Close Packed and Checkerboard Fuel Storage

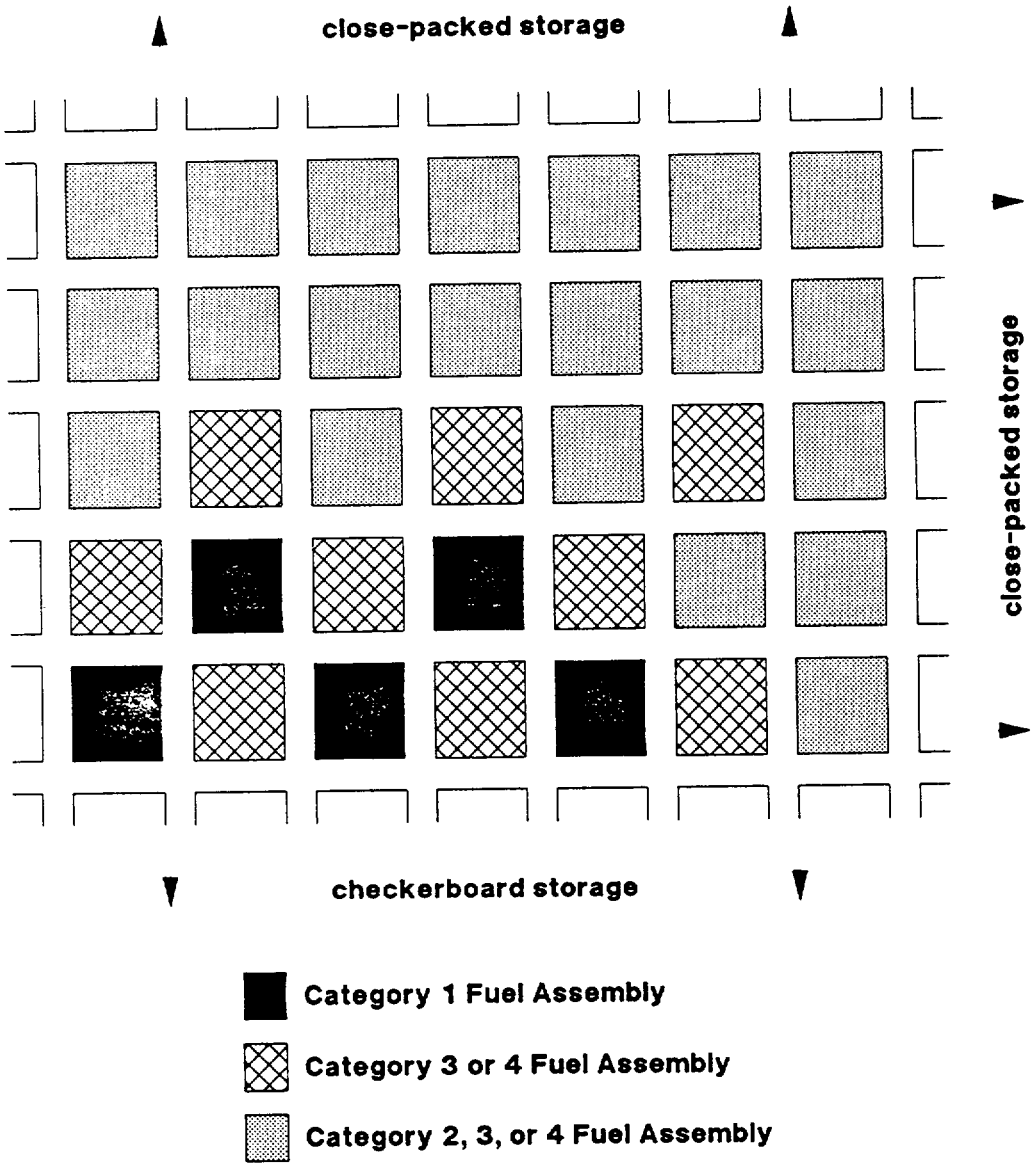


Figure 5.6-5

Region 2 Close Packed and Checkerboard Fuel Storage

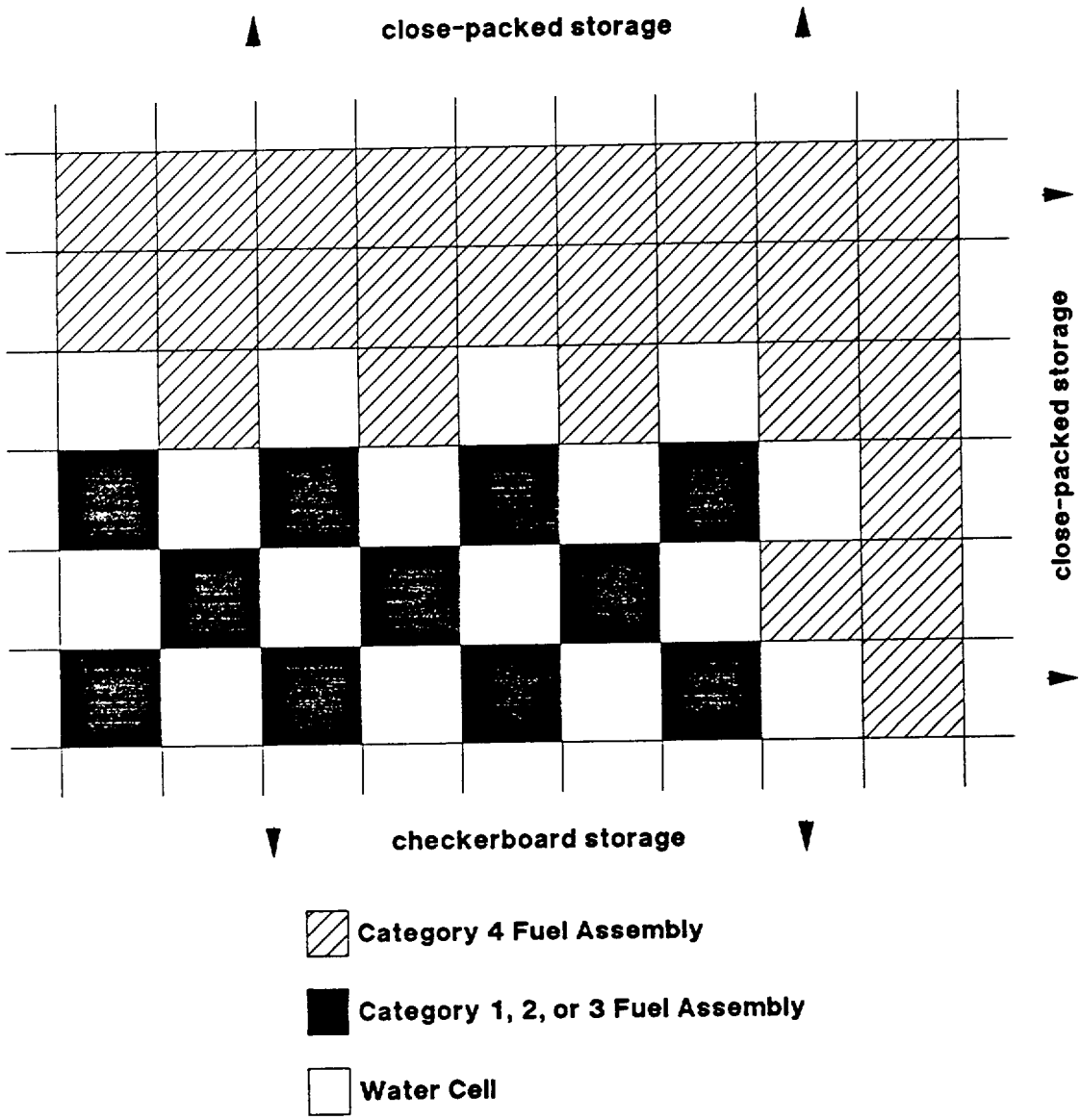


Figure 5.6-6

5.7 COMPONENT CYCLIC OR TRANSIENT LIMIT

5.7.1 The components identified in Table 5.7-1 are designed and shall be maintained within the cyclic or transient limits of Table 5.7-1.

TABLE 5.7-1

COMPONENT CYCLIC OR TRANSIENT LIMITS

COMPONENT	CYCLIC OR TRANSIENT LIMIT	DESIGN CYCLE OR TRANSIENT
Reactor Coolant System	200 heatup cycles at ≤ 100°F/h and 200 cooldown cycles at ≤ 100°F/h.	Heatup cycle - T_{avg} from ≤ 200°F to > 550°F. Cooldown cycle - T_{avg} from ≥ 550°F to ≤ 200°F.
	200 pressurizer cooldown cycles at ≤ 200°F/h.	Pressurizer cooldown cycle temperatures from ≥ 650°F to ≤ 200°F.
	80 loss of load cycles, without immediate Turbine or Reactor trip.	> 15% of RATED THERMAL POWER to 0% of RATED THERMAL POWER.
	40 cycles of loss-of-offsite A.C. electrical power.	Loss-of-offsite A.C. electrical ESF Electrical System.
	80 cycles of loss of flow in one reactor coolant loop.	Loss of only one reactor coolant pump.
	400 Reactor trip cycles.	100% to 0% of RATED THERMAL POWER.
	10 auxiliary spray actuation cycles.	Spray water temperature differential > 621°F.
	200 leak tests.	Pressurized to ≥ 2485 psig.
	10 hydrostatic pressure tests.	Pressurized to ≥ 3110 psig.
Secondary Coolant System	1 steam line break.	Break in a > 6-inch steam line.
	10 hydrostatic pressure tests.	Pressurized to ≥ 1600 psig.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 43 AND 32 TO

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

HOUSTON LIGHTING & POWER COMPANY

DOCKET NOS. 50-498 AND 50-499

SOUTH TEXAS PROJECT, UNITS 1 AND 2

1.0 INTRODUCTION

By application dated May 26, 1992, as supplemented by letter dated June 3, 1992, Houston Lighting & Power Company (HL&P), et. al., (the licensee) requested changes to the Technical Specifications (Appendix A to Facility Operating License Nos. NPF-76 and NPF-80) for the South Texas Project (STP) Units 1 and 2. The proposed changes would reflect the revised criticality analyses and rack utilization schemes for the spent fuel storage racks in the STP units.

The spent fuel storage pool contains two rack types. The Region 1 racks use Boraflex panels in a removable stainless steel box to absorb neutrons and are currently licensed to accept fresh fuel with a maximum U-235 enrichment of 4.5 weight percent (w/o). The Region 2 racks are fabricated by trapping Boraflex panels between the cell walls. The Region 2 racks are currently licensed to take credit for the burnup of discharged fuel to allow a higher storage density.

The original criticality analyses for the STP fuel storage racks were performed by Pickard, Lowe, & Garrick (PLG), under subcontract to U.S. Tool & Die. A subsequent reanalysis by Westinghouse, which was undertaken to investigate the reactivity effects of possible Boraflex gaps, indicated that the original analysis overestimated the maximum fuel enrichment of the Region 1 racks and that the current limit of 4.5 w/o U-235 should actually be 4.0 w/o. This finding was partly responsible for the issuance of NRC Information Notice 92-21 and Supplement 1, "Spent Fuel Pool Reactivity Calculations." Therefore, HL&P has submitted TS changes to correct the error and allow for a more effective utilization of the available storage racks. The criticality aspects of these proposed changes are evaluated below.

The staff, after telephone conversations with the licensee, has made several editorial changes to the original proposed technical specification (TS) revisions. Table of Contents, page xv, was revised to incorporate the changes to the Bases related to minimum spent fuel pool boron concentrations; the page numbers in Sections 5.6 and 5.7 were revised to reflect the additional pages; and the section number of 5.6.1 was added to CRITICALITY to be consistent with

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the standard format. The editorial changes were minor in nature and did not affect the scope of the proposed amendment or the initial no significant hazards consideration determination published in the Federal Register (57 FR 32572).

2.0 EVALUATION

The design basis for preventing criticality in a storage rack is that, including uncertainties, there is a 95 percent probability at a 95 percent confidence level (95/95 probability/confidence) that the effective neutron multiplication factor, k-eff, of the fuel assembly array in the racks will be no greater than 0.95 under all conditions. Criticality of fuel assemblies in a fuel storage rack is prevented by the design of the rack which limits fuel assembly interaction. This is accomplished in the STP spent fuel storage racks by fixing the minimum separation between fuel assemblies and inserting neutron poison (Boraflex) between fuel assemblies. In addition, the concept of reactivity equivalencing is used. Reactivity equivalencing has been approved by the NRC for numerous fuel storage facilities and is predicated upon the reactivity decrease associated with fuel depletion or the addition of integral fuel burnable absorber (IFBA) fuel rods. IFBAs consist of neutron absorbing material applied as a thin zirconium diboride (ZrB_2) coating on the outside of the UO_2 fuel pellet.

The reanalysis of the reactivity effects of fuel storage in Region 1 and 2 was performed with the KENO Va Monte Carlo computer code with neutron cross sections generated by the AMPX code package from the 227 energy group ENDF/B-V library. Since the KENO Va code package does not have depletion capability, burnup analyses were performed with the two-dimensional transport theory code, PHOENIX. These codes are widely used for the analysis of fuel rack reactivity and burnup and have been benchmarked against results from numerous critical experiments. The staff concludes that the analysis methods used are acceptable.

Regions 1 and 2 of the STP spent fuel racks were analyzed for both closely packed configurations and for checkerboard configurations. Fuel assemblies may be stored in every location for the close packed configuration. The checkerboard configurations involve alternating fresh fuel with low enriched fuel or water holes and are described more fully below.

For the Region 1 close packed storage configuration, the KENO Va model assumed minimum center-to-center fuel assembly spacings, minimum Boraflex material dimensions, maximum stainless steel thicknesses, and symmetrically placed fuel assemblies. These assumptions conservatively give a worst case calculated k-eff. In addition, U-235 enrichment was assumed to be 4.05 w/o which conservatively accounts for enrichment manufacturing variability. The resulting k-eff was 0.9359, including all uncertainties at a 95/95 probability/confidence level. Therefore, the NRC acceptance criterion of k-eff no greater than 0.95 is met for Region 1 close packed storage of fuel assemblies enriched to a maximum nominal 4.0 w/o U-235. This is categorized as Category 2 fuel.

Storage of close packed fuel assemblies with nominal enrichments greater than 4.0 w/o U-235 in Region 1 was also analyzed by means of reactivity equivalencing in which reactivity credit was taken for assembly burnup or for the presence of IFBAs in fuel assemblies. For the reactivity decrease associated with fuel depletion, a series of reactivity calculations were performed to generate a set of enrichment-fuel assembly discharge burnup ordered pairs which yield the equivalent k-eff when the fuel is stored in the racks. The results are shown in Figure 5.6-1 of the STP TS, which shows that the reactivity of a rack containing fuel that is initially enriched to 5.0 w/o U-235 and achieves a burnup of 5400 MWD/MTU is equivalent to the reactivity of a rack containing fresh unirradiated fuel with nominal U-235 enrichment of 4.0 w/o. As mentioned previously, this fuel resulted in a maximum k-eff of 0.9359 and is, therefore, acceptable. Fuel which meets the minimum burnup as shown in Figure 5.6-1 is also categorized as Category 2 fuel.

Reactivity equivalencing was also determined based upon the reactivity decrease associated with the presence of IFBAs. In this scheme, a series of reactivity calculations were performed to generate a set of enrichment-fuel assembly IFBA content ordered pairs which yield the same equivalent k-eff when the fuel is stored in the Region 1 racks. Figure 5.6-2 of the STP TS shows the minimum number of IFBA pins required in a fuel assembly, as a function of initial enrichment, for close packed storage in Region 1. The curve shows that the reactivity of the spent fuel rack array when filled with 4.0 w/o fuel with no IFBA pins is equivalent to the reactivity of the rack when filled with 5.0 w/o fuel with 80 IFBA pins. Therefore, fuel which meets the minimum IFBA content shown in Figure 5.6-2 also results in an acceptable k-eff equal to 0.9359 and is categorized as Category 2 fuel.

The infinite multiplication factor, k-inf, was used as an alternative method for determining the acceptability of fuel assembly storage in Region 1. The fuel array model was based on a unit assembly configuration, infinite in lateral and axial extent, for a nominal fresh 4.0 w/o assembly in the STP reactor core geometry with unborated water at a temperature of 68° F. The resulting k-inf was 1.445. Therefore, fuel which has a reference k-inf of less than or equal to 1.445 in the core geometry will result in a maximum spent fuel rack reactivity of less than 0.95 (k-eff equal to 0.9359) when stored in a close packed configuration. This fuel is also categorized as Category 2 fuel.

Storage of fresh fuel of nominal enrichment of 5.0 w/o U-235 in a two-out-of-four checkerboard array alternating with depleted assemblies which meet a burnup credit criterion was analyzed for Region 1. The same worst case consideration of mechanical and material tolerances assumed for the close packed analysis was used. As shown in Figure 5.6-3 of the STP TS, the depleted fuel is assumed to have a reactivity equivalent to a fresh assembly with an initial nominal enrichment of 2.8 w/o U-235 and is categorized as Category 3 fuel. This minimum burnup curve starts at 2.8 w/o at 0 MWD/MTU and ends at 5.0 w/o at 17,500 MWD/MTU. The maximum k-eff for the storage of fresh 5.0 w/o and depleted fuel assemblies, meeting the minimum burnup requirements shown in Figure 5.6-3, in a checkerboard pattern was 0.9252, including all

appropriate uncertainties at a 95/95 probability/confidence level. This configuration meets the 0.95 reactivity criterion and is, therefore, acceptable. Since the Category 3 fuel has a lower reactivity than the Category 2 fuel, Category 3 fuel can also be stored in Region 1 in a close packed configuration.

Since the Region 2 racks have a smaller center-to-center spacing between fuel assemblies, close packed storage in Region 2 requires a lower enrichment than for Region 1 in order to meet the 0.95 criticality criterion. As for the Region 1 calculations, the KENO Va model for Region 2 assumed minimum center-to-center fuel assembly spacings, minimum Boraflex material dimensions, maximum stainless steel thicknesses, and symmetrically placed fuel assemblies. The U-235 enrichment was held to the nominal value since the enrichment tolerance is incorporated into the minimum burnup requirements curve shown in Figure 5.6-4 of the STP TS. Unirradiated fuel enriched to a nominal 1.7 w/o U-235 resulted in a 95/95 k-eff of 0.9412. Therefore, the acceptance criterion for criticality is met for Region 2 close packed storage of fuel assemblies enriched to a nominal 1.7 w/o U-235.

Reactivity equivalencing for burnup credit is shown in Figure 5.6-4 from which it is seen that the spent fuel rack reactivity with fuel enriched to 5.0 w/o U-235 which has achieved a minimum burnup of 42,000 MWD/MTU is equivalent to the rack reactivity of fresh 1.7 w/o enriched fuel. This is categorized as Category 4 fuel. Therefore, Category 4 fuel can also be stored in a close packed configuration in both Region 1 and Region 2.

The calculated maximum k-eff for fresh fuel with nominal enrichment of 5.0 w/o U-235 in a checkerboard pattern alternating with empty water holes in Region 2 was 0.8790, including uncertainties at a 95/95 level. This configuration also meets the criticality acceptance criterion of 0.95 and is acceptable. The same worst case mechanical and material tolerances assumptions were used as in the close packed analysis with the fuel at a maximum enrichment of 5.05 w/o U-235 to account for enrichment manufacturing variability.

Since the neutron poison material used in the STP fuel storage racks consists of Boraflex panels between the cells, an analysis was performed to determine the reactivity effects of radiation induced shrinkage and gap formation in these panels. The results show that the criticality acceptance criterion of 0.95 will still be met even if the ends of the Boraflex panels shrink up to 8.75 inches in Region 1 and up to 7.50 inches in Region 2. In addition, the development of gaps of up to 3.75 and 3.00 inches in length at the midplane of every panel were found not to result in a violation of the 0.95 k-eff criterion in Region 1 and Region 2, respectively. Since gaps would not be expected to occur in every panel or precisely at the midplane, these gap size and location assumptions are conservative. A Boraflex surveillance program is followed at STP to detect any Boraflex degradation and to institute appropriate corrective actions if degradation of the panels is indicated.

Most abnormal storage conditions will not result in an increase in the k-eff of the racks. However, it is possible to postulate events, such as the inadvertent misloading of an assembly into a position for which the

restrictions on enrichment, burnup, or IFBA content are not met or dropping an assembly adjacent to a rack module, which could lead to an increase in reactivity. However, for such events credit may be taken for the presence of at least 700 ppm of boron in the pool water required whenever fuel is stored in the spent fuel racks by TS 3.9.13 since the staff does not require the assumption of two unlikely, independent, concurrent events to ensure protection against a criticality accident (Double Contingency Principle). The reduction in k-eff caused by the boron more than offsets the reactivity addition caused by credible accidents.

In summary, the staff has reviewed the proposed TS changes as well as the Updated Final Safety Analysis Report (UFSAR) changes which were developed based on the reanalysis of the criticality aspects and the rack utilization schemes for the STP spent fuel storage racks. Based on the above safety evaluation, these proposed changes were found to be acceptable.

3.0 STATE CONSULTATION

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

4.0 ENVIRONMENTAL CONSIDERATION

The amendment changes 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 amendment involves 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 amendment involves no significant hazards consideration and there has been no public comment on such finding (57 FR 32572). 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 amendment.

5.0 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, and (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.

Principal Contributor: L. Kopp (NRR/SRXB)

Date: August 25, 1992