January 20, 1995

Mr. D. L. Farrar
Manager, Nuclear Regulatory Services
Commonwealth Edison Company
Executive Towers West III
1400 Opus Place, Suite 500
Downers Grove, IL 60515

SUBJECT: ISSUANCE OF AMENDMENTS - BYRON AND BRAIDWOOD STATIONS (TAC NOS. M90831, M90832, M90833, M90834)

Dear Mr. Farrar:

The Commission has issued the enclosed Amendment No. 68 to Facility Operating License No. NPF-37 and Amendment No. 68 to Facility Operating License No. NPF-66 for the Byron Station, Unit Nos. 1 and 2, respectively, and Amendment No. 58 to Facility Operating License No. NPF-72 and Amendment No. 58 to Facility Operating License No. NPF-77 for the Braidwood Station, Unit Nos. 1 and 2, respectively. The amendments are in response to your application dated November 7, 1994, as supplemented December 16, 1994.

The amendments approve the use and storage in the spent fuel racks of fuel with an enrichment not to exceed a nominal 5.0 weight percent U-235.

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

Sincerely,

original signed by R. Assa for

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

9501260253 950120
PDR ADOCK 05000454
P PDR

Docket Nos. STN 50-454, STN 50-455,
STN 50-456, STN 50-457

Enclosures:
1. Amendment No. 68 to NPF-37
2. Amendment No. 68 to NPF-66
3. Amendment No. 58 to NPF-72
4. Amendment No. 58 to NPF-77
5. Safety Evaluation

cc w/encls: see next page

Distribution:	Docket File	PUBLIC	PDIII-2 r/f
J. Roe	R. Capra	C. Moore	G. Dick
R. Assa	OGC	G. Hill (8)	C. Grimes
L. Kopp	ACRS (4)	OPA	OC/LFDCB
L. Miller RIII			

DOCUMENT NAME: BRAID-BY\BB90831.AMD

To receive a copy of this document, indicate in the box: "C" = Copy without enclosures "E" = Copy with enclosures "N" = No copy

OFFICE	LA:PDIII-2	PM:PDIII-2	PM:PDIII-2	D:PDIII-2	OGC
NAME	CMOORE	GDICK	RASSA	RCAPRA	
DATE	01/11/95	01/12/95	01/12/95	01/20/95	01/17/95

OFFICIAL RECORD COPY

January 20, 1995

Mr. D. L. Farrar
Manager, Nuclear Regulatory Services
Commonwealth Edison Company
Executive Towers West III
1400 Opus Place, Suite 500
Downers Grove, IL 60515

SUBJECT: ISSUANCE OF AMENDMENTS - BYRON AND BRAIDWOOD STATIONS (TAC NOS. M90831, M90832, M90833, M90834)

Dear Mr. Farrar:

The Commission has issued the enclosed Amendment No. 68 to Facility Operating License No. NPF-37 and Amendment No. 68 to Facility Operating License No. NPF-66 for the Byron Station, Unit Nos. 1 and 2, respectively, and Amendment No. 58 to Facility Operating License No. NPF-72 and Amendment No. 58 to Facility Operating License No. NPF-77 for the Braidwood Station, Unit Nos. 1 and 2, respectively. The amendments are in response to your application dated November 7, 1994, as supplemented December 16, 1994.

The amendments approve the use and storage in the spent fuel racks of fuel with an enrichment not to exceed a nominal 5.0 weight percent U-235.

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

Sincerely,

original signed by R. Assa for

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

Docket Nos. STN 50-454, STN 50-455,
STN 50-456, STN 50-457

Enclosures:
1. Amendment No. 68 to NPF-37
2. Amendment No. 68 to NPF-66
3. Amendment No. 58 to NPF-72
4. Amendment No. 58 to NPF-77
5. Safety Evaluation

cc w/encls: see next page

Distribution:	Docket File	PUBLIC	PDIII-2 r/f
J. Roe	R. Capra	C. Moore	G. Dick
R. Assa	OGC	G. Hill (8)	C. Grimes
L. Kopp	ACRS (4)	OPA	OC/LFDCB
L. Miller RIII			

DOCUMENT NAME: BRAID-BY\BB90831.AMD

To receive a copy of this document, indicate in the box: "C" = Copy without enclosures "E" = Copy with enclosures "N" = No copy

OFFICE	LA:PDIII-2		PM:PDIII-2	C	PM:PDIII-2	C	D:PDIII-2	E	OGC
NAME	CMOORE		GDICK	RA for	RASSA		RCAPRA		
DATE	01/11/95		01/12/95		01/12/95		01/20/95		01/17/95

OFFICIAL RECORD COPY

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

January 20, 1995

Mr. D. L. Farrar
Manager, Nuclear Regulatory Services
Commonwealth Edison Company
Executive Towers West III
1400 Opus Place, Suite 500
Downers Grove, IL 60515

SUBJECT: ISSUANCE OF AMENDMENTS - BYRON AND BRAIDWOOD STATIONS (TAC NOS. M90831, M90832, M90833, M90834)

Dear Mr. Farrar:

The Commission has issued the enclosed Amendment No. 68 to Facility Operating License No. NPF-37 and Amendment No. 68 to Facility Operating License No. NPF-66 for the Byron Station, Unit Nos. 1 and 2, respectively, and Amendment No. 58 to Facility Operating License No. NPF-72 and Amendment No. 58 to Facility Operating License No. NPF-77 for the Braidwood Station, Unit Nos. 1 and 2, respectively. The amendments are in response to your application dated November 7, 1994, as supplemented December 16, 1994.

The amendments approve the use and storage in the spent fuel racks of fuel with an enrichment not to exceed a nominal 5.0 weight percent U-235.

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

Sincerely,

for

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

Docket Nos. STN 50-454, STN 50-455,
STN 50-456, STN 50-457

Enclosures:
1. Amendment No. 68 to NPF-37
2. Amendment No. 68 to NPF-66
3. Amendment No. 58 to NPF-72
4. Amendment No. 58 to NPF-77
5. Safety Evaluation

cc w/encls: see next page

cc:

Mr. William P. Poirier
Westinghouse Electric Corporation
Energy Systems Business Unit
Post Office Box 355, Bay 236 West
Pittsburgh, Pennsylvania 15230

Joseph Gallo
Gallo & Ross
1250 Eye St., N.W., Suite 302
Washington, DC 20005

Regional Administrator
U.S. NRC, Region III
801 Warrenville Road
Lisle, Illinois 6013

Ms. Bridget Little Rorem
Appleseed Coordinator
117 North Linden Street
Essex, Illinois 60935

U.S. Nuclear Regulatory Commission
Braidwood Resident Inspectors Office
Rural Route #1, Box 79
Braceville, Illinois 60407

Mr. Ron Stephens
Illinois Emergency Services
and Disaster Agency
110 East Adams Street
Springfield, Illinois 62706

Howard A. Learner
Environmental Law and Policy
Center of the Midwest
203 North LaSalle Street
Suite 1390
Chicago, Illinois 60601

EIS Review Coordinator
U.S. Environmental Protection Agency
77 W. Jackson Blvd.
Chicago, Illinois 60604-3590

Chairman
Will County Board of Supervisors
Will County Board Courthouse
Joliet, Illinois 60434

U.S. Nuclear Regulatory Commission
Byron/Resident Inspectors Office
4448 North German Church Road
Byron, Illinois 61010-9750

Ms. Lorraine Creek
Rt. 1, Box 182
Manteno, Illinois 60950

Mrs. Phillip B. Johnson
1907 Stratford Lane
Rockford, Illinois 61107

Attorney General
500 South Second Street
Springfield, Illinois 62701

Michael Miller, Esquire
Sidley and Austin
One First National Plaza
Chicago, Illinois 60690

George L. Edgar
Newman & Holtzinger, P.C.
1615 L Street, N.W.
Washington, DC 20036

Commonwealth Edison Company
Byron Station Manager
4450 North German Church Road
Byron, Illinois 61010

Illinois Dept. of Nuclear Safety
Office of Nuclear Facility Safety
1035 Outer Park Drive
Springfield, Illinois 62704

Commonwealth Edison Company
Braidwood Station Manager
Rt. 1, Box 84
Braceville, Illinois 60407

Chairman, Ogle County Board
Post Office Box 357
Oregon, Illinois 61061

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

COMMONWEALTH EDISON COMPANY

DOCKET NO. STN 50-454

BYRON STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 68
License No. NPF-37

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

   A. The application for amendment by Commonwealth Edison Company (the licensee) dated November 7, 1994, as supplemented December 16, 1994, 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, 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 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.

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-37 is hereby amended to read as follows:

9501260256 950120
PDR ADOCK 05000454
P PDR

(2) Technical Specifications

The Technical Specifications contained in Appendix A as revised through Amendment No. 68 and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated into this license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

for

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

Attachment:
Changes to the Technical
Specifications

Date of Issuance: January 20, 1995

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

COMMONWEALTH EDISON COMPANY

DOCKET NO. STN 50-455

BYRON STATION, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 68
License No. NPF-66

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

   A. The application for amendment by Commonwealth Edison Company (the licensee) dated November 7, 1994, as supplemented December 16, 1994, 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 1;

   B. The facility will operate in conformity with the application, 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 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.

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-66 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A (NUREG-1113), as revised through Amendment No. 68 and revised by Attachment 2 to NPF-66, and the Environmental Protection Plan contained in Appendix B, both of which were attached to License No. NPF-37, dated February 14, 1985, are hereby incorporated into this license. Attachment 2 contains a revision to Appendix A which is hereby incorporated into this license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

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

Attachment:
Changes to the Technical
Specifications

Date of Issuance: January 20, 1995

ATTACHMENT TO LICENSE AMENDMENT NOS. 68 AND 68

FACILITY OPERATING LICENSE NOS. NPF-37 AND NPF-66

DOCKET NOS. STN 50-454 AND STN 50-455

Revise the Appendix A Technical Specifications by removing the pages identified below and inserting the attached pages. The revised pages are identified by the captioned amendment number and contain marginal lines indicating the area of change.

Remove Pages	Insert Pages
5-5	5-5
5-5a	5-5a
-	5-5b

5.6 FUEL STORAGE

CRITICALITY

5.6.1.1 The spent fuel storage racks are designed and shall be maintained with a k_{eff} less than or equal to 0.95 when flooded with unborated water, which includes a conservative allowance for uncertainties as described in Section 9.1 of the UFSAR. This is ensured by controlling fuel assembly placement in each region as follows:

a. REGION 1

1. A nominal 10.32 inch north-south and 10.42 inch east-west, center-to-center distance is maintained between fuel assemblies placed in the spent fuel storage racks.

2. Fuel assemblies may be stored in this region with

a) a maximum nominal initial U-235 enrichment of less than or equal to 4.2 weight percent, or

b) a maximum nominal initial U-235 enrichment of 5.0 weight percent with sufficient Integral Fuel Burnable Absorbers present in each fuel assembly such that the maximum reference fuel assembly k_∞ is less than or equal to 1.470 at 68°F.

b. REGION 2

1. A nominal 9.03 inch center-to-center distance is maintained between fuel assemblies placed in the spent fuel storage racks.

2. a) Fuel assemblies may be stored in this region with a maximum nominal initial U-235 enrichment of 1.6 weight percent with no burnup and up to 5.0 weight percent U-235 with a minimum discharge burnup as specified in Figure 5.6-1, or

b) Fuel assemblies with a maximum nominal initial U-235 enrichment of greater than 1.6 and less than or equal to 4.2 weight percent that do not meet the minimum burnup specified in Figure 5.6-1, shall be loaded in a checkerboard pattern for storage in this region.

5.6.1.2 The k_{eff} for new fuel for the first core loading stored dry in the spent fuel storage racks shall not exceed 0.98 when aqueous foam moderation is assumed.

DRAINAGE

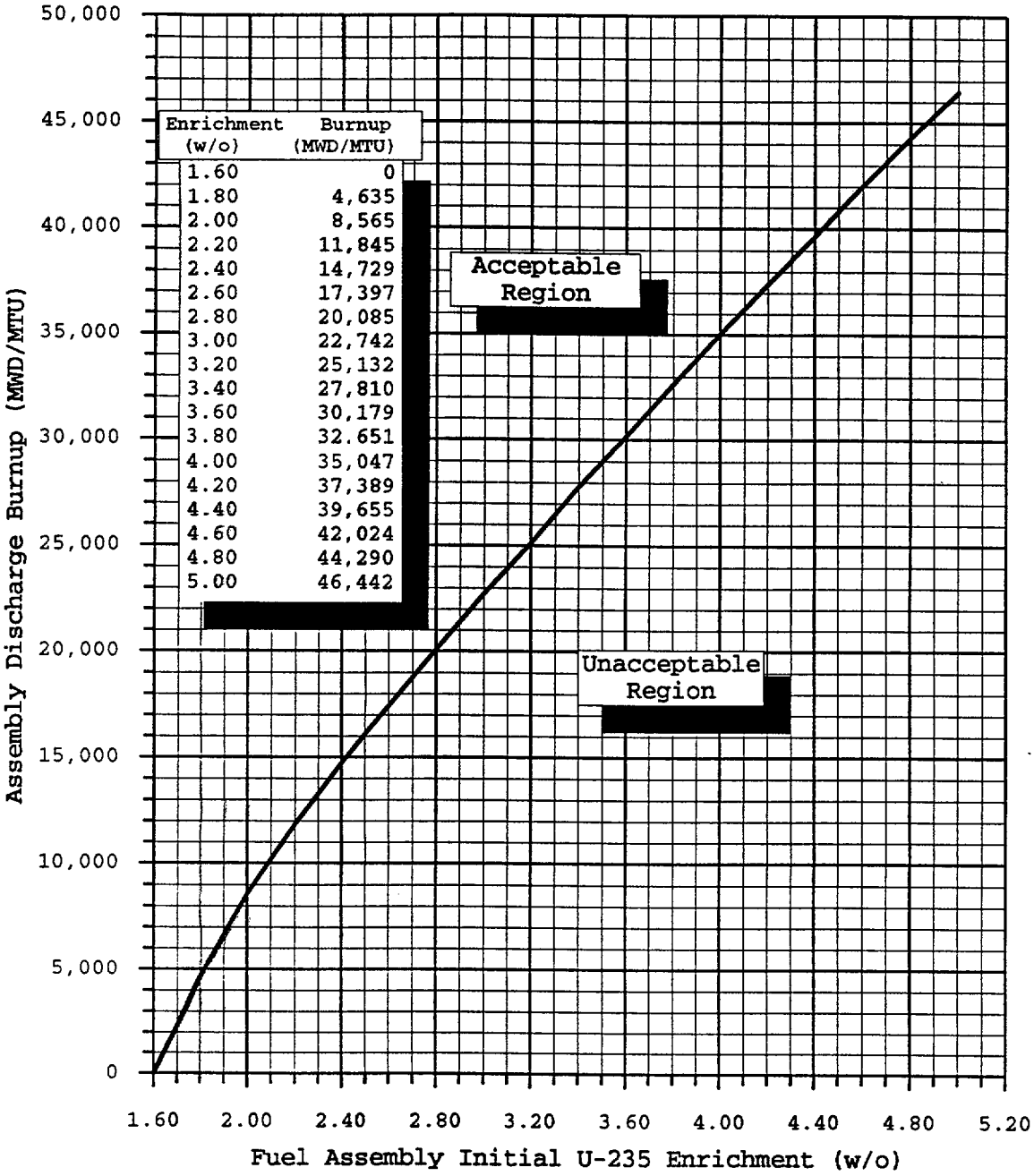
5.6.2 The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 423 feet 2 inches.

CAPACITY

5.6.3 The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 2870 fuel assemblies.

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.



Notes: The use of linear interpolation between the minimum burnups reported above is acceptable.

FIGURE 5.6 - 1

MINIMUM BURNUP VERSUS INITIAL ENRICHMENT
FOR REGION 2 STORAGE

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

COMMONWEALTH EDISON COMPANY

DOCKET NO. STN 50-456

BRAIDWOOD STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 58
License No. NPF-72

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

   A. The application for amendment by Commonwealth Edison Company (the licensee) dated November 7, 1994, as supplemented December 16, 1994, 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, 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 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.

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-72 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A as revised through Amendment No. 58 and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated into this license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Ramin R. Assa, Project Manager
Project Directorate III-2
Division of Reactor Projects - III/IV
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: January 20, 1995

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

COMMONWEALTH EDISON COMPANY

DOCKET NO. STN 50-457

BRAIDWOOD STATION, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 58
License No. NPF-77

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

   A. The application for amendment by Commonwealth Edison Company (the licensee) dated November 7, 1994, as supplemented December 16, 1994, 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 1;

   B. The facility will operate in conformity with the application, 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 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.

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-77 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A as revised through Amendment No. 58 and the Environmental Protection Plan contained in Appendix B, both of which were attached to License No. NPF-72, dated July 2, 1987, are hereby incorporated into this license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of the date if its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Ramin R. Assa, Project Manager
Project Directorate III-2
Division of Reactor Projects - III/IV
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: January 20, 1995

ATTACHMENT TO LICENSE AMENDMENT NOS. 58 AND 58

FACILITY OPERATING LICENSE NOS. NPF-72 AND NPF-77

DOCKET NOS. STN 50-456 AND STN 50-457

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 area of change.

Remove Pages	Insert Pages
5-5	5-5
5-5a	5-5a
-	5-5b

5.6 FUEL STORAGE

CRITICALITY

5.6.1.1 The spent fuel storage racks are designed and shall be maintained with a k_{eff} less than or equal to 0.95 when flooded with unborated water, which includes a conservative allowance for uncertainties as described in Section 9.1 of the UFSAR. This is ensured by controlling fuel assembly placement in each region as follows:

a. REGION 1

1. A nominal 10.32 inch north-south and 10.42 inch east-west, center-to-center distance is maintained between fuel assemblies placed in the spent fuel storage racks.

2. Fuel assemblies may be stored in this region with

a) a maximum nominal initial U-235 enrichment of less than or equal to 4.2 weight percent, or

b) a maximum nominal initial U-235 enrichment of 5.0 weight percent with sufficient Integral Fuel Burnable Absorbers present in each fuel assembly such that the maximum reference fuel assembly k_∞ is less than or equal to 1.470 at 68°F.

b. REGION 2

1. A nominal 9.03 inch center-to-center distance is maintained between fuel assemblies placed in the spent fuel storage racks.

2. a) Fuel assemblies may be stored in this region with a maximum nominal initial U-235 enrichment of 1.6 weight percent with no burnup and up to 5.0 weight percent U-235 with a minimum discharge burnup as specified in Figure 5.6-1, or

b) Fuel assemblies with a maximum nominal initial U-235 enrichment of greater than 1.6 and less than or equal to 4.2 weight percent that do not meet the minimum burnup specified in Figure 5.6-1, shall be loaded in a checkerboard pattern for storage in this region.

5.6.1.2 The k_{eff} for new fuel for the first core loading stored dry in the spent fuel storage racks shall not exceed 0.98 when aqueous foam moderation is assumed.

DRAINAGE

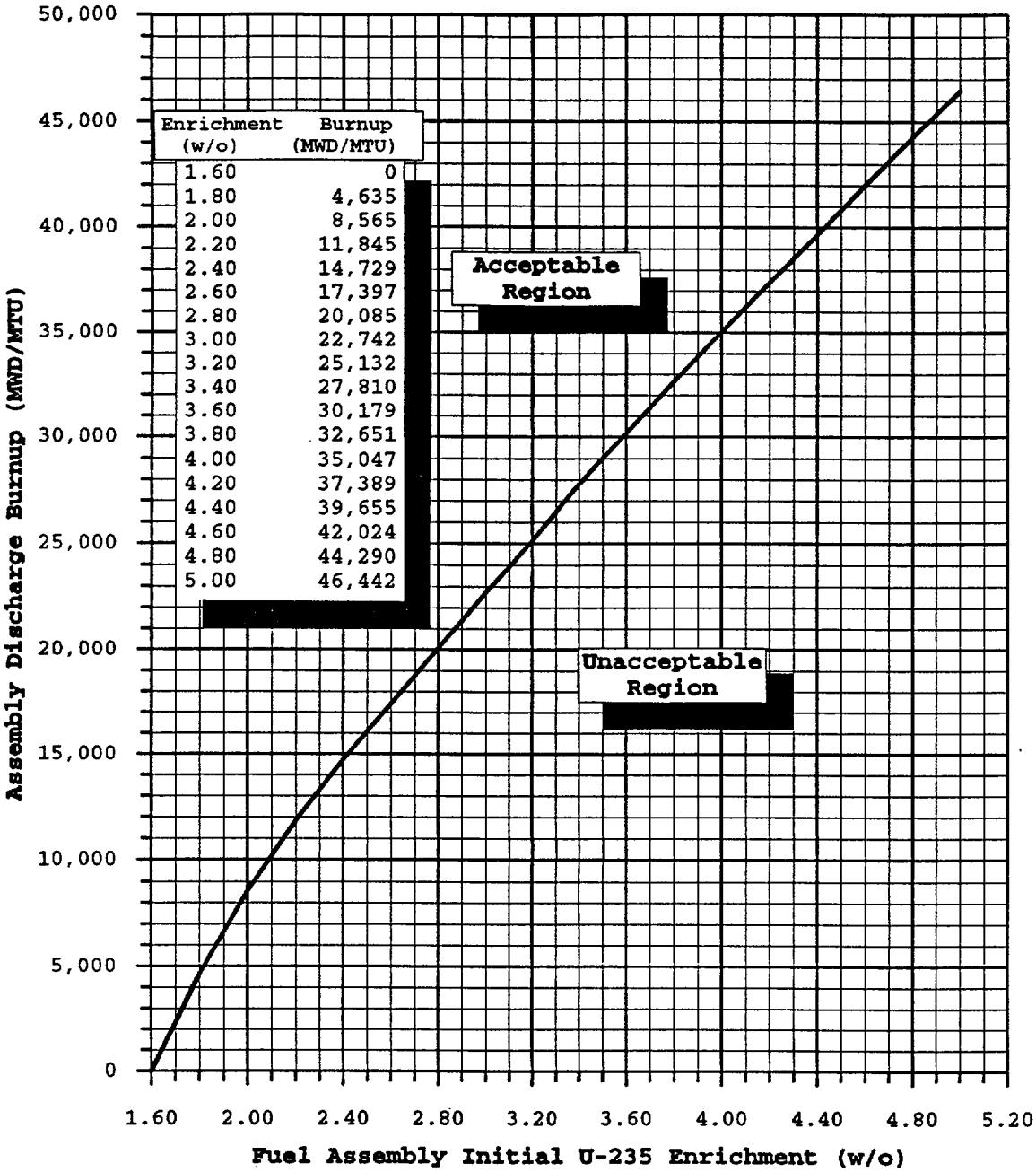
5.6.2 The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 423 feet 2 inches.

CAPACITY

5.6.3 The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 2870 fuel assemblies.

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.



Notes: The use of linear interpolation between the minimum burnups reported above is acceptable.

FIGURE 5.6 - 1

MINIMUM BURNUP VERSUS INITIAL ENRICHMENT
FOR REGION 2 STORAGE

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 68 TO FACILITY OPERATING LICENSE NO. NPF-37,

AMENDMENT NO. 68 TO FACILITY OPERATING LICENSE NO. NPF-66,

AMENDMENT NO. 58 TO FACILITY OPERATING LICENSE NO. NPF-72,

AND AMENDMENT NO. 58 TO FACILITY OPERATING LICENSE NO. NPF-77

COMMONWEALTH EDISON COMPANY

BYRON STATION, UNIT NOS. 1 AND 2

BRAIDWOOD STATION, UNIT NOS. 1 AND 2

DOCKET NOS. STN 50-454, STN 50-455, STN 50-456 AND STN 50-457

1.0 INTRODUCTION

By letter dated November 7, 1994, Commonwealth Edison Company (ComEd, the licensee) requested changes to the technical specifications (TS) for Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2, to permit the use of higher enriched fuel and specifies the spent fuel storage requirements for Regions 1 and 2 of the spent fuel pools. The staff requested additional information on December 6, 1994, which was provided by the licensee by letter dated December 16, 1994. The December 16, 1994, submittal provided additional clarifying information that did not change the initial proposed no significant hazards consideration determination.

The proposed changes would allow for the storage of fuel with enrichment not to exceed a nominal 5.0 weight percent (w/o) U-235 in the spent fuel storage racks. An enrichment manufacturing tolerance of ±0.05 percent U-235 about the nominal value was incorporated into the analysis. The new fuel storage vaults for Byron and Braidwood Stations were previously approved for storage of fresh fuel enriched up to 5.0 percent and, consequently, were not addressed in this evaluation.

2.0 EVALUATION

The licensee's analysis of the reactivity effects of fuel storage in the spent fuel storage racks was performed with the three-dimensional multi-group Monte Carlo computer code, KENO Va, using neutron cross sections generated by the AMPX code package from the 227 energy group ENDF/B-V data library. Since the KENO Va code package does not have depletion capability, burnup analyses were performed with the two-dimensional transport theory code, PHOENIX, using a 42 energy group nuclear data library. PHOENIX was also used to determine the reactivity effects of material and manufacturing tolerances. These codes are

9501260259 950120
PDR ADOCK 05000454
P PDR

widely used for the analysis of fuel rack reactivity and have been benchmarked against results from numerous critical experiments. These experiments simulate the Byron and Braidwood fuel storage racks with respect to parameters important to reactivity such as enrichment, assembly spacing, and absorber worth. The intercomparison between two independent methods of analysis (KENO Va and PHOENIX) also provides an acceptable technique for validating calculational methods for nuclear criticality safety. To minimize the statistical uncertainty of the KENO Va reactivity calculations, a minimum of 60,000 neutron histories were typically accumulated in each calculation. Experience has shown that this number of histories is quite sufficient to assure convergence of KENO Va reactivity calculations. The staff concludes that the analysis methods used are acceptable and capable of predicting the reactivity of the Byron and Braidwood spent fuel storage racks with a high degree of confidence.

The licensee reevaluated the spent fuel storage racks in Region 1 for 4.2 w/o U-235 enriched fuel moderated by pure water at 20 degrees Celsius with a density of 1.0 grams per cubic centimeter (gm/cc). For the nominal storage cell design in Region 1, uncertainties due to tolerances in fuel enrichment and density, fuel pellet dishing, storage cell I.D., cell lattice spacing, stainless steel thickness, Boraflex width and thickness, and boron-10 (B-10) loading were accounted for as well as eccentric fuel positioning. These uncertainties were appropriately determined at the 95/95 probability/confidence level. In addition, calculational and methodology biases and uncertainties due to benchmarking, B-10 self shielding, and pool water temperature ranges were included. The reactivity calculations also considered the effects of Boraflex shrinkage and gap formation. All Boraflex panels were modeled with four percent width shrinkage. In addition, five axial shrinkage/gap scenarios were evaluated which covered the spectrum of shrinkage-to-gap ratios from 100 percent gaps and zero percent shrinkage through zero percent gaps and 100 percent shrinkage. Maximum length shrinkage was assumed to be four percent. Based on the results of blackness testing performed at other storage facilities, and on upper bound values recommended by Electric Power Research Institute (EPRI), the staff concurs that these assumptions bound the current measured data and future development of additional shrinkage and gaps. Due to the presence of Boral inserts (described in Amendment No. 25 and Amendment No. 20 for Byron and Braidwood, respectively), and added to the flux trap gaps of the Region 1 racks prior to their initial installation, the worst case effects of Boraflex shrinkage and gap formation resulted in no increase in k_{eff} for the Region 1 storage configuration. The final Region 1 design, when fully loaded with fuel enriched to 4.2 w/o U-235, resulted in a k_{eff} of 0.9389 when combined with all known uncertainties. This meets the staff's criterion of k_{eff} no greater than 0.95 including all uncertainties at the 95/95 probability/confidence level and is, therefore, acceptable.

To enable the storage of fuel assemblies with nominal enrichments greater than 4.2 w/o U-235, the concept of reactivity equivalencing was used. In this technique, which has been previously approved by the NRC, credit is taken for the reactivity decrease due to the integral fuel burnable absorber (IFBA)

material coated on the outside of the UO_2 pellet. Based on these calculations, the reactivity of the fuel rack array, when filled with fuel assemblies enriched to 5.0 w/o U-235 with each containing 64 IFBA rods, was found to be equivalent to the reactivity of the rack when filled with fuel assemblies enriched to 4.2 w/o and containing no IFBAs.

Since the worth of individual IFBA rods can change depending on position within the assemblies due to local variations in thermal neutron flux, the licensee has included a conservative reactivity margin to assure that the IFBA requirement remains valid at intermediate enrichments where standard IFBA patterns may not be available. In addition, to account for calculational uncertainties, the IFBA requirements also include a conservatism of approximately ten percent on the total number of IFBA rods at the 5.0 w/o enrichment limit (i.e., about 6 extra IFBA rods for a 5.0 w/o fuel assembly). The staff concludes that sufficient conservatism has been incorporated to bound the calculational assumption that the IFBA requirements were based on the standard IFBA patterns used by Westinghouse.

As an alternative method for determining the acceptability of fuel storage in Region 1, the infinite multiplication factor, k_∞, is used as a reference reactivity point. The PHOENIX code was used for the fuel assembly k_∞ calculations based on a unit assembly configuration in the Byron and Braidwood core geometry moderated by pure water at a temperature of 20 degrees Celsius with a density of 1.0 gm/cc. A one percent reactivity bias was included to account for calculational uncertainties. Calculations for a fresh 4.2 w/o Westinghouse 17x17 OFA fuel assembly, which yields equivalent or bounding reactivity results relative to the other Westinghouse 17x17 fuel types, in the core geometry resulted in a reference k_∞ of 1.470. Since the fuel rack reactivity of a fresh 4.2 w/o assembly is less than 0.95 and has been shown to be equivalent to a 5.0 w/o assembly with the standard number of IFBA rods, an assembly of maximum nominal enrichment of 5.0 w/o U-235 with a maximum reference k_∞ less than or equal to 1.470 at 20 degrees Celsius can be safely stored in the Region 1 racks.

The Region 2 spent fuel storage racks were reanalyzed for storage of Westinghouse 17x17 fuel assemblies with nominal enrichments up to 1.6 w/o U-235. The same initial assumptions, biases and uncertainties as used for the Region 1 analyses were included. In addition, the effects of Boraflex shrinkage and gaps were accounted for by assuming that 50 percent of the panels experience non-uniform shrinkage (random gaps) and the remaining 50 percent of the panels experience uniform shrinkage (pullback) from the bottom end. Although calculations have shown that positioning all of the Boraflex shrinkage at the bottom results in the most conservative k_{eff}, the staff considers this an overly conservative estimate and concurs that the assumption used is more realistic and still conservative since, based on Blackness test results, not all panels would be expected to undergo a four percent total shrinkage at one end. The maximum k_{eff} for Region 2 is 0.9449; within the NRC acceptance criterion of 0.95.

To enable the storage of fuel assemblies initially enriched to greater than 1.6 w/o U-235 in Region 2, the concept of burnup credit reactivity equivalencing was used. This is predicated upon the reactivity decrease associated with fuel depletion and has been previously accepted by the staff for spent fuel storage analysis. For burnup credit, a series of reactivity calculations is performed to generate a set of initial enrichment-fuel assembly discharge burnup ordered pairs which all yield an equivalent k_{eff} less than 0.95 when stored in the spent fuel storage racks. This is shown in Figure 5.6-1 of the TSs in which a fresh 1.6 w/o enriched fuel assembly yields the same rack reactivity as an initially enriched 5.0 w/o assembly depleted to 46,442 megawatt days per metric ton of uranium (MWD/MTU). This curve includes a three percent penalty factor to account for the uncertainty in measured burnup for each individual assembly.

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 cooldown events or the misloading of an assembly with a burnup and enrichment combination outside of the acceptable area in Figure 5.6-1, which could lead to an increase in reactivity. However, for such events credit may be taken for the presence of approximately 2000 parts per million (ppm) of boron in the pool water (refueling canal) as required by TS 3.9.1 during fuel handling operations and by plant procedures during all other times 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 fact, the licensee has determined that only 300 ppm of boron is necessary to mitigate the worst postulated accident in any pool region. Therefore, the staff criterion of k_{eff} no greater than 0.95 for any postulated accident is met.

3.0 TECHNICAL SPECIFICATION REVISIONS

The following Technical Specification changes have been proposed as a result of the requested enrichment increase. The staff finds these changes acceptable.

(1) Figure 5.6-1 has been revised to place restrictions on fuel burnup as a function of initial enrichment up to 5.0 w/o U-235 and to account for the effects of Boraflex panel shrinkage and gaps in Region 2 of the spent fuel pool.

(2) TS 5.6.1.1 has been revised to clearly delineate the requirements for each region of the spent fuel pool, to add the new minimum burnups as a function of initial enrichment, to permit the storage of 5.0 w/o U-235 fuel, and to add the requirements for k_∞.

3.1 SUMMARY

Based on the review previously described, the staff finds the criticality aspects of the proposed enrichment increase to the Byron and Braidwood spent

a cycle-by-cycle basis as part of the reload safety evaluation process. Each reload design is evaluated to confirm that the cycle core design adheres to the limits that exist in the accident analyses and TS to ensure that reactor operation is acceptable.

4.0 STATE CONSULTATION

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

5.0 ENVIRONMENTAL CONSIDERATION

Pursuant to 10 CFR 51.21, 51.32 and 51.35, an environmental assessment and finding of no significant impact has been prepared and published in the Federal Register on January 20, 1995 (60 FR 4200).

Accordingly, based upon the environmental assessment, the Commission has determined that the issuance of this amendment will not have a significant effect on the quality of the human environment.

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.

Principal Contributor: L. Kopp

Date: January 20, 1995