Docket No. 50-346

November 19, 1993

Mr. Louis F. Storz
Vice President, Nuclear - Davis-Besse
Centerior Service Company
c/o Toledo Edison Company
Davis-Besse Nuclear Power Station
5501 North State Route 2
Oak Harbor, Ohio 43449

Dear Mr. Storz:

SUBJECT: AMENDMENT NO. 181 TO FACILITY OPERATING LICENSE NO. NPF-3 (TAC NO. M86933)

The Commission has issued Amendment No. 181 to Facility Operating License No. NPF-3 for the Davis-Besse Nuclear Power Station, Unit No. 1. The amendment revises the Technical Specifications in response to your application dated June 23, 1993, as supplemented on October 5, 1993.

This amendment revises the Technical Specifications to allow storage of new and spent fuel assemblies with an initial enrichment of uranium - 235 no greater than 5.0 weight percent.

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

Sincerely,

Original signed by Jon B. Hopkins

Jon B. Hopkins, Sr. Project Manager
Project Directorate III-3
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No. 181 to License No. NPF-3
2. Safety Evaluation

cc w/enclosures:
See next page

CP-1

OFFICE	LA:PDIII-3	PM:PDIII-3	PD:PDIII-3	BC:PRPB	OGC
NAME	MRushbrook	JHopkins:dy	JHannon	LCunningham	C. Barth
DATE	11/4/93	11/4/93	11/4/93	11/10/93	11/19/93

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

November 19, 1993

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Jon B. Hopkins, Sr. Project Manager
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2. Safety Evaluation

cc w/enclosures:
See next page

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DISTRIBUTION FOR:
AMENDMENT NO. 181 FOR DAVIS-BESSE NUCLEAR POWER STATION, UNIT NO. 1

Docket File
NRC & Local PDRs
PD3-3 Reading File
JRoe
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MRushbrook
JHopkins
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GHill (2)
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ACRS (10)
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OC/LFDCB
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AAttard

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

TOLEDO EDISON COMPANY

CENTERIOR SERVICE COMPANY

AND

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

DOCKET NO. 50-346

DAVIS-BESSE NUCLEAR POWER STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 181
License No. NPF-3

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

   A. The application for amendment by the Toledo Edison Company, Centerior Service Company, and the Cleveland Electric Illuminating Company (the licensees) dated June 23, 1993, as supplemented on October 5, 1993, 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-3 is hereby amended to read as follows:

(a) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 181, are hereby incorporated in the license. The Toledo Edison Company shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented not later than 90 days after issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Jon B. Hopkins, Sr. Project Manager
Project Directorate III-3
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical Specifications

Date of issuance: November 19, 1993

ATTACHMENT TO LICENSE AMENDMENT NO. 181

FACILITY OPERATING LICENSE NO. NPF-3

DOCKET NO. 50-346

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. The corresponding overleaf pages are also provided to maintain document completeness.

Remove	Insert
3/4 9-13	3/4 9-13
3/4 9-14	3/4 9-14
5-5	5-5

VOLUME

5.4.2 The total water and steam volume of the reactor coolant system is 12,1110 ± 200 cubic feet at a nominal T_{avg} of 525°F.

5.5 METEOROLOGICAL TOWER LOCATION

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

5.6 FUEL STORAGE

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, which includes a conservative allowance of 1% delta k/k for calculation uncertainty.

b. A rectangular array of stainless steel cells spaced 12 31/32 inches on centers in one direction and 13 3/16 inches on centers in the other direction. Fuel assemblies stored in the spent fuel pool shall be placed in a stainless steel cell of 0.125 inches nominal thickness or in a failed fuel container.

c. Fuel assemblies stored in the spent fuel pool in accordance with Technical Specification 3.9.13.

5.6.1.2 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, which includes a conservative allowance of 1% delta k/k for uncertainties as described in Section 9.1 of the USAR.

b. A K_{eff} equivalent to less than or equal to 0.98 when immersed in a hydrogenous "mist" of such a density that provides optimum moderation (i.e., highest value of K_{eff}), which includes a conservative allowance of 1% delta k/k for uncertainties as described in Section 9.1 of the USAR.

c. A nominal 21 inch center-to-center distance between fuel assemblies placed in the storage racks.

d. Fuel assemblies having a maximum initial enrichment of 5.0 weight percent uranium-235.

DRAINAGE

5.6.2 The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below 9 feet above the top of the fuel storage racks.

CAPACITY

5.6.3 The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 735 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 limit of Table 5.7-1.

REFUELING OPERATIONS

SPENT FUEL POOL FUEL ASSEMBLY STORAGE

LIMITING CONDITION FOR OPERATION

3.9.13 Fuel assemblies stored in the spent fuel pool shall be placed in the spent fuel storage racks in accordance with the criteria shown in Figure 3.9-1.

APPLICABILITY: Whenever fuel assemblies are in the spent fuel pool.

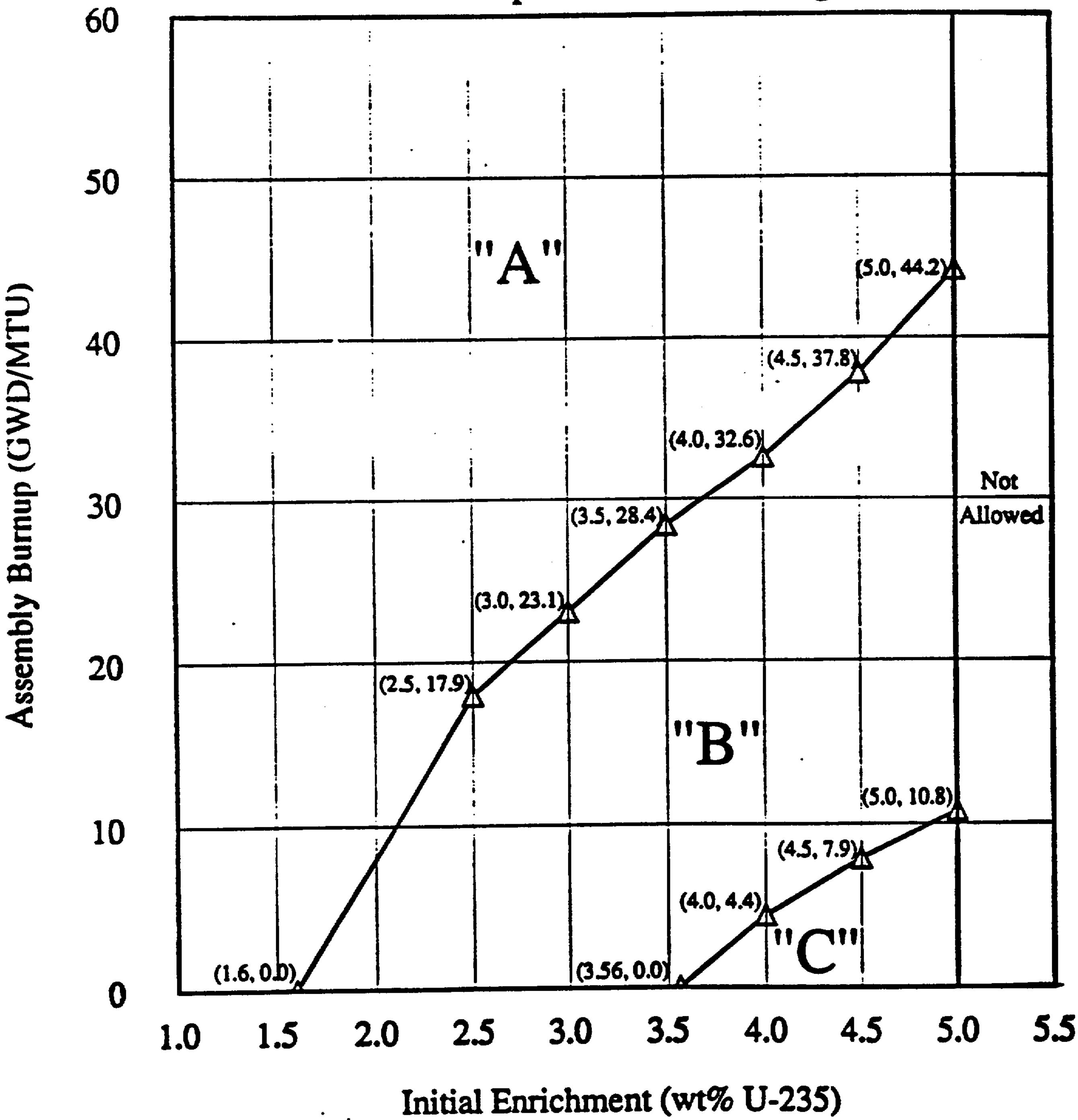
ACTION:

With the requirements of the above specification not satisfied, suspend all other fuel movement within the spent fuel pool and move the non-complying fuel assemblies to allowable locations in the spent fuel pool in accordance with Figure 3.9-1. The provisions of Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.13.1 Prior to storing the fuel assembly in the spent fuel pool, verify by administrative means that the initial enrichment and burnup of the fuel assembly is in accordance with Figure 3.9-1.

Figure 3.9-1
Burnup vs. Enrichment Curves For Davis-Besse Spent Fuel Storage Racks



Category "A": May be placed in any rack location

Category "B": Must not be placed directly adjacent to Category "C" assemblies

Category "C": May only be placed directly adjacent to Category "A" assemblies or non-fuel locations

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 181 TO FACILITY OPERATING LICENSE NO. NPF-3

TOLEDO EDISON COMPANY

CENTERIOR SERVICE COMPANY

AND

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

DAVIS-BESSE NUCLEAR POWER STATION, UNIT NO. 1

DOCKET NO. 50-346

1.0 INTRODUCTION

By letter dated June 23, 1993, as supplemented on October 5, 1993, Toledo Edison (the licensee), requested changes to the Davis-Besse Nuclear Power Station, Unit 1 Technical Specifications (TS) to reflect storage of new and spent fuel of higher enrichment. The existing TS Figure 3.9-1, "Burnup versus Enrichment Curve for Davis-Besse Spent Fuel Storage Racks," limits the initial enrichment of U-235 fuel that can be stored at the site to 3.8 weight percent (wt%). The requested TS change would revise TS Figure 3.9-1 to reflect the storage of higher enriched fuel of 5.0 wt%. The licensee is also proposing to revise TS 5.6.1.1 and TS 5.6.1.2 to add an appropriate cross-reference to the TS 3.9.13 description of the spent fuel storage racks, and to reflect the limitation in the description of the new fuel storage racks.

The proposed amendment is needed because the licensee intends to use fuel of higher enrichment than currently used, which will permit longer fuel cycles with smaller fuel assembly feed batches resulting in more efficient uranium utilization. Along with the reduction in reload batch size, there will be an increase in the fuel assembly average discharge burnup not to exceed 60,000 megawatt days per metric ton (MWD/MTU).

The supplemental letter provided additional information and did not alter the proposed action or affect the NRC staff's evaluation of a proposed no significant hazards consideration published in the Federal Register.

2.0 EVALUATION

2.1 Fuel Racks Safety Issues

New fuel storage racks (NFSRs) are designed to store new non-irradiated nuclear fuel assemblies in a dry and upright configuration. NFSRs are subject to the same safety functions as those performed by the reactor core and nuclear fuel, that is, to retain the fuel in an appropriate geometry, and to prevent the migration of radioactive fission products by encapsulating the fuel pellets in a Zircaloy cladding. The NFSR are designed to prevent damage to the fuel assemblies from seismic events, and store fuel in a non-critical configuration. Spent fuel storage racks (SFSRs), on the other hand, store new and depleted fuel assemblies in a upright configuration under water. The safety functions for SFSRs are the same as those stated above. The structural composition, rack spacing, flux trapping and other characteristics, can be found in the Davis-Besse updated Safety Analysis Report (USAR) Sections 9.1.1 and 9.1.2.

Analysis by the licensee has shown that since the actual mass of the fuel assemblies has not changed, increasing the fuel enrichment does not affect the safety functions performed by the reactor core or the nuclear fuel. Since actual fuel assembly mass does not change, seismic protection functions for NFSRs and SFSRs will not be degraded. However, because the higher enrichment will affect the criticality associated with NFSRs and SFSRs, the licensee conducted the necessary calculations according to 5.0 wt% enrichment. The calculations and the corresponding results are discussed below.

2.2 Criticality Analysis

All criticality analysis required for the proposed changes was performed by the Babcock and Wilcox Fuel Company, using NRC-approved methods and computer codes (CASMO-3, KENO-IV, NITAWL, and the latest cross-sectional library codes). Typically, these codes are widely used for the analysis of fuel rack reactivity and have been benchmarked against results from numerous critical experiments. The codes mentioned above have been used extensively in the past to perform criticality calculations for the Davis-Besse new and spent fuel racks. These calculations simulate the Davis-Besse spent fuel racks as realistically as possible with respect to such characteristics important to reactivity as enrichment, assembly spacing, and absorber thickness. The criticality analyses were performed with several assumptions which tend to maximize the rack reactivity. These include:

(1) unborated pool water at the temperature yielding the highest reactivity over the TS range of water temperatures

(2) infinite array of storage cells in all directions (except for the assessment of peripheral effects and certain abnormal conditions where neutron leakage is inherent)

(3) neutron absorption effects of structural material is neglected.

2.3 New Fuel Storage Rack Calculations

All KENO-IV calculations for NFSRs were benchmarked against appropriate critical experiments and subject to all the normally applied biases and statistical uncertainties, that is, cell pitch penalty, temperature penalty, and assembly homogenization bias. CASMO-3 was used to calculate biases and penalties for off-nominal conditions (off-center assembly in rack, moderator temperature dependence, generate fuel assembly isotopic as a function of assembly exposure, etc.). The output of CASMO-3 was then used as input to KENO-IV to perform a totally statistical calculation. All statistical calculations were subject to the 95/95 confidence level criteria.

NFSR criticality analysis shows that fuel assemblies with enrichment up to 5.0 wt% U-235 could not be stored in all of the 80 locations of the NFSRs unless certain rows (rows C and F) were left empty. Data submitted by the licensee show that this configuration limits the storage capacity of the NFSR to 60 fuel assemblies. A maximum K_{eff} of 0.93555, assuming 5.0 wt% enrichment, flooded conditions, and all the associated biases and uncertainties etc., was calculated for all of the 80 NFSR locations occupied. This is less than the TS (5.6.1.2) value of 0.95 (under the same conditions), and that the calculation was performed with the NFSR containing 20 more assemblies than will actually be permitted. Under optimum moderation conditions, with biases and uncertainties stated above, with rows C and F left empty and all the remaining locations containing 5.0 wt% fuel, a K_{eff} of 0.96829 was determined. This is less than the optimum moderation criterion of 0.98. Based on its review of the above, the NRC staff finds that the storage of 60 assemblies of 5.0 wt% U-235 in Davis-Besse, Unit 1 NFSR with no assemblies placed in NFSR rows C and F is acceptable.

2.4 Spent Fuel Storage Racks Calculations

In calculating the SFSR criticality, the licensee again assumed all the statistical uncertainties and the various biases associated with the various penalties, subject to the 95/95 confidence level. The spent pool temperature assumed was such that it maximized reactivity. Penalties without associated statistical uncertainties were deterministically calculated using CASMO-3.

2.4.1 Axial Burnup Shapes

The licensee conducted axial burnup shape calculations to study the effects of storing non-uniform axial burnup fuel assemblies next to other depleted assemblies and also next to new fuel assemblies. The analysis showed that when the depleted fuel was placed next to fresh fuel, the effects of the non-uniform axial burnup were statistically insignificant. However, for cases involving the storage of depleted fuel assemblies next to each other, an axial effect penalty and a statistical uncertainty was included in the calculation to account for non-uniform axial burnup. In addition to these penalties and uncertainties, the licensee also included an additional 5-percent penalty to the burnup curves (TS Figure 3.9.1) to account for measurement uncertainties in assembly-average burnup, and to ensure that all KENO-IV calculations that included depleted fuel assemblies also assumed bounding burnable poison effects.

Fuel storage in the Davis-Besse SFSR is based on the checkerboard pattern in which highly enriched, low-burnup assemblies are interspersed with low-enriched, high-burnup assemblies. As in previous NRC-approved criticality analysis, three categories of fuel assemblies were determined. Category A designates fuel assemblies of lowest reactivity; these can be stored in the SFSR without restriction. Category B designates fuel assemblies of intermediate reactivity and can be stored in any location in the SFSR except directly adjacent to a Category C assembly. Category C designates fuel assemblies of the highest reactivity; these can only be stored adjacent to Category A fuel assemblies and/or locations not containing fuel assemblies. Data submitted by the licensee as part of TS Figure 3.9.1 indicate the three designated regions. The licensee also conducted bounding calculations of possible permitted combinations of the loading patterns subject to the rules stated in the preceding paragraph. In all cases, the value of the maximum K_{eff} obtained was less than 0.95. This includes all uncertainties, biases, and penalties as defined in the preceding paragraphs, and assuming no soluble boron in the spent fuel pool. The licensee is implementing a set of rigorous controls to ensure that the basis for TS 3.9.13 will be preserved during all fuel movements in the spent fuel pool. The NRC staff concludes that the analysis methods used are acceptable (subject to the rules stated above and the initial enrichment of 5 wt%) and are capable of predicting the reactivity of the Davis-Besse, Unit 1 storage racks with a high degree of confidence.

The NRC staff has reviewed the information submitted by the licensee and finds that storage of fuel enriched to 5 wt% in the Davis-Besse, Unit 1 spent fuel pool storage racks to be acceptable and meets the requirements of General Design Criterion 62 for the prevention of criticality in fuel storage and handling.

2.5 Design Basis Accidents

In addition to the information provided by the licensee, the NRC staff has also reviewed a report, NUREG/CR-5009 dated February 1988, "Assessment of the Use of Extended Burnup Fuel in Light Water Power Reactors," prepared by Pacific Northwest Laboratory (PNL) for the NRC. In this report, the changes that could result in the NRC design basis accident (DBA) assumptions were examined to determine which assumptions contained in various Standard Review Plan sections and/or Regulatory Guides might be changed as a result of extended burnup fuel up to 60,000 MWD/MTU. The report concluded that the only DBA which could be affected by the use of extended burnup fuel would be the potential thyroid doses that could result from a fuel handling accident (FHA). Based on its review, the NRC staff agrees with that assessment.

The licensee reevaluated the FHA for Davis-Besse assuming an initial fuel enrichment of 5.0 wt% uranium-235 and an assembly-average burnup of 60,000 MWD/MTU. The licensee concluded that the thyroid dose and whole body dose results met the appropriate criteria and were acceptable. The NRC staff reviewed the information provided by the licensee and found that the FHA evaluation results meet the acceptance criteria of Standard Review Plan Section 15.7.4, are within the dose guidelines set forth in 10 CFR Part 100, and are acceptable.

2.6 Finding

Based on the above, the NRC staff finds that the storage of spent fuel enriched to 5.0 wt% with a burnup fuel up to 60,000 MWD/MTU, and the storage of new fuel enriched to 5.0 wt% prior to use in the reactor during an operating cycle, is acceptable.

3.0 STATE CONSULTATION

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

4.0 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 November 5, 1993 (58 FR 59080). 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.

5.0 CONCLUSION

The staff 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 this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: A. Attard
J. Hopkins

Date: November 19, 1993