June 28, 1993

Docket No. 50-313

Mr. Jerry W. Yelverton
Vice President, Operations ANO
Entergy Operations, Inc.
Route 3 Box 137G
Russellville, Arkansas 72801

Dear Mr. Yelverton:

SUBJECT: ISSUANCE OF AMENDMENT NO. 166 TO FACILITY OPERATING LICENSE NO. DPR-51 - ARKANSAS NUCLEAR ONE, UNIT NO. 1 (TAC NO. M80884)

The Commission has issued the enclosed Amendment No. 166 to Facility Operating License No. DPR-51 for the Arkansas Nuclear One, Unit No. 1 (ANO-1). This amendment consists of changes to the Technical Specifications (TSs) in response to your application dated June 27, 1991.

The amendment changes Technical Specifications (TS) 5.3.1.6 and 5.4.1.1 to increase the maximum allowable enrichment for future reload fuel from 3.5 to 4.1 weight percent uranium-235 (U-235). TS 5.4.1.1 is also revised to delineate the allowable storage positions in the fresh fuel rack. Additionally, "235U" is corrected to "U-235."

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

Sincerely,

ORIGINAL SIGNED BY:
Roby B. Bevan, Project Manager
Project Directorate IV-1
Division of Reactor Projects - III/IV/V
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No. 166 to DPR-51
2. Safety Evaluation

cc w/enclosures:
See next page

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

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R B Bevan

Roby B. Bevan, Project Manager
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Mr. Jerry W. Yelverton
Entergy Operations, Inc.

Arkansas Nuclear One, Unit 1

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

ENTERGY OPERATIONS INC.

DOCKET NO. 50-313

ARKANSAS NUCLEAR ONE, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 166
License No. DPR-51

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

   A. The application for amendment by Entergy Operations, Inc. (the licensee) dated June 27, 1991, 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 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.

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. DPR-51 is hereby amended to read as follows:

   2. Technical Specifications

      The Technical Specifications contained in Appendix A, as revised through Amendment No. 166 , are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. The license amendment is effective as of its date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Terence L. Chan, Acting Director
Project Directorate IV-1
Division of Reactor Projects - III/IV/V
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
  Specifications

Date of Issuance: June 28, 1993

ATTACHMENT TO LICENSE AMENDMENT NO. 166

FACILITY OPERATING LICENSE NO. DPR-51

DOCKET NO. 50-313

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
114	114
116	116
-	116a

5.3 REACTOR

Specification

5.3.1 Reactor Core

5.3.1.1 The reactor core contains approximately 93 metric tons of slightly enriched uranium dioxide pellets. The pellets are encapsulated in Zircaloy-4 tubing to form fuel rods. The reactor core is made up of 177 fuel assemblies. Each fuel assembly is fabricated with 208 fuel rods. (1,2) Starting with Batch 11, a reconstitutable fuel assembly design is implemented. This design allows the replacement of up to 208 fuel rods in the assembly. For Cycle 10 operation only, fuel assembly NJ0539 wil contain one stainless steel filler rod in place of one fuel rod.

5.3.1.2 The reactor core approximates a right circular cylinder with an equivalent diameter of 128.9 inches and an active height of 144 inches. The active fuel length is approximately 142 inches.[2]

5.3.1.3 The average enrichment of the initial core is a nominal 2.62 weight percent of U-235. Three fuel enrichments are used in the initial core. The highest enrichment is less than 3.5 weight percent U-235.

5.3.1.4 There are 60 full-length control rod assemblies (CRA) and 8 axial power shaping rod assemblies (APSRA) distributed in the reactor core as shown in FSAR Figure 3-60. The full-length CRA contain a 134-inch length of silver-indium-cadminum alloy clad with stainless steel. Each APSRA contains a 63-inch length of Inconel-600 alloy.(3)

5.3.1.5 The initial core had 68 burnable poison spider assemblies with similar dimensions as the full-length control rods. The cladding is Zircaloy-4 filled with alumina-boron and placed in the core as shown in FSAR Figure 3-2.

5.3.1.6 Reload fuel shall conform to the design and evaluation described in FSAR and shall not exceed an enrichment of 4.1 weight percent of U-235.

5.3.2 Reactor Coolant System

5.3.2.1 The reactor coolant system is designed and constructed in accordance with code requirements.[4]

5.4 NEW AND SPENT FUEL STORAGE FACILITIES

Applicability

Applies to storage facilities for new and spent fuel assemblies.

Objective

To assure that both new and spent fuel assemblies will be stored in such a manner that an inadvertent criticality could not occur.

Specification

5.4.1 New Fuel Storage

1. New fuel assemblies may be stored in the Fresh Fuel Storage Rack (FFSR). The FFSR consists of a nine by eight array of storage cells on nominal center to center distance of 21 inches in both directions. Ten interior storage cells, as shown in Figure 5.4-1, are precluded from use and will be physically blocked prior to any storage in the fresh fuel rack. This configuration is sufficient to maintain a K_{eff} of less than 0.98 with optimum moderation and 0.95 under normal conditions, based on fuel with an enrichment of 4.1 weight percent U-235.

2. New fuel may also be stored in the spent fuel pool or in its shipping containers.

5.4.2 Spent Fuel Storage

1. The spent fuel racks are designed and shall be maintained so that the calculated effective multiplication factor is no greater than 0.95 (including all known uncertainties) when the pool is flooded with unborated water.

2. The spent fuel pool and the new fuel pool racks are designed as seismic Class I equipment.

REFERENCES

FSAR, Section 9.6

FIGURE 5.4-1 ANO FFSR LOADING PATTERN

<----- NORTH

		NO			NO		
			NO	NO			
			NO	NO			
			NO	NO			
		NO			NO		

"NO" Indicates a location in which fuel loading is prohibited.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 166 TO

FACILITY OPERATING LICENSE NO. DPR-51

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT NO. 1

DOCKET NO. 50-313

1.0 INTRODUCTION

By letter dated June 27, 1991 (Reference 1), Entergy Operations, Inc. (EOI), the licensee, submitted proposed Technical Specification (TS) changes which would permit fresh, unirradiated fuel having an initial enrichment of up to 4.1 weight percent U-235 to be stored in the fresh fuel storage racks (FFSRs) for use in the core of Arkansas Nuclear One, Unit No. 1 (ANO-1).

ANO-1 is a Babcock & Wilcox (B&W) designed pressurized water reactor (PWR), and B&W 15 x 15 fuel rod lattice array fresh fuel of this enrichment has previously been reviewed and approved (Reference 2) for storage in the spent fuel pool storage racks. However, the existing ANO-1 TSs state that the FFSRs are capable of storing fuel having an enrichment no greater than 3.5 weight percent U-235. The licensee's request would revise TS 5.3.1.6, "Reactor Core," and TS 5.4.1.1, "New Fuel Storage", to increase the maximum initial U-235 enrichment of future reload fuel being cycled through the facility from 3.5 to 4.1 weight percent. The requested changes to TS 5.4.1.1 also include the addition of Figure 5.4-1, "ANO FFSR Loading Pattern," to indicate the locations in the FFSR that will be prohibited from use. To support these proposed changes, the licensee has included a criticality analysis (Reference 3) of the ANO-1 FFSR which addresses the storage of 4.1 weight percent U-235 fuel assemblies, using the same methodology (Reference 4) which was previously accepted for the Unit No. 2 (ANO-2) FFSR criticality analysis (Reference 5).

2.0 EVALUATION

The design basis for preventing criticality in new fuel storage is based on the NRC Standard Review Plan (SRP), NUREG-800 (Reference 6). Section 9.1.1, "New Fuel Storage," effectively requires (by reference to the ANS 57.1 {Reference 7} and ANS 57.3 {Reference 8} standards) that there is a 95 percent probability at a 95 percent confidence level (95/95 probability/confidence) that the effective multiplication factor (k-effective), including uncertainties, will be no greater than 0.95 under unborated moderator conditions and no greater than 0.98 under optimum moderation. General Design Criterion (GDC) 62 (Reference 9) also states that:

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

2.1 Criticality Analysis Methods

The analysis of the criticality aspects of the storage of ANO-1 fresh fuel assemblies having a fuel enrichment of 4.1 weight percent U-235 was performed by the licensee. The analysis methods used consist of the AMPX/NITAWL/KENO computer codes, which are part of the Oak Ridge National Laboratory (ORNL) Standard Computer Analysis for Licensing Evaluations (SCALE) code package (Reference 10). The AMPX code uses the 123 group SCALE cross-section library with the NITAWL routine to derive weighted cross-sections for U-238 in the resonance region with the Nordheim resonance integral treatment. The NITAWL output is used by the KENO program, a three-dimensional Monte Carlo neutron tracking code, that calculates the system effective neutron multiplication factor (k_{eff}).

The AMPX/KENO methodology has been extensively benchmarked by the nuclear industry, including the current fuel vendor (B&W Fuel Company). However, the licensee has also performed additional critical experiment benchmarks with their own specific methodology to determine the calculational uncertainty and bias for their specific applications. The benchmark measurements included a standard set of B&W critical experiments (Reference 11) and a set of 70 shipping cask critical experiments at ORNL (Reference 12) which verified the application of the SCALE library. The results of the licensee comparisons from Reference 4 yielded a KENO one-sided upper tolerance limit of 0.021 with a probability of 95% that at least 95% of the calculated KENO results will be within this limit (95/95 probability/confidence level).

Another industry standard code, CASMO, is used to determine the reactivity effects of variations in fuel pellet density and U-235 enrichment. CASMO is a multigroup two-dimensional transport theory code which has been validated by the licensee for calculations of PWR fuel lattice reactivities (Reference 13).

2.2 New Fuel Storage Rack Analysis

The FFSR consists of a nine-by-eight array of storage cells on a nominal center to center distance of 21 inches in both directions as described in the ANO-1 UFSAR. The criticality of fuel assemblies in the ANO-1 FFSRs is prevented by limiting the U-235 enrichment in the fuel rods to 4.1 weight percent and by maintaining a minimum separation of 21 inches between assemblies. Since unirradiated fuel contains no radioactive fission products, it requires no cooling or shielding and is normally stored in a dry condition. However, the NRC acceptance criteria that fuel assembly storage must meet are that the k_{eff} shall be no greater than 0.95 when the racks are fully loaded and flooded with pure, unborated water and that the k_{eff} shall be no greater than 0.98 under "optimum" moderation when the racks are immersed with low-density hydrogenous material due to such causes as mist, fog, or fire-fighting foam. The k_{eff} shall include all biases and uncertainties at a 95/95 probability/confidence level.

The licensee has performed calculations for the FFSRs at various moderator densities in order to obtain the optimum moderator density which results in the maximum reactivity. Since ANO-1 fresh fuel is stored in cavities whose internal dimensions are larger than the outside fuel assembly dimensions, there is an uncertainty in the lateral placement of any one assembly in its cavity. However, the licensee has previously shown that eccentric placement of assemblies reduces the multiplication factor in optimum moderation analyses. The assemblies, therefore, were modeled as centered in the cells.

The licensee analyses showed that a fully loaded FFSR (72 assemblies) would meet the NRC acceptance criterion of k_{eff} less than 0.95 under flooded conditions; however, in order to meet the NRC acceptance criterion of k_{eff} less than 0.98 for conditions of optimum moderation, it is necessary to preclude (by physical blockage) the placement of fresh fuel assemblies in 10 interior storage cell locations as shown in the proposed Figure 5.4-1. A conservative analysis shows that this partially loaded rack configuration can safely accommodate 4.1 weight percent U-235 fuel with a 95/95 probability/confidence level for k_{eff} of 0.96957 under conditions of optimum moderation. This meets the staff acceptance criterion for k_{eff} no greater than 0.98 and also satisfies GDC 62, and is, therefore, acceptable.

2.3 <u>Accident Analysis</u>

Certain postulated events which could lead to a storage rack reactivity increase were evaluated. Asymmetric positioning of fuel assemblies in the cells has been shown to yield equal or conservative results compared to symmetrically positioned fuel assemblies. A dropped fuel assembly on top of the rack will be sufficiently separated from the active fuel height of the assemblies in the rack such that there will be no storage rack reactivity increase. Conditions which would result in an increase in reactivity such as dropping or misloading a fuel assembly outside or adjacent to the rack were evaluated for the normally dry rack. This is acceptable by application of the double-contingency principle of ANSI N16.1-1975, "American National Standard for Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors," which states that the evaluation is not required to assume two unlikely, independent concurrent events to provide for protection against a criticality accident. The evaluation showed that an assembly dropped or misloaded in a maximum reactivity configuration beside the normally dry FFSR results in a 95/95 k_{eff} of 0.546718, well below the staff acceptance criterion of k_{eff} no greater than 0.95.

In our review and evaluation of the proposed changes, the following considerations apply:

1. The criticality analyses involved in this change were performed with an industry standard methodology which has been additionally benchmarked by the licensee.

2. Appropriate uncertainties were accounted for at the 95/95 probability/confidence level.

3. Abnormal events and accidents were considered.

4. The effective neutron multiplication factor, including uncertainties, met our acceptance criteria for all postulated conditions.

Based on our review, we conclude that up to 62 fresh, unirradiated fuel assemblies having a maximum initial enrichment of 4.1 weight percent U-235 may be stored in the ANO-1 fresh fuel storage racks and that TS 5.3.1.6, "Reactor Core," and TS 5.4.1.1, "New Fuel Storage," may be revised accordingly, including the addition of Figure 5.4-1 to indicate the physically blocked storage locations.

3.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Arkansas 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 and changes surveillance requirements. 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 (56 FR 37580). 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 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, (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.

REFERENCES

1. Letter from N. Carns (Entergy Operations) to Document Control Desk (USNRC), dated June 27, 1991, "Proposed Change to the Technical Specification for Increased Fresh Fuel Enrichment."

2. Letter from J. Stolz and R. Clark (NRC) to J. Griffin, (AP&L) dated April 15, 1983, issuing Amendment No. 76 to Facility Operating License No. DPR-51 for Arkansas Nuclear One, Unit No. 1 and Amendment No. 43 to Facility Operating License NPF-6 for Arkansas Nuclear One, Unit No 2.

3. "Criticality Analysis of ANO-1 Fresh Fuel Rack," by M. R. Eastburn, Entergy Operations, Inc., December 1990.

4. Letter from J. Enos (AP&L) to G. Knighton (NRC), dated January 29, 1986, submitting "ANO-2 Fresh Fuel Pit Criticality Analysis, Storage of 4.1 Weight Percent U-235 Assemblies," by M. R. Eastburn, Middle South Services, Inc., October 17, 1984.

5. Letter from R. Lee (NRC) to J. Griffin (AP&L), dated April 16, 1986, "Issuance of Amendment No. 71 to Facility Operating License NPF-6 - Arkansas Nuclear One, Unit No. 2."

6. USNRC Standard Review Plan, Section 9.1.1, "New Fuel Storage," NUREG-0800 (Rev. 2), July 1981.

7. ANS 57.1/ANSI-N208, "Design Requirements for Light-Water Reactor Fuel Handling Systems."

8. ANS 57.3, "Design Requirements for New LWR Fuel Storage Facilities."

9. Code of Federal Regulations, Title 10 Part 50, Appendix A, General Design Criterion 62, "Prevention of Criticality in Fuel Storage and Handling."

10. R. M. Westfall, et al., "SCALE-2: A Modular Code System for Performing Standardized Computer Analysis for Licensing Evaluation," NUREG/CR-0200, Oak Ridge National Laboratory.

11. N. M. Baldwin et al., "Critical Experiments Supporting Close Proximity Water Storage of Power Reactor Fuel," BAW-1487-7, Babcock and Wilcox, July 1979.

12. R. M. Westfall, J. R. Knight, "SCALE System Cross Section Validation with Shipping Cask Critical Experiments," Transactions of the American Nuclear Society, Vol. 33, 1979, p. 368.

13. Letter from R. A. Clark and J. F. Stolz (NRC) to W. Cavanaugh (APL), dated August 11, 1982, transmitting "Evaluation of Report MSS-NA1-P, 'Qualification of Reactor Physics Methods for Application to Pressurized Water Reactors of the Middle South Utilities System.'"

Principal Contributor: E. Kendrick

Date: June 28, 1993