February 26, 2007

Mr. Timothy G. Mitchell
Vice President, Operations
Arkansas Nuclear One
Entergy Operations, Inc.
1448 S. R. 333
Russellville, AR 72802

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT NO. 1- CORRECTION TO AMENDMENT NO. 228 FOR THE USE OF METAMIC® POISON INSERT ASSEMBLIES IN THE SPENT FUEL POOL (TAC NO. MD2674)

Dear Mr. Mitchell:

By letter dated January 26, 2007, the Nuclear Regulatory Commission (NRC) issued Amendment No. 228 to Renewed Facility Operating License (DPR-51) for Arkansas Nuclear One, Unit No. 1 (ANO-1) regarding use of Metamic® poison insert assemblies in the spent fuel pool. The amendment consisted of changes to the Technical Specifications (TSs) in response to Entergy's application dated July 27, 2006, as supplemented by Entergy's letters dated October 4, October 9 (proprietary), and December 14, 2006.

It was subsequently brought to our attention that the safety evaluation (SE) supporting the amendments contains a typographical error on page 7. The licensee also identified errors in the revised page (Page 3) of the license and TS pages provided in the January 26, 2007, letter. These were administrative errors in formatting the text and revision bars in the revised license page and TS pages. Further, the licensee requested that the NRC add clarifications to the NRC staff's review on Pages 5, 13, and 15 of the SE.

Enclosed are the corrected pages to the license, TS, and the SE. The corrected SE pages are provided with marginal lines indicating the areas changed. Please use these pages to replace corresponding pages in the January 26, 2007, amendment package. The NRC staff's conclusions associated with Amendment No. 228 are not affected by these corrections. We regret any inconvenience this may have caused.

Sincerely,

/RA/
Farideh E. Saba, Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-313

Enclosures: As stated

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NAME	FSaba	LFeizollahi	DTerao
DATE	2/23/07	2/23/07	2/26/07

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ATTACHMENT TO LICENSE AMENDMENT NO. 228

TO RENEWED FACILITY OPERATING LICENSE NO. DPR-51

DOCKET NO. 50-313

Replace the following page of Renewed Facility Operating License with the attached revised pages.

REMOVE	INSERT
- 3 -	- 3 -

Replace the following pages Appendix A, “Technical Specifications,” with the attached revised pages.

REMOVE	INSERT
3.7.15-2	3.7.15-2
3.7.15-3	3.7.15-3
4.0-3	4.0-3
4.0-5	4.0-5
4.0-6	4.0-6
5.0-25	5.0-25
5.0-25a	5.0-25a

Replace the following page of the Safety Evaluation (SE) with the attached revised pages. The revised pages of SE contain marginal lines indicating the areas of change.

REMOVE	INSERT
5	5
7	7
13	13
15	15

Enclosure

(4) EOI, pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess and use at any time any byproduct, source and special nuclear material as sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;

(5) EOI, pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components;

(6) EOI, pursuant to the Act and 10 CFR Parts 30 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility.

c. This renewed license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations in 10 CFR Chapter I: Part 20, Section 30.34 of Part 30, Section 40.41 of Part 40, Sections 50.54 and 50.59 of Part 50, and Section 70.32 of Part 70; is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

EOI is authorized to operate the facility at steady state reactor core power levels not in excess of 2568 megawatts thermal.

(2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 228, are hereby incorporated in the renewed license. EOI shall operate the facility in accordance with the Technical Specifications.

(3) Safety Analysis Report

The licensee's SAR supplement submitted pursuant to 10 CFR 54.21(d), as revised on March 14, 2001, describes certain future inspection activities to be completed before the period of extended operation. The licensee shall complete these activities no later than May 20, 2014.

(4) Physical Protection

EOI shall fully implement and maintain in effect all provisions of the Commission-approved physical security, training and qualification,

July 27, 2006. These corrections resulted in a slightly higher minimum burnup requirement for the fuel assemblies that are stored in Region 1 and Region 2 of the ANO SFP. In addition, the required minimum boron concentration to ensure that k_{eff} remains $\leq$ 0.95 is slightly lower than the previously submitted value.

The supplement also made minor weld changes that resulted in slight wording changes in the summary of the structural considerations, and corrected a typographical error. Two more supplements dated October 9 and December 14, 2006, were submitted in response to staff requests for drawings of the poison insert assemblies, and to the staff request for additional information (RAI) related to the Metamic® coupon sampling program and explanation of a few specific areas of the structural/seismic analysis, respectively.

3.2 Evaluation of TS Changes

3.2.1 Criticality Safety and Thermal-Hydraulic Analyses Evaluation

Evaluated Changes to the ANO -1 TSs

A. TS 3.7.14, "Spent Fuel Pool Boron Concentration"

The requested amendment proposed to increase the requirement for the minimum boron concentration to greater that 2,000 ppm. This proposed increase in the boron concentration provides a sufficient margin that assures the maximum neutron multiplication factor, k-effective (k_{eff}), will remain below 0.95 in the unlikely event of a criticality accident. The upper limit on SFP boron concentration is 3,500 ppm per ANO-1 Final Safety Analysis Report (FSAR) Section 9.6.2.4.3.4. The boron concentrations for each region of the SFP, as determined by the criticality analyses to assure that k_{eff} remains below 0.95, are bounded by the TS value. The fuel loading patterns in the proposed changes, as defined by the criticality safety analysis, are governed, as they are currently, by procedure.

The proposed change also modifies the applicability of TS 3.7.14 to require the designated boron concentration any time fuel assemblies are stored in the SFP, regardless of whether SFP verification has been performed.

B. TS 3.7.15, "Spent Fuel Pool Storage"

Region 1 of the SFP contains Boraflex® poison panels, and currently there are no loading restrictions required by TS for Region 1. The proposed change no longer credits Boraflex® in Region 1, and meets the regulatory requirements with regard to k_{eff} through loading restrictions based on minimum burnup requirements at varying initial U-235 enrichment and cooling times for Regions 1. This results in the creation of a new Table 3.7.15-1 based on new SFP criticality analysis and the concomitant deletion of Figure 3.7.15-1.

Currently, ANO-1 TS 3.7.15 and Figure 3.7.15-1 define loading restrictions for fuel assemblies that are stored in Region 2 of the ANO-1 SFP. Under the proposed changes a portion of the SFP racks in Region 2 are modified by the installation of Metamic® PIAs. This portion of Region 2 is redefined as Region 3 and subject to loading restrictions specified for Region 3 in Table 3.7.15-1. The following restrictions are applied to Region 3: Unrestricted storage is allowed for fuel

TS 4.3.1.2 addresses the design and constraints of the new fuel storage racks with regard to criticality as:

- TS 4.3.1.2 a allows fuel assemblies with a maximum U-235 enrichment of 4.95 wt%.

- TS 4.3.1.2 b specifies that k_{eff} is to be maintained at less than or equal to 0.95 under normal conditions, which includes an allowance for uncertainties.

- TS 4.3.1.2 c specifies that k_{eff} is to be less than 0.98 with optimum moderation, which includes an allowance for uncertainties.

- TS 4.3.1.2 d specifies a nominal 21-inch center-to-center distance between fuel assemblies placed in the storage racks.

- TS 4.3.1.2 e specifies that fuel assembly loading is prohibited in the interior storage cells as shown in Figures 4.3.1.2-1 or 4.3.1.2-2, based on U-235 fuel enrichment.

Criticality Safety Analyses

The objective of the SFP criticality analysis is to insure that the effective neutron multiplication factor (k_{eff}) is less than or equal to 0.95 with the storage racks fully loaded with fuel of the highest permissible reactivity and the pool flooded with borated water at a temperature corresponding to the highest reactivity. In addition, it is demonstrated that k_{eff} is less than 1.0 under the assumed loss of soluble boron in the pool water. The maximum calculated reactivities include a margin for uncertainty in the reactivity calculations, including manufacturing tolerances, and are calculated with a 95 percent probability at a 95 percent confidence level. Reactivity effects of abnormal and accident conditions are also evaluated to assure that under all credible abnormal and accident conditions the reactivity will not exceed the regulatory limit of 0.95.

A. The specific evaluation performed for the ANO-1 SFP are:

- The Region 1 racks are evaluated for storage of spent fuel assemblies with specific burnup requirements as a function of initial enrichment between 2.0 wt% and 5.0 wt% U-235 and decay times between 0 and 20 years for both of the cases without and with soluble boron credit.

- The Region 1 racks are evaluated for storage of fresh fuel assemblies with a maximum nominal enrichment of 5.0 wt% U-235 in a checkerboard configuration with empty storage cells for both of the cases without and with soluble boron credit.

- The Region 2 racks are evaluated for storage of spent fuel assemblies with specific burnup requirements as a function of initial enrichment between 2.0 wt% and 5.0 wt% U-235 and decay times between 0 and 20 years for both of the cases without and with soluble boron credit.

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

The NRC staff has reviewed the licensee's supplements to the original license amendment request. Based on the supporting information submitted to the staff with regard to the corrections made to the relevant computations in the original submittal, the staff finds the changes to the TSs for ANO-1 acceptable with regard to the supporting criticality analyses and thermal-hydraulic analyses.

3.2.2 Coupon Sampling Program Evaluation

Metamic® Coupon Sampling Program

Metamic® is a cermet composed primarily of B_4C and aluminum Al 6061. A cermet is a composite material composed of ceramic (B_4C) and metallic (Al) materials. B_4C is the constituent in the Metamic® known to perform effectively as a neutron absorber and Al 6061 is a marine-qualified alloy known for its resistance to corrosion. In spite of these corrosion resistant positive properties, Metamic® has not been previously used in SFP applications.

In its submittal dated July 27, 2006, the licensee has provided a Metamic® Coupon Sampling Program which consists primarily of monitoring the physical properties of the absorber material by performing periodic neutron attenuation testing to confirm the physical properties. By letter dated December 14, 2006, Entergy submitted its response to the staff RAI related to the Metamic® coupon sampling program

Program Description

The purpose of the licensee's Metamic® coupon surveillance program is to ensure the physical and chemical properties of Metamic® behave in a similar manner as that found at the test facilities. The coupon program will monitor how the Metamic® absorber material properties change over time under the radiation, chemical, and thermal environment found in the SFP.

The coupon program will be incorporated in TS 5.5.17, "Metamic Coupon Sampling Program." In addition, the licensee will create a new SR 3.7.15.2, which will direct the performance of the sampling program.

The coupons will be installed on a stainless steel coupon tree that holds 10 or more coupons. Each coupon is approximately 7-inch long, 5-inch wide, and 0.10-inch thick. Coupons are identical in composition and manufacturing process as the Metamic® in the PIAs. Each coupon will be mounted in stainless steel jackets simulating the actual insert design. The coupon tree will be placed in the SFP at a location where localized burn-up is greater than assembly average burn-up. In addition, this location will accurately simulate the flow characteristics, pool chemistry, and differential metal interfaces that the Metamic® PIAs will experience. The coupon samples contain 25 percent B_4C, which is consistent with the B_4C content in the Metamic® used in the spent fuel racks in Region 3.

measurements taken do not meet the established acceptance criteria, the licensee may perform an investigation and engineering evaluation which may include early retrieval and measurement of one or more of the remaining coupons to confirm the indicated change(s).

The licensee also stated that regardless of whether the acceptance criteria are met, neutron attenuation testing will be performed on any coupon removed. By performing neutron attenuation testing, the licensee will be able to validate the B_{10} loading in the Metamic® panels and coupons. After all testing is finished, the coupons might be returned to the coupon tree, depending on whether the integrity of the coupon is compromised or contamination levels are too high.

The licensee's coupon measurement schedule is as follows:

Coupon #	Duration in SFP (Years)	Sampling Period Years
1	2	2
2	4	2
3	6	2
4	10	4
5	15	5
6	20	5
7	25	5
8	30	5
9	35	5
10	40	5
11	Spare	At Any Time
12	Spare	At Any Time

As shown in the above table, there is a sufficient number of coupons to last 40 years, which bounds the current operating license for ANO-1. Since the last two coupons are not needed, they will be removed only if additional testing is required.

Conclusion

Based on its review of the licensee's coupon sampling program, the staff concludes that the Metamic® neutron absorber is compatible with the environment of the SFP. Also, the staff finds the proposed surveillance program, which includes visual, physical and confirmatory tests, is capable of detecting potential degradation of the Metamic® material that could impair the neutron absorption capability. Therefore, the staff concludes that the use of Metamic® as a neutron absorber panel in the spent fuel racks in Region 3 is acceptable.