November 18, 2005

Mr. Jeffrey S. Forbes
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SUBJECT: CORRECTION LETTER - ARKANSAS NUCLEAR ONE, UNIT NO. 2 ISSUANCE OF AMENDMENT RE: REQUEST TO ADD CASK LOADING RESTRICTIONS (TAC NO. MC7648)

Dear Mr. Forbes:

On September 6, 2005, the U.S. Nuclear Regulatory Commission issued Amendment No. 261 to Renewed Facility Operating License No. NPF-6 for Arkansas Nuclear One, Unit No. 2. The amendment incorporated new Technical Specifications in support of dry cask loading operations in the spent fuel pool. The amendment was in response to your application dated July 21, 2005, as supplemented by letters dated August 4 and August 26, 2005.

After issuance, it was discovered that the safety evaluation provided with Amendment No. 261 contained a number of typographical, nontechnical errors. Enclosed is the corrected safety evaluation for Amendment No. 261. Please replace the incorrect version with the enclosure.

If you have any questions, please contact me at 301-415-1436.

Sincerely,

/RA

Drew G. Holland, Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-368

Enclosure: Corrected safety evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 261 TO

RENEWED FACILITY OPERATING LICENSE NO. NPF-6

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT NO. 2

DOCKET NO. 50-368

1.0 INTRODUCTION

By application dated July 21, 2005 (Agencywide Documents and Access Management System (ADAMS) Accession No. ML052080049) (Reference 1), as supplemented by letters dated August 4 (ADAMS Accession No. ML052230282), and August 26, 2005 (ADAMS Accession No. ML052500597), (Refs. 2 and 3) Entergy Operations, Inc. (Entergy or the licensee) requested approval of a license amendment for Arkansas Nuclear One, Unit 2 (ANO-2). Entergy requested this amendment to incorporate new ANO-2 technical specifications (TSs) in support of dry cask loading operations in the spent fuel pool (SFP). The licensee's amendment request would ensure subcritical conditions were maintained in the SFP during dry cask loading operations by relying on a realistically conservative fuel burnup credit.

The supplemental letters dated August 4 and August 26, 2005, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on August 16, 2005, (70 FR 48196).

The ANO-2 TSs currently permit the licensee to store 988 fuel assemblies in the SFP. However, since the ANO-2 SFP was not designed with the storage capacity necessary for all the spent fuel generated over the full term of the facility's operating license or for the permanent storage of the plant's spent fuel following the cessation of operations, the cask pit area provides plant operators with a safe location to load storage and transportation casks. Entergy is planning to operate an independent spent fuel storage installation (ISFSI) facility at ANO-2 in accordance with the general license provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 72, Subpart K, using the Holtec HI-STORM 100 Cask System Multi-Purpose Canister (MPC)-32. Entergy intends to load spent fuel into the MPC-32 in its SFP cask pit area for subsequent removal and dry storage in the ISFSI.

On March 23, 2005, the NRC issued Regulatory Issue Summary (RIS) 2005-05, "Regulatory Issues Regarding Criticality Analyses for Spent Fuel Pools and Independent Spent Fuel Storage Installations." (Ref. 4) The NRC issued RIS 2005-05 for three purposes: (1) to alert addressees to findings at pressurized-water reactor facilities suggesting that the SFP licensing and design bases and applicable regulatory requirements may not be met during loading, unloading, and handling of dry casks in the spent fuel pools; (2) to emphasize the importance of maintaining subcritical conditions for spent fuel storage in moderated environments; and (3) to

encourage addressees to review the current SFP and ISFSI licensing and design bases at their facilities to ensure compliance during dry cask loading, unloading, and handling operations. Based on Entergy's review of RIS 2005-05, the licensee determined that it required a license amendment to facilitate the loading, unloading, and handling of dry storage casks in its SFP.

To ensure its continued compliance with NRC regulations governing the safe handling of irradiated fuel in the SFP, the licensee proposed a number of changes to the ANO-2 TSs. Section 2.2 of this safety evaluation (SE) provides a descriptive summary of the proposed changes and Section 3.0 provides the staff's technical evaluation of the proposed changes.

2.0 REGULATORY EVALUATION

2.1 Regulatory Requirements and Review Documents

Title 10 of the *Code of Federal Regulations*, Part 50 Appendix A, "General Design Criteria for Nuclear Power Plants" (Ref. 5), provides a list of the minimum design requirements for nuclear power plants. According to General Design Criteria (GDC) 62, "Prevention of criticality in fuel storage and handling," the licensee must limit the potential for criticality in the fuel handling and storage system by physical systems or processes. The staff reviewed the amendment request to ensure that the licensee complied with GDC 62.

Provided in 10 CFR Section 50.68, "Criticality accident requirements" (Ref. 6), are the NRC regulatory requirements for maintaining subcritical conditions in SFPs. By letter dated September 3, 2003 (Ref. 7), the NRC approved Amendment 250 to the ANO-2 license to incorporate new TSs governing spent fuel storage in the ANO-2 SFP. In that amendment, the staff approved the proposed TSs based on a satisfactory demonstration that the 10 CFR 50.68 regulatory requirements were met.

The 10 CFR 50.68 acceptance criteria for criticality prevention in the SFP that are applicable to the licensee's proposed amendment are the following:

1. Plant procedures shall prohibit the handling and storage at any one time of more fuel assemblies than have been determined to be safely subcritical under the most adverse moderation conditions feasible by unborated water;

2. The effective neutron multiplication factor (k_{eff}) shall be less than 1.0 if fully flooded with unborated water, which includes an allowance for uncertainties at a 95 percent probability, 95 percent confidence (95/95) level; and

3. k_{eff} shall be less than or equal to 0.95 if fully flooded with borated water, which includes an allowance for uncertainties at a 95/95 level.

Under 10 CFR 72.124, "Criteria for nuclear criticality safety" (Ref. 8), the NRC regulates dry cask storage activities to ensure that subcriticality is maintained during the handling, packaging, transfer, and storage of spent fuel assemblies. The NRC regulations for dry cask criticality prevention rely on favorable geometric configurations and fixed neutron absorbers. However, unlike 10 CFR 50.68, the 10 CFR Part 72 regulations for criticality prevention in dry casks allow licensees to credit the SFP soluble boron for maintaining subcritical conditions during cask loading, unloading, and handling operations in the SFP. Therefore, many cask designs have

incorporated soluble boron credit in lieu of a burnup credit as a means of increasing dry cask storage capacity while maintaining subcritical conditions. Entergy's amendment request proposes to demonstrate that it can satisfy the applicable 10 CFR 50.68 criticality prevention requirements, with a burnup credit, during cask loading, unloading, and handling operations in the SFP.

The NRC has defined acceptable methodologies for performing SFP criticality analyses in three documents:

1. NUREG-0800, Standard Review Plan, Section 9.1.2, "Spent Fuel Storage," Draft Revision 4 (Ref. 9);

2. Proposed Revision 2 to Regulatory Guide 1.13, "Spent Fuel Storage Facility Design Basis," (Ref. 10); and

3. Memorandum from L. Kopp (NRC) to T. Collins (NRC), "Guidance on the Regulatory Requirements for Criticality Analysis of Fuel Storage at Light-Water Reactor Power Plants" (Ref. 11).

The staff used the guidance contained in these documents to assist in its review of the licensee's amendment request.

2.2 Description of Proposed Technical Specification Changes

In Enclosure 3 of Reference 1, Entergy provided marked-up TS pages. The staff reviewed each of these changes against the acceptance criteria described in Section 2.1 of this SE and found them acceptable. The basis for the staff's acceptance and a description of the review it performed is located in Section 3.0 of this report. The following is the descriptive list of proposed changes in the license amendment request:

1. New Limiting Condition for Operation (LCO) 3.9.12.d: Entergy proposed the addition of a new TS paragraph to restrict the storage of spent fuel in the MPC-32 by the limits specified in new TS Figure 3.9-1.

2. New TS Figure 3.9-1: Entergy proposed the addition of this figure to support the new LCO 3.9.12.d loading requirements. The figure provides a curve of acceptable fuel assembly burnups as a function of initial Uranium-235 enrichment. Spent fuel assemblies with a burnup greater than the limits proposed by the curve would be acceptable for storage in the MPC-32 at ANO-2.

3. New TS Surveillance Requirement (SR) 4.9.12.d: Entergy proposed the addition of this SR to verify that all fuel assemblies placed in a storage cask are within the limits of Figure 3.9-1. The licensee will be required to confirm that the limits are met by checking the assemblies' design and burnup documentation.

3.0 TECHNICAL EVALUATION

In determining the acceptability of Entergy's amendment request, the staff reviewed three aspects of the licensee's analyses: 1) the computer codes employed; 2) the methodology used to calculate the maximum k_{eff}; and 3) the storage configuration and limitations proposed. For each part of the review, the staff evaluated whether the licensee's analyses and methodologies provided reasonable assurance that adequate safety margins in accordance with NRC acceptance criteria were developed and could be maintained in the ANO-2 SFP during cask loading, unloading, and handling operations.

3.1 Computer Codes

The licensee performed the analysis of the reactivity effects for the MPC-32 with the MCNP4a code (Ref. 12) . MCNP4a is a three-dimensional Monte Carlo criticality code. The licensee benchmarked the code against criticality experiments and the KENO-Va code under conditions that reflect the variables for fuel storage in the MPC-32. The critical benchmark experiments considered the effects of varying fuel enrichment, Boron-10 loading, lattice spacing, fuel pellet diameter, and soluble boron concentration. The experimental data are sufficiently diverse to establish that the method bias and uncertainty will apply to the MPC-32 under the proposed fuel storage and handling conditions. The licensee determined that the MCNP4a code calculational (methodology) bias is 0.0009 with a 95/95 bias uncertainty of +/- 0.0011. The MCNP4a values strongly correlate to those predicted by the KENO5a code using the same critical benchmark experiments. The NRC has previously accepted the use of these data for benchmarking the MCNP4a code under storage conditions similar to those proposed in the Entergy amendment request (Refs. 7 and 13).

In addition to using the MCNP4a code to perform the criticality analyses, the licensee employed the CASMO-4 code to perform the fuel depletion analyses that were used to develop the proposed TS Figure 3.9-1. CASMO-4 is a two-dimensional multi-group transport theory code capable of performing the fuel depletion analyses. Specifically, CASMO-4 is capable of analytically restarting burned fuel assemblies in an infinite representation of the MPC-32 configuration. CASMO-4 performs a heterogeneous multigroup transport calculation for an explicit representation of a fuel assembly to determine the isotopic composition of the spent fuel as a function of fuel burnup and initial feed enrichment. The CASMO-4 code and its cross section set have been used in the design of reload cores and extensively benchmarked against operating reactor history and test data. In accordance with NRC guidance documents, the licensee applied a five percent burnup measurement uncertainty to ensure that the results obtained for the depletion analysis were conservative. Additionally, the licensee determined the reactivity effect (delta-k) for each manufacturing tolerance of the fuel assemblies and storage racks using the CASMO-4 code.

The staff reviewed the licensee's application of the codes to determine whether each could reasonably calculate, based on conservative assumptions and inputs, the appropriate parameters necessary to support the maximum k_{eff} analyses. The staff concludes that Entergy's use of the MCNP4a code for calculation of the nominal k_{eff} was appropriate since it was benchmarked against experimental data that bound the proposed assembly and MPC-32 storage conditions. Additionally, the staff finds that the licensee's use of the CASMO-4 code was acceptable for determining the delta-k for each manufacturing tolerance and for performing the fuel depletion analyses.

3.2 Methodology

In accordance with the guidance contained in Refs. 9, 10, and 11, the licensee performed criticality analyses of the MPC-32 under fully loaded conditions. The licensee employed a methodology that combines a worst-case analysis based on the bounding fuel and MPC-32 conditions with a sensitivity study using 95/95 analysis techniques. The major components in this analysis were a calculated (nominal) k_{eff} based on the limiting fuel assembly and storage configuration, SFP temperature and code biases, and a statistical sum of 95/95 uncertainties and worst-case delta-k manufacturing tolerances.

For added conservatism, Entergy assumed a bounding upper subcriticality limit. Instead of designing the loading configuration for the MPC-32 based on maintaining an unborated k_{eff} less than 1.0, as is required in NRC regulations, Entergy chose to determine the limiting loading configuration based on an unborated upper subcriticality limit of 0.95 including all applicable biases and uncertainties. This effectively incorporates added conservative margin into the calculations performed to demonstrate compliance with NRC acceptance criteria.

In performing its criticality analysis, the licensee first calculated a k_{eff} based on nominal MPC-32 loading conditions using the MCNP4a code. Entergy calculated this nominal k_{eff} for its fuel assembly design, fuel enrichment, and MPC-32 storage configuration at ANO-2. Since the licensee only uses the Combustion Engineering (CE) 16 X 16 Fuel assembly at ANO-2, Entergy applied this fuel design in its normal and accident analyses to ensure bounding K_{eff} values were determined. As added conservatism, Entergy performed the criticality analyses for fuel loaded into the MPC-32 based on a nominal initial Uranium-235 enrichment of 4.95 weight percent with a tolerance of 0.05 weight percent. This bounds the 4.55 weight percent permissible enrichment in the SFP (TS 3.9.12.a). Therefore, the staff finds that Entergy has applied appropriate and conservative assumptions to its criticality analysis for fuel assembly design and fuel enrichment.

In addition to determining the bounding fuel design and enrichment, the licensee included the effects of the bounding SFP temperatures in the determination of the nominal k_{eff}. The licensee used the minimum and maximum permissible design basis SFP temperatures and corresponding water densities to determine which resulted in the most limiting nominal k_{eff}. In Reference 2, Entergy provided the results of sensitivity calculations performed over the range of design basis SFP temperatures. The results showed that optimum moderation occurred under full density conditions. Therefore, with respect to optimum moderation, the licensee added a temperature bias to the calculated k_{eff} to account for differences between the analysis temperature and the optimum moderation temperature. This is consistent with NRC acceptance criteria and guidance documents; therefore, the staff finds that Entergy has appropriately included a SFP temperature bias. To the calculated k_{eff}, the licensee added the methodology bias. As stated in the description of the MCNP4a code, the licensee determined the methodology bias from the critical benchmark experiments.

Additionally, to determine the maximum k_{eff}, the licensee performed a statistical combination of the reactivity effects for code and methodology uncertainties, manufacturing tolerances, and burnup uncertainties. The code and methodology uncertainties account for the mean calculational variance and uncertainty in the benchmarking of the KENO V.a code. The licensee determined this uncertainty to a 95/95 threshold which is consistent with NRC acceptance criteria and guidance documents.

In addition to including the code uncertainty, the licensee performed analyses to determine appropriate and conservative fuel and storage cask mechanical tolerances as well as including a tolerance for eccentric positioning of the fuel assemblies in the storage cells. For each tolerance, the licensee calculated a delta-k between the nominal condition and the most limiting tolerance condition. For the fuel rod manufacturing tolerances the dominating contributor is the fuel enrichment. As previously described the licensee performed the criticality analyses based on an initial nominal Uranium-235 enrichment of 4.95 weight percent even though its current TS 3.9.12.a restricts the spent fuel in the SFP to a maximum initial nominal enrichment of 4.55 weight percent. This provides considerable conservatism in the licensee's criticality analysis. Additionally, the licensee calculated the delta-k associated with the 0.05 weight percent enrichment tolerance of its fuel assemblies and included this value in the uncertainty calculations. Likewise, for the storage cask fabrication tolerances, the licensee included conservative and bounding tolerances on key parameters, such as the cell pitch and cell inner dimension that result in maximizing the delta-k. By using the most limiting tolerance conditions, the licensee calculated the highest reactivity effect possible. This results in conservative margin since the tolerances will always bound the actual parameters. In addition to manufacturing tolerances, Entergy analyzed eccentric positioning of fuel assemblies in the MPC-32 lattice cells. Entergy determined that eccentric positioning of the assemblies such that the center-to-center pitch was at its minimum resulted in a minor increase in the k_{eff}. Entergy appropriately included the bounding delta-k from eccentric positioning in its tolerance calculations.

Finally, in lieu of performing detailed burnup uncertainty analyses, the licensee chose to apply a 5 percent burnup measurement uncertainty in accordance with NRC guidance documents (Ref. 11). This uncertainty, in conjunction with the use of the other conservative assumptions and inputs, assures that NRC regulatory requirements are satisfied.

The licensee's proposed TS changes place considerable emphasis in the criticality analyses on a burnup credit; therefore, the accurate determination of the burnup profile is essential to ensure the acceptance criteria for k_{eff} are satisfied. As previously stated, the licensee employed the CASMO-4 code for determining the appropriate burnup credit. For a given spent fuel assembly, the fuel burnup is a function of axial position. Typically, for fuel assemblies burned less than 30 gigawatt-days per metric ton unit (GWD/MTU), a uniform axial burnup model yields higher multiplication factors. Above 30 GWD/MTU, an axially distributed burnup model is more conservative due to the suppressed fission rate near the axial ends of higher burnup assemblies. Since the proposed TSs are based on classifying assemblies based on burnups less than 30 GWD/MTU, Entergy employed a uniform axial burnup model to ensure that its conservative properties were included in the criticality analyses. In order to generate the isotopic concentrations in the depletion analysis, appropriate fuel and moderator temperatures and soluble boron concentrations that both reflect historical operating conditions at ANO-2 as well as represent appropriately conservative values intended to maximize the residual reactivity of the spent fuel assemblies were used in the depletion analysis. In Reference 2, Entergy provided additional information that demonstrated the values chosen for these parameters satisfied these criteria. The data provided by Entergy demonstrated that the values used in the burnup credit analysis represented realistic but conservative assumptions for the fuel and moderator temperatures and soluble boron concentrations relative to the historical operating conditions at ANO-2. Therefore, the staff finds that the methodology employed and the assumptions used to perform the burnup credit analysis are acceptable.

In addition to a burnup credit, Entergy proposed to credit the fixed neutron absorbers in the MPC-32. The MPC-32 contains Metamic neutron absorbers loaded between fuel assemblies in the cask lattice structure. Metamic acts as a poison, absorbing neutrons and holding down the k_{eff} in the MPC-32. In the criticality analyses, Entergy credited the minimum areal density of the Boron-10 in the Metamic panels. Section 3.2.5.2 of the Hi-Storm Certificate of Compliance 1014 (Ref. 14), Appendix B requires that the Boron-10 loading be greater than or equal to 0.0310 grams per centimeter squared (g/cm^2). This represents a TS minimum acceptable areal density for Metamic in the MPC-32. Entergy conservatively applied the minimum areal density in its criticality analyses. Since Entergy applied the worst case condition to its calculation of the nominal k_{eff}, it did not include an associated delta-k uncertainty for the areal density. The staff finds that Entergy used an appropriately conservative and limiting value for the minimum areal density of Boron-10 in the Metamic neutron absorbers.

Finally, Entergy credited 3 years of cooling time in its criticality analysis. In Reference 3, the licensee stated that the methodology it used to perform the cooling time credit calculation is identical to that used in its SFP criticality analysis methodology that was approved by the NRC in Amendment 250 (Ref. 7). Since the NRC staff has previously reviewed and approved the cooling time credit methodology, the staff finds its application to the criticality analyses performed for the spent fuel storage cask acceptable.

Once the reactivity effects for each of the tolerances and uncertainties were determined, the licensee statistically combined these results in accordance with the guidance contained in Reference 11. The staff reviewed the licensee's methodology for calculating each of the reactivity effects associated with uncertainties and manufacturing tolerances as well as the statistical methods used to combine these values. The staff finds the licensee's methods for calculating the maximum k_{eff} conservative and acceptable.

3.3 Proposed Storage Configuration

The primary purpose of the licensee's amendment request was to gain the staff's approval for a proposed storage configuration within the MPC-32 during loading, unloading, and handling operations in the SFP. The licensee's proposed TS LCO 3.9.12.d would permit unrestricted storage of spent fuel assemblies in the MPC-32 provided each assembly satisfied minimum burnup requirements as a function of initial enrichment. The minimum burnup requirements are provided in proposed TS Figure 3.9 -1.

The first step in the process for loading an MPC-32 at ANO-2 involves placing the canister in the SFP. The ANO-2 cask storage area is physically separated from the spent fuel in the SFP by a transfer canal. In its criticality analyses, Entergy assumed that the MPC-32 was neutronically isolated from the rest of the SFP because the loaded fuel will be at least 12 inches from the fuel stored in the adjacent racks. Entergy based its MCNP4a model of the MPC-32 on the model described in the Final Safety Analysis Report for the Holtec HI-STORM 100 Cask System (Ref. 15). The NRC reviewed and approved that model when it issued the 10 CFR Part 72 certification of compliance for the HI-STORM 100 cask design. Therefore, the staff finds that the spacing assumed in the criticality analysis appropriately reflects the storage conditions at ANO-2 and that the model employed is acceptable.

In determining the acceptable burnup versus enrichment curves, Entergy used the codes and

methodologies described in Sections 3.1 and 3.2, respectively, of this report. TS Figure 3.9-1 provides the fuel assembly burnup limit requirements for cask storage. This figure depicts the limiting burnup as a function of initial fresh fuel enrichment required to load spent fuel assemblies into the MPC-32 at ANO-2. An assembly with a burnup greater than the limits on the curve may be loaded into the MPC-32 without restrictions on its storage configuration. In developing this burnup versus enrichment curve, Entergy performed MCNP4a analyses, as described previously, based on limiting storage conditions. To ensure that the NRC acceptance criteria were satisfied, Entergy set its target value of k_{eff} at its self-imposed limit of 0.950 minus the magnitude of the limiting analytical biases and uncertainties. The sum of the biases and uncertainties was conservatively calculated to be 0.0163. Therefore, each data point on the burnup versus enrichment curve is based on a limiting k_{eff} value of 0.9337. The licensee calculated minimum burnups as a function of initial enrichment such that the limiting k_{eff} value was not exceeded. Then, the licensee applied a bounding second order polynomial of limiting assembly burnup as a function of initial enrichment to this data. This polynomial will be used to determine the acceptability of assemblies for loading into the MPC-32.

In addition to analyzing the nominal MPC-32 loading configurations, the licensee performed detailed accident analyses. The accidents analyzed included the following: (1) a dropped fresh fuel assembly on top of the MPC-32; (2) a misloaded fresh fuel assembly inside of the MPC-32; (3) an accident resulting in the misalignment of active fuel with poison material; and (4) MPC-32 water temperature increase. Entergy developed an even more conservative bounding analysis by assuming that all of the poison plates are replaced by water in the MPC-32. This scenario is the equivalent of a loss of all fixed neutron absorbers from the MPC-32. Since the staff does not require a licensee to assume two independent accidents occurring simultaneously, Entergy calculated the amount of soluble boron required to mitigate the consequences of this accident. Entergy determined that 950 parts per million (ppm) of soluble boron would be required to compensate for the reactivity increase caused by this worst-case accident scenario and still maintain the k_{eff} less than 0.95. Since TS LCO 3.9.12.c will require the minimum cask storage area boron concentration to be greater than or equal to 2000 ppm, the staff agrees that sufficient soluble boron will be available to preclude an inadvertent criticality event for this and all less severe accidents.

During cask loading activities, the licensee must install the cask pit gates to isolate the cask pit from the remainder of the SFP. This action is necessitated by the need to move heavy loads over the SFP. During periods when the gate is closed, the cask pit area is hydraulically decoupled from the remainder of the SFP and mixing of soluble boron is prevented. Therefore, during periods when the gates are installed, the licensee will be unable to control the soluble boron concentration in the cask pit area. However, the licensee’s criticality analyses show that even if the cask pit area were flooded with unborated water, the maximum k_{eff} would be 0.95. Additionally, at all times during the loading, unloading, and handling of a flooded cask, the licensee is still required to comply with the Part 72 general license requirements for soluble boron concentration in the cask. Therefore, during times when the cask pit gates are installed, the licensee will be required to comply with TS 3.3.1 of the Holtec HI-STORM 100 Certificate of Compliance (CoC) 1014, Amendment 2. This TS ensures that the boron concentration is above 1900 ppm inside the flooded cask. Therefore, the staff has reasonable assurance that the cask will remain safely subcritical at all times.

4.0 EXIGENT CIRCUMSTANCES

The NRC staff has made a determination that exigent circumstances exist, with regard to issuance of a license amendment, in response to the licensee's application dated July 21, 2005, as supplemented by letters dated August 4 and 26, 2005, as defined in 10 CFR 50.91(a)(6). In this regard, Entergy believed that the calculation that considered the requirements of 10 CFR 50.68 for loading/unloading an MPC-32 met the criteria of 10 CFR 50.59 and 10 CFR 50.36, and did not require NRC review and approval. However, based on RIS 2005-05, Entergy submitted a preapplication letter to the NRC outlining the plans to submit a non-exigent TS change and justification for continued operations without prior NRC approval, based on guidance contained in Administrative Letter 98-10 and Generic Letter 91-18. In a teleconference between Entergy and the NRC staff held on July 19, 2005, the NRC stated that it did not believe ANO-2 was in compliance with 10 CFR 50.68 and, therefore, the proposed change required NRC approval prior to proceeding with cask loading activities. Currently, should it become necessary, the ANO-2 SFP does not contain enough space to allow a full core offload of fuel in the reactor core. Spent fuel assemblies must be relocated to dry cask storage to regain full core offload capacity and to allow for the receipt of new fuel prior to the next ANO-2 refueling outage. An aggressive cask loading campaign has been initiated which is impacted by the need for the approval of the proposed TS change. Entergy could not have avoided the exigency due to the rapidly developing nature of this situation and its applicability to moving spent fuel for ANO-2.

5.0 FINAL NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

The Commission's regulations in 10 CFR 50.92, "Issuance of amendment," state that the Commission may make a final determination that a license amendment involves no significant hazards considerations, if operation of the facility, in accordance with the amendment would not (1) involve a significant increase in the probability or consequences of an accident previously evaluated, (2) create the possibiliy of a new or different kind of accident from any accident previously evaluated, or (3) involve a significant reduction in a margin of safety.

The amendment has been evaluated against the three standards in 10 CFR 50.92(c). In its analysis of the issue of no significant hazards consideration, as required by 10 CFR 50.91(a), the licensee has provided the following:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

   The fuel handling accidents described below can be postulated to increase reactivity. However, for these accident conditions, the double contingency principle of ANS [American Nuclear Society] N16.1-1975 is applied. This states that it is unnecessary to assume two unlikely, independent, concurrent events to ensure protection against a criticality accident. Thus, for accident conditions, the presence of soluble boron in the SFP water can be assumed as a realistic initial condition since its absence would be a second unlikely event.

   Loading/unloading a storage cask in the SFP does not affect the previously evaluated fuel handling accidents (i.e., criticality effects) in the SFP. The ANO-2 TS for SFP boron concentration ensures subcritical conditions in the SFP during

fuel movement activities, whether within the SFP racks or to a storage cask during normal and accident conditions.

The cask configuration for the storage cask (MPC-32) is sufficiently similar to spent fuel racks in the SFP as to not induce new or different spent fuel assembly damage in the unlikely event of the occurrence of a fuel handling accident during storage cask loading/unloading activities. The fuel handling accident includes four drop scenarios (fuel drop horizontally on a cask, fuel drop on a fuel assembly, fuel drop next to a cask, and a fuel drop on the cask basket). The same equipment and procedural controls for controlling fuel within the SFP are utilized when loading/unloading a storage cask. In addition, the postulated fuel handling accidents associated with loading/unloading a storage cask are bounded by current ANO-2 TS SFP requirements for minimum boron concentration.

Loading/unloading a storage cask will have no impact on the boron dilution event probability. The same controls for prohibiting a dilution event during spent fuel movement activities in the SFP are in use when loading/unloading fuel in a cask located in the cask pit.

Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

   The storage casks have the same basic design and control of a SFP rack. The cask cell walls are thicker than the SFP rack walls; the outside wall on the cask is thicker than the SFP racks and the space for mishandling is tighter than around the racks. When the cask loading pit gate is open and the Technical Specifications are applicable, the pit is in direct communications with the SFP. Boron concentrations and decay heat removal for fuel in the cask loading pit is controlled in the same manner as it is for fuel in the SFP proper.

   An accident analysis for the MPC-32 was performed assuming the same SFP rack accidents that are discussed in the ANO-2 SAR [safety analysis report]. The ANO-2 TS boron concentration assures that a subcritical margin is maintained during any postulated accident condition (i.e., k_{eff} is less than or equal to 0.95).

   Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

   Response: No.

The ANO-2 TSs require for criticality concerns in the SFP that k_{eff} remain less than or equal to 0.95. For the MPC-32, the criticality analysis demonstrated that when the ANO-2 TS for SFP boron concentration is met, a loading restriction is required to ensure k_{eff} remains less than or equal to 0.95. The proposed change to the ANO-2 TS will ensure the criticality margin is maintained.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

The NRC staff has reviewed the licensee's analysis, and based on this review, has determined that the three standards of 10 CFR 50.92©) are satisfied. Therefore, the NRC staff finds that the amendment request involves no significant hazards consideration.

6.0 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.

7.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has made a final finding that the amendment involves no significant hazards consideration. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

8.0 CONCLUSION

The staff reviewed the effects of the proposed changes using the appropriate requirements of 10 CFR 50.68 and GDC 62. In its review of the criticality analyses supporting the proposed changes, the staff found that Entergy employed realistically conservative assumptions, inputs, and methodologies in every step of the analysis. Based on the results of the criticality analyses, the staff found that the licensee’s amendment request provided reasonable assurance that under both normal and accident conditions the licensee would be able to operate the plant safely and comply with NRC regulations. Therefore, the staff finds the licensee’s amendment request acceptable.

Nothing in the approval of this amendment is intended or authorized to replace or supercede any requirements of the Holtec HI-STORM 100 CoC 1014, Amendment 2 (Ref. 14). Entergy is required to comply with all of the 10 CFR Part 72-approved TSs and limitations in CoC 1014.

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

9.0 REFERENCES

1. Letter from J.S. Forbes (Entergy) to U.S. Nuclear Regulatory Commission, "License Amendment Request to Add Cask Loading Restrictions," dated July 21, 2005, ADAMS Accession No. ML052080049.

2. HOLTEC REPORT - "Part 50 Criticality Analysis of the MPC-32 for ANO-2," Holtec Report No. HI-2043262, ADAMS Accession No. ML052230282

3. Letter from D. E. James (Entergy) to U.S. Nuclear Regulatory Commission, "Supplement to License Amendment Request for Cask Loading Restrictions," dated August 26, 2005, ADAMS Accession No. ML052450194.

4. NRC Regulatory Issue Summary 2005-05, "Regulatory Issues Regarding Criticality Analyses for Spent Fuel Pools and Independent Spent Fuel Storage Installations," dated March 23, 2005, ADAMS Accession No. ML043500532.

5. Title 10 Code of Federal Regulations, Part 50 Appendix A, General Design Criteria 62, "Prevention of criticality in fuel storage and handling."

6. Title 10 CFR Section 50.68, "Criticality accident requirements."

7. Letter from T.W. Alexion (NRC) to C.G. Anderson (Entergy), "Arkansas Nuclear One, Unit No. 2 - Issuance of Amendment Re: Revised Spent Fuel Pool Loading Pattern (TAC No. MB9758)," dated September 3, 2003, ADAMS Accession No. ML032461501.

8. Title 10 CFR Section 72.124, "Criteria for nuclear criticality safety."

9. NUREG-0800, Standard Review Plan, Section 9.1.2, "Spent Fuel Storage," Draft Revision 4, April 1996.

10. Proposed Revision 2 to Regulatory Guide 1.13, "Spent Fuel Storage Facility Design Basis," December 1981.

11. NRC Memorandum from L. Kopp to T. Collins, "Guidance on the Regulatory Requirements for Criticality Analysis of Fuel Storage at Light-Water Reactor Power Plants," dated August 19, 1998.

12. MCNP4a General Monte Carlo N-Particle Transport Code, LA-12625, Los Alamos National Laboratory, 1993.

13. Letter from B.T. Moroney (NRC) to J.A. Stall (Florida Power and Light Company), "St. Lucie Plant, Unit 1 - Issuance of Amendment Regarding Spent Fuel Pool Soluble Boron Credit (TAC No. MB6864)," dated September 23, 2004, ADAMS Accession No. ML0426705620.

14. Holtec HI-STORM 100 Certificate of Compliance 1014, Amendment 2, ADAMS Accession No. ML051580527.

15. Final Safety Analysis Report for the Holtec HI-STORM 100 Cask System, Chapter 6, ADAMS Accession No. ML041120295.

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