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May 2, 2001

2CAN050102

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: Arkansas Nuclear One – Unit 2
Docket No. 50-368
License No. NPF-6
Request to Revise Technical Specification Surveillance Requirement 4.1.1.4.2.c to Allow Option to Eliminate Moderator Temperature Coefficient Determination at Two-Thirds of Core Burnup

Gentlemen:

The proposed change will modify the Arkansas Nuclear One, Unit 2 (ANO-2) Technical Specification Surveillance Requirement 4.1.1.4.2.c. If the results of the first two Moderator Temperature Coefficient (MTC) measurements required at the beginning-of-cycle are within a tolerance of $\pm$ 0.16 x 10^{-4} $\Delta k/k/°F$ of the calculated MTC (design value), then the change will allow eliminating the measurement of MTC upon reaching two-thirds of core burnup. However, if the results of either of the first two measurements are not within that limit, then performance of the two-thirds cycle surveillance will be required. The NRC approved a Combustion Engineering Owners Group topical report, CE NPSD-911-A, "Analysis of Moderator Temperature Coefficients in Support of a Change in the Technical Specifications End-of-Cycle Negative MTC Limits" on June 14, 2000. The report and its amendment provide justification for the proposed change. Copies of the draft TS mark-up pages are included for your review.

A similar change was previously approved by the NRC on April 21, 2000, for Waterford Steam Electric Station, Unit 3.

The proposed change has been evaluated in accordance with 10CFR50.91(a)(1) using criteria in 10CFR50.92(c) and it has been determined that this change involves no significant hazards considerations. The bases for these determinations are included in the attached submittal.

A001

Entergy Operations requests that the effective date for this TS change be within 60 days of approval. Although this request is neither exigent nor emergency, your prompt review is requested. Entergy Operations desires to use the proposed change in the current ANO-2 operating cycle. Therefore, NRC review and approval of the proposed change in December 2001 is requested. The proposed change does not contain any commitments.

I declare under penalty of perjury that the foregoing is true and correct. Executed on May 2, 2001.

Very truly yours,

C. G. Anderson
Vice President, Operations
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CGA/dm

Attachments

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ATTACHMENT

TO

2CAN050102

PROPOSED TECHNICAL SPECIFICATION

AND

RESPECTIVE SAFETY ANALYSES

IN THE MATTER OF AMENDING

LICENSE NO. NPF-6

ENTERGY OPERATIONS, INC.

DOCKET NO. 50-368

DESCRIPTION OF PROPOSED CHANGES

The proposed change will modify Technical Specification (TS) Surveillance Requirements (SR) 4.1.1.4.2.c. The change will eliminate the need to determine the Moderator Temperature Coefficient (MTC) upon reaching two-thirds of core burnup if the results of the MTC determinations required at the beginning of cycle (BOC) are within a tolerance of $\pm$ 0.16 x 10^{-4} $\Delta k/k/°F$ of the calculated MTC (design value). The BOC measurements are performed prior to initial operation above 5% after each fuel loading and prior to reaching a boron concentration of 800 ppm. The calculated design value is the MTC predicted value for the point in time the measurements are taken. The results of both of the BOC measurements must be within the specified tolerance in order to eliminate the performance of the two-thirds cycle surveillance. The NRC approved a Combustion Engineering Owners Group topical report, CE NPSD-911, "Analysis of Moderator Temperature Coefficients in Support of a Change in the Technical Specifications End-of-Cycle Negative MTC Limits" on June 14, 2000. This report and its amendment will be used to justify this proposed change.

Current Surveillance Requirement:

"The MTC shall be determined at the following frequencies and THERMAL POWER conditions during each fuel cycle: c. At any THERMAL POWER, within 14 EFPD after reaching a RATED THERMAL POWER equilibrium boron concentration of 300 ppm."

Proposed Surveillance Requirement:

"The MTC shall be determined at the following frequencies and THERMAL POWER conditions during each fuel cycle: c. At any THERMAL POWER, within 14 EFPD after reaching a RATED THERMAL POWER equilibrium boron concentration of 300 ppm. Note 1 (Note 1: The MTC determination of surveillance 4.1.1.4.2.c is not required if the results of the tests required in surveillances 4.1.1.4.2.a and 4.1.1.4.2.b are within a tolerance of $\pm$ 0.16 x 10^{-4} $\Delta k/k/°F$ from the corresponding design values.)"

BACKGROUND

General Design Criteria (GDC) 11 requires that the reactor core and associated coolant systems be designed so that in the power operating range the net effect of the prompt inherent nuclear feedback characteristics tends to compensate for a rapid increase in reactivity. The MTC relates changes in reactivity to uniform changes in moderator temperature, including the effects of moderator density changes with changes in moderator temperature. Typically, an increase in the moderator temperature causes a decrease in the core moderator density and therefore a reduction in the number of neutrons that are slowed to thermal energy and a reduction in the core reactivity. A positive MTC means that reactivity increases with increasing moderator temperature; conversely, a negative MTC means that reactivity decreases with increasing moderator temperature. The reactor is designed to operate with a negative MTC over the largest

possible range of fuel cycle operation. Therefore, a coolant temperature increase will cause a reactivity decrease, so that the coolant temperature tends to return toward its initial value. Reactivity increases that cause a coolant temperature increase will thus be self-limiting, and stable power operation will result.

TS 3.1.1.4 requires that MTC have a maximum upper design limit that is less positive than $+0.5 \times 10^{-4}$ $\Delta k/k/°F$ whenever thermal power is $\leq$ 70% of Rated Thermal Power and less positive than 0.0 $\Delta k/k/°F$ whenever thermal power is > 70% Rated Thermal Power. Additionally, based on each fuel loading a cycle dependent limit is determined and specified in the Core Operating Limit Report (COLR). The COLR is generated from the reload analysis, which is performed using Combustion Engineering methodology.

Analyses are performed using NRC-approved codes to establish an expected design or predicted value. The proposed note would permit the comparison of the actual test results with the predicted design value and, if the actual test values are within the specified tolerance, the third test of the cycle may be eliminated.

BASIS FOR PROPOSED CHANGE

CE NPSD-911-A and Amendment 1-A was prepared for the C-E Owners Group and provided an analysis of MTC. The report was reviewed and approved by the NRC on June 14, 2000. The purpose of the report was to provide the justification to support eliminating the determination of MTC upon reaching two-thirds of core burnup. Typically, three tests are required by the TS. The proposed change would allow eliminating the third test (performed two-thirds core burnup) if the results of the first two MTC tests performed at the BOC are within a tolerance of $\pm 0.16 \times 10^{-4}$ $\Delta k/k/°F$ of the calculated MTC (design value). However, if the results of either of the first two tests are not within that limit, then performance of the two-thirds cycle surveillance will be required. The reports concluded that if the MTC measurements at the beginning-of-cycle were within $\pm 0.16 \times 10^{-4}$ $\Delta k/k/°F$ of the design value, then the MTC at the end-of-cycle (EOC) would also be within $\pm 0.16 \times 10^{-4}$ $\Delta k/k/°F$ of the design value.

The following conditions were required by the NRC safety evaluation for the report:

1. In order to ensure that the moderator temperature coefficient will not exceed the TS limit with a confidence/tolerance of 95/95 percent, the cycle must be designed , using the CE methodology, such that the best estimate MTC is:

   a. more negative than the BOC TS limit by the design margin

   b. more positive than the EOC TS limit by the design margin.

2. The design margin is determined to be 1.6 pcm/°F at all times in life (1 pcm = $1X\ 10^{-5}$ $\Delta k/k/°F$).

3. The analysis of the revised data base, including the most recent measured and calculated MTCs, has established that if the measured beginning-of-cycle moderator temperature coefficients are within 1.6 pcm/°F of the best estimate prediction, then it can be assumed that the end-of-cycle coefficient will also be within 1.6 pcm/°F of the prediction and its measurement is not required.

4. The measured data reduction must be based on the current CE methodology as described in the report.

5. If the beginning-of-cycle measurements fail the acceptance criteria of ± 1.6 pcm/°F and the discrepancy cannot be resolved, the end-of-cycle surveillance test must be performed.

Entergy Operations has reviewed these conditions and meets them as follows:

1. The condition is met during the design of the core. Combustion Engineering performs the ANO-2 core design. TS 3.1.1.4 defines the design limits and these limits are maintained in the COLR as the cycle specific limits, which are based on the cycle specific core design. .

2. This condition is met during the design of the core. This design margin is built into the design process.

3. The topical report has proven this condition. Based on approval of the proposed change, ANO will perform a measurement of MTC prior to achieving 5% after each fuel loading and prior to reaching an equilibrium boron concentration of 800 ppm. Each of these will be compared to the predicted value. If both measurements fall within ± 1.6 pcm/°F of the predicted value, then the EOC measurement will not be performed.

4. See response to Question 4 in Amendment 1 of CE NPSD-911.

5. The proposed TS change will require the EOC measurement to be performed if the BOC measurements fail the acceptance criteria of ± 1.6 pcm/°F.

DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

Entergy Operations, Inc. is proposing that the Arkansas Nuclear One, Unit 2 (ANO-2) Operating License be amended to allow the elimination of the end-of-cycle (EOC) Moderator Temperature Coefficient (MTC) measurement. This will be allowed if the first two MTC measurements required at beginning-of-cycle (BOC) are within ± 0.16 x 10^{-4} Δk/k/°F of the design value. If either of the BOC MTC measurements are not within the above limit, then the EOC measurement will be required. Combustion Engineering Owners Group topical report, "Analysis of Moderator Temperature Coefficients (MTC) in Support of a Change in the Technical Specifications End-of-Cycle Negative MTC

Limits" (CE NPSD-911-A and Amendment 1-A) was prepared to evaluate eliminating the EOC MTC measurement. The results of this topical report have been reviewed and approved by the NRC and thereby, provide justification for the proposed ANO-2 Technical Specification (TS) change. Fuel cycles for ANO-2 are designed using CE methodology and the method used to measure MTC at ANO-2 is similar to that described in the topical report.

An evaluation of the proposed change has been performed in accordance with 10CFR50.91(a)(1) regarding no significant hazards considerations using the standards in 10CFR50.92(c). A discussion of these standards as they relate to this amendment request follows:

1. **Will operation of the facility in accordance with this proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?**

   Under the proposed change, compliance with the TS is maintained by measuring the beginning of cycle temperature coefficients.

   This change does not require a modification to any of the assumptions used in the input to the safety analyses. The assumptions were based on the current range of MTC allowed by TSs. The proposed change does not include a revision to the TS allowed range of MTC.

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

2. **Will operation of the facility in accordance with this proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?**

   This change does not result in changing plant operation or any TS limits. The MTC will continued to be acceptably verified within specified limits. As described in the Combustion Engineering topical report, if the BOC MTC measurements are within the specified tolerance when compared to the design value, then the EOC value is expected to fall within the design margin.

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

3. **Will operation of the facility in accordance with this proposed change involve a significant reduction in a margin of safety?**

   This change does not modify the range of allowed temperature coefficients. The surveillance program consisting of BOC measurements, of plant parameter

monitoring, and of explicit EOC predictions will ensure that the MTC remains witin the range of acceptable values.

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

Therefore, based on the reasoning presented above and the previous discussion of the amendment request, Entergy Operations has determined that the requested change does not involve a significant hazards consideration.

ENVIRONMENTAL IMPACT EVALUATION

Pursuant to 10CFR51.22(b), an evaluation of the proposed amendment has been performed to determine whether or not it meets the criteria for categorical exclusion set forth in 10CFR 51.22 (c) (9) of the regulations. The basis for this determination is as follows:

1. The proposed license amendment does not involve a significant hazards consideration as described previously in the evaluation.

2. As discussed in the significant hazards evaluation, this change does not result in a significant change or significant increase in the radiological doses for any Design Basis Accident. The proposed license amendment does not result in a significant change in the types or a significant increase in the amounts of any effluents that may be released off-site.

3. The proposed license amendment does not result in a significant increase to the individual or cumulative occupational radiation exposure because this change provides an option of eliminating the performance of the third measurement of MTC based on the previous test results. It does not impact occupational radiation exposure.

MARKUP OF CURRENT TECHNICAL SPECIFICATIONS

REACTIVITY CONTROL SYSTEMS

MODERATOR TEMPERATURE COEFFICIENT

LIMITING CONDITION FOR OPERATION

3.1.1.4 The moderator temperature coefficient (MTC) shall be within the limits specified in the CORE OPERATING LIMITS REPORT. The maximum upper design limit shall be:

a. Less positive than $+0.5 \times 10^{-4}$ $\Delta k/k/°F$ whenever THERMAL POWER is ≤70% of RATED THERMAL POWER, and

b. Less positive than 0.0 $\Delta k/k/°F$ whenever THERMAL POWER is >70% of RATED THERMAL POWER.

APPLICABILITY: MODES 1 and 2*#

ACTION:

With the moderator temperature coefficient outside any one of the above limits, be in at least HOT STANDBY within 6 hours.

SURVEILLANCE REQUIREMENTS

4.1.1.4.1 The MTC shall be determined to be within its limits by confirmatory measurements. MTC measured values shall be extrapolated and/or compensated to permit direct comparison with the above limits.

4.1.1.4.2 The MTC shall be determined at the following frequencies and THERMAL POWER conditions during each fuel cycle:

a. Prior to initial operation above 5% of RATED THERMAL POWER, after each fuel loading.

b. At any THERMAL POWER, prior to reaching a RATED THERMAL POWER equilibrium boron concentration of 800 ppm.

c. At any THERMAL POWER, within 14 EFPD after reaching a RATED THERMAL POWER equilibrium boron concentration of 300 ppm. (Note 1)

*With $K_{eff} \geq 1.0$.

#See Special Test Exception 3.10.2.

Note 1: The MTC determination of surveillance 4.1.1.4.2.c is not required if the results of the tests required in surveillances 4.1.1.4.2.a and 4.1.1.4.2.b are within a tolerance of ± 0.16×10^{-4} $\Delta k/k/°F$ from the corresponding design values.

MARKUP OF TECHNICAL SPECIFICATION BASES

3/4.1 REACTIVITY CONTROL SYSTEMS

BASES

3/4.1.1 BORATION CONTROL

3/4-1-1.1 and 3/4.1.1.2 SHUTDOWN MARGIN

A sufficient SHUTDOWN MARGIN ensures that 1) the reactor can be made subcritical from all operating conditions, 2) the reactivity transients associated with postulated accident conditions are controllable within acceptable limits, and 3) the reactor will be maintained sufficiently subcritical to preclude inadvertent criticality in the shutdown condition.

SHUTDOWN MARGIN requirements vary throughout core life as a function of fuel depletion, RCS boron concentration, and RCS Tavg The most restrictive condition occurs at EOL, with Tavg at no load operating temperature, and is associated with a postulated steam line break accident, and resulting uncontrolled RCS cooldown. In the analysis of this accident, a minimum SHUTDOWN MARGIN is required to control the reactivity transient. Accordingly, the SHUTDOWN MARGIN requirement is based upon this limiting condition and is consistent with FSAR safety analysis assumptions. With Tavg ≤200°F, the reactivity transients resulting from any postulated accident are minimal and the shutdown margin provides adequate protection.

314.1.1.3 BORON DILUTION

A minimum flow rate of at least 2000 GPM provides adequate mixing, prevents stratification and ensures that reactivity changes will be gradual during boron concentration reductions in the Reactor Coolant System. A flow rate of at least 2000 GPM will circulate an equivalent Reactor Coolant System volume of 6,650 cubic feet in approximately 25 minutes. The reactivity change rate associated with boron concentration reductions will therefore be within the capability of operator recognition and control.

3/4.1.1.4 MODERATOR TEMPERATURE COEFFICIENT (MTC)

The limitations on MTC are provided to ensure that the assumptions used in the accident and transient analysis remain valid through each fuel cycle. ~~The surveillance requirements for measurement of the MTC during each fuel cycle are adequate to confirm the MTC value since this coefficient changes slowly due principally to the reduction in RCS boron concentrations associated with fuel burnup. The confirmation that the measured MTC value is within its limit provides assurances that the coefficient will be maintained within acceptable values throughout each fuel cycle. The MTC limits defined in the Technical Specification are maximum upper design limits. Actual operating limits are specified in the CORE OPERATING LIMITS REPORT.~~ The Surveillance Requirements consisting of beginning of cycle measurements and end of cycle MTC predictions ensure that the MTC remains within acceptable values. The confirmation that the measured values are within a tolerance of ± 0.16 X 10^{-4} $\Delta k/k/°F$ from the corresponding design values (MTC predicted values based on core data) prior to 5% power and prior to reaching a Rated Thermal Power equilibrium boron concentration of 800 ppm provides assurances that the MTC will be maintained within acceptable values throughout each fuel cycle. CE NPSD 911-A and CE NPSD 911 Amendment 1-A, "Analysis of Moderator Temperature Coefficients in Support of a Change in the Technical Specifications End of Cycle Negative MTC Limits", provide the analysis that established the design margin of ± 0.16 X 10^{-4} $\Delta k/k/°F$. The option to eliminate the EOC MTC measurement requires that the reload analysis be performed using the CE methodology. The predicted design value is performed using NRC approved codes.