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2CAN080106

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

Arkansas Nuclear One – Unit 2
Docket No. 50-368
License No. NPF-6
Supplemental Response to the Option to Eliminate the End-of-Cycle Moderator Temperature Coefficient Measurement

Ladies and Gentlemen:

On May 2, 2001 Arkansas Nuclear One – Unit 2 (ANO-2) submitted a request to modify the ANO-2 Technical Specifications Surveillance Requirement 4.1.1.4.2.c (2CAN050102). The proposed change will allow eliminating the measurement of the Moderator Temperature Coefficient (MTC) upon reaching two-thirds core burnup if the results of the beginning of cycle measurements are within ± 1.6 pcm/°F of the calculated MTC (design value). The request was based on an NRC approved 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 August 7, 2001, Entergy and members of your staff discussed four additional questions regarding the above submittal. Please see the enclosed attachment for the response to those questions.

No changes are required to the no significant hazards considerations contained in the original submittal (2CAN050102). No new commitments are proposed in this letter.

A001

I declare under penalty of perjury that the foregoing is true and correct. Executed on August 23, 2001.

Very truly yours,

Dale E. James
Acting Director, Nuclear Safety Assurance

DEJ/dm
Attachments

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ATTACHMENT

TO

2CAN080106

PROPOSED TECHNICAL SPECIFICATION

AND

RESPECTIVE SAFETY ANALYSES

IN THE MATTER OF AMENDING

LICENSE NO. NPF-6

ENTERGY OPERATIONS, INC.

DOCKET NO. 50-368

Question 1

Page 3 of 5 of the Attachment, Answer on Condition 1: The justification for elimination of the end-of-cycle (EOC) moderator temperature coefficient (MTC) measurement was based on analysis using the Combustion Engineering (CE) methodology. The first condition for use of this method of eliminating EOC MTC measurement requires that the CE methodology must be used. Please state that the cycle will be designed using the CE methodology, such that the best estimate MTC is more negative than the beginning of cycle (BOC) technical specification (TS) limit by the design margin and that the best estimate MTC is more positive than the EOC TS limit by the design margin.

Response to Question 1

The cycle will be designed using the CE methodology, such that the best estimate MTC is more negative than the BOC TS limit by the design margin and that the best estimate MTC is more positive than the EOC TS limit by the design margin. The current Arkansas Nuclear One, Unit 2 (ANO-2) Design Guidelines used by Westinghouse (CE) requires that a design margin to the Core Operating Limits Report (COLR) for the predicted MTC be at least 1.6 pcm/°F.

Question 2

Page 3 of 5 of the Attachment, answer on Condition 2: Condition 2 of the NRC's Safety Evaluation for the approval of Combustion Engineering Owners Group Topical Report CE NPSD-911-A and Amendment 1-A stated that the design margin is 1.6 pcm/°F at all times in life. Please state that the design margin will be 1.6 pcm/°F at all times in life.

Response to Question 2

The design margin will be at least 1.6 pcm/°F at all times in life. For ANO-2 cycle 15, the minimum design margin to the COLR limit at any time in the cycle is expected to be no less than 2 pcm/°F. For ANO-2 cycle 16, the minimum design margin to the COLR limit is expected to be no less than 2 pcm/°F. The predictions for both cycles were derived using CE methodology. The cycle 16 values considered the proposed power uprate.

Question 3

Page 3 of 5 of the Attachment, answer on Condition 4: The response to Question 4 in Amendment 1 of the CE NPSD-911-A was NOT accepted by NRC. Condition 4 requires that the current CE methodology as described in the report be used. Use of any other methodology is not approved. Please state that the current CE methodology as described in the report will be used.

Response to Question 3

Current methodology as described in the CE topical report will be used. Included in the bases of the proposed change (2CAN050102) is the following: "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 the NRC approved codes." The intent of the wording in the bases was to allow Entergy to perform the analysis for the predicted design value using currently NRC approved codes. However, as a result of the discussion between ANO-2 personnel and your staff, it is clear that only the approved CE methodology can be used when determining the predicted design value. Therefore, the proposed wording (attached) contained in the bases will be modified as follows: "The option to eliminate the EOC MTC measurement requires that the reload analysis and predicted design value be performed using the CE methodology."

Question 4

Control element assembly (CEA) tip loss was discovered by the unexpected results of the EOC MTC measurement in another CE plant. What precautions and actions is ANO-2 taking to prevent and detect CEA tip loss?

Response to Question 4

ANO-2 does not use the CEAs to induce the moderator temperature change. The steam dump and bypass control system or the turbine is used instead. Integrity of all CEAs is verified, as a minimum, by CEA drop time testing performed at the beginning of each cycle and by verifying full insertion of CEAs following any plant shutdown.

The ANO-2 core contains 81 CEAs. Originally there were 73 full-length full strength CEAs and 8 part length CEAs. In late 1995, during the 2R11 refueling outage, all 81 CEAs were replaced with new full-length full strength CEAs. The replacement CEAs were identical in design to the original full-length full strength CEAs except for the middle finger. The four outer fingers in the original CEAs had silver-indium-cadium (AgInCd) plugs in the lower tip of the finger. The center finger had an Inconel 625 slug. All five fingers of the new CEAs have AgInCd plugs at the lower tip of each finger. This is a different design than was used for Palo Verde Unit 1.

There are two areas of concern with CEA integrity. These are the irradiation induced swelling and associated induced stress and strain and the mechanical fretting of the clad material. Entergy has recently analyzed the current ANO-2 CEAs using the CE CEA Lifetime Limits (CEALL) computer code. This code is based on the updated, generally best-estimate models of the CEA finger material irradiation behavior, criteria for performance limits, and neutronic correlations. Predictions of fast neutron fluence accumulation, B-10 depletion in the B_4C pellets, and swelling of the B_4C pellets and AgInCd slug are combined with life limit criteria for Inconel 625 strain and Irradiation

Assisted Stress Corrosion Cracking (IASCC) failure thresholds. The results of the CEALL analysis demonstrates that the CEAs are justified for use at least through the end of Cycle 18. ANO-2 is currently in Cycle 15 of operation. The analysis did account for the power uprate in Cycles 16 through 18. The analysis did not extend beyond EOC 18. Extrapolation from EOC 18 results indicate that CEA lifetimes will most likely extend through Cycle 22. A future CEALL analysis will be performed prior to EOC 18 in order to justify the continued use of the current CEAs.

Section 4.2.1.3 of the ANO-2 UFSAR presents the fuel assembly design evaluation. The presentation of the vibration analyses performed states that "the Unit 2 design includes three specific means for eliminating the consequences of CEA vibration. These are the extension of upper guide structure flow channels; the sleeving of all guide tubes in the fuel assemblies; and the programmed insertion of CEAs. Measurements taken following Cycle 1 operation confirmed the effectiveness of this design change in limiting CEA guide tube wear." All ANO-2 fuel assemblies utilize sleeves in the guide tubes. Although previously judged by the NRC to be unnecessary, ANO-2 has to date continued the use of programmed insertion limits also.

In Section 2.1.5 of the SER supporting Amendment 24 to the ANO-2 license, the question of increased CEA cladding wear was raised. The results of testing performed following Cycle 1 were consistent with comparable measurements made on similar CEAs from other C-E NSSS reactors. The measured wear was within the limits for continued CEA operation. Observed wear rates did not indicate a potential for CEA integrity loss in the near term. Prior to replacement, the original ANO-2 CEAs were inspected at the end of Cycle 7, after ~ 6.5 EFPY of operation. The inspection found only a limited amount of cladding wear, no cladding crack, and no detectable circumferential strains. Currently these CEAs are in the ANO-2 spent fuel pool.

ANO-2 has continued the same operational philosophy for the replacement CEAs as was used for the original CEAs. Based on this and the information above, Entergy believes the risk of losing the tip of a CEA is minimal.

MARKUP OF TECHNICAL SPECIFICATION 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} Δk/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} Δk/k/°F. The option to eliminate the EOC MTC measurement requires that the reload analysis and predicted design value be performed using the CE methodology.