

## Industry/TSTF Standard Technical Specification Change Traveler

### Predicting end-of-cycle MTC and deleting need for end-of-cycle MTC verification (NPSD-911-A)

NUREGs Affected:  1430  1431  1432  1433  1434

Classification: 1) Technical Change

Recommended for CLIP?: Yes

Priority: 1)High

Simple or Complex Change: Complex

Correction or Improvement: Improvement

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### 1.0 DESCRIPTION

NUREG 1432 Surveillance Requirements SR 3.1.3.2 (Digital) and SR 3.1.3.2 (Analog) are each divided into two Surveillance Requirements. The end of cycle (EOC) required MTC measurement Frequency is removed from SR 3.1.3.2 and becomes the Frequency for the new SR 3.1.3.3. SR 3.1.3.3 requires the same MTC verification as SR 3.1.3.2 except a third Note is added. The Note states that the EOC measurement of MTC is only required if the MTC measured in SR 3.1.3.1 and SR 3.1.3.2 (e.g., the BOC measurements) are not within a specified amount with respect to the limits in the COLR.

### 2.0 PROPOSED CHANGE

NUREG-1432, Revision 2 is revised to incorporate the allowances approved in Topical Report CE NPSD-911-A (Ref. 1).

In addition, TSTF-284, Revision 3, deleted Note 1 from SR 3.1.3.2 (SR 3.1.4.2 in Revision 1 of NUREG-1432), but this Note was not deleted in the published version of Revision 2 of NUREG-1432. The Note is deleted to correct the NUREG.

SR 3.1.3.2 (Analog and Digital) are revised to eliminate Surveillance Note 2 and the Frequency requiring measurement at the two-thirds of the expected core burnup. A new Surveillance, SR 3.1.3.3, is added which requires an MTC measurement at two-thirds of the expected core burnup only if the MTC determined in SR 3.1.3.1 and SR 3.1.3.2 is not within  $\pm 0.16 \times 10^{-4} \Delta\rho/F$  of the respective limits in the COLR.

### 3.0 BACKGROUND

Topical Report CE NPSD-911-A, Analysis of Moderator Temperature Coefficients in support of a change in the Technical Specification End-of-Cycle Negative MTC limit, CEOG Task 764, analyzed a database of measured and calculated MTC's and established that if the measured beginning-of-cycle moderator temperature coefficients fall within  $0.16 \times 10^{-4} \Delta\rho/F$  of the best estimate prediction, that it can be assumed that the end-of-cycle coefficient will also. Therefore, the EOC measurement is not required. The measured data analysis must be based on the current ABB-CE methodology as described in the report. This change reflects the conclusions of this analysis. The Topical Report was approved by the NRC on June 14, 2000.

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#### 4.0 TECHNICAL ANALYSIS

The TS provide limitations on the moderator temperature coefficient (MTC) to ensure that the assumptions used in the accident and transient analysis remain valid through each fuel cycle. The requirements to measure the MTC at the beginning-of-cycle (BOC) (once at hot zero power and once at power) and near end-of-cycle (EOC) (i.e., 2/3 expected core burnup) provide confirmation that the measured MTC value is within its limits and will remain in its limits throughout each cycle. The purpose of Topical Report CE NPSD-911 (Ref. 1) is to provide the justification to support eliminating the need to determine the MTC upon reaching two-thirds of core burnup if the results of the MTC tests required at the beginning-of-cycle are within a tolerance of  $0.16 \times 10^{-4} \Delta k/k/F$  of the calculated MTC (design value). However, if the results of the first two tests are not within that limit, then performance of the 2/3 cycle surveillance will be required. The reports concluded that if the MTC at the beginning-of-cycle is within  $0.16 \times 10^{-4} \Delta k/k/F$  of the design value, then the MTC at the end-of-cycle will also be within  $0.16 \times 10^{-4} \Delta k/k/F$  of the design value.

The analysis used measured MTC data from several plants and compared that data to the calculated MTC. This was done to evaluate the methodology used in calculating the MTC. The reports concluded that evaluation of the data showed that if the MTC measured at the beginning-of-cycle is within  $0.16 \times 10^{-4} \Delta k/k/F$  of the calculated MTC, then the near end-of-cycle calculated MTC will be within  $0.16 \times 10^{-4} \Delta k/k/F$  of the true MTC. Thus, the method would adequately model the MTC for the entire cycle, and the near end-of cycle MTC surveillance would not be required.

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## 5.0 REGULATORY ANALYSIS

### 5.1 Applicable Regulatory Requirements/Criteria

The proposed changes have been evaluated to determine whether applicable regulations and requirements continue to be met.

The proposed changes do not require any exemptions or relief from regulatory requirements, other than the TS, and do not affect conformance with any GDC. The approval of this change will continue to meet conformance with 10 CFR 50.36.

### 5.2 No Significant Hazards Consideration

A change to NUREG-1432 is proposed to eliminate the measurement of EOC MTC if the BOC measurements are within a given tolerance to the predicted value.

In accordance with the criteria set forth in 10 CFR 50.92, the Industry has evaluated these proposed Improved Technical Specification changes and determined they do not represent a significant hazards consideration. The following is provided in support of this conclusion.

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

Response: No.

A change to NUREG-1432 is proposed to eliminate the measurement of EOC MTC if the BOC measurements are within a given tolerance to the predicted value. MTC is not an initiator of any accident previously evaluated. Consequently, the probability of an accident previously evaluated is not significantly increased. The EOC MTC value is an important assumption in determining the consequences of accidents previously evaluated. The analysis presented in the Topical Report determined that the EOC MTC will be within limit if the BOC measured MTC values are within a given tolerance of the measured values. Therefore, the EOC MTC will continue to be within limit and the consequences of accidents will continue to be as previously evaluated. Therefore, the consequences of an accident previously evaluated are not significantly increased by this change. Therefore, this change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

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

Response: No.

A change to NUREG-1432 is proposed to eliminate the measurement of EOC MTC if the BOC measurements are within a given tolerance to the predicted value. The proposed change does not involve a physical alteration of the plant (no new or different type of equipment will be installed) or a change in the methods governing normal plant operation. Thus, this change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

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

Response: No.

A change to NUREG- 1432 is proposed to eliminate the measurement of EOC MTC if the BOC measurements are within a given tolerance to the predicted value. The Topical Report concluded that the risk of not measuring the EOC MTC is acceptably small provided that the BOC measured values are within a specific tolerance of the predicted values. Therefore, this change does not involve a significant reduction in a margin of safety.

Based on the above, the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of “no significant hazards consideration” is justified.

## 6.0 ENVIRONMENTAL CONSIDERATIONS

The proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

## 7.0 REFERENCES

1. Topical Report CE NPSD-911-A, “Analysis of Moderator Temperature Coefficients in Support of a Change in the Technical Specification End-of Cycle Negative MTC Limit,” CEOG Task 764, June 2000.
2. NRC Safety Evaluation Report, “Arkansas Nuclear One, Unit No. 2 - Issuance of Amendment RE: Deletion of Moderator Temperature Coefficient (MTC) Determination at Two-Thirds Core Burnup (TAC No. MB1840), dated November 16, 2001.
3. NRC Safety Evaluation Report, “Waterford Steam Electric Station, Unit 3 - Issuance of Amendment RE: Moderator Temperature Coefficient Test Near End of Each Cycle (TAC No. MA3781), dated April 21, 2000.

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## Revision History

### OG Revision 0

**Revision Status: Closed**

Revision Proposed by: CEOG

Revision Description:  
Original Issue

22-Sep-02

**OG Revision 0****Revision Status: Closed****Owners Group Review Information**

Date Originated by OG: 17-Mar-99

Owners Group Comments:  
(No Comments)

Owners Group Resolution: Approved Date: 30-Jun-99

**TSTF Review Information**

TSTF Received Date: 20-Jul-99 Date Distributed for Review: 06-Apr-01

OG Review Completed:  BWOG  WOG  CEOG  BWROG

TSTF Comments:

2/14/2001 - discussed by TSTF. CEOG only. Needs Safety Evaluation quality justification.

TSTF Resolution: Approved Date: 02-May-01

**NRC Review Information**

NRC Received Date: 24-May-01

NRC Comments:

8/14/2002 - NRC letter providing comments. The proposed Bases changes did not conform to the proposed changes to SR 3.1.3.2 (Digital and Analog) and the addition of SR 3.1.3.3. TSTF-406, Rev. 0 will require revision.

Final Resolution: NRC Rejects: TSTF to Revise

Final Resolution Date: 14-Aug-02

**TSTF Revision 1****Revision Status: Active****Next Action: NRC**

Revision Proposed by: CEOG

Revision Description:

On August 14, 2002, the NRC provided comments on TSTF-406, Revision 0. Comments are addressed below.

Comment: Several administrative errors noted on the TS Bases markup pages (wrong SR numbers, etc.). TSTF has been provided description of errors which must be corrected prior to approval.

Response: The following corrections have been made. In addition, the TSTF has been revised to the accepted submittal format and discussions added as necessary.

1. The title to TS 3.1.3 SR Bases (Analog) is modified to include new SR 3.1.3.3.
2. Reference to SR 3.1.3.2 in the 1st sentence of the 2nd paragraph of TS 3.1.3 SR Bases (Analog) is corrected to reference new SR 3.1.3.3.
3. The title to TS 3.1.3 SR Bases (Digital) incorrectly references SR 3.1.4.2 and is changed to correctly reference SR 3.1.3.2.

**TSTF Review Information**

TSTF Received Date: 12-Sep-02 Date Distributed for Review: 12-Sep-02

OG Review Completed:  BWOG  WOG  CEOG  BWROG

22-Sep-02

**TSTF Revision 1**

**Revision Status: Active**

**Next Action: NRC**

TSTF Comments:

(No Comments)

TSTF Resolution: Approved Date: 12-Sep-02

**NRC Review Information**

NRC Received Date: 30-Sep-02

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**Affected Technical Specifications**

SR 3.1.3.2 MTC (Analog)

SR 3.1.3.2 MTC (Digital)

SR 3.1.3.2 Bases MTC (Analog)

SR 3.1.3.2 Bases MTC (Digital)

SR 3.1.3.3 MTC (Analog)

Change Description: New

SR 3.1.3.3 MTC (Digital)

Change Description: New

SR 3.1.3.3 Bases MTC (Analog)

Change Description: New

SR 3.1.3.3 Bases MTC (Digital)

Change Description: New

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.1.3.2</p> <p><del>1. This Surveillance is not required to be performed prior to entry into MODE 1 or 2.</del></p> <p><del>2. If the MTC is more negative than the COLR limit when extrapolated to the end of cycle, SR 3.1.3.2 may be repeated. Shutdown must occur prior to exceeding the minimum allowable boron concentration at which MTC is projected to exceed the lower limit.</del></p> <hr/> <p>Verify MTC is within the lower limit.</p>	<p>Each fuel cycle within 7 effective full power days (EFPD) of reaching 40 EFPD core burnup</p> <p><del>AND</del></p> <p>Each fuel cycle within 7 EFPD of reaching 2/3 of expected core burnup</p>

<p><u>SR 3.1.3.3</u> -----</p> <p>1. <u>If the MTC is more negative than the COLR limit when extrapolated to the end of cycle, SR 3.1.3.3 may be repeated. Shutdown must occur prior to exceeding the minimum allowable boron concentration at which MTC is projected to exceed the lower limit.</u></p> <p>2. <u>Only required if MTC determined in SR 3.1.3.1 and SR 3.1.3.2 is not within +/- 0.16*10E-4 Δρ/°F of the respective limits in the COLR.</u></p> <p>-----</p> <p><u>Verify MTC is within the lower limit.</u></p>	<p><u>Each fuel cycle within 7 EFPD of reaching 2/3 of expected core burnup</u></p>
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## BASES

## ACTIONS (continued)

MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE  
REQUIREMENTS

[SR 3.1.3.1](#), [SR 3.1.3.2](#), and [SR 3.1.3.3~~2~~](#)

The SRs for measurement of the MTC at the beginning and middle of each fuel cycle provide for confirmation of the limiting MTC values. The MTC changes smoothly from most positive (least negative) to most negative value during fuel cycle operation, as the RCS boron concentration is reduced to compensate for fuel depletion. The requirement for measurement prior to operation > 5% RTP satisfies the confirmatory check on the most positive (least negative) MTC value. The requirement for measurement, within 7 days after reaching 40 effective full power days and  $\frac{2}{3}$  core burnup, satisfies the confirmatory check of the most negative MTC value. The measurement is performed at any THERMAL POWER, so that the projected EOC MTC may be evaluated before the reactor actually reaches the EOC condition. MTC values may be extrapolated and compensated to permit direct comparison to the specified MTC limits.

[SR 3.1.3.3~~2~~](#) is modified by a Note, which indicates that if the extrapolated MTC is more negative than the EOC COLR limit, the Surveillance may be repeated, and that shutdown must occur prior to exceeding the minimum allowable boron concentration at which MTC is projected to exceed the lower limit. An engineering evaluation is performed if the extrapolated value of MTC exceeds the Specification limits.

[SR 3.1.3.3 is modified by a second Note, which indicates that the Surveillance, which determines MTC towards the end of core life, is only required if the MTC determined in SR 3.1.3.1 and SR 3.1.3.2 is not within  \$0.16 \times 10^{-4} \Delta\rho/^\circ\text{F}\$  of the respective limits in the COLR. Analysis in Reference 5 has shown that if the measured beginning of cycle moderator temperature coefficients fall within  \$0.16 \times 10^{-4} \Delta\rho/^\circ\text{F}\$  of the best estimate prediction, then it can be assumed that the end of cycle coefficient will also agree with the prediction and measurement is not required.](#)

[BASES](#)

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REFERENCES

1. 10 CFR 50, Appendix A, GDC 11.
  2. FSAR, Section [ ].
  3. FSAR, Section [ ].
  4. FSAR, Section [ ].
  5. [CF-NPSD-911-A, Analysis of Moderator Temperature Coefficients in Support of a Change in the Technical Specification End-of-Cycle MTC Limit, September 2000.](#)
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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.1.3.2</p> <p><del>1. This Surveillance is not required to be performed prior to entry into MODE 1 or 2.</del></p> <p><del>2. If the MTC is more negative than the COLR limit when extrapolated to the end of cycle, SR 3.1.3.2 may be repeated. Shutdown must occur prior to exceeding the minimum allowable boron concentration at which MTC is projected to exceed the lower limit.</del></p> <hr/> <p>Verify MTC is within the lower limit.</p>	<p>Each fuel cycle within 7 effective full power days (EFPD) of reaching 40 EFPD core burnup</p> <p><del>AND</del></p> <p><del>Each fuel cycle within 7 EFPD of reaching 2/3 of expected core burnup</del></p>

<p><u>SR 3.1.3.3</u> -----</p> <p>1. <u>If the MTC is more negative than the COLR limit when extrapolated to the end of cycle, SR 3.1.3.3 may be repeated. Shutdown must occur prior to exceeding the minimum allowable boron concentration at which MTC is projected to exceed the lower limit.</u></p> <p>2. <u>Only required if MTC determined in SR 3.1.3.1 and SR 3.1.3.2 is not within +/- 0.16*10E-4 <math>\Delta\rho/^\circ\text{F}</math> of the respective limits in the COLR.</u></p> <p>-----</p> <p><u>Verify MTC is within the lower limit.</u></p>	<p><u>Each fuel cycle within 7 EFPD of reaching 2/3 of expected core burnup</u></p>
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## BASES

## ACTIONS (continued)

MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE  
REQUIREMENTS

[SR 3.1.3.1](#), [SR 3.1.3.2](#), and [SR 3.1.3.3~~2~~](#)

The SRs for measurement of the MTC at the beginning and middle of each fuel cycle provide for confirmation of the limiting MTC values. The MTC changes smoothly from most positive (least negative) to most negative value during fuel cycle operation, as the RCS boron concentration is reduced to compensate for fuel depletion. The requirement for measurement prior to operation > 5% RTP satisfies the confirmatory check on the most positive (least negative) MTC value. The requirement for measurement, within 7 days after reaching 40 effective full power days and  $\frac{2}{3}$  core burnup, satisfies the confirmatory check of the most negative MTC value. The measurement is performed at any THERMAL POWER, so that the projected EOC MTC may be evaluated before the reactor actually reaches the EOC condition. MTC values may be extrapolated and compensated to permit direct comparison to the specified MTC limits.

[SR 3.1.3.3~~2~~](#) is modified by a Note, which indicates that if the extrapolated MTC is more negative than the EOC COLR limit, the Surveillance may be repeated, and that shutdown must occur prior to exceeding the minimum allowable boron concentration at which MTC is projected to exceed the lower limit. An engineering evaluation is performed if the extrapolated value of MTC exceeds the Specification limits.

[SR 3.1.3.3 is modified by a second Note, which indicates that the Surveillance, which determines MTC towards the end of core life, is only required if the MTC determined in SR 3.1.3.1 and SR 3.1.3.2 is not within  \$0.16 \times 10^{-4} \Delta\rho/^\circ\text{F}\$  of the respective limits in the COLR. Analysis in Reference 5 has shown that if the measured beginning of cycle moderator temperature coefficients fall within  \$0.16 \times 10^{-4} \Delta\rho/^\circ\text{F}\$  of the best estimate prediction, then it can be assumed that the end of cycle coefficient will also agree with the prediction and measurement is not required.](#)

BASES

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## REFERENCES

1. 10 CFR 50, Appendix A, GDC 11.
  2. FSAR, Section [ ].
  3. FSAR, Section [ ].
  4. FSAR, Section [ ].
  5. [CF-NPSD-911-A, Analysis of Moderator Temperature Coefficients in Support of a Change in the Technical Specification End-of-Cycle MTC Limit, September 2000.](#)
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