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SUBJECT: Application for amend to License DPR-74,revising Tech Specs re steam line break analysis.

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AMERICAN ELECTRIC POWER

AEP:NRC:0916AB
TAC 65677
10 CFR 50.90

Donald C. Cook Nuclear Plant Unit 2
Docket No. 50-316
License No. DPR-74
STEAM LINE BREAK ANALYSIS
TECHNICAL SPECIFICATION CHANGES

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

Attn: T. E. Murley

August 15, 1988

Dear Dr. Murley:

This letter and its attachments constitute an application for amendment to the Technical Specifications (T/Ss) for the Donald C. Cook Nuclear Plant Unit 2. Specifically, these changes are necessary to accommodate the new steam line break analysis performed by Advanced Nuclear Fuels (ANF) for Unit 2 of the Cook Nuclear Plant. The steam line break analysis, published as ANF report No. XN-NF-87-31(P), was transmitted to the NRC directly by ANF via their letter No. GNW:047:87, dated May 29, 1987. It was placed on our docket via our letter AEP:NRC:0916D, dated June 15, 1987.

We believe the proposed changes will not result in (1) a significant change in the types of effluents or a significant increase in the amounts of any effluent that may be released offsite, or (2) a significant increase in individual or cumulative occupational radiation exposure.

These proposed changes have been reviewed by the Plant Nuclear Safety Review Committee and will be reviewed by the Nuclear Safety and Design Review Committee at their next regularly scheduled meeting.

In compliance with the requirements of 10 CFR 50.91 (b)(1), copies of this letter and its attachments have been transmitted to Mr. R. C. Callen of the Michigan Public Service Commission and Mr. George Bruchmann of the Michigan Department of Public Health.

Pursuant to 10 CFR 170.12 (c), we have enclosed an application fee of $150 for the proposed amendments.

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w/check $150
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This submittal proposes changes to Unit 2 T/S pages 3/4 1-2, 3/4 1-5, and 3/4 1-6. Additional changes to these pages were submitted in our letter AEP:NRC:0916W, dated March 26, 1987. During discussions on July 19, 1988, your staff indicated the changes proposed in AEP:NRC:0916W were expected to be granted in the near future. Therefore, we have included these pending changes in our present submittal.

This document has been prepared following Corporate procedures which incorporate a reasonable set of controls to ensure its accuracy and completeness prior to signature by the undersigned.

Sincerely,

M. P. Alexich
Vice President

ldp

Attachments

cc: D. H. Williams, Jr.
W. G. Smith, Jr. - Bridgman
G. Bruchmann
R. C. Callen
G. Charnoff
A. B. Davis - Region III
NRC Resident Inspector - Bridgman

Attachment 1 to AEP:NRC:0916AB

Reasons and 10 CFR 50.92
Significant Hazards Evaluation
for Changes to the
Technical Specifications for the
Donald C. Cook Nuclear Plant Unit 2

Introduction

The changes proposed in this letter are those necessary to accommodate the new steam line break analysis performed by Advanced Nuclear Fuels (ANF). This analysis, published as ANF report No. XN-NF-87-31(P), was transmitted to the NRC directly by ANF via their letter No. GNW:047:87, dated May 29, 1987. It was placed on the Cook Nuclear Plant Unit 2 docket via our letter No. AEP:NRC:0916D, dated June 15, 1987.

The changes fall into four categories. These categories are:

1) Increase in the required shutdown margin.

2) Additional time response testing requirements.

3) Reduction in the lower limit for the moderator temperature coefficient.

4) Change to the description of the full steam flow function.

Background information on the steam line break issues, as well as a discussion of each of the categories of changes, is provided below.

Background Information for Unit 2 Steam Line Break Analysis

For Unit 2 Cycle 4, ANF performed a steam line break analysis using their code, PTSPWR2. This analysis is documented in XN-NF-82-32(P), which was referenced by our letter AEP:NRC:0637B, dated July 8, 1982. In the Safety Evaluation Report (SER) for Amendment 48 to the Unit 2 T/Ss, the staff found the use of PTSPWR2 unsatisfactory for prediction of minimum departure from nucleate boiling ratio (MDNBR). The SER enumerated a number of license conditions, including limits on core peaking factors and prohibitions against using PTSPWR2 analyses to justify changes to reactor protection system and engineered safeguards features instrumentation setpoints.

For Cycle 6, ANF addressed all the Standard Review Plan Chapter 15 events. The PTSPWR2 code, modified to address the NRC's concerns, was used for many of the transients, but could not be modified to perform the steam line break analysis. Because of time constraints, ANF was unable to complete a new steam line break analysis prior to cycle startup. In our letter AEP:NRC:0916A, dated May 21, 1985, we committed to providing the analysis by the midpoint of Cycle 6. The SER for Unit 2 Amendment 82 states, "This is acceptable based on similarity to previous cores and the commitment by the licensee to provide analyses of steam line breaks during mid-cycle. Steam line breaks are overcooling events for which limiting conditions are not reached until the end of core life."

As discussed above, the analyses were submitted on May 29, 1987, by ANF. The analyses use the ANF methodology outlined in their document XN-NF-84-93(P), which is currently undergoing NRC review. The methodology has been accepted by the NRC on a plant specific basis for the St. Lucie and H. B. Robinson plants.

Summary of Analysis

The analyses which were presented in XN-NF-87-31(P) demonstrate the acceptability of operation of Unit 2 under conditions of a steam line break. The break was taken as a double-ended guillotine break, located inside the containment building between the steam generator outlet and the venturi flow meter located downstream in the steam line. This break location was chosen because it results in the largest cross-sectional flow area and therefore produces the most rapid cooldown and the highest return to power.

The analysis was performed using the computer code RELAP5. Four transient scenarios were considered. The scenarios considered initiation of the transient from two operating conditions, hot zero power (HZP) and hot full power (HFP). The main differences between the two initial conditions are the presence of the delayed neutrons and the higher stored energy in the HFP case. From both these initial conditions, the transient was then assumed to occur both with and without offsite power. Here, the main differences result from the coastdown of the primary coolant pumps and the effect the resulting flow coastdown has on the timing of the events occurring during the transient.

The HZP scenario with loss of offsite power was determined to be the most limiting from a MDNBR standpoint. This case resulted in a MDNBR of 1.26, which is above the 1.135 MDNBR safety limit for the correlation used. The HFP and HZP scenarios, with offsite power maintained for operation of the primary coolant pumps, resulted in a return to higher power levels than the scenarios where offsite power is lost. However, these scenarios provide substantially greater margin to the MDNBR limit because of the higher coolant flow rate. In no scenario evaluated was fuel failure calculated to occur as a result of penetration of the MDNBR safety limit.

The HZP scenario with offsite power available was determined to be the most limiting from the standpoint of fuel centerline melt. This scenario resulted in the highest calculated linear heat generation rate, 19.7 kW/ft. This value is within the limit of 21 kW/ft discussed in XN-NF-87-31(P). Thus, no fuel failures would be expected due to fuel melt. As discussed above, the HFP and HZP scenarios with offsite power maintained for operation of the primary coolant pumps returned to higher power levels than the scenarios in which offsite power is lost. Although these scenarios have substantially greater margin to the MDNBR limit because of a higher coolant flow rate, the higher power levels, in combination with the highly skewed power distribution due to the assumption of a stuck rod cluster, resulted in them being limiting in regard to the fuel centerline melt criteria.

Results of the analysis are summarized in the table below.

Steam Line Break Analysis Summary

Initial Power Level	Offsite Power Available	Maximum Post Scram Return to Power, MWt	MDNBR	Core Ave. Power @ MDNBR, MWt
HZP	Yes	1329	2.00	1329
HZP	No	416	1.26	321
HFP	Yes	1158	2.10	1158
HFP	No	387	1.63	215

Discussion of Technical Specification Changes

1) Increase in Required Shutdown Margin

The first proposed T/S change increases the minimum shutdown margin requirements for Modes 1 through 4. The value is changed from its current value of 1.6% Δ k/k to 2.0% Δ k/k in T/Ss 3/4.1.1.1 (Modes 1 through 3), T/S 3.1.1.2.a (Mode 4), and Figure 3.1-3. Additionally, we are proposing a change to Bases page B 3/4 1-1 to reflect the proposed increase in shutdown margin. The proposed minimum value of 2.0% Δ k/k is consistent with the new steam line break analysis found in XN-NF-87-31(P). The value of the minimum shutdown margin is discussed on page 6 of that report. The change is in the more restrictive direction. A larger value for the minimum required shutdown margin helps to minimize the return to power caused by the cooldown effects of a steam line break accident.

10 CFR 50.92 Criteria

Per 10 CFR 50.92, a proposed amendment will not involve a significant hazards consideration if the proposed amendment does not:

1) Involve a significant increase in the probability or consequences of an accident previously evaluated,

2) Create the possibility of a new or different kind of accident from any accident previously analyzed or evaluated, or

3) Involve a significant reduction in a margin of safety.

Criterion 1

The T/S requirements with regard to required minimum shutdown margin are being made more restrictive. Thus, we would not expect the change to involve a significant increase in the probability or consequences of a previously evaluated accident, nor would it be expected to involve a significant reduction in a margin of safety.

Criterion 2

The change will require the plant to be operated under more restrictive conditions than currently required. Additionally, no physical modifications to the plant are required as a result of the change. Therefore, the change should not create the possibility of a new or different kind of accident from any accident previously analyzed or evaluated.

Criterion 3

See Criterion 1 above.

Lastly, we note that the Commission has provided guidance concerning the determination of significant hazards by providing certain examples (48 FR 14870) of amendments considered not likely to involve significant hazards consideration. The second of these examples refers to changes which constitute additional limitations, restrictions, or controls not presently included in the T/Ss. As described above, this change is more restrictive in nature than the present T/S. Therefore, we believe the example cited is applicable and that the change should not involve significant hazards consideration.

2) Time Response Testing

The second proposed change adds a 10 second response time to Function 5.h in T/S Table 3.3-5. The function is steam line isolation derived from high steam flow in two steam lines coincident with low-low T_{avg}. Since previous steam line break analyses for Unit 2 did not take credit for this signal, the required response time is currently listed as "Not Applicable" in Table 3.3-5. The proposed value of 10 seconds is consistent with the analysis assumptions, as denoted on page 15 of XN-NF-87-31(P). The value is also consistent with the requirements for the identical functional unit in the Unit 1 T/Ss.

10 CFR 50.92 Criteria

Per 10 CFR 50.92, a proposed amendment will not involve a significant hazards consideration if the proposed amendment does not:

1) Involve a significant increase in the probability or consequences of an accident previously evaluated,

2) Create the possibility of a new or different kind of accident from any accident previously analyzed or evaluated, or

3) Involve a significant reduction in a margin of safety.

Criterion 1

The proposed change adds an additional time response test to the T/Ss and therefore imposes additional requirements on the unit. Thus, we would not expect the change to involve a significant increase in the probability or consequences of a previously evaluated accident, nor would it be expected to involve a significant reduction in a margin of safety.

Criterion 2

The change will require the plant to be operated under more restrictive conditions than currently required. Additionally, no physical modifications to the plant are required as a result of the change. Therefore, the change should not create the possibility of a new or different kind of accident from any accident previously analyzed or evaluated.

Criterion 3

See Criterion 1 above.

Lastly, we note that the Commission has provided guidance concerning the determination of significant hazards by providing certain examples (48 FR 14870) of amendments considered not likely

to involve significant hazards consideration. The second of these examples refers to changes which constitute additional limitations, restrictions, or controls not presently included in the T/Ss. As described above, this change is more restrictive in nature than the present T/S. Therefore, we believe the example cited is applicable and the change should not involve significant hazards consideration.

3) Moderator Temperature Coefficient

The third proposed change reduces the end of life (EOL) moderator temperature coefficient (MTC) limit from -3.9×10^{-4} $\Delta k/k/^{\circ}F$ to -3.5×10^{-4} $\Delta k/k/^{\circ}F$ in T/S 3.1.1.4.b. The proposed change is required by the ANF steam line break analysis. The MTC value is discussed on page 7 of XN-NF-87-31(P). The change is in the more restrictive direction. Reducing the magnitude of the negative MTC limit reduces the return to power associated with the cooldown effects of a steam line break accident. The MTC becomes more negative throughout the cycle as the boron concentration of the reactor coolant system decreases. Therefore, the most limiting negative value of the MTC is associated with the EOL conditions.

We are also proposing an accompanying change to surveillance requirement 4.1.1.4. The current Unit 2 requirement is to measure the MTC at 300 ppm boron and compare the measured value to a value which provides 0.9×10^{-4} $\Delta k/k/^{\circ}F$ margin to the EOL limit. If the MTC is more negative than this value, the MTC must be remeasured every 14 effective full power days (EFPD) during the remainder of the cycle.

The current Unit 1 surveillance requirement is somewhat different. It also requires the MTC to be measured at 300 ppm boron concentration but requires the measured MTC value to be extrapolated to EOL conditions to ensure compliance with the EOL negative MTC limit. There are no requirements to remeasure the MTC in the event the extrapolated value exceeds the limit.

We are proposing to modify the current Unit 2 surveillance requirements such that they are a blend of the present Unit 1 and Unit 2 requirements. Our proposed version requires extrapolation to the EOL conditions rather than comparison to a bounding 300 ppm value, but retains the current Unit 2 requirement to remeasure the MTC value every 14 EFPD in the event MTC values are outside the limits. (The criterion for retesting, however, is changed from failure to meet the bounding 300 ppm value to failure to meet the EOL negative MTC limit based on extrapolation of the 300 ppm test data).

The current Unit 2 requirement to compare the 300 ppm test data to an intermediate value is very conservative. Thus, the EOL limit is not necessarily violated if the 300 ppm criteria is violated. According to Westinghouse Electric Corp., our NSSS vendor, the margin of 0.9×10^{-4} $\Delta k/k/^{\circ}F$ between the 300 ppm allowable value and the EOL limit was chosen to conservatively bound all plants for the purpose of writing a standard T/S. The value does not allow us to take advantage of cycle specific data, which is provided by the fuel vendor and confirmed at various points throughout the fuel cycle. Additionally, the requirement to compare the 300 ppm MTC to

an intermediate value results in the use of different methods for Unit 1 and 2, since the Unit 1 T/S is based upon an earlier version of the standard T/Ss.

Extrapolation of the measured MTC at 300 ppm is achieved using cycle design data provided by the fuel vendor. The predicted MTC as a function of exposure is illustrated in Figure 1. (The curve is from Unit 2 Cycle 6). The 300 ppm measured value is extrapolated to the EOL exposure, using the same shape as the design curve.

The MTC is primarily dependent on the reactor coolant system boron concentration. Therefore, the slope of the MTC versus cycle exposure curve depends on the slope of the critical boron versus cycle exposure curve. Comparison of the measured critical boron concentration to the design value is required at least once per 31 effective full power days by T/S 4.1.1.1.2. This T/S requires the core reactivity to agree with the predicted value within 1% $\Delta k/k$, which corresponds to critical boron concentration within approximately 100 ppm. Other indication that the core is functioning as designed is provided by the incore flux maps, which are taken at least once every 31 EFPD to satisfy the requirements of T/S 4.2.2.2 ($F_Q(Z)$) and 4.2.3 ($F^N_{\Delta H}$). Since the validity of the core design, including the boron concentration curve, is assured by T/S surveillances, we believe that using design information to extrapolate the measured MTC at 300 ppm is justified.

As an example, the measured MTC for Unit 2 Cycle 6 was -1.67×10^{-4} $\Delta k/k/^{\circ}F$ normalized to hot full power, all rods out, 300 ppm boron concentration conditions. Extrapolation of this data, as shown in Figure 1, yielded a predicted MTC value of -2.23×10^{-4} $\Delta k/k/^{\circ}F$ at EOL. This value is compared to the limit of -3.5×10^{-4} $\Delta k/k/^{\circ}F$. As can be seen, there is a substantial margin between the extrapolated MTC and the EOL limit.

<u>10 CFR 50.92 Criteria</u>

Per 10 CFR 50.92, a proposed amendment will not involve a significant hazards consideration if the proposed amendment does not:

1) Involve a significant increase in the probability or consequences of an accident previously evaluated,

2) Create the possibility of a new or different kind of accident from any accident previously analyzed or evaluated, or

3) Involve a significant reduction in a margin of safety.

Criterion 1

The decrease in the magnitude of the negative EOL MTC value is in the more restrictive direction and is consistent with the assumptions of the new Unit 2 steam line break analysis. This change will reduce the potential consequences of a steam line break by reducing the return to power associated with the cooldown effects of the accident. Thus, this change would be expected to decrease the consequences of a steam line break accident and to increase the margin of safety. Extrapolation of the 300 ppm test data to EOL conditions may result in operation (without testing every 14 EFPD) with less margin to the EOL negative MTC limit. However, assurance that the core is operating as designed is obtained regularly through surveillance testing (e.g., core reactivity) and provides confirmation that the extrapolation method is valid. We also note that the extrapolation method is consistent with the current Unit 1 T/S requirements. For these reasons, we believe that any increase in the probability or consequences of a previously evaluated accident would be insignificant, and that the change does not involve a significant reduction in a margin of safety.

Criterion 2

The MTC value is being made more restrictive in accordance with the new steam line break analysis. The change to allow extrapolation of test data to the EOL limits does not introduce any new modes of plant operation or changes in plant configuration. Thus, we believe the changes do not create the possibility of a new or different kind of accident from any accident previously analyzed or evaluated.

Criterion 3

See Criterion 1 above.

Lastly, we note that the Commission has provided guidance concerning the determination of significant hazards by providing certain examples (48 FR 14870) of amendments considered not likely to involve significant hazards consideration. The second of these examples refers to changes which constitute additional limitations, restrictions, or controls not presently included in the T/Ss. The change in the EOL negative MTC limit is in the more restrictive direction, and therefore, the example cited is applicable. The sixth of these examples refers to changes which may result in some increase to the probability or consequences of a previously analyzed accident, but the results of which are clearly within limits established as acceptable. The change to allow extrapolation of the 300 ppm test data to the EOL conditions is allowed by the current Unit 1 T/Ss. Therefore, the example cited is relevant to this change.

4) Full Steam Flow Function Description

The fourth proposed change involves the description of the steam line isolation actuation on high steam flow coincident with low-low T_{avg}. This setpoint is specified in Table 3.3-4 Functional Unit 4.d. The upper limit on the function is currently expressed as a percentage of full steam flow at full load. We are proposing to change this such that the upper limit is expressed as a fixed value of steam flow. The value we have specified for the full load trip setpoint is 4.02×10^6 lbs/hr, which is consistent with the value specified in Table 2.2 (page 15) of XN-NF-87-31(P). The proposed value in the "Allowable Value" column of Table 2.2 is derived by the same methods used to obtain the allowable value currently in Table 3.3-4.

The method of describing the full load setpoint is similar to that used for the same function in the Unit 1 T/Ss. We believe it is desirable since it ensures the setpoint is consistent with the accident analysis assumptions. Our experience with steam flow values based on calorimetric measurements has indicated that the value determined by the calorimetric measurement tends to be slightly greater than the design value. This could lead to use of a value for the trip setpoint greater than that assumed in the accident analysis. Thus, we believe that specifying a specific value is conservative and helps eliminate the potential for operation outside the analysis assumptions.

10 CFR 50.92 Criteria

Per 10 CFR 50.92, a proposed amendment will not involve a significant hazards consideration if the proposed amendment does not:

1) Involve a significant increase in the probability or consequences of an accident previously evaluated,

2) Create the possibility of a new or different kind of accident from any accident previously analyzed or evaluated, or

3) Involve a significant reduction in a margin of safety.

Criterion 1

We have proposed a value for the setpoint which is consistent with the accident analysis assumptions. Our proposal to change the way the function is described in the T/S will help to eliminate the potential for operation outside the safety analysis assumptions. Our experience with steam flow rates based on calorimetric measurements leads us to conclude that the proposed change will constitute a more restrictive method of defining the setpoint. The method proposed is also consistent with that currently found in the

Unit 1 T/S. Thus, the change should not involve a significant increase in the probability or consequences of a previously evaluated accident, nor should it involve a significant reduction in a margin of safety.

Criterion 2

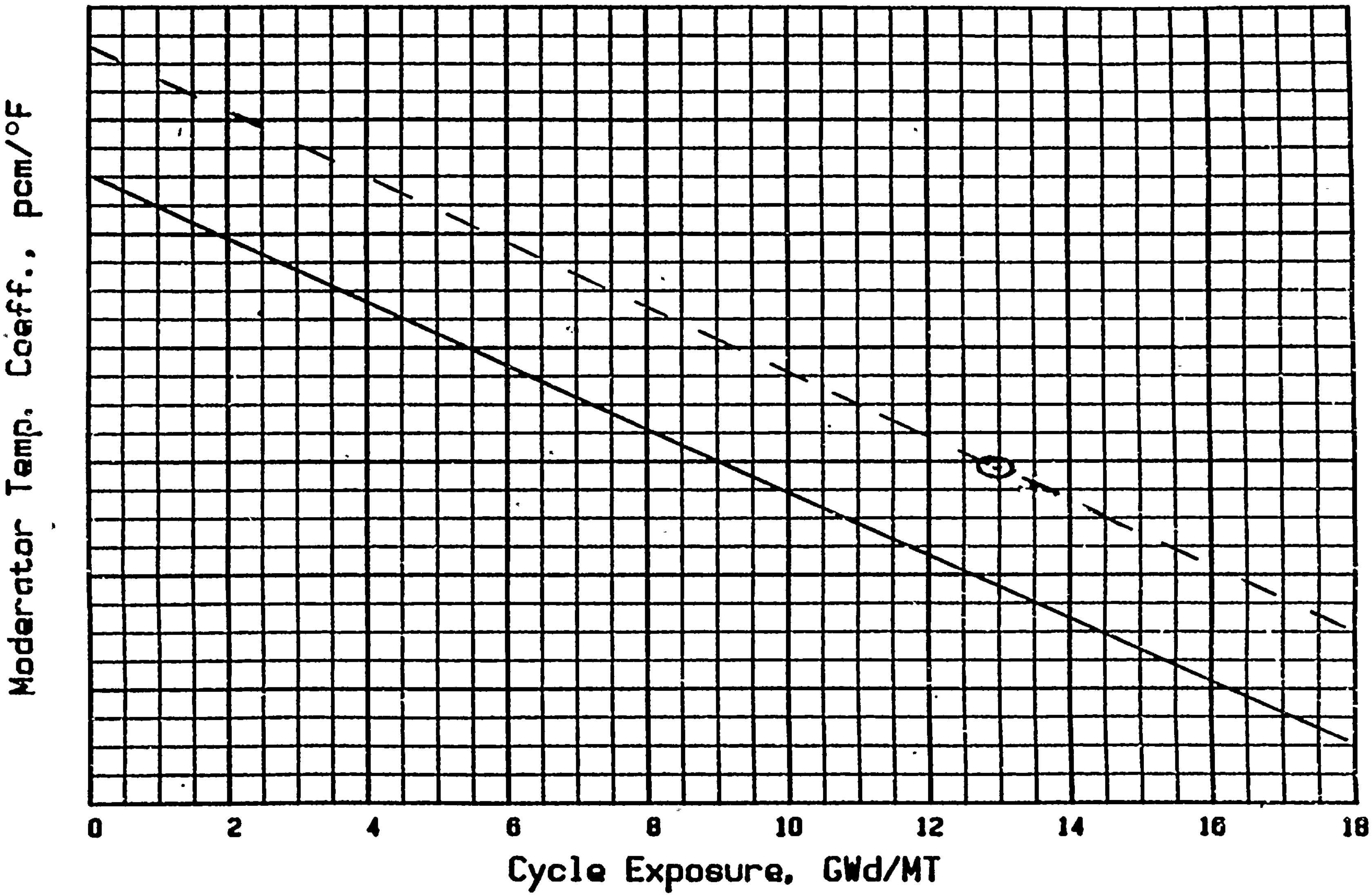
The change involves no physical modifications to the plant. It restricts plant operation such that the accident analysis assumptions are protected. Thus, the change should not create the possibility of a new or different kind of accident from any previously analyzed or evaluated.

Criterion 3

See Criterion 1 above.

Lastly, we note that the Commission has provided guidance concerning the determination of significant hazards by providing certain examples (48 FR 14870) of amendments considered not likely to involve significant hazards consideration. The second of these examples refers to changes which constitute additional limitations, restrictions, or controls not presently included in the T/Ss. As described above, this change is more restrictive in nature than the present T/S. Therefore, we believe the example cited is applicable and that the change should not involve significant hazards consideration.

FIGURE 1



D. C. Cook Unit 2 Cycle 6, Moderator Temperature Coefficient vs. Exposure, HFP Equilibrium Xenon

——— DESIGN
- - - - - EXTRAPOLATED
⊙ 300 PPM DATA POINT