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SUBJECT: Forwards response to NRC 911025 request for addl info re 901029 & 910618 applications for amend to License DPR-58, changing TS re low temp overpressure protection setpoint.

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AEP:NRC:0894R

Donald C. Cook Nuclear Plant Unit 1
Docket No. 50-315
License No. DPR-58
ADDITIONAL INFORMATION IN SUPPORT OF THE
TECHNICAL SPECIFICATIONS AMENDMENT REQUEST TO
CHANGE THE LTOP SETPOINT

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

Attn: T. E. Murley

April 13, 1992

Dear Dr. Murley:

References: 1) Letter, AEP:NRC:0894O, M. P. Alexich (I&M) to T. E. Murley (NRC), October 29, 1990.

2) Letter, AEP:NRC:0894Q, E. E. Fitzpatrick (I&M) to T. E. Murley (NRC), June 18, 1991.

3) Letter, T. G. Colburn (NRC) to E. E. Fitzpatrick (I&M), October 25, 1991.

This letter responds to several questions from your staff regarding our previous submittals (References 1 and 2), which proposed to change the low temperature overpressurization protection (LTOP) setpoint contained in the Donald C. Cook Nuclear Plant Unit 1 Technical Specifications. Your staff's questions are documented in Reference 3. Our responses to those questions are presented in the attachment to this letter.

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

Sincerely,

E. E. Fitzpatrick
Vice President

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Attachment

cc: D. H. Williams, Jr.
A. A. Blind - Bridgman
J. R. Padgett
G. Charnoff
NFEM Section Chief
A. B. Davis - Region III
NRC Resident Inspector - Bridgman

NRC Question 1 - Explain clearly how the LTOP setpoint was determined using LOFTRAN analysis.

Westinghouse performed a LOFTRAN analysis titled, "D. C. Cook Unit 2 Low Temperature Overpressure Protection System (LTOPS) Setpoint Evaluation," dated June 1989. This analysis was done at AEPSC request to obtain as wide an operating pressure window as possible between the minimum reactor coolant pump (RCP) start pressure of 325 psig and the LTOP pressure setpoint protection for 10CFR50 Appendix G reactor coolant system (RCS) limits. This analysis also eliminated an iterative analysis process and allowed us to directly compute the LTOP setpoint should future conditions warrant. See the response to Question 2 for more historical information.

The Westinghouse analysis was performed using the most bounding Unit 1 or Unit 2 Cook Nuclear Plant plant-specific input parameters to allow the analysis to bound both units (see the response to Question 2 for further details regarding bounding of both units). The analysis also contained a parametric study varying pressurizer power operated relief valve (PORV) opening times from 2 to 10 seconds, with a constant 4-second closing time. Also included was a parametric study varying the LTOP pressure setpoint from 400 to 700 psig. LOFTRAN analyses were then performed while varying both the pressure setpoint and PORV stroke times for the mass addition event of a normal charging pump flow with letdown isolated.

The AEPSC calculation (ECP12-N1-05) previously submitted in AEP:NRC:0894Q, was ambiguous in that it implied use of the WOG report 4-factor methodology. This 4-factor methodology was not used in the calculation. The calculation correctly used Tables 3.4, 3.5, and 3.6 of the June 1989 Westinghouse report, which contain LOFTRAN-generated overshoot/undershoot pressure values vs. PORV opening time. Table 3.4 contains the LOFTRAN analysis of the anticipated mass addition scenario (letdown isolation and mass injection of a single charging pump). Tables 3.5 and 3.6 contain the LOFTRAN analyses for heat injection scenarios at RCS temperatures of 85°F and 150°F (RCS to steam generator delta temperature of 50°F). All of these tables can be linearly interpolated to a specific LTOP pressure setpoint and specific PORV stroke times.

The AEPSC calculation first compared the mass addition and the two heat injection LOFTRAN results and confirmed that mass addition was the dominant or most limiting scenario. In other words, the mass addition overshoot came closest to the Appendix G limit without exceeding it. It also confirmed and validated that a 435 psig setpoint and a stroke time of less than or equal to 6 seconds would result in a maximum pressure overshoot (505.55 psig) that is less than the minimum Appendix G pressure (514.93 psig) at an RCS temperature of 85°F.

NRC Question 2 - Explain how LOFTRAN analysis submitted with Unit 2 heatup and cooldown curves was conservative with respect to both units and can be applied to Unit 1.

In 1988, the NRC issued Generic Letter (GL) 88-11, which endorsed the more conservative methods of calculating radiation embrittlement of reactor vessel materials contained in Revision 2 to Regulatory Guide 1.99. Implementation of the GL was anticipated to result in a downward shift in the 10CFR50, Appendix G pressure-temperature (P-T) limits. The low temperature operating window has an upper boundary corresponding to the P-T limit, and the LTOP setpoint is conservatively selected to prevent pressure overshoots associated with low temperature pressure transients from exceeding the P-T curves. Implementation of the GL was expected to require selection of a lower LTOP pressure setpoint, reducing the already narrow low temperature operating window.

Following the issuance of GL 88-11, in 1989 AEPSC contracted with Westinghouse to perform plant-specific LOFTRAN analyses to allow selection of LTOP setpoints for the Cook Nuclear Plant units. The intent was to allow the widest possible low temperature operating window. Since the Cook Nuclear Plant Unit 2 P-T curves were scheduled to be updated first following issuance of GL 88-11, the Westinghouse analyses were performed to support the Unit 2 Technical Specifications change request submittal, and the report made various references to that unit. However, the inputs used for the LOFTRAN analyses (e.g., RCS volume, steam generator heat transfer area, and PORV characteristics) were intentionally the most conservative of the two units, so that the results could be applied to either Unit 1 or Unit 2 for future LTOP setpoint determinations.

NRC Question 3 - Discuss how the LTOP enable temperature was determined. Included in the above would be a discussion of any differences between the D.C. Cook methodology and Standard Review Plan methodology and whether this would represent a safety concern.

The LTOP enable temperature was selected based on the establishment of a pressurizer steam bubble and an evaluation of

the shape of the Appendix G curve. Specifically, the enable temperature was chosen as the first temperature greater than 150°F where the rate of change in the pressure/temperature relationship shown on the Appendix G curve begins to continuously increase. This methodology has been consistently applied over the life of the plant.

Revision 2 of the Standard Review Plan, in conjunction with Branch Technical Position RSB 5-2, establishes the LTOP enable temperature as at least RT(ndt)+90°F. The intent of this requirement is to implement the 10CFR50 Appendix G requirement that the reactor vessel be protected from overpressurization while operating at low RCS temperatures. The current (170°F) and proposed (152°F) enable temperatures for the pressurizer PORVs do not conform to the criterion noted in the Standard Review Plan; however, additional overpressure protection is provided by the residual heat removal (RHR) pump suction safety valve over the full range of LTOP concern. This ensures that the intent of the Standard Review Plan is met.

A substantial amount of plant-specific analysis has been performed by Westinghouse to establish the capability of the pressurizer steam bubble, the pressurizer PORVs, and the RHR system safety valves in coping with transients that would cause an increase in RCS pressure. The results of these calculations indicate the following:

1. The pressurizer steam bubble provides a significant improvement in the amount of time available to respond to a transient. While the steam bubble by itself will not adequately protect against a design basis transient, proper control of pressurizer level does significantly supplement the ability of the pressurizer PORVs and the RHR safety valves to cope with a transient. For an example case, with the pressurizer at 50% level, RCS pressure between 325 and 485 psig, and no relief path available, mass injection from one centrifugal charging pump can be accommodated for 3 to 5.5 minutes before RHR system limits are exceeded.

2. A single pressurizer PORV is capable of protecting the RCS during water solid operation assuming that mass addition is limited to one centrifugal charging pump and heat addition transients are limited by a 50 degree temperature difference between the RCS and steam generator water temperature.

3. The RHR safety valve is capable of protecting the RCS from mass injection transients associated with either one or two centrifugal charging pumps or the combination of one centrifugal charging pump and one safety injection pump. Plant operating procedures are being revised to ensure that the assumptions used in the analysis are not violated.

Therefore, the operation with the steam bubble in conjunction with one PORV and/or the RHR safety valve ensures that the intent of the Standard Review Plan is met. The LTOP system has always relied on operations being conducted with a pressurizer steam bubble and blocking of the RHR autoclosure interlock. The intent of the enable temperature listed in the Technical Specifications has been to ensure that the RCS is protected during water solid operation. Allowable operations during water solid conditions are limited to RHR system operation and letdown and charging using one centrifugal charging pump. The pressurizer steam bubble is established early during RCS fill and vent operations. The pressurizer steam bubble and RHR safety valve provide overpressure protection for the remaining range of LTOP concern.

<u>NRC Question 4 - Confirm that these changes are proposed for end of vessel life unless other parameters, such as PORV stroke time would change.</u>

The above changes for Cook Nuclear Plant Unit 1 are valid for 32 EFPYs based on the "Analysis of Capsule U From the American Electric Power Company D.C. Cook Unit 1 Reactor Vessel Radiation Surveillance Program" (WCAP-12483) performed by Westinghouse in January 1990. Westinghouse Report WCAP-12483 was submitted to the NRC in our letter AEP:NRC:0894M, dated June 22, 1990. This analysis contains the heatup/cooldown Appendix G curves for 32 EFPYs that are also a part of this licensing submittal. Since the life expectancy of Cook Nuclear Plant Unit 1 is less than or equal to 32 EFPYs, no further changes to LTOP enable temperatures or pressure setpoints are anticipated. Also, the Unit 1 capsules scheduled to be removed prior to 32 EFPYs have been withdrawn and analyzed.

It should be noted that the current Unit 2 LTOP setpoint calculation is based on a 12 EFPY P-T limit curve. The current 32 EFPY P-T curve is more limiting and, if implemented, would require a 3.5 second PORV stroke time in the open direction. It is expected that the analysis of future Unit 2 reactor vessel surveillance capsules will result in a less severe P-T curve for 32 EFPYs due to the realization of reduced fluence from low leakage cores implemented several years ago. Therefore, Unit 2 may require changes based on the next capsule analysis, although this does not impact the current Unit 1 license submittal being discussed here.

NRC Question 5 - Confirm that PORVs currently meet assumed opening and closure times.

The LTOP setpoint analyses performed by Westinghouse include a parameter study on PORV opening time. The PORV stroke time assumed in calculating the LTOP setpoint for Unit 2 was 6.5 seconds in the open direction and 4.0 seconds in the closed direction. For Unit 1, the LTOP setpoint selection was based on assumed PORV stroke times of 6.0 seconds in the open direction and 4.0 seconds in the closed direction. Actual stroke times for the PORVs in both Cook Nuclear Plant units, as measured during historical in-service testing are 5.0 seconds or less in the open direction and 2.0 seconds or less in the closed direction. Therefore, the performance of the valves in each unit exceeds the performance assumed in the LTOP analyses. Plant procedural in-service testing program limits ensure that the assumed values will continue to be met in the future.