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Subject: Beaver Valley Power Station, Unit No. 1 and No. 2
BV-1 Docket No. 50-334, License No. DPR-66
BV-2 Docket No. 50-412, License No. NPF-73
Response to Information Request dated March 19, 1993
(TAC Nos. M85819/M85820)

This letter provides a response to your request for additional information regarding proposed Technical Specification Change Request No. 208 and 74 submitted by Duquesne Light Company on February 18, 1993. The questions are related to the evaluations performed by Westinghouse to support the proposed reduction in RCS total flow rate. The specific questions are stated below followed by our response.

SECTION 1.1

Question 1

For DNB considerations, please provide explanation and quantitative basis for statement that "Existing conservatism in DNB calculations bound the effect on DNB due to 1.5% flow reduction" and statements regarding UFSAR 14.1.3 and 14.2.7.

Response 1

The 1.5% reduction in TDF has an adverse effect on DNB on the order of ≤2.4% in DNBR. Therefore, as long as the available DNBR margin between the design limit DNBR and the safety analysis DNBR limit exceeds 2.4%, sufficient DNBR margin exists to account for the 1.5% reduction in TDF. It is standard Westinghouse design practice to maintain some amount of DNBR margin to allow for flexibility in design and safety analyses. When this retained DNBR margin is allocated for a given purpose (e.g., reduction in

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Response 1 (Continued)

TDF), its use is appropriately accounted for in the design documentation. For the evaluation of the 1.5% reduction in TDF, 2.4% of the retained DNBR margin was used for all DNB related events.

It should be noted that, in addition to the retained DNBR margin, event specific DNBR margin (i.e., the margin in DNBR between the minimum DNBR for the transient and the safety analysis limit DNBR) may also exist and can be used. However, no event specific DNBR margin was used in the evaluations for the 1.5% reduction in TDF. Based on the current licensing basis for Beaver Valley Units 1 and 2 which apply the use of the mini-Revised Thermal Design Procedure, the retained DNBR margin is that between the safety analysis DNBR limit of 1.33 and the design limit DNBR of 1.21.

Therefore, as indicated in Section 1.1 for the DNB related events listed, the combined available DNBR margin (both event specific and retained) is more than sufficient to account for the 2.4% DNBR penalty associated with the 1.5% reduction in TDF.

FSAR events 14.1.3 (RCCA Misoperation) and 14.2.7 (Locked Rotor) were explicitly called out in Section 1.1 because the Westinghouse analysis methodology associated with these events uses the safety analysis DNBR limit to determine limits on $F_{\Delta H}$. Therefore, so as to not affect the existing $F_{\Delta H}$ limits, only available retained DNBR margin was used to account for the 1.5% reduction in TDF. Here too, event specific DNBR margin may also exist, but was not supplied in the evaluation for the 1.5% reduction in TDF.

Question 2

Identify which events on DNB list were reanalyzed using reduced TDF. Identify which events were evaluated using existing sensitivity data. Address the list one-by-one and provide explanation and pertinent numbers, margins, etc.

Response 2

None of the events on the DNB list were specifically reanalyzed using the reduced TDF. All of the DNB related events were evaluated based on a sensitivity of $\leq$ 2.4% change in DNBR for a 1.5% reduction in TDF as indicated in the response to Question 1. In all cases, sufficient DNBR margin exists to offset the 2.4% DNBR penalty associated with the 1.5% reduction in TDF.

Response 2 (Continued)

The use of this approach for evaluating DNB is possible based on the fact that small changes to plant operating conditions (e.g., 1.5% reduction in TDF) will not significantly affect the transient statepoints used in the DNBR calculations. The transient statepoints for DNB events include power, temperature, pressure, and flow. The flow statepoints resulting from the transient analysis are always given as a fraction of the design flow (e.g., 0.7 x TDF) assumed in the transient analysis. This fraction of TDF (which will not change as a result of a small decrease in TDF) is subsequently used with the appropriate reduced TDF in determining the amount of retained DNBR margin needed to offset the reduction in TDF.

Question 3

First paragraph: please clarify the reason why DNB limit lines (based on W-3 R-grid) do not need to be revised. What is given does not seem to relate to the change in DNBR resulting from reduced TDF.

Response 3

The existing Core Thermal DNB limits were derived using the W-3 R-grid DNB correlation. Revised DNB limits (based on the WRB-1 DNB correlation, use of the mini-Revised Thermal Design Procedure, and with a 1.5% reduction in TDF) were found to be less limiting than the existing DNB limits. Hence, the existing DNB limits remain conservatively applicable.

Question 4

Please provide a discussion on why exit boiling lines were revised. What was the impact of reduced TDF on subcooling margin?

Response 4

The vessel exit boiling limits are a function of power, pressure, and flow and represent the maximum Tavg (as a function of power for a given pressure and flow) allowed to just preclude vessel exit boiling. For a reduction in TDF, the maximum allowable Tavg limits also must be reduced accordingly. As can be seen from the revised Reactor Core Safety Limits given in Technical

Response 4 (Continued)

Specification Figure 2.2-1, this results in a ≤ 1°F decrease in the vessel exit boiling limits. Hence, the 1.5% reduction in TDF reduces the subcooling margin by ≤ 1°F.

SECTION 1.2

Question 1

For each of the events listed, provide some numbers that show changes in margins resulting from reduced TDF and explain how the numbers were arrived at (reanalysis, existing sensitivity data, etc.). The present discussion simply states a conclusion; the basis for the conclusion is needed.

Response 1

Loss of Load/Turbine Trip (LOL/TT)

The acceptance criteria for RCS and secondary-side pressure for the LOL/TT events are 2748.5 psia and 1318.5 psia, respectively. These limits are 110% of the design pressures for these systems. The maximum RCS pressure for this event without the 1.5% reduction in TDF is 2551 psia (i.e., 197.5 psi below the limit). Similarly, the maximum secondary-side pressure is below the steam generator safety valve (MSSV) set pressure of 1133 psia (i.e., 185.5 psi below the limit).

Existing analyses for this event show a 6.7% reduction in RCS flow increases the peak RCS pressure by 4 psi. The same analyses show the secondary-side pressure peaks at the MSSV set pressure with a 6.7% reduction in RCS flow and that the maximum pressurizer water volume increases by 2 ft^3. The current maximum pressurizer water volume for the LOL/TT event is less than 1100 ft^3 in comparison to a total pressurizer volume of 1437 ft^3 (including surge line) needed to result in a water-solid pressurizer condition.

Hence, as indicated in Section 1.2.1, existing sensitivities to changes in RCS flow show that the results of this transient are insensitive to small changes in RCS flow. Therefore, based on these sensitivities and the current LOL/TT analysis results, sufficient margin clearly exists to the applicable acceptance criteria to offset the subject 1.5% reduction in TDF.

Loss of Offsite Power to the Station Auxiliaries (LOOP)/Loss of Normal Feedwater (LONF)

The Condition II LOOP and LONF events are analyzed to demonstrate that sufficient auxiliary feedwater is available to remove residual heat following these events; thus avoiding RCS and secondary-side overpressure conditions and pressurizer overfill. The effect of the 1.5% reduction in TDF with a 20% steam generator tube plugging level was evaluated based on a sensitivity analysis performed specifically for this application. This sensitivity analysis was performed for the Beaver Valley Unit 1 LONF event and bounds the LOOP event and the Beaver Valley Unit 2 LONF and LOOP events. The results of this sensitivity analysis show an increase in maximum pressurizer water volume of 40 ft^3, primarily due to the conservative decrease in initial steam generator liquid mass modeled and available for decay heat removal. The maximum pressurizer water volume reached was 1393 ft^3 which is less than the pressurizer volume of 1437 ft^3 required to reach a water-solid pressurizer condition. Hence, as indicated in Section 1.2.2, adequate auxiliary feedwater and steam generator inventory exists to remove decay heat and stored energy and sufficient margin exist to the applicable acceptance criteria to offset the subject 1.5% reduction in TDF.

Feedwater System Pipe Break

The Feedline Break event is analyzed to demonstrate that sufficient auxiliary feedwater is available to remove residual heat following this event and that the core remains in a coolable geometry. Like the LONF and LOOP events above, the effect of the 1.5% reduction in TDF with a 20% steam generator tube plugging level was evaluated based on a sensitivity analysis performed specifically for this application. The results of this sensitivity analysis show a 15°F decrease in the margin to hot leg saturation, primarily due to the conservative decrease in initial steam generator liquid mass modeled and available for decay heat removal. Considering the effect of the 1.5% reduction in TDF with a 20% steam generator tube plugging level, the minimum margin to hot leg saturation is 22°F. This sensitivity analysis was performed for Beaver Valley Unit 1, and is valid for Unit 2. For Beaver Valley Unit 2, the current licensing basis analysis without consideration of the 1.5% reduction in TDF shows that there is at least 30°F margin to hot leg saturation. Hence, as indicated in Section 1.2.3, adequate auxiliary feedwater and steam generator inventory exists to remove decay heat and stored energy and sufficient margin exists to the applicable acceptance criteria to offset the subject 1.5% reduction in TDF.

Reactor Coolant Pump Shaft Seizure (Locked Rotor)

As indicated in Section 1.2.4, in addition to DNB (which is addressed in Section 1.1), the Locked Rotor event is analyzed to demonstrate that maximum reactor coolant system pressure is less than 110% of design pressure (2748.5 psia), the maximum fuel clad temperature is less than 2700°F, and the amount of zirconium-water reaction is small (≤ 16.0%).

The current licensing basis analysis of the Locked Rotor event without consideration of the 1.5% reduction in TDF shows a peak clad temperature of 1870°F, zirconium water reduction of 0.415%, and peak RCS pressure of 2642 psia; all well below the applicable limits. This analysis supports both Beaver Valley Units 1 and 2. Existing analyses for this event show a 2.7% reduction in RCS flow decreases the peak RCS pressure by 1.0 psi. The same analyses show an increase in the peak clad temperature of 14°F and a 0.055% increase in zirconium water reaction for the 2.7% reduction in RCS flow. Hence, as indicated in Section 1.2.4, sufficient margin exists to the applicable acceptance criteria to offset the subject 1.5% reduction in TDF.

Uncontrolled RCCA Bank Withdrawal at Power (RWAP)

As indicated in Section 1.2.5, in addition to DNB (which is addressed in Section 1.1), the RWAP event is analyzed to demonstrate that the pressurizer does not overfill. For Beaver Valley Units 1 and 2, the maximum pressurizer water volumes for the RWAP event (without consideration of the 1.5% reduction in TDF) are 1338 ft^3 and 1345 ft^3, respectively. These compare to the limit of 1437 ft^3 required for the pressurizer to become water-solid.

A reduction in TDF results in increased heatup and pressurizer insurge due to the decrease in coolant density. The LOL/TT event discussed earlier is significantly more limiting than the RWAP event in terms of pressurizer insurge and showed that the effect of a 6.7% reduction in TDF only resulted in an increase of 2 ft^3 in the maximum pressurizer water volume. Hence, with ≥ 92 ft^3 of margin to pressurizer filling for the RWAP event, sufficient margin exists to the applicable acceptance criterion to offset the subject 1.5% reduction in TDF.

Uncontrolled Boron Dilution

The Boron Dilution event is analyzed to demonstrate that sufficient operator action time is available to terminate the dilution before the minimum required shutdown margin is lost and the core becomes critical. For Beaver Valley Unit 1, the Boron Dilution event is analyzed for Modes 1, 2, and 6. For Unit 2, Modes 1, 2, and 3 are analyzed. None of the analyses of the

Uncontrolled Boron Dilution (Continued)

Boron Dilution event are adversely impacted by a reduction in TDF since the RCS flow rate is not used in these calculations. Therefore, as indicated in Section 1.2.6, the conclusions of the UFSAR remain valid for the 1.5% reduction in TDF.

Rupture of a RCCA Drive Housing (RCCA Ejection)

The negligible impact on the analysis results (PCT, fuel temperatures) to a small change in RCS flow (e.g., 1.5% reduction in TDF) as described in Section 1.2.7 for the RCCA Ejection event is based on the sensitivity to RCS flow reported in WCAP-7588 Rev. 1-A, "An Evaluation of the Rod Ejection Accident in Westinghouse Pressurized Water Reactors Using Spatial Kinetics Method," D.H. Risher, Jr., January, 1975. This document reports the sensitivity to a 10% decrease in RCS flow for the RCCA Ejection event. Peak transient fuel temperatures were found to be nearly unaffected by the 10% decrease in RCS flow since the transient is so rapid and nearly adiabatic. However, due to the reduced heat transfer coefficient between the fuel cladding and the coolant under reduced flow conditions, the peak transient clad temperature is slightly higher (by only 1.5%). Scaling this to the 1.5% reduction in TDF flow results in an increase in peak transient clad temperature of less than 0.25% (e.g., 7°F based on a peak clad temperature limit of 2700°F). The maximum peak clad temperature for the RCCA Ejection without consideration of the 1.5% reduction in RCS flow is 2671°F (29°F below the 2700°F limit). Hence, sufficient margin exists to the applicable acceptance criteria to offset the subject 1.5% reduction in TDF. Therefore, as indicated in Section 1.2.7, the conclusions of the UFSAR remain valid.

Steamline Break Mass & Energy Release-Inside and Outside Containment

As indicated in Section 1.2.8, the Steamline Break (SLB) and Mass and Energy (M&E) Release analyses are performed to maximize the M&E releases. No specific SLB M&E release calculations were performed or referenced to determine the effect of a 1.5% reduction in TDF. The evaluation performed was qualitative as described in Section 1.2.8 with the basis being that the small effects of changes resulting from the reduction in TDF are offset by changes which resulted from increased steam generator tube plugging (i.e., previously increased to 20%). However, with respect to the 1.5% reduction in TDF alone, reduced TDF would tend to reduce the M&E releases since less of a primary side cooldown would occur and, in the presence of a negative moderator temperature coefficient, a reduction in the reactivity insertion associated with the cooldown event also occurs. Therefore, the existing SLB M&E releases inside and outside containment remain conservative and valid for the 1.5% reduction in TDF.

SECTION 3.1

Question 1

Please confirm/clarify that the change in Tavg in Table 3.2-1 is not a result of reduced TDF but, rather, due to revised uncertainty evaluation. The statement in Para 2 of pg. 4 (Attachment B) regarding Tavg does not seem consistent.

Response 1

The change in Tavg indicated in Table 3.2-1 is not a result of reduced TDF. The change in Tavg is associated with revised uncertainties for Tavg for both Beaver Valley Unit 1 and Unit 2. For Unit 1, a 0.5°F increase in the Tavg uncertainty was considered, resulting in a revised Tavg value of 580.7°F. For Unit 2, the Tavg uncertainty was reduced by 0.1°F, resulting in a revised Tavg value of 580.2°F.

These changes in the Tavg uncertainties are reflected in the revisions to Technical Specification Table 3.2-1 to make the Technical Specification consistent with the safety analysis bases supporting the evaluations for the 1.5% TDF reduction. As such, the statement in paragraph 2 of page 4 was included. Since the changes in the Tavg specification for both Unit 1 and Unit 2 reflect a reduction in the allowable Tavg, paragraph 2 of page 4 reflects the changes as being conservative relative to the existing specification (i.e., revised technical specifications are more restrictive).

Question 2

Last Para on pg. 7 and top Para on pg. 8 needs clarification.

Response 2

The third paragraph in Section 3.1 on Page 7, beginning with "A recent evaluation...," should be moved to immediately after the first paragraph on the top of page 8, ending with the sentence "Therefore, no PCT penalty or benefit is incurred."

If you have any further questions or require additional information concerning the above, please contact G.S. Sovick at (412) 393-5211.

Sincerely,

George S. Thomas for

J. D. Sieber

cc: Mr. L. W. Rossbach, Sr. Resident Inspector
Mr. T. T. Martin, NRC Region I Administrator
Mr. G. E. Edison, Project Manager