April 16, 1992

Docket No. 50-482

Mr. Bart D. Withers
President and Chief Executive Officer
Wolf Creek Nuclear Operating Corporation
Post Office Box 411
Burlington, Kansas 66893

Dear Mr. Withers:

SUBJECT: WOLF CREEK GENERATING STATION - REQUEST FOR ADDITIONAL INFORMATION REGARDING TRANSIENT ANALYSIS METHODOLOGY TOPICAL REPORT (TAC NO. M79740)

Enclosed are questions related to the Wolf Creek Nuclear Operating Corporation Topical Report "Transient Analysis Methodology for the Wolf Creek Generating Station." The questions have not been changed from the draft versions which were provided to your staff during the January 28, 1992, meeting held at the NRC office in Rockville, Maryland.

The reporting requirements contained in this letter affect fewer than ten respondents; therefore, OMB clearance is not required under Public Law 96-511.

Please provide your response to these questions such that the NRC review can proceed and support the schedules discussed at the January 28, 1992, meeting and summarized in the February 6, 1992, meeting summary.

Sincerely,

Original Signed By

William D. Reckley, Project Manager
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Division of Reactor Projects III/IV/V
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Enclosure:
Request for Additional Information

cc w/enclosure:
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Request for Additional Information
Review of Wolf Creek RETRAN Model Qualification

Part 1

1.0 General Approach

1. Justify thoroughly: (i) the plant nodalization on a transient-by-transient basis; and (ii) the variables (and values obtained) which were permitted to be adjusted by the RETRAN initialization routine. Furthermore, provide and describe in depth all parametric studies performed to lead WCNOC to conclude that the nodalization presented in Section 2.1 is either a best-estimate or a conservative representation of the plant, and demonstrate that use of code models is conservative.

2. In modeling the steam generator, the nodalization (Figure A.1) shows use of only one volume for the entire steam generator secondary side.

   a. Justify the steam generator modeling and demonstrate that it will produce conservative results. In addition, provide details of qualification of the steam separator model, liquid level model, steam line model, bypass valve sizing, etc. and assess and justify the uncertainty level (or bias) associated with each one of these models. Describe thoroughly the impact of the secondary side modeling on secondary side initiated and dominated transients and justify (through parametric studies) the particular modeling selected.

   b. The topical report stated that inability to match certain primary side parameters when compared to the USAR analyses was attributable to the heat transfer modeling in the SG component. Identify and explain thoroughly the source(s) of these differences and justify not obtaining identical or more conservative results.

3. On a transient-by-transient basis, justify modeling the pressurizer on the unaffected side (the single loop in the model representing three unaffected loops in the plant) instead of the affected side and explain the impact on transient system behavior and conservatism.

4. Justify that the upper head circulation path modeling and predicted flows are realistic.

5. Provide the sequence of events tables for the analyses performed in the Start-Up Test Comparison and the USAR Benchmark Section, comparing the actually measured or current USAR predicted events with WCNOC predicted events indicating the time as well as the key system conditions. Similarly, provide the sequence of events tables for the

analyses performed in the Enveloping Transient Section.

6. The RETRAN-02 MOD3 SER states that each user is expected to develop and qualify a boron transport model which must be approved. Describe the RETRAN model used for comparison to USAR and envelope main steam line break analyses and provide its qualification analysis.

7. Describe the decay heat model used in comparison to USAR and envelope transient analyses.

2.0 Startup Test Comparisons

Generally the WCGS base model exhibited difficulties in replicating the secondary side behavior recorded during the tests. Therefore, for secondary side initiated transients, the primary side behavior was not well predicted.

2.1 Large Load Reduction

8. Explain thoroughly how this analysis was performed. Discuss the reasons why the RETRAN computed steam dump demand (Figure D.1-1) did not match the test data and the impact of not matching on the results. Explain how this mismatch supports (or fails to support) the RETRAN control system model of the steam dump system.

9. Explain the source(s) of the RETRAN underprediction of the peak in the cold leg temperature at roughly 50 and again at 200 seconds into the test while the coolant average temperature remained overpredicted between 75 to 400 seconds.

2.2 Turbine Trip Without Steam Dump

10a. Explain and justify the reduced SG heat transfer in the RETRAN analysis which resulted in a 55.2°F drop in primary coolant temperature across the steam generator while the test had a 58.7°F delta T.

10b. Check and identify the source of discrepancies between the data on the plots on pg. D-20 and the initial conditions provided in Table D-2 and resubmit any corrected results for review.

2.3 Reactor Coolant Pump Coastdown

11. Explain the necessity for and justify using an initial RC flowrate which was more than 10% less than test data.

3.0 USAR Comparison

12. Explain the need for two WCGS RETRAN models: one for the test comparison and the other for the USAR comparison. Discuss the differences between these two models and their impact on USAR comparison since a simplified model is used for such comparison. Explain which of the benchmark comparison with the test data is

relevant to the qualification of the evaluation model.

13. Discuss the differences in modeling used in the USAR and RETRAN analysis with emphasis on the following:

    a. reactivity feedback modeling in the two sets of analyses.

    b. Substantiate the statement made in several transient analyses that the differences seen in the computed results are due to "effects of the Doppler coefficient interpolation schemes in combination with the trip reactivity characteristics." What system behavior led the licensee to the conclusion that the difference in RETRAN predicted and USAR analyses was attributable to the difference in the interpolation scheme of Doppler feedback. On a transient-by-transient basis, provide a thorough explanation of how these differences would results in the differences observed between the RETRAN computed and USAR results.

    c. Explain in depth the differences between RETRAN steam generator modeling and those used in the USAR. Discuss further the minimum water volumes required to cover the tubes in the USAR and RETRAN analysis. Provide also initial SG liquid mass and liquid levels assumed in the USAR and RETRAN analyses on a transient-by-transient basis.

    d. With respect to the difference identified on pages B-4 through-6, justify using these models which are not necessarily conservative for some transients.

    e. Discuss the difference in the low-low SG level trip models and setpoints used in analyses. Justify that the RETRAN base model is able to predict the SG mixture level accurately for this use.

3.1 Uncontrolled RCCA Withdrawal at Power

See Q13.b. No other specific questions.

3.2 Complete Loss of Reactor Coolant Flow

See Q13.b.

14. Explain the statement on page B-14 that "the RETRAN pressurizer pressure variation results from...... a more conservative primary-to-secondary heat transfer.."

3.3 Locked Rotor

15. Identify the location of the maximum RCS pressure (Figures B.3-5 and B.3-10) if other than the pressurizer. Explain the source of oscillatory behavior in the RETRAN RCS pressure between 0 - 4 seconds since in the enveloping calculation this behavior was not exhibited.

Explain the difference of over 20 psia in the initial RETRAN and USAR pressures on Figure B.3-5 as well as more than a 50 psi difference between stated pressure on Table B-3 and the values on Figure B.3-5 (and B-3-10) and discuss their impact on the analysis. Discuss thoroughly the causes for the large underprediction (over 100 psi) of RCS pressure by RETRAN.

3.4 Loss of Load/Turbine Trip

16. Explain the large difference in the pressurizer water volume between the RETRAN and USAR predictions in Figures B.4-3, 8, 13, and 18.

17. Explain, in terms of the SG modeling and primary-to-secondary heat transfer, why the core inlet temperatures are consistently predicted higher in the RETRAN calculations than in the USAR predictions while the coolant average temperature is initially lower in the RETRAN calculations but becomes higher after 30-40 seconds. Explain further the difference in low-low steam generator level trip models and setpoints used in RETRAN and USAR analyses.

3.5 Loss of Normal Feedwater

18. Provide a thorough discussion of this transient by inter-comparing system parameters and identifying the sources of differences in these parameters. Furthermore, provide thorough discussion and justification of the SG heat transfer modeling and discuss it vs. the nominal plant conditions. Compare and justify the initial SG mass and water levels assumed in the USAR and RETRAN analyses.

3.6 Feedwater Line Break

19. Provide information related to the SG secondary side, such as the mass inventory and heat transfer coefficients as a function of tube height. Explain thoroughly the predicted results on the basis of such SG secondary side modeling.

20. Provide further qualification of the pressurizer model (as required by the RETRAN SER) for the situation where the pressurizer goes solid. Justify use of the non-equilibrium pressurizer model for this transient.

21. Provide details of assumption differences between with and without offsite power cases to cause large differences in the faulted cold leg temperature (Figs. B.6-6 and 15) and pressurizer liquid volume (Figs. B.6-3 and 12).

3.7 Main Steamline Break

22. If, as stated, the same moderator temperature coefficients were used, explain the inconsistent trends between the slower cooldown and faster power increase predicted by RETRAN when compared with those by USAR.

Part 2

4.0 WCNOC Enveloping Transients

1. Provide descriptions of model changes and justify the basis for the following assumptions:

   a. SG tube plugging, the amount of adjustments made to HT areas, RC flow area, fluid volumes, metal masses;

   b. Reduced thermal design flow: the method by which an allowance for future flow degradation in the RCS was determined;

   c. Increased secondary side blowdown: Reference NRC approval of setpoint changes for the main steam safety valves.

2. Provide a table of transient specific actuation setpoints of trips, time delays, trip parameters and initial values.

3. Explain thoroughly what is meant by the statement (p. 7) "the initial reactor power, RCS temperatures, and pressures were adjusted to the <u>maximum allowable value</u> including allowances for calibration and instrument errors consistent with maximizing the challenges to the RCS boundary."

4. Discuss the rational behind setting some initial plant conditions at conservative values and others at "nominal" values for RETRAN analyses. Provide differences between initial conditions used in the RETRAN and DNB analysis.

5. Identify any changes, regardless of magnitude, to transient assumptions and initial conditions (including reactivity coefficients and power profiles) assumed in the enveloping transients from the current USAR analyses on a transient-by-transient basis.

6. Justify the selection criteria for reanalysis of Chapter 15 transients presented in the topical report and the reason why some parametrics were not included (i.e., varying reactivity insertion rates, partial power cases for uncontrolled RCCA Withdrawal at power analysis, analysis at subcritical conditions, break sizes and locations, etc.). If any of these have been already performed, provide detailed results with thorough analysis.

4.1 Uncontrolled RCCA Withdrawal at Power

7. Explain Figure 2.1-6.

4.2 Complete Loss of Reactor Coolant Flow

8. Explain Figure 2.2-2. Explain why the transient was started from 120% flow.

4.3 Locked Rotor

9. The pressurizer pressure is computed to peak at about 4 seconds into the transient (Fig. 2.3-3) while in the comparison to the current USAR analysis (Section B.3) it was computed to occur prior to 3 seconds with a different pressurization rate. Explain the difference between these two sets of calculations (initial conditions, transient assumptions, etc.).

4.4 Loss of Load/Turbine Trip

10. Which case does the MDNBR plotted on Figure 2.4-6 represent? How do the DNBRs for the other cases differ from this?

11. Explain what reactivity feedback mechanism modeled in Cases 2 and 4 causes the power to increase during the first 5 seconds of the transient. Explain further the reasons why when PZR pressure control is modeled, the PZR pressure increases (Cases 1 and 2) and when the pressure is allowed to increased, the pressure peak is lower by more than 100 psi. Explain why similar inconsistency is predicted in the PZR water volume.

4.5 Loss of Normal Feedwater

12. Discuss the rational used in determining the initial conditions shown on Table V. Justify the value used for the AFW flowrate used.

13. Justify the changes made to this analysis including the reactivity coefficients to cause the system behavior to change from that presented in the comparison with the current USAR prediction.

4.6 Feedwater Line Break

14. Discuss the changes made to this analysis to cause the system behavior to change from those presented in the comparison with the current USAR prediction. Explain Figure 2.6-5.

15. Describe the effect of modeling pressurizer pressure control on the margins to hot leg saturation and pressurizer solid conditions.

4.7 Main Steamline Break

16. Re-analyze this transient using a split-core model and demonstrate that WCNOC's MSLB model is conservative. Discuss, in depth, the mixing and reactivity feedback modeling assumed in the analysis.