Duke Power Company
Catawba Nuclear Generation Department
4800 Concord Road
York, SC 29745

D. L. Rehn
Vice President
(803)831-3205 Office
(803)831-3426 Fax

DUKE POWER

June 27, 1994

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

Subject: Catawba Nuclear Station, Unit 2
Docket No. 50-414
Revised Chapter 7 Pages for Unit 2 Cycle 7 Reload Report
(TAC Nos. M89127 and M89126)

Gentlemen:

Please find attached revised pages for Chapter 7 of the Reload Report for Catawba Unit 2 Cycle 7 operation. This revision reflects an increase of 23F in calculated peak clad temperature (PCT) as a result of the use of axial blanket fuel for Cycle 7. The calculated PCT remains below the acceptance criteria of 2200F.

These revised pages are provided for information only and no action is required on the part of the NRC. If you have any questions, please call L.J. Rudy at (803) 831-3084.

Very truly yours,

D.L. Rehn

LJR/s

Attachment

9407110033 940627
PDR ADOCK 05000414
P PDR

IE26
1/1

xc (with attachment):
S.D. Ebneter, Regional Administrator
Region II

R.J. Freudenberger, Senior Resident Inspector

R.E. Martin, Senior Project Manager
ONRR

7. ACCIDENT ANALYSIS

Safety Analysis

Each FSAR accident listed below has been examined with respect to changes in Cycle 7 parameters to determine the effect of the Cycle 7 reload and to ensure that thermal performance during hypothetical transients is not degraded.

- Increase in feedwater flow
- Excessive load increases
- Steam system piping failure
- Turbine trip
- Feedwater system pipe break
- Partial loss of forced reactor coolant flow
- Complete loss of forced reactor coolant flow
- Reactor coolant pump shaft seizure (locked rotor)
- Uncontrolled rod bank withdrawal from subcritical or low power startup condition
- Uncontrolled rod bank withdrawal at power
- Dropped rod/rod bank
- Statically misaligned rod
- Single rod withdrawal
- Startup of an inactive reactor coolant pump
- Boron dilution
- Rod ejection
- Steam generator tube failure
- Loss-of-coolant accidents

With the exception of two analyses, the Catawba 2 Cycle 7 thermal-hydraulic and physics parameters are bounded by the existing CNS FSAR Chapter 15 analyses. In addition, the post-LOCA boron precipitation and post-LOCA containment sump pH analyses given in CNS FSAR Chapter 6 have been reanalyzed. The analyses are as follows.

For Catawba 2 Cycle 7, an eighty-eight assembly feed batch is being loaded incore. Out of those eighty-eight assemblies, there are forty-eight assemblies that are unique relative to the standard Duke Mark-BW fuel design. Those forty-eight assemblies, originally fabricated by the B&W Fuel Company for Portland General Electric (PGE) Company's Trojan plant, have three key differences relative to the standard Duke design. First, the PGE fuel has a lower density (95% TD PGE vs. 96% TD Duke), which reduces the thermal conductivity of the fuel pellet, resulting in greater energy retention in the fuel; second, the PGE fuel has a higher enrichment, which results in higher fission gas release over time, resulting in higher end of life pressures; and finally the PGE fuel has six inch natural uranium axial blankets at each end of the fuel stack, which result in slightly higher axial peaks. All of these factors combined to create an increase of approximately 24 °F on the average fuel temperature at the peak power elevation. When incorporated into the LOCA limits analysis, this increase in fuel temperature translated into a 23 °F increase in peak clad temperature (PCT). The maximum local oxide thickness reacted increased from 4.9% to 5.2% (an increase of +0.3%). The whole-core oxidation increased from 0.55% to 0.63% (an increase of +0.08%). These changes in the large break LOCA analysis are small and result in PCT, maximum local oxide thickness reacted and whole-core oxidation totals which are well

below the acceptance criteria of 2200 °F PCT, 17% maximum local oxide thickness reacted and 1.0% whole-core oxidation respectively.

The dropped rod event is reanalyzed with a cycle specific axial flux shape. The axial flux shape calculated for Catawba 2 Cycle 7 resulted in an axial flux shape which is more peaked than that assumed in the current analysis. The results of the reanalysis demonstrate that the existing limiting case is unchanged by the change in axial flux shape, and remains limiting. The reanalysis requires no Technical Specification changes.

The axial blanketed fuel used in this reload requires the allocation of 3.0% DNBR margin for DNB analyses. This DNBR penalty is to account for the potential non-conservative behavior of the axial power distribution generator in VIPRE-01 when compared to SIMULATE power distributions in blanketed fuel assemblies. This penalty applies only to the axial blanketed fuel and leaves 4.4% DNBR margin for SCD transient analyses and 3.7% DNBR margin for non-SCD transient analyses. Table 7-1 provides the DNBR penalties which are assessed against the available margin.

Post-LOCA subcriticality is reanalyzed for Catawba Unit 2 with higher boron concentrations in the refueling water storage tank (RWST) and the cold leg accumulators (CLA), because the post-LOCA subcriticality for Catawba 2 Cycle 7 fails the acceptance criteria with the existing RWST and CLA boron concentrations. Post-LOCA subcriticality is reanalyzed for Unit 2 with an RWST minimum boron concentration of 2175 ppm and a CLA minimum boron concentration of 2000 ppm. The results of the reanalysis demonstrate that the Catawba 2 Cycle 7 core remains subcritical. Based on the reanalysis, the RWST minimum boron concentration limit is increased from 2000 ppm to 2175 ppm, and the CLA minimum boron concentration limit is increased from 1900 ppm to 2000 ppm. In addition, the RWST and CLA maximum boron concentration limits are increased from 2100 ppm to 2275 ppm in order to preserve operating margin. A Technical Specification change which moves these values to the COLR was submitted January 13, 1993. An SER for this submittal is expected to be issued prior to plant startup for Cycle 7. Therefore, Technical Specification changes are not required, these changes will be made to the COLR for Catawba Unit 2 Cycle 7. Changes to the minimum boron concentrations for the RCS, refueling canal and spent fuel storage pool are being changed to be consistent with the boron concentration changes in the RWST.

The increase in the RWST and CLA maximum boron concentration limits necessitates a reanalysis of the post-LOCA boron precipitation evaluation. The results of the reanalysis demonstrate that, with the increased RWST and CLA boron concentrations, post-LOCA boron precipitation is prevented with a reduction in the hot leg recirculation initiation time from 9 hours to 7 hours.

The increase in the RWST and CLA maximum boron concentration limits also necessitates a reanalysis of the post-LOCA containment sump pH. The results of the analysis remain within the existing allowable pH range in the Technical Specification Bases. Therefore, the reanalysis requires no Technical Specification changes.

In addition, the positive breakpoint and slope of the f(ΔI) function of the overtemperature delta T (OTΔT) reactor trip function has been reevaluated for the Cycle 7 reload design. The results of the evaluation demonstrate that the current slope of the f(ΔI) function is overly conservative with respect to optimal core operation. This results in an unacceptable decrease in OTΔT margin to trip during plant

startup. It is proposed to decrease the current positive f(ΔI) slope from its current value of 2.316% to 1.525%. All existing licensing basis safety analyses for Catawba Unit 2 Cycle 7 remain valid with the new positive f(ΔI) slope of 1.525%. Note, this Technical Specification change may be unnecessary if the TS change, submitted January 13, 1993, to move this value to the COLR, gets approved before Catawba Unit 2 Cycle 7 startup. If the TS change is approved the new value will be included in the Catawba Unit 2 Cycle 7 COLR. The Technical Specification changes due to the reevaluation are provided in Section 8 of this report.

Table 7-1

Transient Analysis DNBR Penalties for Mark-BW Fuel

	SCD Analyses	Non-SCD Analyses
Margin included in CHF limit	10.7%	10.0%
DNBR Penalties		
Instrumentation Biases	2.8%	2.8%
Flow Anomaly	0.5%	0.5%
Axial Blankets	3.0%	3.0%
Total DNBR Penalty	6.3%	6.3%
Available Margin Remaining	4.4%	3.7%