MISSISSIPPI POWER & LIGHT COMPANY
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May 12, 1982

NUCLEAR PRODUCTION DEPARTMENT

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U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

Attention: Mr. Harold R. Denton, Director

Dear Mr. Denton:

SUBJECT: Grand Gulf Nuclear Station
Units 1 and 2
Docket Nos. 50-416 and 50-417
File 0260/L-334.0/L-350.0
NUREG-0619, CRD Pump Test, FSAR
Question & Response, SER
Item 1.11(6)
AECM-82/208

Enclosed for your review is a summary report of preoperational testing performed by Mississippi Power & Light Company to demonstrate the adequacy of the Control Rod Drive System pumps to meet the requirements of NUREG-0619.

The submittal represents information requested in support of the Grand Gulf Safety Evaluation Report (NUREG-0831) Item 1.11(6) and Auxiliary Systems Branch reviewer J. Wermiel. It is not planned, at this time, to place this information into the Final Safety Analysis Report.

If you have any questions or require additional information, please contact this office.

Yours truly,

John D Richardson for

L. F. Dale
Manager of Nuclear Services

RFP/JGC/JDR:lm
Enclosure

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SUMMARY REPORT

CRD Tests In Response to NUREG-0619

This report summarizes the work performed to satisfy requirements of NUREG-0619, Section 8.1(6). These requirements are to perform tests to demonstrate:

1. Satisfactory CRD system operation.
2. Return flow capability equal to or in excess of the base case requirements.
3. Two pump operation.

Each requirement has been addressed and successfully completed under GGNS preoperational test C11PT01. Items 1 and 3 are routine preoperational test requirements and will not be discussed further. The remainder of this report will address the development of acceptance criteria and the test performance in satisfying Item 2.

The acceptance criteria for return flow capability was established based on a G.E. letter to the NRC, MFN 082-79, which discusses the results of an analysis to determine the minimum flow requirements to keep the core covered under base case conditions (described in Section 7.3 of NUREG-0619) for bounding plant sizes. The base case conditions specify that the required flow must be delivered to the reactor when reactor pressure is equal to the set pressure of the lowest setpoint safety/relief valve setting. The acceptance criteria for return flow capability was thus established as 215 gpm at a reactor pressure of 1103 psig.

The test was performed under preoperational test 1C11PT01, Section 7.17 and consisted of essentially 3 parts. The first was to establish a pump total developed head (TDH) vs. flow curve for two pump operation. With two pumps in operation, specified flows were established (a dp cell was installed across the flow element to determine system flow; minimum flow valves and the recirculation pump seal purge isolation valves were closed), pump suction and discharge pressures were recorded and pump TDH was calculated for each flow and plotted.

Second, a total system resistance vs. flow curve was generated for a system configuration that maximized CRD return flow to the vessel. This configuration consisted of the following lineup:

1. Minimum flow valves closed.
2. Total recirc pump seal purge flow adjusted to 20 gpm.
3. The RPS system scrammed so that all scram valves are open.
4. The standby suction filter, the filter bypass line and the standby drive water filter valved in.

5. Pressure control valve (F003) opened.

6. Pressure control valve (F004) opened.

7. Flow controller (FK-R600) in MANUAL and demanding 100% open.

8. Backup flow control valve valved in and adjusted to full open.

(Pump motor amps and pump suction pressures were being monitored to ensure operating limits were not being exceeded.)

With the CRD system aligned as indicated above, the CRD pumps were started and data such as system flow, pump suction and discharge pressures, RPV level, and CST level were recorded. This data was used in calculation of the system friction head loss (SFHL) for the CRD system while aligned to the configuration that would yield the maximum CRD system flow to the vessel.

SFHL = Pump TDH - Static Head

Having calculated the SFHL for maximum CRD flow, specific SFHL's were calculated for additional flows as indicated in the attachment to this report. A total system resistance curve was developed by plotting SFHL plus Static Head vs. flow.

The third part was to determine the maximum CRD return flow to the RPV that would overcome a backpressure of 1103 psig in the reactor. This was done by utilizing the curves generated and noting the flow where the difference between pump TDH and total system resistance is 1103 psig. This flow was determined to be 238 gpm which complies with the acceptance criteria set forth above.

With the acceptance criteria of Item 2 met, it is concluded that all testing requirements of NUREG-0619 have been satisfied.

Attachment to Summary Report

Derivation of a Formula for System Friction Head Loss Calculation

Given: $F = K\sqrt{\Delta P}$; F = Flow, K = Flow Constant

Then: $\Delta P = \frac{1}{K^2} * F^2$

And: $\text{Log } \Delta P = \text{Log } (\frac{1}{K^2} * F^2) = \text{Log } (\frac{1}{K^2}) + \text{Log } F^2$

(1) $= 2 \text{ Log } F + \text{Log } (\frac{1}{K^2})$

for Linear Equations: $y = ax + b$

and: the slope $= a = \frac{y1 - y2}{x1 - x2}$

Applying this to Equation 1: $y = \text{Log } \Delta P$, $a = 2$, $x = \text{Log } F$, $b = \text{Log } (\frac{1}{K^2})$

(2) and $\therefore$ the slope $= 2 = \frac{\text{Log} \Delta P_1 - \text{Log} \Delta P_2}{\text{Log } F_1 - \text{Log } F_2}$

ΔP_1 and F_1 were determined when the CRD system was placed in the configuration to maximize flow.

Solving Equation (2) for $\text{Log} \Delta P_2$:

(3) $\text{Log} \Delta P_2 = \text{Log} \Delta P_1 - 2 (\text{Log } F_1 - \text{Log } F_2)$

Equation 3 was used to determine SFHL for flows of 60, 100, 120, 180, 200 and 240 gpm. These values were used to generate a curve for total system resistance vs. flow.