THE CINCINNATI GAS & ELECTRIC COMPANY

CINCINNATI, OHIO 45201

E. A. BORGMANN
SENIOR VICE PRESIDENT

Docket No. 50-358

May 28, 1982

Mr. Harold Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

RE: WM. H. ZIMMER NUCLEAR POWER STATION -
UNIT 1 - "FAST SCRAM" HYDRODYNAMIC
LOADS ON CONTROL ROD DRIVE SYSTEMS

Dear Mr. Denton:

This is in reply to the NRC April 7 letter from B. J. Youngblood to Mr. E. A. Borgmann. Our response to the information requests in the April 7 letter is attached. This information will be placed in the FSAR in Revision 85. Revision 85 is scheduled to be submitted around the end of June.

Very truly yours,

THE CINCINNATI GAS & ELECTRIC COMPANY

By E. A. Borgmann
E. A. BORGMANN

EAB:dew
Enclosure
cc: John H. Frye III
M. Stanley Livingston
Frank F. Hooper
Troy B. Conner, Jr.
James P. Fenstermaker
Steven G. Smith
William J. Moran
J. Robert Newlin
Samuel H. Porter
James D. Flynn
W. F. Christianson
Lynne Bernabei
John D. Woliver
Deborah F. Webb
David K. Martin
George E. Pattison
Andrew B. Dennison

State of Ohio)
County of Hamilton) ss

Sworn to and subscribed before me this 28th day of May, 1982.

Alice M. Leurck
Notary Public

ALICE M. LEURCK
Notary Public, State of Ohio
My Commission Expires December 16, 1986

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Docket No. 50-358

May 28, 1982

Wm. H. Zimmer Nuclear Power Station - Unit 1

Reference: April 7, 1982 letter from B. J. Youngblood (NRC) to E. A. Borgmann (CG&E), "'Fast Scram' Hydraulic Loads on Control Rod Drive Systems."

The following are responses to the five information requests in the referenced letter:

1) The inlet scram valve opening time used in the Zimmer analysis is 0.060 sec. GE identified a valve opening time range of 0.060 - 0.100 sec. for Zimmer. This range was based on the one available test data point for the specific Zimmer valve/solenoid combination, and test results for similar valves which GE judged to be applicable. The lower-bound value of this range was conservatively used.

2) Not applicable. Scram actuation waterhammer loads were incorporated into the CRD system design basis.

3) Two plant conditions were considered in determining bounding waterhammer loads: normal operation and start-up.

   The plant start-up condition is governing for insert lines, since the pressure differential across the scram inlet valve is maximized. Zero reactor pressure is conservatively assumed. Withdraw line waterhammer loading will not occur under this condition.

   Normal plant operation is governing for withdraw lines, maximizing ΔP across the scram outlet valve. Normal reactor pressure is assumed upstream of the outlet valve, atmospheric pressure downstream.

   Due to the conservative assumptions and modelling methods employed in the analysis, control rod position (% withdrawn/inserted) for the above plant conditions is not relevant (see item 4, below).

   A failed buffer case was not considered. However, the normal end-of-stroke transient condition was conservatively analyzed (see item 4), and loads were only about half of the valve opening transient loads. The end-of-stroke transient (normal or failed buffer) appears to be significant only for BWR-6 "fast-scram" systems. The valve-opening transient loads (insert and withdraw lines) provide a conservative, bounding design basis for Zimmer.

For the start-up scram condition, RPV pressure is insufficient to lift the SRV's (or to produce significant loads if SRV's are actuated in the relief mode). SRV-related loads are therefore not combined with start-up scram waterhammer loads. Seismic loading is, however, combined with start-up scram.

Normal operation scram waterhammer loads are added into both the Upset and Faulted design basis load combinations.

4) The NRC's concern for the "appropriateness" of the mathematical model used appears to be based on the last paragraph of RCI's Oct. 14, 1981 letter, in which the ability of analytical models to accurately predict actual conditions is questioned. RCI's question is valid; however, the problem is that the analytical predictions are too conservative. This problem is now well known in the industry.

The Zimmer thermal-hydraulic analysis conservatively decouples the initial valve-opening transient from the end-of-scram transient (occuring at the end of control rod stroke). For the valve-opening transient analysis, a stationary control rod was assumed. Determination of control rod position (% withdrawn/inserted) is therefore not necessary. This is believed to be the major conservatism in the analytical prediction of this transient.

The end-of-scram transient was analyzed as a fast-closing valve (at the CRD housing buffer region), which models the quick deacceleration of the control rod at the end of its stroke. End-of-scram loads were approximately 50% of the valve-opening loads.

Since the valve-opening and end-of-scram transients occur at different points in time, only the valve-opening transient waterhammer loads were used in design.

S&L's in-house computer program HYTRAN was used for the waterhammer thermal-hydraulic analyses. This program has been used for hydraulic transient analyses on all current S&L projects. Valve-opening and valve-closing transient analyses are routinely performed. Aside from the inherent conservatisms in the application of this program to the CRD problem (inability to model moving CRD piston), the analytical approach is appropriate and conservative.

5) Not applicable. Scram actuation waterhammer loads were incorporated into the CRD system design basis.