ILLINOIS POWER COMPANY

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September 24, 1982

Mr. Cecil O. Thomas, Chief
Standardization & Special Projects Branch
Division of Licensing
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Reference: Letter 3/26/82, J. R. Miller (NRC) to L. J. Koch (IP), "Fast Scram Loads on Control Rod Drive Systems".

Dear Mr. Thomas:

Clinton Power Station Unit 1
Docket No. 50-461

This letter is in response to the referenced letter which requested information on the hydrodynamic water hammer analysis of the Control Rod Drive (CRD) System for the Clinton Power Station Unit 1.

The water hammer analysis was performed with the aid of IMPULSE-1 Computer program which simulated the CRD system for a refined analysis. The piping and other components in the CRD system were modeled, and the resulting hydrodynamic loads were used in the design of the pipe supports.

In this analysis all the water hammer events are considered and load histories were developed for use in piping and structure design. These loads are currently part of the design basis for the CRD Piping and Supports of the Clinton Power Station Unit 1.

The following are responses for the five items of information requested:

1. Requested:

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The design basis opening time for the inlet line scram valve.

Response:

The design basis opening time for the Inlet Valve V126 is twenty milliseconds (20ms).

2. Requested:

An evaluation of the hydrodynamic loads in your CRD system resulting from actuation of the inlet line scram valve using the design basis opening time specified in Item 1.

Response:

The hydrodynamic loads were well above the original design basis loads and required extensive modification to the pipe support design. However the final design for the piping and supports accommodates these loads.

This evaluation has been performed based on computer simulation IMPULSE-1 that was benchmarked against test data (see response to Item 4).

3. Requested:

A description of the conditions and configurations of the plant which result in maximum hydrodynamic loads in the CRD System.

Response:

A number of different normal and abnormal operating conditions that can exist in the CRD System were reviewed and short stroke scram for the normal and start-up reactor conditions were chosen as the limiting conditions. To assure conservatism of results, accumulator over pressure and minimum valve opening time were chosen.

In addition, a failed buffer was evaluated under the same system conditions as the start-up scram. The other conditions are considered to be bounded by this analysis.

4. Requested:

A statement regarding the appropriateness of the mathematical model used to calculate the hydrodynamic loads in the CRD System resulting in a scram.

Response:

The computer code and mathematical model used for the analysis have been benchmarked against the BWR-6-Pre-operational Test Data. IMPULSE-1, the computer code that was used for this purpose has the capability to simulate the mechanical CRD System and the resultant water hammer effects. These effects are verified using BWR-6 Standard Short Stroke Test Data that was made available by General Electric Company.

IMPULSE-1 has been verified using combination of experimental data and hand calculations to test its various capabilities.

The conclusion of the studies confirms that the mathematical model used to calculate the hydrodynamic load is accurate, and using IMPULSE-1 code is suitable in predicting hydrodynamic load for the Clinton Unit 1 CRD System.

5. Requested:

A comparison of the hydrodynamic loads evaluated in Item 2 with the present design basis loads for the CRD System.

Response:

The hydrodynamic loads evaluated in Item 2 are included in the design basis for the Clinton Power Station Unit 1 CRD System Piping and Supports.

Sincerely,

G. E. Wuller
Supervisor-Licensing
Nuclear Station Engineering

GEW/lt

Enclosure

cc: Mr. J. H. Williams, NRC Clinton Project Manager
Mr. H. H. Livermore, NRC Resident Inspector
Illinois Dept. of Nuclear Safety