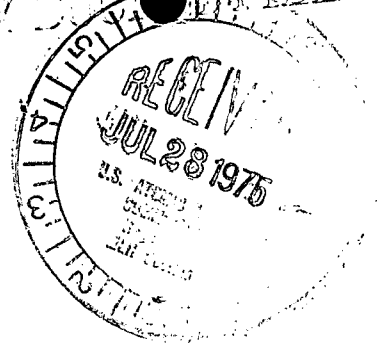
William J. Cahill, Jr.
Vice President

Consolidated Edison Company of New York, Inc.
4 Irving Place, New York, N Y 10003
Telephone (212) 460-3819



July 25, 1975

Re Indian Point Unit No. 2
Docket No. 50-247

Mr. George Lear, Chief
Operating Reactors Branch #3
Division of Reactor Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Lear

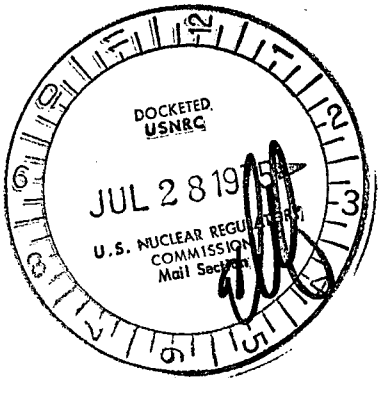
Attached is Con Edison's response to your letter of May 27, 1975, which requested information concerning experience with secondary system fluid flow instabilities at Indian Point Unit No. 2. The results of the three phases of the test program which Con Edison performed when it investigated this problem were transmitted to the Commission by letters dated January 14, 1974, March 12, 1974 and August 30, 1974. These test reports are referenced in the attached responses to your questions.

Very truly yours

William J. Cahill, Jr.

mrb

William J. Cahill, Jr.
Vice President



1. Describe all operating occurrences that could cause the level of the water/steam interface in the steam generator to drop below the feedwater sparger or inlet nozzles, and allow steam to enter the sparger and/or the feedwater piping.

Certain plant operating conditions such as the steam generator level problem that was experienced on November 13, 1973 can result in the steam generator water level dropping below the feedwater sparging ring. However, as a result of this problem and the waterhammer that occurred in the feedwater system on that date, "J" tubes were installed on the Indian Point Unit No. 2 feedwater sparging rings in the steam generators. As described in Con Edison's report of March 12, 1974 (page 13-14) these "J" tubes preclude the rapid draining of the feedwater sparging rings and prevent steam from entering the rings even if they are uncovered.

2. Describe and show by isometric diagrams, the routing of the main and auxiliary feedwater piping from the steam generators outwards through containment up to the outer containment isolation valve and restraint. Note all valves and provide the elevations of the sparger and/or inlet nozzles and all piping runs needed to perform an independent analysis of drainage characteristics.

As the third phase of Con Edison's testing program ("Results of Test Program Following Modifications to Steam Generator Internals, August 30, 1974") and experience since that submittal indicate, the "J" tubes that were installed on the feedwater sparging rings prevent rapid drainage of the feedwater lines. Isometric and other drawings of the feedwater piping were provided, however in the March 12, 1974 submittal, Appendix I, Figure 3, and in the January 14, 1974 submittal, Figures B and C.

3. Describe any "waterhammer" experiences that have occurred in the feedwater system and the means by which the problem was permanently corrected.

Con Edison's initial experience with "waterhammer" phenomenon in the feedwater system was on November 13, 1973. This incident is fully described in the first five chapters and appendices I-III of the report submitted on January 14, 1974. The subsequent testing and reproduction of the plant conditions are described in the report of March 12, 1974. Phase I of this testing is described on pages 2-5 of this March 12, 1974 submittal and Phase II Testing on Pages 5-11.

To eliminate the phenomenon and the problems associated with it, a number of modifications were made to the plant. Three of these modifications were described in the report of January 14, 1974. On page 6-1 to 6-2 of this submittal, a description is made of the modification to feedwater line no. 22 which prevents its rapid draining. Also on page 6-2, the change made to the feedwater piping supports is explained. This modification precludes the rebound-type failure of this feedwater line from recurring. Finally, the modification to the feedwater regulating valves and bypass system is described on pages 6-2 to 6-3. With this change, control of low feedwater flows is improved and the likelihood of level variances in the steam generators is reduced.

The final modification to the feedwater system, the installation of "J" tubes in the sparging ring to prevent its rapid draining, is described in the report submitted on March 12, 1974, pages 13-14.

Other experiences with waterhammer at Indian Point Unit No. 2 are described the Con Edison letter of February 20, 1974 which replied to the Directorate of Regulatory Operations' Information Request No. 74-1 which was transmitted by a letter of January 22, 1974.

4. Describe all analyses of the feedwater and auxiliary feedwater piping system for which dynamic forcing functions were assumed. Also, provide the results of any test programs that were carried out to verify that either uncovering of the feedwater lines could not occur at your facility, or if it did occur, that "waterhammer" would not occur.
   a. If forcing functions were assumed in analyses, provide the technical bases that were used to assure that an appropriate choice was made and that adequate conservatisms were included in the analytical model.
   b. If a test program was followed, provide the basis for assuring that the program adequately tracked and predicted the flow instability event that occured, and further, that the test results contained adequate conservatisms and an acceptable factor of safety, e.g., range of parameters covered all conceivable modes of operation.
   c. If neither a. or b have been performed, present your basis for not requiring either and your plans to investigate this potential transient occurrence.

An analytical investigation of the feedwater line response to postulated waterhammer effects was studied in Appendix VI of the January 14, 1974 report. This analysis and the investigations described in Chapter 4 and Appendices III and V in the same report were performed with the intention of determining the cause of the incident which was experienced on November 13, 1973.

A second analysis was performed by Westinghouse and is described in Appendix II of the March 12, 1974 submittal. This analysis evaluated the stresses that were experienced in the feedwater piping following the waterhammer shock of February 3, 1974. In conjunction with the visual and magnetic particle examinations, this report provided the assurance of integrity needed in order to restore the plant to operation at that time.

In addition to these analyses, a three phase test program was performed to verify the effectiveness of the modifications that were made. The tests were performed at a range of power levels and auxiliary feedwater flows including the plant conditions that had cuased the original waterhammer on November 13,1973 and the subsequent waterhammers. A description of the testing programs is given in the reports of March 12, 1974 and August 30, 1974.

5. Discuss the possibility of a sparger or nozzle uncovering and the consequent pressure wave effects that could occur in the piping following a design basis loss-of-coolant accident, assuming concurrent turbine trip and loss of off-site power.

The installation of the "J" tubes on the feedwater sparging ring has precluded the rapid draining of the feedwater piping. The mechanism which Con Edison established to be the cause of the past pressure wave effects in the feedwater system is therefore prevented from recurring by this modification.

In the very remote event that the feedwater system experienced another large pressure wave, additional pipe restraints were installed along the feedwater pipe. As described on page 6-2 of the January 14, 1974 submittal, this modification prevents recurrence of the rebound - type failure of the feedwater line.

6. If plant system design changes have been or are planned to be made to preclude the occurrence of flow instabilities, describe these changes or modifications, and discuss the reasons that made this alternative superior to other alternatives that might have been applied. Discuss the quality assurance program that was or will be followed to assure that the planned system modifications will have been correctly accomplished at the facility. If changes are indicated to be necessary for your plant, consider and discuss the effects of reduced auxiliary feedwater flow as a possible means of reducing the magnitude of induced pressure waves, including positive means (e.g., interlocks) to assure sufficiently low flow rates and still meet the minimum requirements for the system safety function.

As the result of our testing programs it was determined that the waterhammer phenomenon in the steam generators and feedwater piping was the result of steam-water reactions within the feedwater piping and sparging ring. Installation of the "J" tubes prevented the rapid draining of this piping under all plant conditions and therefore eliminated the interface between the steam and water inside the pipe. As the third phase of the testing program and experience since that time indicates, the waterhammer has effectively been precluded from recurring under any condition as a result of the installation of the "J" tubes.

Other modifications were made to Indian Point Unit No. 2 as described in the answer to Question 3 in this letter. These modifications were directed at preventing the conditions which caused the original waterhammer from recurring or, in the case of the modifications to the piping supports and the additional insulation over the containment liner, to reduce the consequences of any potential future

shocks.

All modifications that were made to the Unit following the incident and test program were performed in accordance with the Con Edison Ouality Assurance Program for operating nuclear plants that was currently in effect. A description of that QA program was submitted to the Commission on July 6, 1973 by a Con Edison letter.

In the course of Con Edison's testing program, following the experience with waterhammers in the feedwater systems, it was discovered that high auxiliary feedwater flows were necessary to reproduce the waterhammer. The use of operational procedures to preclude the high auxiliary feedwater flows was consequently considered as a means of preventing recurrence of the waterhammer shocks. It was determined, however, that the installation of "J" tubes offered the greatest assurance for Indian Point Units 2 and 3 that the source of the waterhammer problem would be eliminated (refer to Con Edison's submittal of March 12, 1974, pages 11-12).