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JSP-0458-90
June 22, 1990

Docket No. 50-461

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

Subject: Clinton Power Station
Response to Bulletin 88-08 Supplement 3

Dear Sir:

The purpose of this letter is to provide an update to an August 17, 1989, letter (U-601492), which submitted the Illinois Power Company response to Nuclear Regulatory Commission (NRC) Bulletin 88-08 Supplement 3, "Thermal Stresses in Piping Connected to Reactor Coolant Systems". Attached are the review results, and a proposed schedule for implementing any required actions.

I hereby affirm that the information in this letter is correct to the best of my knowledge.

Sincerely yours,

R. B. Gil FOR
J. S. Perry
Vice President

REL/alh

Attachment

cc: NRC Clinton Licensing Project Manager
NRC Resident Office
Illinois Department of Nuclear Safety
Regional Administrator, Region III, USNRC

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Attachment

As documented in Supplement 3 of NRC Bulletin 88-08, a recent event at a foreign reactor facility raised new concerns on thermal stratification in unisolable piping connected to the Reactor Coolant System (RCS). At this foreign facility, cracks were found in piping connected to the RCS. The cracks resulted from thermal fatigue caused by hot water, which was drawn periodically from the RCS hot leg, leaking through the packing gland of a Residual Heat Removal (RHR) valve. The hot fluid flowed on top of the cool fluid in the pipe and produced a temperature gradient between the top and bottom of the pipe resulting in thermal stresses on the pipe. The valve leakage and resultant thermal stresses were cyclic due to the thermal expansion and contraction of the RHR valve disc.

This event is different than the event documented in the original NRC Bulletin 88-08 where thermal stratification resulted from leakage of higher-pressure cold water into hot RCS water. The NRC has requested that the three actions in the original bulletin be addressed for the event documented in Supplement 3. These actions are as follows:

A. Action 1 - Review systems connected to the RCS to determine whether unisolable sections of piping connected to the RCS can be subjected to stresses from temperature stratification or temperature oscillations that could be induced by leaking valves and that were not evaluated in the design analysis of the piping. For those addressees who determine that there are no unisolable sections of piping that can be subjected to such stresses, no additional actions are required.

B. Action 2 - For any unisolable sections of piping connected to the RCS that may have been subjected to excessive thermal stresses, examine non-destructively the welds, heat affected zones and high stress locations, including geometric discontinuities, in that piping to provide assurance that there are no existing flaws.

C. Action 3 - Plan and implement a program to provide continuing assurance that unisolable sections of all piping connected to the RCS will not be subjected to combined cyclic and static thermal stresses and other stresses that could cause fatigue failure during the remaining life of the unit.

Evaluation for Clinton Power Station

Response to Action 1

The effects of stratified flow on Clinton Power Station (CPS) piping systems connected to the RCS were evaluated as required by NRC Bulletin 88-08, Supplement 3. All unisolable piping connected to the RCS was identified and evaluated to determine which piping could be subjected to the stratified flow phenomena. The piping which was judged to be susceptible to this phenomena was then grouped into one of three categories: 1) process piping, 2) instrumentation piping, and 3) vent and drain piping.

The NRC Bulletin addressed leakage through the packing gland on wedge-type gate valves. This study was expanded to postulate leakage past the seats for wedge-type gate valves, stem leakage for globe valves and seat leakage for check valves. Leakage past the check valve and gate valve seats was postulated based on Inservice Inspection (ISI) and Technical Specification limits for allowable leakage. Stem leakage for globe valves was postulated based on industry experience.

A summary of the results for each of the three categories is presented below:

1. Process Piping

   Twelve process piping subsystems were determined to be susceptible to stratified flow. These subsystems and associated piping line numbers are tabulated below:

Subsystem No.	Piping Line No.
1LP-01	1LP02B/C
1LP-21	1LP26A
1HP-01	1HP02D/E
1HP-18	1HP23A
1RH-01	1RH03CA/DA
1RH-03	1RH03CB/DB
1RH-05	1RH04B/C
1RH-34	1RH09A/C
1RH-60	1RH59AA
1RH-68	1RH59AB
1RH-76	1RH49AC
1SC-07	1SC02DC/DE

   Subsystem 1RH-34 was selected for analysis since it most directly reflected the configuration represented in the Bulletin. Subsystem 1LP-01 was selected and analyzed as a representative sample for subsystems 1LP-01, 1HP-01, 1RH-01, 1RH-03 and 1RH-05.

Subsystems 1LP-21, 1HP-18, 1RH-60, 1RH-68 and 1RH-76 are the 3/4 inch equalizing lines for testing of the check valves in subsystems 1LP-01, 1HP-01, 1RH-01, 1RH-03 and 1RH-05, respectively. These subsystems were not analyzed since it was judged that the results of the analysis for instrumentation lines and for vent and drain lines would be bounding for these lines.

Subsystem 1SC-07 was not analyzed since its configuration was not conducive to the cyclical type of stratification to which subsystems 1RH-34, 1LP-01, 1HP-01, 1RH-01, 1RH-03 and 1RH-05 may be subjected.

The results of the analysis for subsystem 1RH-34 indicate that piping stresses, support loadings and penetration loadings resulting from this phenomena are acceptable. The results of the analysis for subsystem 1LP-01 indicate areas of high stress and cyclical loadings beyond code allowable limits. Based on the maximum usage factor from the analysis, a conservative determination of the fatigue life of the piping system (to satisfy code allowables) with the occurrence of stratification is 4 years.

2. Instrumention Piping

Seventy-five instrumentation lines were judged to be susceptible to stratified flow. Of these lines, 1NB06BA/BB (piping subsystem 1NB-07) and 1NB06CA/CB (1NB-08) were selected as a representative sample for instrumentation piping systems. These subsystems were analyzed for two types of thermal stratification: 1) steady state stratification and 2) transient thermal stratification. The results of the analysis indicate that steady state thermal stratification, characterized by gradual deterioration of the valve packing (greater than one hour), is not detrimental to the integrity of the instrument lines. Transient thermal stratification, characterized by a sudden failure of the valve packing (less than one minute), can have an adverse effect on the piping; however, this type of stratification is judged to be an unlikely occurrence and therefore of no concern.

3. Vent and Drain Piping

Twenty-two vent and drain lines were judged to be susceptible to thermal stratification. A typical representation of a vent and drain line was analyzed. The results of this analysis indicate that thermal stratification may increase the stress level in vent or drain lines; however, the increase is considered negligible and does not warrant further consideration.

Response to Action 2

Action 2 of NRC Bulletin 88-08, Supplement 3 requires that unisolable sections of piping connected to the RCS that may have been subjected to excessive thermal stresses be examined. Examination requirements include Non- Destructive Examination of welds, heat-affected zones and high stress locations to provide assurance that there are no existing flaws.

In order to satisfy the requirements of Action 2, the following welds will be examined during the second refueling outage (RF-2):

Subsystem No.	Weld No.	Illinois Power Company Weld Identification Isometric
1LP-01	1-LP-1-10	A-23B
	1-LP-1-11*	A-23B
	3/4" tap adjacent to 1-LP-1-9-3	A-23B
	1-LP-1-7A	A-23A
1HP-01	1-HP-5-11	A-25A
	1-HP-5-10	A-24
	1-HP-5-7A	A-24
1RH-01	1-RH-18-4Q1	A-26A
	1-RH-18-5Q1	A-26A
	1-RH-18-18	A-26A
	3/4" tap adjacent to 1-RH-18-2-2Q1	A-26A
1RH-03	1-RH-23-3B	A-27A
	1-RH-23-5	A-27B
	1-RH-23-6	A-27B
	3/4" tap adjacent to 1RH-23-6-3	A-27B
1RH-05	1-RH-12-19	A-28B
	1-RH-12-12	A-28C
	1-RH-12-13A*	A-28C

* Denotes weld already scheduled for ISI during RF-2

The welds listed above are those welds for each subsystem that would be a concern if a stratified flow condition existed. It should be noted that those welds listed for subsystem 1LP-01 are based on the results of the thermal stratification analysis performed for that subsystem. The welds listed for the remaining subsystems were identified based on similarities between these subsystems and subsystem 1LP-01.

Examination of other unisolable process lines, instrumentation lines, vents and drains is not required for the reasons summarized above in Response to Action 1.

Response to Action 3

Action 3 of NRC Bulletin 88-08 Supplement 3, requires that a program be implemented to provide continuing assurance that unisolable sections of piping connected to the RCS will not be subjected to thermal stresses that could cause fatigue failure during the remaining life of the unit. The ISI Program will be revised by the start of the third refueling outage (RF-3) to include the inspection of susceptible welds once every two refueling outages for each of the five subsystems specified above.