Illinois Power Company
P.O. Box 678
Clinton, IL 61727
Tel 217 935-8881 x3900
Fax 217 935-4632

John P. McElwain
Chief Nuclear Officer

ILLINOIS POWER
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Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Subject: Illinois Power Response to Generic Letter 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," Request for Additional Information

Dear Madam or Sir:

The purpose of this letter is to provide the Illinois Power (IP) response to the NRC's Request for Additional Information (RAI) related to Generic Letter (GL) 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," dated May 28, 1999. The information requested by the subject RAI is provided in Attachment 1 to this letter. Please note that the subject RAI required IP to provide a response within 45 days of receipt of the RAI. The required IP response date was changed to August 31, 1999, per telecon with Mr. S. G. Tingen of NRC Nuclear Reactor Regulation (NRR) staff and Mr. M. A. Reandeau of Clinton Power Station (CPS) Licensing staff. IP requested the additional response time in order to evaluate one additional potential pressure locking scenario involving the High Pressure Core Spray (HPCS) pump Suppression Pool suction valve (1E22-F015). Subsequent evaluation (IP calculation IP-M-0570, Attachment 4 to this letter) determined that the additional pressure locking scenario considered was not a concern for the 1E22-F015 valve.

Previous IP responses to the NRC relevant to GL 95-07 (letters U-602553 dated February 9, 1996, and U-602601 dated June 27, 1996) have identified the Clinton Power Station (CPS) valves susceptible to pressure locking and the actions to be taken by IP to address this condition. Subsequent to the aforementioned letters being provided to the NRC, additional evaluations have been completed by IP regarding the susceptibility of CPS valves to thermally induced pressure locking. These evaluations identified additional CPS valves susceptible to pressure locking. Attachment 2 to this letter provides additional detail regarding the evaluations performed and actions taken

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by IP to address the evaluation results. Additionally, IP letter U-602553 identified certain valves which were to be modified to address GL 95-07 concerns. Attachment 2 to this letter provides an update on the valves which have had modifications completed.

Should there be any questions regarding the information provided in this letter, please contact Mr. Michael A. Reandeau, CPS Licensing.

Sincerely yours

John P. McElwain

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Chief Nuclear Officer

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Attachments

cc: NRC Clinton Licensing Project Manager
NRC Resident Office, V-690
Regional Administrator, Region III, USNRC
Illinois Department of Nuclear Safety

Illinois Power (IP) RAI Response Regarding GL 95-07

NRC Question 1:

In a letter dated May 23, 1996, the NRC requested your analysis or evaluation that demonstrated that the high pressure core spray pump suppression pool suction valve, 1E22-F015, and the reactor core isolation cooling pump suppression pool suction valve, 1E51-F031, were not susceptible to thermal induced pressure locking following postulated accidents that cause the suppression pool temperature to increase. Your responses dated June 27, and August 5, 1996, use engineering judgment to determine that the temperature of these valves would not increase; and therefore, these valves are not susceptible to thermal induced pressure locking. The NRC staff considers that it is not appropriate to use engineering judgment to determine that these valves are not susceptible to pressure locking due to the geometry of the piping between the valves and the suppression pool. Provide the calculations that demonstrate that heat will not be transferred from the suppression pool to the valves during a postulated accident.

IP Response:

The Reactor Core Isolation Cooling (RCIC) and High Pressure Core Spray (HPCS) pump suction lines are aligned horizontally from the Suppression Pool. Both pump suction lines contain an open manual valve (which acts as a heat sink/fin) located between the normally closed motor operated valve (MOV) (1E51-F031 and 1E22-F015 respectively) and the Suppression Pool. The distance between the Suppression Pool and the RCIC pump suction valve is approximately 7.5 feet. The distance between the Suppression Pool and the HPCS pump suction valve is approximately 11.5 feet. The pump suction lines are not insulated.

The highest Suppression Pool heat-up rate occurs under a high demand/low pressure scenario (i.e., LOCA) due to the large heat input to the pool. In this scenario, significant Suppression Pool temperatures (greater than 150°F) do not occur until approximately one (1) hour after the initiation of the event[1]. The HPCS/RCIC pump Suppression Pool suction valves are closed during the initial portions of the event since pump suction is initially taken from the RCIC storage tank. Under a high demand/low pressure scenario, the HPCS/RCIC pumps would deplete the RCIC storage tank and pump suction would be transferred to the suppression pool suction in less than 30 minutes. Due to the long horizontal distance between the Suppression Pool and the HPCS pump/RCIC pump suction valve, heat-up of the fluid in the valve bonnet due to increased Suppression Pool temperatures would not be significant at the time the valve is required to open.

[1] Reference CPS Updated Safety Analysis Report (USAR) Figure 6.2-15

Temperature in a dead-ended, uninsulated line decays exponentially with distance from the heat source. Conduction, the acting heat transfer mechanism, does not rapidly transfer heat down a water-filled horizontal pipe run. As shown in IP calculation IP-M-0556 (Attachment 3), the subject piping will approach ambient temperature at approximately five (5) pipe diameters distance from the heat source (i.e. the Suppression Pool). The heat sink/fin (normally open manual valve) located between the heat source and the point of interest will further reduce the distance before ambient is reached (due to the additional convection surface area).

For low demand/high pressure scenarios, the Suppression Pool heat-up rate is much slower. The expected peak Suppression Pool temperature for this event utilizing the RCIC system is approximately 140°F[2,3]. This temperature would be representative of the peak Suppression Pool temperature which would be experienced in the low demand/high pressure scenario involving either the RCIC or HPCS system. Due to the long horizontal distance between the Suppression Pool and the HPCS pump/RCIC pump suction valve, significant heat-up of the fluid in the pump suction valve bonnet would not occur as discussed previously.

NRC Question 2:

During a postulated accident, the containment would be initially pressurized to a peak pressure and the bonnets of 1E22-F015 and 1E51-F031 could also be pressurized to containment peak pressure. When transferring to the recirculation phase of a postulated accident, containment pressure could be lower than the peak pressure but the pressure in the bonnets of 1E22-F015 and 1E51-F031 could still be at containment peak pressure. Discuss if the pressure in the bonnets of the valves could be higher than upstream and downstream pressure due to changes in containment pressure when the valves are required to open and, if applicable, if the valves will open during the pressure locking condition.

IP Response:

The HPCS pump Suppression Pool suction valve is a 20" Anchor Darling flex wedge gate valve and the RCIC Suppression Pool suction valve is a 6" Anchor Darling flex wedge gate valve. As identified in the response to NRC question 1 above, the bonnets of these valves will not experience significant temperature inputs; therefore, these valves are not susceptible to thermally induced pressure locking. Pressure induced pressure locking requires the valve bonnet to be pressurized followed by a rapid line depressurization. Pressure locking due to containment pressurization could only occur if there was a rapid containment depressurization and the residual bonnet pressure exceeded valve actuator and motor capability. The only potential scenario that would cause the rapid containment depressurization would be if containment spray were initiated. The rapid depressurization

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[2] Reference USAR Figure 5.4-10 and GE RCIC process diagram 762E421AA.

[3] 170°F worst case per GE design specification is not expected for this scenario.

experienced under these conditions would be of small magnitude and would not result in a significant bonnet pressurization.

Pressure locking due to the above scenario is not considered credible due to the low pressures that the valves would be exposed to. The maximum Suppression Pool swell level during accident conditions is approximately 752 feet. Both valve elevations are at approximately 720 feet. Therefore, the maximum pressure seen by both valves due to elevation head of the Suppression Pool water would be approximately 14 psig. Combined with containment pressure, the resultant maximum bonnet pressure for these valves would be approximately 23 psig. If it is conservatively assumed that the line pressure went to zero psig, the maximum differential pressure would be 23 psig.

The opening differential pressures utilized for Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," evaluations for these valves was approximately 107 psig and 84 psig for 1E22-F015 and 1E51-F031, respectively. The large margin between GL 89-10 opening differential pressures and the maximum differential pressure noted above for the pressure locking scenario eliminates any potential pressure locking concerns due to containment pressurization.

Based on the above discussion, pressure locking due to containment pressurization is not a concern for these valves.

Additional Information

Update on Valve Modifications

As provided in Illinois Power (IP) letter U-602553 dated February 9, 1996, four (4) Probabilistic Risk Assessment (PRA) safety significant valves were to be modified during Clinton Power Station's (CPS's) sixth refueling outage (RF-6) and six (6) PRA low safety significant valves were to be modified in CPS's seventh refueling outage (RF-7) to address pressure locking concerns. All of these valves, with the exception of 1E12-F028B have been modified to address pressure locking concerns. Valve 1E12-F028B (a PRA low safety significant valve) will be modified in RF-7.

The following table provides a summary of the valves modified in RF-6 which were addressed in letter U-602553.

Valve EIN	Valve Name
1E12-F042B	Low Pressure Coolant Injection "B" injection valve
1E12-F028A	Residual Heat Removal (RHR) 1A Containment Spray valve
1E32-F006/7	Main Steam Isolation Valve (MSIV) Leakage Control System (LCS) outboard bleed valves
1E32-F008/9	MSIV LCS outboard differential pressure valves
1E12-F024A/B	RHR test return valves
1E51-F013	Reactor Core Isolation Cooling injection valve

Results of Subsequent Evaluations

In July 1997, IP identified that two additional valves, 1E12-F064A/B (RHR Pump 1A/1B minimum flow valve), were susceptible to pressure locking. This condition was entered into the CPS corrective action process. As corrective action , IP modified these valves during RF-6 to eliminate their susceptibility to pressure locking.

During an extent of condition review for the above mentioned condition, IP identified that thermally induced pressure locking as a result of temperature increases in plant areas caused by high energy line breaks (HELBs) had not been appropriately considered. As noted in CPS Licensee Event Report 1998-028-00, when considering thermally induced pressure locking resulting from HELB temperatures, it was determined that the "A" and "B" RHR Heat Exchanger service water inlet and outlet valves (1E12-F014A/B and 1E12-F068A/B respectively) were susceptible to this condition. IP modified these valves during RF-6 to eliminate their susceptibility to thermally induced pressure locking as a result of a HELB.

The following table provides a summary of the additional valves modified in RF-6 to address pressure locking.

Valve EIN	Valve Name
1E12-F064A/B	RHR Pump 1A/1B minimum flow valve
1E12-F014A/B	RHR Heat Exchanger A/B service water inlet valve
1E12-F068A/B	RHR Heat Exchanger A/B service water outlet valve