Commonwealth Edison Company
1400 Opus Place
Downers Grove, IL 60515-5701

July 5, 1996

ComEd

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Subject: Braidwood Station Units 1 and 2
Byron Station Units 1 and 2
Dresden Station Units 2 and 3
LaSalle County Station Units 1 and 2
Quad Cities Station Units 1 and 2
Zion Station Units 1 and 2

Commonwealth Edison Company (ComEd) Response to NRC Request for Additional Information (RAI) - Generic Letter (GL) 95-07, "Pressure Locking and Thermal Binding of Safety Related Power-Operated Gate Valves"

NRC Docket Nos. 50-454 and 50-455
NRC Docket Nos. 50-456 and 50-457
NRC Docket Nos. 50-237 and 50-249
NRC Docket Nos. 50-373 and 50-374
NRC Docket Nos. 50-254 and 50-265
NRC Docket Nos. 50-295 and 50-304

References:
(a) NRC Generic Letter 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," dated August 17, 1995.

(b) Letter from P. L. Piet (ComEd) to U.S. Nuclear Regulatory Commission, dated February 13, 1996, transmitting the 180 day ComEd response to Generic Letter 95-07.

(c) Letter from Clyde Shiraki (NRC) to D.L. Farrar (ComEd), dated June 5, 1996, transmitting a Request For Additional Information regarding the ComEd 180 Day Response to Generic Letter 95-07.

In Reference (a), the NRC staff requested licensees to provide various evaluations and analyses regarding the susceptibility of power-operated gate valves to pressure locking and thermal binding. Responses were required at 60 days and 180 days. In Reference (b), the Commonwealth Edison Company (ComEd) provided the 180 day response to the Generic Letter (GL). Reference (c) is a request for additional information (RAI) regarding various aspects of the 180 day letter. ComEd's response to this RAI is attached.

A056 1/1

If there are any questions required on this matter, please contact this office.

Sincerely,

for John Hosmer
Vice President Engineering

Attachments: ComEd Response to NRC Staff Request for Additional Information

cc: H. Miller, Regional Administrator-RIII
C. Phillips, Senior Resident Inspector-Braidwood
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Office of Nuclear Safety - IDNS

ATTACHMENT

ComEd Response to NRC Staff Request for Additional Information

ATTACHMENT

BRAIDWOOD/BYRON

1. **Regarding valves 1(2)RH8716A/B, RHR Crosstie Isolation, Commonwealth Edison's (ComEd's) submittal states that an operability assessment has been completed for these valves which concludes that the valves remain operable and no operability issue exists. Please provide the operability assessment for the staff's review, including any applicable heat transfer, thrust requirement, and actuator capability calculations which may have been performed as part of the operability assessment.**

   In addition, the licensee's submittal states that corrective actions will be performed in accordance with the operability assessment. Please explain the corrective actions planned for these valves.

   Response:

   Byron Station and Braidwood performed an operability assessment for these valves in accordance with station procedures. The Operability Assessments are attached as Appendix A and Appendix B, for Byron and Braidwood, respectively. There were no applicable heat transfer, thrust requirement, or actuator capability calculations required for these valves.

   The 1(2)RH8716B valves were evaluated and pressure locking was determined not to be a concern due to the piping configuration. Currently, a design change (hole drilled in one side of the disk) is being considered for the 1(2)RH8716A valves; however, evaluations to determine the appropriateness of this design change are still in progress. Byron and Braidwood will complete this evaluation by December 31, 1996. Byron and Braidwood will provide this information to the NRC staff upon their completion.

2. **Regarding the following valves:**

   1(2)RY8000A/B, Pressurizer PORV Isolation
   1(2)SI8801A/B, Charging Pump to RCS Cold Legs Isolation
   1(2)SI8802A/B, SI Pump to RCS Hot Leg Isolation
   1(2)SI8840, RHR to RCS Hot Legs Isolation

   Commonwealth Edison's submittal states that an operability assessment has been completed for these valves, which concludes that the valves remain operable and no operability issue exists. Please provide the operability assessment for the staff's review, including any applicable thrust requirement and actuator capability calculations performed as part of the operability assessment.

   Response:

   The operability assessment referenced in Response 1 and included as Appendices A and B also addressed each of these valves. The actuator capability calculations performed in support of the operability assessment of the 1(2)RY8000A/B and 1(2)SI8802A/B are attached as Appendix C and Appendix D for Byron and Braidwood, respectively. There were no applicable thrust requirement or actuator capability calculations required for the 1(2)SI8801A/B or 1(2)SI8840 valves.

3. **Through review of operational experience feedback, the staff is aware of instances in which licensees have completed design or procedural modifications to preclude pressure locking or thermal binding which may have had an adverse impact on plant safety due to incomplete or incorrect evaluation of the potential effects of these modifications. Please describe evaluations and training for plant personnel that have been conducted for each design or procedural modification completed to address potential pressure locking or thermal binding concerns.**

Response:

Byron and Braidwood use approved station procedures to perform a design change, such as modification of equipment to prevent pressure locking or thermal binding, or for performing a procedure change. The approved station procedures for these processes ensure that the change does not result in any unreviewed safety issue in accordance with 10CFR50.59. Controls in the processes ensure that appropriately qualified personnel are involved in the review of the changes. The procedures also ensure that appropriate training requirements are identified associated with each modification or procedure change and tracked to completion.

ATTACHMENT

LASALLE

1. In Attachment 1 to GL 95-07, the staff requested that licensees include consideration of the potential for gate valves to undergo pressure locking or thermal binding during surveillance testing. During workshops on GL 95-07 in each Region, the staff stated that if the closing and subsequent pressure locking or thermal binding of a safety related power operated gate valve during the performance of a test or surveillance would defeat the capability of the safety system or train, the appropriate technical specifications must be followed unless one of the following actions has been taken within the scope of GL 95-07:

1. Verify that the valve is not susceptible to pressure locking or thermal binding while closed,

2. Demonstrate that the actuator has sufficient capacity to overcome these phenomena, or

3. Make appropriate hardware and/or procedural modifications to prevent pressure locking and thermal binding.

The staff stated that normally open, safety-related power-operated gate valves which are closed for test or surveillance but which must be returned to the open position should be evaluated within the scope of GL 95-07. Please discuss if all valves which meet this criterion were included in the review, and the way in which potential pressure locking or thermal binding concerns were addressed.

Response:

All normally open safety related power operated valves that are stroked closed for surveillance and must reopen were addressed in LaSalle's response to Generic Letter 95-07 transmitted via Reference (b). All of these valves were determined not to be susceptible to pressure locking or thermal binding. Surveillance performance was determined not susceptible for one or a combination of the following reasons:

1. Surveillances requiring a valve to cycle are performed under stable conditions and the timeframe the valve is closed is short (on the order of a few minutes). These conditions do not permit the pressure locking or thermal binding mechanism to occur.

2. None of these valves are susceptible to sudden depressurization.

3. The valve is stroked in a condition that does not require the safety function. This means the surveillance is performed in a plant condition that does not require the safety function or the associated Technical Specification is rendered inoperable by performance of the surveillance and the Technical Specification Action statement is followed during the surveillance.

2. Through review of operational experience feedback, the staff is aware of instances in which licensees have completed design or procedural modifications to preclude

pressure locking or thermal binding which may have had an adverse impact on plant safety due to incomplete or incorrect evaluation of the potential effects of these modifications. Please describe evaluations and training for plant personnel that have been conducted for each design or procedural modification completed to address potential pressure locking or thermal binding concerns.

Response:

LaSalle uses approved station procedures to perform a design change, such as modification of equipment, to prevent pressure locking or thermal binding, or for performing a procedure change. The approved station procedures for these processes ensure that the change does not result in any unreviewed safety issue in accordance with 10CFR50.59. Controls in the processes ensure that appropriately qualified personnel are involved in the review of the changes. The procedures also ensure that appropriate training requirements are identified associated with each modification or procedure change and tracked to completion. To date, LaSalle has not experienced any problems resulting form design changes installed to resolve pressure locking or thermal binding.

ATTACHMENT

ZION

1. **Commonwealth Edison's (ComEd's) submittal discusses the potential susceptibility of valves 1(2)SI9011A,B, safety injection (SI) Pump Discharge to reactor coolant system (RC) Hot Leg, to pressure locking under certain conditions, and states that the motor operated valves (MOVs) are capable of opening under pressure locking conditions. Please provide this calculation for the staff's review.**

   In addition, ComEd's submittal states that a design change to install a new motor actuator is being reviewed for inclusion in upcoming refueling outages. Please provide specific information and calculations, if applicable, regarding the increase actuator thrust capability as compared to the thrust requirement under pressure locked conditions.

   Response:

   The thrust calculation for 1(2)SI9011A, B is documented in calculation 22S-B-005M-162 and is provided in Appendix E.

   A design change for 1(2)SI9011A & B has been approved by the Station Business Review Committee and is scheduled for installation during refueling outages Z1R15 (March 1997) and Z2R15 (March 1998). The existing actuator hardware and the proposed changes are listed below for each valve.

Valve	Existing Motor	Existing Speed	Existing OAR	Proposed Motor	Proposed Speed	Proposed OAR
1SI9011A	SMB-0-15	3600 RPM	69.6	SB-0-25	3600 RPM	96.2
1SI9011B	SMB-0-15	3600 RPM	78.8	SB-0-25	3600 RPM	96.2
2SI9011A	SMB-0-15	3600 RPM	69.6	SB-0-25	3600 RPM	96.2
2SI9011B	SMB-0-40	1800 RPM	41.3	SB-0-40	1800 RPM	61.6

   At the time the design change was being scoped (prior to February 13, 1996), many different hardware changes were evaluated, and five actuator hardware change options were presented to the Station Technical Review Board. The final design (and supporting calculations) of the approved changes listed above are scheduled to be completed by July 8, 1996, for the Unit 1 valves and approximately July 21, 1997, for the Unit 2 valves. Zion Station will provide this information to the NRC staff upon their completion.

2. **Regarding valves 1(2)RC8000A,B Pressurizer Power Operated Relief Valve Block Valves, ComEd's submittal states that in a steam generator tube rupture scenario, the valves will be opened as quickly as possible after event initiation prior to significant cooldown. Has ComEd determined the postulated RCS pressure at the time the valve would be required to open and completed thrust requirement and actuator capability calculations assuming this pressure? If so, please provide these calculations for the staff's review.**

In addition, ComEd's submittal discusses the potential susceptibility of these valves to thermal binding with respect to low temperature overpressurization protection (LTOP). Commonwealth Edison's submittal states that these valves are not required to perform a safety function prior to implementing LTOP and that the valves are required to open prior to implementing LTOP. This wording is somewhat unclear. Please provide a more detailed explanation of the potential susceptibility of these valves to thermal binding.

Response:

The Reference (b) response was based upon engineering judgment which determined that a steam generator tube rupture would not result in a rapid depressurization of the Reactor Coolant System (RCS). As such, Zion did not analytically determine the postulated RCS pressure at the time the valve would be required to be opened following a Steam Generator Tube Rupture (SGTR). However, in response to the subject Request for Additional Information (RAI), prior to August 15, 1996, Zion will complete calculations which demonstrate the valve capability under pressure locking conditions. Preliminary calculations using the Byron and Braidwood analysis technique show significant positive margin for Zion Station.

The following discussion is intended to provide a more detailed explanation of the potential susceptibility of the 1(2)RC8000 A & B Pressurizer Power Operated Relief Valve (PORV) Block Valves to thermal binding. The valves can be closed at RCS operating temperature to isolate a leaking PORV. The valves are potentially susceptible to thermal binding if the RCS is then cooled to enter hot shutdown. The valves are not required to perform an opening safety function during RCS cooldown. The valves would be required to be opened in order to enter hot shutdown (Mode 4) and engage the low temperature overpressurization protection (LTOP) system. The inability to open the valves when trying to initiate LTOP would cause the affected unit to enter the Limiting Condition for Operation (LCO) for LTOP. Alternate means of overpressure protection can be accomplished as provided in the LCO action statement. Furthermore, RCS cooldown and subsequent opening of the PORVs is a common evolution and years of industry operating experience has not shown problems with thermal binding in this scenario. The only reason these valves would be closed during RCS cooldown is to isolate a leaking or inoperable PORV. Zion does not consider it prudent to periodically stroke these valves open during cooldown in this case due to the potential of causing RCS leakage and/or a pressure transient.

ATTACHMENT

DRESDEN

1. **Valves 2(3)-2301-36, HPCI Suppression Pool Suction, if flexible-wedge, split-wedge or double-disk gate valves, may be potentially susceptible to thermally-induced pressure locking caused by heat transfer from the suppression pool during a design basis event. Has the licensee evaluated the potential heat transfer from the suppression pool during a design basis event, and the associated thrust requirement/actuator capability calculations? If so, please provide these evaluations for the staff's review.**

   Response:

   The 2(3)-2301-36, HPCI Suppression Pool Suction, motor operated valves (MOV) are solid wedge gate valves and thus, are not susceptible to thermally induced pressure locking.

2. **Valves 2(3)-2301-3, HPCI Turbine Steam Admission, if flexible-wedge, split-wedge or double-disk gate valves, may be potentially susceptible to thermally-induced pressure locking if they exist in a configuration which may trap steam condensate. In addition, these valves if flexible-wedge, split-wedge or double-disk gate valves, may be potentially susceptible to thermal binding if opened for HPCI testing, shut in a hot condition, allowed to cool, and subsequently required to open at a lower temperature. Please discuss the pressure locking/thermal binding evaluation completed for these valves.**

   Response:

   The 2(3)-2301-3, HPCI Turbine Steam Admission MOVs are flexible-wedge gate valves. The valves are insulated and located in vertical pipe lines with the stems horizontal. There are drain pots/steam traps upstream and downstream of the valve which keep the steam line drained of condensate. Therefore, the 2(3)-2301-3 is not susceptible to pressure locking because the valve is drained of condensate.

   The upstream drain pot/steam trap also provide a continuous supply of steam, at normal reactor pressure and temperature, to the normally closed 2(3)-2301-3 which maintains the valve in a hot condition during standby operation. There is no actual measured temperature data which provides valve body temperature in the test or standby conditions. HPCI system testing, which simulates ECCS initiation from a standby condition (DOS 2300-07, HPCI Fast Initiation Test), is performed each operating cycle and provides proof that thermal binding does not occur in MOV 2(3)-2301-3. A motor current trace of MOV 3-2301-3 was performed coincident with the HPCI Fast Initiation Test performed on April 1, 1995, and indicated that there was no thermal binding occurring in the standby condition. Therefore, the 2(3)-2301-3 is not susceptible to thermal binding because the valve is kept in a hot condition prior to an initiation signal.

3. **In Attachment 1 to GL 95-07, the staff requested that licensees include consideration of the potential for gate valves to undergo pressure locking or thermal binding during surveillance testing. During workshops on GL 95-07 in each Region, the staff stated that if the closing and subsequent pressure locking or thermal binding of a safety related power operated gate valve during the performance of a test or surveillance would defeat the capability of the safety system or train, the appropriate technical specifications must be followed unless one of the following actions has been taken within the scope of GL 95-07:**

   1. **Verify that the valve is not susceptible to pressure locking or thermal binding while closed.**

   2. **Demonstrate that the actuator has sufficient capacity to overcome these phenomena, or**

   3. **Make appropriate hardware and/or procedural modifications to prevent pressure locking and thermal binding.**

The staff stated that normally open, safety-related power-operated gate valves which are closed for test or surveillance but which must be returned to the open position should be evaluated within the scope of GL 95-07. Please discuss if all valves which meet this criterion were included in the review, and the way in which the potential pressure locking or thermal binding concerns were addressed.

Response:

Dresden Station's review for susceptibility to pressure locking and thermal binding did include the surveillance testing condition. The following discussions are the results of the original evaluation and the subsequent review performed in response to this RAI.

Thermally induced pressure locking or thermal binding:

No valves were determined to be susceptible to this condition due to the surveillance's short duration and static (no flow) system condition which do not introduce temperature transients.

Sudden depressurization induced pressure locking or thermal binding:

The review did identify 4 valves, 2(3)-1402-24A/B (Core Spray Pump Discharge Outboard Isolation Valve), that would be susceptible to sudden depressurization pressure locking during an IST or stroke time surveillance test or if system operation was altered by having this valve be normally closed. These normally open valves were identified as susceptible in Reference (b) (Dresden Response Attachment 2), with an action to drill a hole in the disk of these valves if they are ever disassembled in the future for other valve maintenance. No procedure changes were made to the IST or stroke time surveillance testing procedures at that time since the event was not considered credible, due to the short time duration that these valves are closed. Subsequent to receipt of this RAI, Dresden Station has reevaluated this low probability scenario. Dresden Station will declare

the corresponding system inoperable whenever any of the 4 normally open valves are closed for surveillance testing when the plant is in a mode that can create the sudden depressurization scenario. Station procedures covering the applicable surveillance tests will be revised to reflect this position by July 31, 1996. This requirement may be eliminated as these valves are modified in the future by drilling a hole in the disc to prevent pressure locking.

4. **Through review of operational experience feedback, the staff is aware of instances in which licensees have completed design or procedural modifications to preclude pressure locking or thermal binding which may have had an adverse impact on plant safety due to incomplete or incorrect evaluation of the potential effects of these modifications. Please describe evaluations and training for plant personnel that have been conducted for each design or procedural modification completed to address potential pressure locking or thermal binding concerns.**

Response:

Dresden Station has precluded pressure locking concerns by drilling a hole in one disk of selected motor operated valves. A safety evaluation was performed for each of these valves. Station Piping and Instrument Drawings (P&ID) and Station Maintenance procedures were also revised to reflect where the hole is located and the correct orientation of the disk in these valves. These activities will be performed for future changes of this type in accordance with station procedures.

A description of pressure locking and thermal binding conditions and the equipment and procedural changes performed was provided to the Licensed Operators in the general training package.

ATTACHMENT

QUAD CITIES

1. **Regarding the potential susceptibility of valves 1(2)-2301-3, HPCI Turbine Steam Supply, to thermal binding, Commonwealth Edison's (ComEd's) submittal states that these valves are closed hot after stroke testing or high pressure coolant injection (HPCI) flow testing and remain hot prior to an initiation signal. Does ComEd have test data, such as temperature measurements of the valve body while open and later shut, to verify this assertion? If so, please provide these results for the staff"s review.**

   Response:

   Quad Cities Station does not have test data such as temperature measurements to support this assertion. Currently, both units are in cold shutdown so the data can not be obtained. Unit 1 and 2 are scheduled to start up in the near future with a HPCI system run when normal operating pressure is reached. Temperature data will be collected during these runs and at a later time when the valves are shut with the system in standby line up to support this assertion. This information will be forward to the Staff within 30 days after the data is collected.

   It should be noted that the systems have been started from the standby lineup after previous HPCI system operation during the same operating cycle without exhibiting thermal binding characteristics. In the standby lineup the valve is closed with normal operating pressure and temperature steam present at the valve at all times.

2. **In Attachment 1 to GL 95-07, the staff requested that licensees include consideration of the potential for gate valves to undergo pressure locking or thermal binding during surveillance testing. During workshops on GL 95-07 in each Region, the staff stated that if the closing and subsequent pressure locking or thermal binding of a safety related power operated gate valve during the performance of a test or surveillance would defeat the capability of the safety system or train, the appropriate technical specifications must be followed unless one of the following actions has been taken within the scope of GL 95-07:**

   1. **Verify that the valve is not susceptible to pressure locking or thermal binding while closed.**

   2. **Demonstrate that the actuator has sufficient capacity to overcome these phenomena, or**

   3. **Make appropriate hardware and/or procedural modifications to prevent pressure locking and thermal binding.**

   The staff stated that normally open, safety-related power-operated gate valves which are closed for test or surveillance but which must be returned to the open position should be evaluated within the scope of GL 95-07. In Section 5.2.2, Valve Functional Review, ComEd's submittal states that inservice testing (IST) stroke time testing or other surveillances which cycle the valve are not to be included in the review. This appears to be inconsistent with the recommendations of GL 95-07. Please discuss how this specific GL 95-07 concern has been addressed.

Response:

Quad Cities Station's review for susceptibility to pressure locking and thermal binding did include the surveillance testing condition of positioning a normally open valve closed with a safety function to reopen. Cases where the susceptibility to pressure locking and thermal binding is caused by surveillances of short duration such as IST and stroke time testing were not included for the following reasons:

Normally open valves are IST and stroke time tested with the plant in a stable condition, without the system in operation. This means that there is no system flow and steady state temperature conditions. Under no flow steady state temperature conditions there is no potential for thermal binding or thermally induced pressure locking. If the valve is required to return to the safety position during an event it would reposition prior to becoming pressure locked or thermally bound due to a temperature transient.

The review did identify 8 valves that would be susceptible to sudden depressurization pressure locking during an IST or stroke time surveillance test. They are 1(2)-1402-24A/B, 1(2)-2301-9, and 1(2)-1301-48. These normally open valves were not included as susceptible because for the short time duration that these valves are closed the event was not considered credible.

To address the low probability that an event could occur during a surveillance test resulting in a sudden depressurization pressure lock condition Quad Cities Station will drill a hole in the disc of these valves if they are ever disassembled in the future for other valve maintenance. A tracking item has been established to alert engineering of pending valve internal maintenance on any of the subject valves so that a modification package can be generated to drill a hole in the valve disc.

Subsequent to receiving the RAI from the NRC staff Quad Cities Station has reevaluated the 8 valves that are susceptible to sudden depressurization pressure locking during IST and stroke time surveillance testing. As a result, Quad Cities Station will declare the corresponding valve inoperable whenever any of the 8 normally open valves are closed for surveillance testing when the plant is in a mode that can create the sudden depressurization scenario. Station procedures covering the applicable surveillance tests will be correspondingly revised. The procedure revisions will be completed by July 31, 1996. This requirement may be eliminated as these valves are modified in the future by drilling a hole in the disc to prevent pressure locking.

3. **Through review of operational experience feedback, the staff is aware of instances in which licensees have completed design or procedural modifications to preclude pressure locking or thermal binding which may have had an adverse impact on plant safety due to incomplete or incorrect evaluation of the potential effects of these modifications. Please describe evaluations and training for plant personnel that have been conducted for each design or procedural modification completed to address potential pressure locking or thermal binding concerns.**

Response:

Quad Cities uses approved station procedures to perform a design change, such as modification of equipment to prevent pressure locking or thermal binding, or for performing a procedure change. The approved station procedures for these processes ensure that the change does not result in any unreviewed safety issue in accordance with 10CFR50.59. Controls in the processes ensure that appropriately qualified personnel are involved in the review of the changes. The procedures also ensure that appropriate training requirements are identified associated with each modification or procedure change and tracked to completion.