

July 14, 2000

Mr. Mike Bellamy
Site Vice President
Entergy Nuclear Generation Company
Pilgrim Nuclear Power Station
600 Rocky Hill Road
Plymouth, MA 02360

SUBJECT: COMPLETION OF LICENSING ACTION FOR GENERIC LETTER 95-07,
"PRESSURE LOCKING AND THERMAL BINDING OF SAFETY-RELATED
POWER-OPERATED GATE VALVES," PILGRIM NUCLEAR POWER STATION
(TAC NO. M93504)

Dear Mr. Bellamy:

On August 17, 1995, the Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," to request that licensees take actions to ensure those safety-related power-operated gate valves that are susceptible to pressure locking or thermal binding are capable of performing their safety functions.

The licensee submitted their 180-day response to GL 95-07 for the Pilgrim Nuclear Power Station to the NRC on February 23, 1996. The NRC staff reviewed the submittal and requested additional information in a letter dated May 21, 1996. On June 20, 1996, the licensee provided a response. On March 24, 1999, the NRC staff made a second request for additional information regarding GL 95-07. By letter dated August 16, 1999, the licensee provided the additional information. The licensee provided an updated GL 95-07 responses on April 11 and June 28, 2000.

The NRC staff has reviewed the licensee's submittals and determined that the licensee has adequately addressed the actions requested in GL 95-07. Enclosed is the NRC staff's Safety Evaluation. We consider TAC No. MA93504 to be complete.

If you have any questions regarding this matter, please contact me at (301) 415-1445.

Sincerely,

/RA/

Alan B. Wang, Project Manager, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-293

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
LICENSEE RESPONSE TO GENERIC LETTER 95-07, "PRESSURE LOCKING
AND THERMAL BINDING OF SAFETY-RELATED POWER-OPERATED GATE VALVES"
PILGRIM NUCLEAR POWER STATION
DOCKET NO. 50-293

1.0 INTRODUCTION

On August 17, 1995, the Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," to request that licensees take certain actions to ensure those safety-related power-operated gate valves that are susceptible to pressure locking or thermal binding are capable of performing their safety functions within the current licensing bases of the facility. GL 95-07 requested that each licensee, within 180 days of the date of issuance of the generic letter (1) evaluate the operational configurations of safety-related power-operated gate valves in its plant to identify valves that are susceptible to pressure locking or thermal binding; and (2) perform further analyses and take needed corrective actions (or justify longer schedules) to ensure that the susceptible valves, identified in (1) above, are capable of performing their intended safety functions under all modes of plant operation, including test configurations. In addition, GL 95-07 requested that licensees, within 180 days of the date of issuance of the generic letter, provide to the NRC a summary description of (1) the susceptibility evaluation used to determine that valves are, or are not, susceptible to pressure locking or thermal binding; (2) the results of the susceptibility evaluation, including a listing of the susceptible valves identified; and (3) the corrective actions, or other dispositioning, for the valves identified as susceptible to pressure locking or thermal binding. The NRC issued GL 95-07 as a "compliance backfit" pursuant to 10 CFR 50.109(a)(4)(i) because modification may be necessary to bring facilities into compliance with the rules of the Commission.

The 180-day response to GL 95-07 for Pilgrim Nuclear Power Station was submitted by Boston Edison Company (now Entergy Nuclear Generation Company/the licensee) to the NRC by letter dated February 23, 1996. The NRC staff reviewed the response and requested additional information in a letter dated May 21, 1996. In a letter of June 20, 1996, the licensee provided the additional information. By letter dated August 16, 1999, the licensee provided a response to a second request for additional information regarding GL 95-07 forwarded by the NRC staff on March 24, 1999. The licensee provided an updated GL 95-07 response by letter dated April 11 and June 28, 2000.

Enclosure

2.0 REGULATORY REQUIREMENTS

Pressure locking and thermal binding represent potential common-cause failure mechanisms that can render redundant safety systems incapable of performing their safety functions. The identification of susceptible valves and the determination of when the phenomena might occur require a thorough knowledge of components, systems, and plant operations. Pressure locking occurs in flexible-wedge and double-disk gate valves when fluid becomes pressurized inside the valve bonnet and the actuator is not capable of overcoming the additional thrust requirements resulting from the differential pressure created across both valve disks by the pressurized fluid in the valve bonnet. Thermal binding is generally associated with a wedge gate valve that is closed while the system is hot and then is allowed to cool before an attempt is made to open the valve.

Pressure locking or thermal binding occurs as a result of the valve design characteristics (wedge and valve body configuration, flexibility, and material thermal coefficients) when the valve is subjected to specific pressures and temperatures during various modes of plant operation. Operating experience indicates that these situations were not always considered in many plants as part of the design basis for valves.

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50 (Appendix A, General Design Criteria 1 and 4) and plant licensing safety analyses require or commit (or both) licensees to design and test safety-related components and systems to provide adequate assurance that those systems can perform their safety functions. Other individual criteria in Appendix A to 10 CFR Part 50 apply to specific systems. In accordance with those regulations and licensing commitments, and under the additional provisions of 10 CFR Part 50 (Appendix B, Criterion XVI), licensees are expected to act to ensure that safety-related power-operated gate valves susceptible to pressure locking or thermal binding are capable of performing their required safety functions.

3.0 STAFF EVALUATION

3.1 Scope of Licensee's Review

GL 95-07 requested that licensees evaluate the operational configurations of safety-related power-operated gate valves in their plants to identify valves that are susceptible to pressure locking or thermal binding. The licensee's letters of February 23 and June 20, 1996, August 16, 1999, and April 11, 2000, described the scope of valves evaluated in response to GL 95-07. Normally open, safety-related power-operated gate valves which are closed for test or surveillance but must return to the open position were evaluated within the scope of GL 95-07. The criteria for determining the scope of power-operated valves for GL 95-07 are consistent with the staff's acceptance of the scope of motor-operated valves associated with GL 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," and GL 96-05, "Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves." The NRC staff has reviewed the scope of the licensee's susceptibility evaluation performed in response to GL 95-07 and found it to be complete and acceptable.

3.2 Corrective Actions

GL 95-07 requested that licensees, within 180 days, perform further analyses as appropriate, and take appropriate corrective actions (or justify longer schedules), to ensure that the susceptible valves identified are capable of performing their intended safety function under all modes of plant operation, including test configurations. The licensee's submittals discussed corrective actions to address potential pressure-locking and thermal-binding problems. The staff's evaluation of the licensee's actions is discussed in the following paragraphs:

a. The licensee stated that the following valves were modified to eliminate the potential for pressure locking:

MO1001-29A/B	Residual Heat Removal (RHR) Inboard Injection
MO1301-49	Reactor Core Isolation Cooling (RCIC) Injection
MO1400-25A/B	Core Spray Loop Inboard Injection
MO2301-8	High Pressure Coolant Injection (HPCI) Inboard Injection

In its letter dated August 16, 1999, the licensee stated that (1) valves MO1001-7A/B/C/D, RHR pump torus suction, were susceptible to pressure locking when the valves are closed for RHR shutdown cooling operation, and (2) procedural controls, modifications, or administrative controls or additional analysis would be evaluated to eliminate the potential for pressure locking. By letter dated June 28, 2000, the licensee committed to modify valves MO1001-7A/B/C/D to eliminate the potential for pressure locking by the end of the refueling outage scheduled for the spring of 2001. As a short-term corrective action, the licensee implemented an operability evaluation to address the potential for the valves to pressure lock. The staff finds that physical modification of valves susceptible to pressure locking is an appropriate corrective action to ensure operability of the valves and is thus acceptable.

b. The licensee stated that it used a thrust-prediction methodology developed by Commonwealth Edison Company (ComEd) to demonstrate that the following valves are capable of opening during pressure locking conditions:

MO1001-23A/B	RHR Containment Spray
MO1001-34A/B	RHR A and B Loop Torus Cooling/Spray Block
MO2301-3	HPCI Turbine Steam Admission

The margin between actuator capability and the required thrust for MO1001-34A was less than that required for long-term corrective action. By letter dated April 11, 2000, the licensee committed to perform a modification to eliminate the potential for pressure locking or increase the margin to an acceptable value. This modification will be implemented by the end of the refueling outage scheduled for April of 2001.

The licensee stated in its submittal dated August 16, 1999, that a relief valve was installed on the bonnet cavity on MO1001-34A and MO1001-34B to limit the pressure in the bonnet of each valve during thermal induced pressure-locking conditions. The licensee used the ComEd thrust-prediction methodology to demonstrate that the valves are capable of opening during pressure-locking conditions when pressure in the bonnet is below the relief valve setpoint.

On April 9, 1997, the staff held a public meeting to discuss the technical adequacy of the ComEd pressure-locking thrust prediction methodology and its generic use by licensees in their submittals responding to GL 95-07. The minutes of the public meeting were issued on April 25, 1997. At the public meeting, ComEd recommended that when using its methodology, minimum margins should be applied between calculated pressure-locking thrust and actuator capability. These margins along with diagnostic equipment accuracy and methodology limitations are defined in a letter from ComEd to the NRC dated May 29, 1998. The NRC considers the use of the ComEd pressure-locking methodology to be an acceptable long-term corrective action provided these margins, diagnostic equipment accuracy requirements, and methodology limitations are incorporated into the pressure-locking calculations. ComEd indicated that its methodology may be revised. The staff considers that calculations that are used to demonstrate that valves can overcome pressure locking are required to meet the requirements of 10 CFR Part 50, Appendix B, Quality Assurance Criteria for Nuclear Power Plants, and therefore, controls are required to be in place to ensure that any industry pressure-locking thrust prediction methodology requirements and revisions are properly implemented. Under this condition, the staff finds that the ComEd methodology provides a technically sound basis for ensuring that valves susceptible to pressure locking are capable of performing their intended safety-related function. The staff also considers use of the ComEd pressure-locking methodology to be an acceptable short-term corrective action provided that there is a positive margin between actuator capability and the thrust required to open the valve during pressure-locking conditions.

c. The licensee stated that all flexible and solid wedge gate valves in the scope of GL 95-07 were evaluated for thermal binding. When evaluating whether valves were susceptible to thermal binding, the licensee assumed that thermal binding would not occur below specific temperature thresholds. The screening criteria used by the licensee appear to provide a reasonable approach to identify those valves that might be susceptible to thermal binding.

Operating conditions for the RCIC turbine steam supply isolation valve, MO1301-17, exceed these temperature limitations; however, operational history demonstrates that the valve is not susceptible to thermal binding.

Operating conditions for the HPCI turbine steam supply isolation valves, MO 2301-3, MO2301-4, and MO2301-5, may exceed these temperature conditions. The actuator for each valve is equipped with a compensating spring pack which reduces valve closing forces and the potential for thermal binding. Until more definitive industry criteria are developed, the staff concludes that the licensee's actions to address thermal binding of gate valves are acceptable.

4.0 CONCLUSION

On the basis of this evaluation, the NRC staff finds that the licensee has performed appropriate evaluations of the operational configurations of safety-related power-operated gate valves to identify valves that are susceptible to pressure locking or thermal binding at the Pilgrim Nuclear

Power Station. In addition, the NRC staff finds that the licensee has taken, or is scheduled to take, the appropriate corrective actions to ensure that these valves are capable of performing their intended safety functions. Therefore, the staff concludes that the licensee has adequately addressed the requested actions discussed in GL 95-07.

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Date: July 14, 2000

Pilgrim Nuclear Power Station

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