



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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"
VERMONT YANKEE NUCLEAR POWER STATION
DOCKET NUMBER 50-271

1.0 INTRODUCTION

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.

2.0 REGULATORY REQUIREMENTS

10 CFR Part 50 (Appendix A, General Design Criteria 1 and 4) and plant licensing safety analyses require or commit (or both) that licensees 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.

On August 17, 1995, the 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 that safety-related power-operated gate valves that are

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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 configuration. 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 referenced above.

In a letter of February 8, 1996, Vermont Yankee Nuclear Power Corporation (VYNPC) submitted its 180-day response to GL 95-07 for the Vermont Yankee Nuclear Power Station. The NRC staff reviewed the licensee's submittal and requested additional information in letters dated May 23, 1996, and November 24, 1997. In letters of June 21, and 26, 1996, and January 23, and August 4, 1998, the licensee provided the additional information.

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 VYNPC letters of February 8, and June 21, and 26, 1996, and January 23, and August 4, 1998, described the scope of valves evaluated in response to GL 95-07. The NRC staff has reviewed the scope of the licensee's susceptibility evaluation performed in response to GL 95-07 and found it complete and acceptable.

The licensing bases for Vermont Yankee Nuclear Power Station is Hot Shutdown; therefore, valves that are operated during conditions below Hot Shutdown are not in 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."

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 configuration. The licensee's submittals discussed proposed 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:

V13-20	Reactor Core Isolation Cooling (RCIC) Injection
V13-21	RCIC Injection
V14-11A/B	Core Spray Injection
V14-12A/B	Core Spray Injection
V23-14	High Pressure Coolant Injection Steam Admission
V23-19	High Pressure Coolant Injection
V23-20	High Pressure Coolant Injection

The staff finds that physical modification to valves susceptible to pressure locking is an appropriate corrective action to ensure operability of the valves and is thus acceptable.

b. During a telephone conversation on September 9, 1998, the licensee clarified to the staff its bases for assuring that V10-26A, Residual Heat Removal (RHR) Drywell Spray Valve, is capable of opening during a pressure locking event. A design change was implemented to V10-26A that involved installation of an accumulator that limits the pressure in the bonnet from exceeding upstream pressure by more than 50 psig. A modified industry gate valve thrust equation (double disk area) was used to calculate the thrust required to open this double disk gate valve during pressure locking conditions when bonnet pressure is 50 psig greater than upstream pressure. The results of the calculation demonstrate that the margin between calculated pressure locking thrust and actuator capability exceed 40%. The information provided by the licensee is subject to confirmation during future NRC inspections. The staff finds that the licensee's modified industry gate valve thrust calculation/methodology provides a technically sound bases for assuring that valves susceptible to pressure locking are capable of performing their intended safety-related function.

c. The licensee stated that procedures were revised to declare the low pressure core injection system inoperable when V10-25A/B, RHR Low Pressure Core Injection Valves, are shut during surveillance testing. The staff finds that the licensee's procedural changes provide assurance that pressure locking conditions are promptly identified, and is thus acceptable.

d. 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. Valve V23-14, High Pressure Core Injection Steam Admission, is susceptible to thermal binding. As corrective action, procedures were revised to cycle V23-14 following every 10 °F increase in steam dome temperature. This corrective action and the screening criteria used by the licensee provide a reasonable approach to identify those valves that might be susceptible to 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 at Vermont Yankee Nuclear Power Station that are susceptible to pressure locking or thermal binding. In addition, the NRC staff finds that the licensee has taken 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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