



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

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"
BROWNS FERRY NUCLEAR PLANT, UNITS 2 AND 3
DOCKET NUMBERS 50-260 AND 50-296

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

Title 10, 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) 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 U.S. 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 that 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 (1.0) 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 13, 1996, Tennessee Valley Authority (TVA) submitted its 180-day response to GL 95-07 for Browns Ferry Nuclear Plant, Units 2 and 3. In a letter dated March 15, 1996, the licensee supplemented its 180-day response to GL 95-07. The NRC staff reviewed the licensee's submittals and requested additional information in a letter dated June 17, 1996. In a letter of July 30, 1996, the licensee provided the additional information. In a letter of February 19, 1999, the licensee supplemented its 180-day response to GL 95-07.

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 TVA letters of February 13, March 15, and July 30, 1996, and February 19, 1999, described the scope of valves evaluated in response to GL 95-07. Reactor Core Isolation Cooling (RCIC) Injection valves, 2/3 FCV-71-39, are not included in the licensee's GL 95-07 Program. However, the licensee stated in a letter dated January 6, 1997, that its RCIC motor operated valves would be included within its GL 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," Program in response to an NRC evaluation of its GL 89-10 scope. These valves were evaluated for pressure locking and thermal binding to ensure their capability to open for mitigation of certain licensing basis events. 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.

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:

2,3 FCV-74-53	Low Pressure Coolant Injection
2,3 FCV-74-67	Low Pressure Coolant Injection
2,3 FCV-75-25	Core Spray Injection
2,3 FCV-75-53	Core Spray 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.

The licensee stated that the RCIC pump injection valves, 2/3 FCV-71-39, were susceptible to pressure locking and that the valves would be modified to eliminate the potential for pressure locking during the Unit 2 refueling outage scheduled for Spring 2001 and the Unit 3 refueling outage scheduled for Fall 2000. In the interim, plant procedures require that the RCIC system be vented and the valves stroked on a monthly interval in order to verify that they will operate during pressure locking conditions. The staff finds that these interim corrective actions are acceptable because they provide assurance that pressure locking conditions are promptly identified and corrected. The long-term corrective actions to modify the valves are acceptable because the potential for pressure locking will be eliminated.

- c. The licensee stated that procedures were modified to cycle the high pressure coolant injection steam admission valves, 2,3 FCV-73-16, following evolutions that could potentially create a thermal binding condition. The staff finds that the licensee's procedural changes to require cycling the valves as corrective actions provide assurance that thermal binding conditions are eliminated, and are 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. The screening criteria used by the licensee appear to 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 the Browns Ferry Nuclear Plant, Units 2 and 3, that are susceptible to pressure locking or thermal binding. In addition, the NRC staff finds that the licensee has taken, or is scheduled to take, 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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