October 26, 2000

Mr. Craig G. Anderson
Vice President, Operations ANO
Entergy Operations, Inc.
1448 S. R. 333
Russellville, AR 72801

SUBJECT: GENERIC LETTER 95-07, RE: "PRESSURE LOCKING AND THERMAL BINDING OF SAFETY-RELATED POWER-OPERATED GATE VALVES," ARKANSAS NUCLEAR ONE, UNIT 1 (TAC M93427)

Dear Mr. Anderson:

On August 17, 1995, the Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 95-07 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 NRC staff has reviewed your submittal for Arkansas Nuclear One, Unit 1 and finds that you have adequately addressed the actions requested in GL 95-07, as discussed in the enclosed safety evaluation. This completes the staff's efforts on TAC M93427.

Sincerely,

/RA/

William D. Reckley, Project Manager, Section 1
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-313

Enclosure: Safety Evaluation

cc w/encls: See next page

October 26, 2000

Mr. Craig G. Anderson
Vice President, Operations ANO
Entergy Operations, Inc.
1448 S. R. 333
Russellville, AR 72801

SUBJECT: GENERIC LETTER 95-07, RE: "PRESSURE LOCKING AND THERMAL BINDING OF SAFETY-RELATED POWER-OPERATED GATE VALVES," ARKANSAS NUCLEAR ONE, UNIT 1 (TAC M93427)

Dear Mr. Anderson:

On August 17, 1995, the Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 95-07 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 NRC staff has reviewed your submittal for Arkansas Nuclear One, Unit 1 and finds that you have adequately addressed the actions requested in GL 95-07, as discussed in the enclosed safety evaluation. This completes the staff's efforts on TAC M93427.

Sincerely,

/RA/

William D. Reckley, Project Manager, Section 1
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-313

cc: See next page

DISTRIBUTION:
PUBLIC
PDIV-1 r/f
RidsOgcRp
RidsAcrsAcnwMailCenter
RidsNrrDlpmLpdiv1 (RGramm)
RidsNrrPMWReckley
RidsNrrLADJohnson
RidsRgn4MailCenter (K. Brockman)
S.Tingen

Accession No.: ML003763370 *SE input

OFFICE	PDIV-1/PM	PDIV-1/LA	EMEB/SC	PDIV-1/SC
NAME	WReckley:am	DJohnson	DTerao*	RGramm
DATE	9/11/00	10/24/00	5/26/00	10/25/00

OFFICIAL RECORD COPY

cc:

Executive Vice President
& Chief Operating Officer
Entergy Operations, Inc.
P. O. Box 31995
Jackson, MS 39286-1995

Director, Division of Radiation
Control and Emergency Management
Arkansas Department of Health
4815 West Markham Street, Slot 30
Little Rock, AR 72205-3867

Winston & Strawn
1400 L Street, N.W.
Washington, DC 20005-3502

Manager, Rockville Nuclear Licensing
Framatone Technologies
1700 Rockville Pike, Suite 525
Rockville, MD 20852

Senior Resident Inspector
U.S. Nuclear Regulatory Commission
P. O. Box 310
London, AR 72847

Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

County Judge of Pope County
Pope County Courthouse
Russellville, AR 72801

Vice President, Operations Support
Entergy Operations, Inc.
P. O. Box 31995
Jackson, MS 39286-1995

Wise, Carter, Child & Caraway
P. O. Box 651
Jackson, MS 39205

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"

ARKANSAS NUCLEAR ONE, UNIT 1

DOCKET NUMBER 50-313

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 requires 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

In Part 50 of Title 10 of The Code of Federal Regulations (10 CFR) (Appendix A, General Design Criteria (GDC) 1 and 4) (or comparable requirements for pre-GDC plants) 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 Nuclear Regulatory Commission (NRC or the Commission) 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 referenced above.

In letters dated February 13 and 20, 1996, Entergy Operations, Inc. (EOI or the licensee), submitted its 180-day response to GL 95-07 for Arkansas Nuclear One, Unit (ANO-1). The NRC staff reviewed the licensee's submittals and requested additional information in a letter dated June 14, 1996. In a letter dated July 15, 1996, the licensee provided the additional information. The NRC staff requested additional information in the letter dated April 1, 1999, and the licensee provided the additional information in letters dated April 30 and August 12, 1999. In a letter dated May 17, 2000, the licensee supplemented its February 13 and July 15, 1996, and April 30, 1999, submittals.

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 EOI letters dated February 13 and July 15, 1996, and April 30 and August 12, 1999, 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 licensee did not include shutdown cooling hot leg suction valves CV-1050, CV-1404, and CV-1410, in the scope of GL 95-07 because these valves are used during plant conditions below Hot Shutdown. This is acceptable because the safe shutdown design basis for ANO-1 is Hot Shutdown. 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, except in the instances when the system/train is declared inoperable in accordance with technical specifications (TSs). 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 Power-Operated Valves.”

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:

CV-2803 Emergency Feedwater (EFW) Pump Service Water Suction
CV-2806 EFW Pump Service Water Suction

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

b. In its letter dated May 17, 2000, the licensee stated that it plans to use a thrust-prediction methodology developed by Commonwealth Edison Company (ComEd) to demonstrate that the following valves are capable of opening during pressure-locking conditions:

CV-1000 Pressurizer Electromatic Relief Valve Isolation (hydraulic pressure locking)
CV-1276 A Decay Heat (DH) Cooler Loop Discharge to Makeup (MU) Suction
CV-1277 B DH Cooler Loop Discharge to MU Pump Suction
CV-1400 Low Pressure Injection (LPI)/DH Loop Isolation
CV-1401 LPI/DH Loop Isolation
CV-2613 EFW Turbine Steam Admission
CV-2620 EFW Pump to Steam Generator (SG) B Emergency Feedwater
CV-2626 EFW Pump to SG B Emergency Feedwater Isolation
CV-2627 EFW Pump to SG A Emergency Feedwater Isolation
CV-2663 EFW Turbine Steam Admission Valve
CV-2670 EFW Pump to SG A Emergency Feedwater Isolation

The licensee committed to re-evaluate and complete the calculations for these valves, using the ComEd methodology, by May 2001 and complete any modifications to achieve an acceptable margin or eliminate the potential for pressure locking, if required, by the end of the refueling outage scheduled for the fall of 2002. Any valve operability concerns that might be identified in the future will be processed in accordance with established regulatory requirements and plant-specific commitments.

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. ComEd indicated that its methodology may be revised in the future

to refine the margins. NRC considers the use of the ComEd pressure locking methodology acceptable, provided these margins (or revised margins), diagnostic equipment accuracy specifications, and methodology limitations are incorporated into the pressure-locking calculations. 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 assuring that valves susceptible to pressure locking are capable of performing their intended safety-related function.

The licensee stated that it is currently using its thrust-prediction methodology (Entergy Hub Method) to demonstrate that these valves are capable of opening during pressure-locking conditions. The NRC staff considers use of the Entergy Hub Method an acceptable short-term corrective action to demonstrate that the valves are capable of operating during pressure-locking conditions.

c. The licensee stated that the pressurizer electromatic relief valve isolation valve, CV-1000, is also susceptible to thermal induced pressure locking during plant heatup evolutions. TS 3.1.1.7 requires that three reactor coolant system (RCS) vent paths be available when the RCS temperature is above 280 °F and CV-1000 can be utilized as one of the vent paths. As corrective action, procedures were revised to require that CV-1000 be maintained in the open position during heatup of the plant when CV-1000 is designated as one of the RCS vent paths. The staff finds that the licensee's procedural changes provide assurance that this thermal induced pressure-locking condition has been adequately identified and 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. Operating conditions for the EFW turbine steam inlet valves, CV-2613 and CV-2663, exceed these temperature thresholds; however, operational history demonstrates that the valves are not susceptible to thermal binding.

Operating conditions for the reactor building sump isolation valves, CV-1405 and CV-1406, also exceed the temperature thresholds for thermal binding. As corrective action, plant procedures were revised to require that the sump suction lines be filled with water when RCS temperature is greater than 200 °F. The licensee stated that the pressurizer electromatic relief valve isolation valve, CV-1000, is susceptible to thermal binding. Procedures were revised to require that CV-1000 be opened at the beginning of a cooldown or cycled every 100 °F during the cooldown if the valve is shut to eliminate the potential for the valve to thermally bind.

The licensee stated that the LPI/DH loop isolation valves, CV-1400 and CV-1401, are susceptible to thermal binding. Procedures were revised to state that the valves should be closed when the RCS temperature is less than 200 °F. The licensee stated that the EFW injection valves, CV-2620, CV-2626, CV-2627, and CV-2670, are susceptible to thermal binding. Procedures were revised to declare the valves inoperable when these

normally open valves are closed hot and then cooled down prior to reopening. If the valves are closed when temperature is above 200 °F (CV-1400 and CV-1401) or 280 °F (CV-2620, CV-2626, CV-2627, and CV-2670), the procedures require that design engineering personnel develop contingency actions (i.e., valve cycle intervals) to maintain the valves operable.

The staff finds that (1) the licensee's procedural changes provide assurance that thermal binding conditions are adequately identified and eliminated, and are thus acceptable; and (2) 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 ANO-1 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 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.

Principal Contributor: S. Tingen

Date: October 26, 2000