VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

August 6, 1999

Attn: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555-0001

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Docket Nos. 50-280/281
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NPF-4/7

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
NORTH ANNA POWER STATION UNITS 1 AND 2
GENERIC LETTER 95-07 PRESSURE LOCKING AND THERMAL BINDING OF SAFETY-RELATED POWER-OPERATED GATE VALVES
REQUEST FOR ADDITIONAL INFORMATION (RAI)

On August 17, 1995 the staff issued Generic Letter (GL) 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves" to request licensees to take actions to ensure safety-related power-operated gate valves that are susceptible to pressure locking or thermal binding are capable of performing their safety functions. In a letter dated February 7, 1996, Virginia Electric and Power Company (Virginia Power) provided our response to GL 95-07 for North Anna and Surry Power Stations. Virginia Power provided additional information to the staff in a July 3, 1996 letter.

In a telephone conference call on May 6, 1999 to discuss gate valve operation, additional information was requested by the NRC to complete their review of safety-related power-operated gate valve operation. The attachments to this letter provide our response to the NRC staff's request for additional information documented in letters dated May 20 and 25, 1999 for North Anna and Surry, respectively.

No new commitments are intended as a result of this letter. If you have any questions or require additional information, please contact us.

Very truly yours,

David A. Christian
Vice President - Nuclear Operations

Attachments

A056

cc: U.S. Nuclear Regulatory Commission
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Mr. R. A. Musser
NRC Senior Resident Inspector
Surry Power Station

Mr. M. J. Morgan
NRC Senior Resident Inspector
North Anna Power Station

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by David A. Christian, who is Vice President - Nuclear Operations, of Virginia Electric and Power Company. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 6th day of August, 1999.

My Commission Expires: 3/31/2000

Maggie McClure
Notary Public

(SEAL)

Attachment 1

NRC Request for Additional Information (RAI)
Generic Letter 95-07

North Anna Power Station Units 1 and 2
Virginia Electric and Power Company

NORTH ANNA POWER STATION
RESPONSE TO GENERIC LETTER 95-07
"PRESSURE LOCKING AND THERMAL BINDING OF SAFETY-RELATED POWER-OPERATED GATE VALVES"

Question #1

Your submittal dated July 3, 1996, stated that calculations were used to demonstrate that the high head safety injection (HHSI) pump discharge to alternate reactor coolant system (RCS) cold leg valves, 1(2)-SI-MOV-1(2)836 and the HHSI pump discharge to RCS hot leg valves, 1(2)-SI-MOV-1(2)869A/B, would operate during pressure locking conditions. Verify that the temperatures of the valves do not increase during the recirculation phase of a postulated accident and that the 0.3 valve factor and the 0.2 stem factor used in your pressure locking calculations are consistent with GL 89-10 Program valve and stem factors.

Response #1

A calculation has been performed that verifies that valves 1(2)-SI-MOV-1(2)836 and 1(2)-SI-MOV-1(2)869A/B do not increase in temperature prior to opening during the recirculation phase of a postulated accident. The values used for valve and stem factors in pressure locking calculations are consistent with the valve and stem factors used in the GL 89-10 program.

Question #2

Your submittal dated July 3, 1996, states that the boron injection tank outlet valves, 1(2)-SI-MOV-1(2)867C/D, are not susceptible to pressure locking because it is acceptable for the actuators to operate for a short period of time under locked rotor conditions. The actuators will operate at locked rotor until a HHSI pump develops full discharge pressure and the boron injection tank valves, 1(2)-SI-MOV-1(2)867A/B, partially open.

NRC Inspection Report 50-338, 339/97-01 states that the actuators for the casing cooling pump discharge isolation valves 1(2)-RS-MOV-1(2)00A/B and the quench spray pump discharge valves 1(2)-QS-MOV-1(2)-1(2)01A/B, may operate at locked rotor conditions until the casing cooling and quench spray pumps develop full discharge pressure.

The NRC has accepted operation of motor-operated valve motor actuators for approximately 1 second at locked rotor conditions because testing performed by Idaho National Engineering Laboratory (NUREG/CR-6478) demonstrates that the capability of the actuator does not degrade for that period of time.

Explain how long valves 1(2)-SI-MOV-1(2)867C/D, 1(2)-RS-MOV-1(2)00A/B and 1(2)-QS-MOV-1(2)01A/B would operate at locked rotor conditions. If greater than 1 second, then explain, how any reduction in actuator capability due to operation at locked rotor was accounted for or describe any testing that demonstrates that actuator capability will or will not degrade after operating at locked rotor for greater than approximately a second.

Response #2

Virginia Power is not taking credit for operation of motor-operated valve operators at locked rotor in pressure locking scenarios. As stated in NRC inspection report (50-338, 339/97-01), in reference to valves 1(2)-SI-MOV-1(2)867C/D and 1(2)-RS-MOV-1(2)00A/B, "The inspectors independently calculated the thrust required to overcome pressure locking and the actuator capability for these valves and concluded that the actuators were able to develop the thrust required to overcome pressure locking without reaching locked rotor conditions." A calculation has been performed that demonstrates that the motor-operators for valves 1(2)-SI-MOV-1(2)867A/B/C/D, 1-RS-MOV-100B, and 2-RS-MOV-200A/B are capable of developing the thrust required to overcome pressure locking. It should be noted that valve 1-RS-MOV-100A is a solid wedge gate valve and therefore not susceptible to pressure locking.

In order to remove valves 1(2)-QS-MOV-1(2)01A/B from potential pressure locking conditions, a change to the surveillance procedure was completed in 1997. The procedural change requires valves 1/2-QS-MOV-1(2)01A/B to be stroked following quench spray pump testing or pump maintenance.

Question #3

Explain why the pressurizer power-operated relief valve (PORV) block valves, 1-RC-MOV-1535, 1-RC-MOV-1536 and 2-RC-MOV-2535, are not susceptible to thermal binding when the valves are shut at approximately 650°F to isolate a leaking pressurizer PORV and then cool down after the loop seal reforms (2-RC-MOV-2536 is not susceptible to thermal binding because it is equipped with a compensating spring pack). These valves are required to be opened during a steam generator tube rupture event. Discuss any operational experience that demonstrates that the valves are not susceptible to thermal binding.

Response #3

The PORV block valves identified above, 1-RC-MOV-1535, 1-RC-MOV-1536 and 2-RC-MOV-2535 are 3 inch, 1500 lb., flexible wedge, Velan gate valves. As a minimum, the North Anna Units 1 and 2 Technical Specifications require the PORV block valves to be demonstrated operable (cycled) at least once per 92 days, unless the valves are required to be closed for Technical Specification compliance.

In 1995 the Westinghouse Owners Group (WOG) Pressure Locking Thermal Binding (PLTB) task team compiled information from participating utilities which documented that there were no occurrences of pressure locking or thermal binding of PORV block valves over many years of PORV block valve operation. In addition, a literature search performed by the WOG PLTB task team discovered only one case of thermal binding of a PORV block valve (reference NUREG 1275) and that PORV block valve was at a non-Westinghouse plant. Further, a discussion between a WOG PLTB member and a NRC staff member revealed that the valve that failed was a solid wedge gate valve and was subsequently replaced with a flexible wedge gate valve.

As stated in question #3, a closed PORV block valve(s) may be required to open in the event of a steam generator tube rupture (SGTR). During the event, when the valve(s) would be required to open the Reactor Coolant System (RCS) would be at a pressure less than 2235 psig due to a loss of inventory. During opening under these conditions, the valves would experience a lower differential pressure across the valve. The lower differential pressure across the valve would result in more actuator motor margin available to open the PORV block valves. Therefore, the surveillance stroking of a closed PORV block valve under normal plant conditions would bound the SGTR conditions when considering thermal binding.

Nine and a half years of historical surveillance testing was reviewed to determine if PORV block valves 1-RC-MOV-1535, 1-RC-MOV-1536 or 2-RC-MOV-2535 were closed and remained closed which allowed for valve cooldown to occur. Two occurrences were discovered, the first on June 19, 1994 and the second on October 11, 1998. In both instances, PORV block valve 1-RC-MOV-1536 was closed for a minimum of 24 hours and then reopened without incident. Valve 1-RC-MOV-1536 was VOTES tested on September 19, 1998 and the seating thrust measured was 9199 lb_f. It should be noted that this seating thrust value is within 6% of the maximum seating thrust for the subject valves. On October 11, 1998, valve 1-RC-MOV-1536 was closed due to PORV 1-RC-PCV-1455C leaking. Therefore, valve 1-RC-MOV-1536 was closed with substantial thrust and remained closed allowing valve cooldown. Subsequently, valve 1-RC-MOV-1536 was cycled on October 31, 1998 and left in the open position.

In summary, the PORV block valves are not susceptible to thermal binding based on the following: 1) the valves are a flexible wedge design which is less susceptible to thermal binding than a solid wedge design; 2) the successful operating history with a valve closed for a period of time which permitted valve cool down and then reopened; 3) the valves are stroke tested once every 92 days to meet Technical Specification

surveillance requirements; and, 4) cycling a closed PORV block valve at normal plant operating conditions bounds the conditions under which the valves would have to operate during a SGTR.

Question #4

In Attachment 1 to GL 95-07, the NRC staff requested that licensees include consideration of the potential for gate valves to undergo pressure locking condition or thermal binding during surveillance testing. Valve stroke time testing is considered a surveillance test. During workshops on GL 95-07 in each region, the NRC staff stated that, if closing a safety-related power-operated gate valve for test or surveillance defeats the capability of the safety-related system or train, the licensee should perform one of the following within the scope of GL 95-07:

a. Verify that the valve is not susceptible to pressure locking or thermal binding while closed,
b. Follow plant technical specifications for the train/system while the valve is closed,
c. Demonstrate that the actuator has sufficient capability to overcome these phenomena, or
d. Make appropriate hardware and/or procedural modifications to prevent pressure locking and thermal binding.

Verify that normally open, safety-related power-operated gate valves, which are closed for surveillance but must be returned to the open position, were evaluated in accordance with one of these criteria.

Response #4

As part of Virginia Power's response to GL 95-07, an assessment was performed regarding the susceptibility of safety-related power-operated gate valves to pressure locking or thermal binding during surveillance testing. Virginia Power has re-reviewed the population of valves that are potentially subject to pressure locking or thermal binding for susceptibility during surveillance testing and determined that the criteria stated above has been satisfied.

Attachment 2

NRC Request for Additional Information (RAI)
Generic Letter 95-07

Surry Power Station Units 1 and 2
Virginia Electric and Power Company

SURRY POWER STATION
RESPONSE TO GENERIC LETTER 95-07
"PRESSURE LOCKING AND THERMAL BINDING OF SAFETY-RELATED POWER-OPERATED GATE VALVES"

Question #1

During a postulated accident, the containment would be initially pressurized to a peak pressure and the bonnets of the low head safety injection (LHSI) pump containment sump isolation valves, 1(2)-SI-MOV-1(2)860A/B, could also be pressurized to containment peak pressure. When transferring to the recirculation phase of a postulated accident, containment pressure could be lower than the initial peak pressure but the pressure in the bonnets of 1(2)-SI-MOV-1(2)860A/B could still be at containment peak pressure. Discuss if the pressure in the bonnets of the valves could be higher than upstream and downstream pressure due to changes in containment pressure when the valves are required to open and, if applicable, if the valves will open during this pressure locking condition.

Response #1

Virginia Power concurs that the bonnets of 1(2)–SI-MOV-1(2)860A/B could be pressurized to containment pressure and therefore the bonnet pressure could be at a slightly higher pressure than the upstream and downstream pressure when transferring to the recirculation phase of a postulated accident. A calculation has been performed that verifies that valves 1(2)-SI-MOV-1(2)860A/B have adequate operator margin and will operate during this pressure-locking scenario.

Question #2

Your submittal dated July 3, 1996, stated that calculations were used to demonstrate that the high head safety injection (HHSI) pump discharge to alternate reactor coolant system (RCS) cold leg valves, 1(2)-SI-MOV-1(2)842, and the HHSI pump discharge to RCS hot leg valves, 1(2)-SI-MOV-1(2)869A/B, would operate during pressure locking conditions. Verify that these valves are flexible wedge gate valves and that the temperature of the valves does not increase during the recirculation phase of the accident.

Response #2

Valves 1-SI-MOV-1842, 1-SI-MOV-1869B and 2-SI-MOV-2869A/B are flexible wedge gate valves. Valves 2-SI-MOV-2842 and 1-SI-MOV-1869A are double disc gate valves.

A calculation has been performed that verifies that valves 1(2)-SI-MOV-1(2)842 and 1(2)-SI-MOV-1(2)869A/B do not increase in temperature prior to opening. This is true whether the valves open prior to the recirculation phase or open after the recirculation phase is initiated.

Question #3

Your submittal dated July 3, 1996, states that the presssurizer power-operated relief valve (PORV) block valves, 1(2)-RC-MOV-1(2)535/536, are not a pressure locking concern because the valves' bonnets are filled with steam. These valves are a pressure locking concern at other Westinghouse plants for steam generator tube rupture events. These pressure locking evaluations assume 2235 psig in the bonnet of the valves (parallel disc or flexible wedge gate valves and steam or water in the bonnet) and an RCS pressure of approximately 1400-1500 psig. As a result, the valves are modified or a calculation is used to demonstrate that the valves will operate during this pressure locking scenario. Explain why pressure locking is not a concern for the pressurizer PORV block valves at Surry.

Response #3

As stated in Virginia Power's submittal dated July 3, 1996, valves 1/2–RC-MOV-1535/1536 (2535/2536) are maintained on steam by a loop seal drain line located upstream of the valves. Virginia Power did not postulate that the bonnet of a closed PORV block valve could fill completely with condensate and become water solid thereby introducing the potential for a pressure lock situation during a steam generator tube rupture (SGTR). A Virginia Power calculation has been performed that demonstrates that the subject block valves have sufficient operator margin to open with a water solid bonnet during this pressure locking scenario.

Question #4

In Attachment 1 to GL 95-07, the NRC staff requested that licensees include consideration of the potential for gate valves to undergo pressure locking condition or thermal binding during surveillance testing. Valve stroke time testing is considered a surveillance test. During workshops on GL 95-07 in each region, the NRC staff stated that the licensee should perform one of

the following actions within the scope of GL 95-07 if closing a safety-related power-operated gate valve for test or surveillance defeats the capability of the safety system or train:

a. **Verify that the valve is not susceptible to pressure locking or thermal binding while closed,**
b. **Follow plant technical specifications for the train/system while the valve is closed,**
c. **Demonstrate that the actuator has sufficient capability to overcome these phenomena, or**
d. **Make appropriate hardware and/or procedural modifications to prevent pressure locking and thermal binding.**

Verify that normally open, safety-related power-operated gate valves, which are closed for surveillance but must be returned to the open position, were evaluated in accordance with one of these criteria.

Response #4

As part of Virginia Power's response to GL 95-07, an assessment was performed regarding the susceptibility of safety-related power-operated gate valves to pressure locking or thermal binding during surveillance testing. Virginia Power has re-reviewed the population of valves that are potentially subject to pressure locking or thermal binding for susceptibility during surveillance testing and determined that the criteria stated above has been satisfied.