VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

February 7, 1996

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

Serial No. 95-566A
NL&P/MAE: R5
Docket Nos. 50-280/-281
50-338/-339
License Nos. DPR-32/-37
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

On August 17, 1995, the NRC issued Generic Letter 95-07, entitled "Pressure Locking and Thermal Binding Of Safety-Related Power-Operated Gate Valves." The generic letter requested two actions. First, within 90 days, 1) perform a screening evaluation of the operational configurations of all safety-related power operated gate valves to identify those valves that are potentially susceptible to pressure locking and thermal binding, and 2) document a basis for their operability. Second, within 180 days, 1) evaluate the operational configurations of all safety-related power operated gate valves susceptible to pressure locking and thermal binding, and 2) perform further analyses and corrective actions with justification for longer implementation schedules as needed.

The completion of the 90 day requested actions was addressed in our letter of November 15, 1995 (Serial No. 95-566). The intent of this letter is to inform you that we have completed the 180 day requested actions. The information requested by the generic letter is attached.

After applying component and system screening criteria, it was determined that 22 valves at North Anna Power Station and 20 valves at Surry Power Station were potentially susceptible to pressure locking and/or thermal binding. However, after performing further analyses, it was determined that only 2 valves from each unit at Surry Power Station require modifications. These modifications will be performed during the 1997 refueling outages, currently scheduled for February 1997 and November 1997 for Units 1 and 2, respectively. Performing the modifications at this time is acceptable because the valves were evaluated for actuator capability at the pressure locked condition assuming degraded voltage, and found to have margin. No

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valves at North Anna Power Station require modifications.

If you have any questions, please contact us.

Very truly yours,

James P. O'Hanlon
Senior Vice President - Nuclear

Attachment

cc: Regional Administrator
U.S. Nuclear Regulatory Commission
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Atlanta, Georgia 30323

Mr. M. W. Branch
NRC Senior Resident Inspector
Surry Power Station

Mr. R. D. McWhorter
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 J. P. O'Hanlon, who is Senior Vice President - Nuclear, of Virginia Electric and Power Company. He is duly authorized to execute and file the foregoing document in behalf of that Company, and the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 7TH day of February, 1996.

My Commission Expires: May 31, 1998.

Vicki L. Hull
Notary Public

(SEAL)

PRESSURE LOCKING AND THERMAL BINDING OF SAFETY-RELATED POWER OPERATED GATE VALVES
NRC GENERIC LETTER 95-07
180 DAY REQUESTED INFORMATION

Due to the various parameters involved in determining valve susceptibility, a joint effort with Westinghouse and other utilities was determined to be the most prudent approach to develop a consistent, effective and comprehensive methodology for valve evaluations.

The scope of the review consisted of all power operated gate valves. The review evaluated the operational configurations (normal, accident and in-service testing) to identify the valves that are susceptible to pressure locking or thermal binding.

Screening criteria were developed in order to reduce the population of valves to facilitate reviews to determine which valves are potentially susceptible to pressure locking or thermal binding. The criteria used were: 1) a valve function review, 2) a component review, and 3) a system review. At the completion of the system review further analyses were performed on the list of potentially susceptible valves to determine susceptibility.

The valve function criteria determined the initial population of valves. The component criteria determined which valves could be removed from being potentially susceptible to either pressure locking or thermal binding due to valve design. The system criteria determined which valves could be removed from potential susceptibility to either pressure locking or thermal binding based on system operating conditions. Finally, further analyses were accomplished on the valves which were determined to be potentially susceptible after the system criteria review. This resulted in the identification of the susceptible valve population.

The following summarizes the **valve function criteria**:

> A list was originated of power operated safety-related gate valves which have a function to open and are normally or intermittently closed.

The following summarizes the **component screening criteria**:

> If a valve is a solid wedge type valve, then it is not susceptible to pressure locking. Therefore, it is removed from further pressure locking consideration.
>
> If the valve has a feature which would mitigate pressure locking (e.g. hole drilled in disc, bonnet equalization line installed etc.), then it is not susceptible to pressure locking. Therefore, it is removed from further pressure locking consideration.
>
> If the valve is a double disc gate valve, then it is not susceptible to thermal binding. Therefore, it is removed from further thermal binding consideration.

The following summarizes the **system screening criteria** to determine the valves potentially susceptible to **pressure locking**:

A review of valve/system operation was accomplished to determine if the valve is subjected to a high differential pressure when closed. If yes, can the subject valve's adjacent piping become depressurized? If yes, then the valve is potentially susceptible. If no, then the evaluation continues.

A review of valve/system operation was accomplished to determine if the valve is subjected to a high differential pressure across the valve due to backleakage (e.g., through check valves) from a high pressure source when closed. If yes, can the subject valve's adjacent piping become depressurized? If yes, then the valve is potentially susceptible. If no, then the evaluation continues.

A review of valve/system operation was accomplished to determine if the valve is subjected to high ambient temperatures or high fluid system temperatures before it is required to open. If yes, then the valve is potentially susceptible. If no, then the evaluation continues.

A review of valve/system operation was accomplished to determine if the valve is orientated in such a way as to trap steam condensate in the bonnet of the valve. If yes, then the valve is potentially susceptible.

If all of the above system screening pressure locking criteria were answered no, then the valve is not potentially susceptible to pressure locking.

The following summarizes the **system screening criteria** to determine the valves potentially susceptible to **thermal binding**:

A review of valve/system operation was accomplished to determine if the valve is closed hot and permitted to cool prior to opening. If no, then the evaluation is complete. If yes, then continue the evaluation.

With the valve closed can a significant temperature gradient develop across the valve? A significant temperature gradient is defined as greater than 100°F for a flexible wedge or greater than 50° F for a solid wedge. If no, then the valve is not susceptible. If yes, then continue with the evaluation.

An operating threshold temperature (less than 200°F) was established at which thermal binding does not have to be considered. If the valve is closed at a temperature less than this temperature, then the valve is not potentially susceptible to thermal binding.

POTENTIALLY SUSCEPTIBLE VALVES/COMPONENT SCREENING

The following is a list of potentially susceptible valves at North Anna and Surry Power Stations based on the completion of the **component screening criteria.** (Note: In the following listings "X" refers to Unit designator, 1 or 2):

NORTH ANNA POWER STATION UNITS 1/2

Chemical Volume and Control System

X-CH-MOV-X115B/D	REFUELING WATER STORAGE TANK ISOLATION
X-CH-MOV-X350	EMERGENCY BORATE ISOLATION

Safety Injection System

X-SI-MOV-X890C/D	LHSI PUMP DISCHARGE TO RCS COLD LEGS
X-SI-MOV-X864A/B	LHSI PUMP DISCHARGE TO RCS COLD LEGS
X-SI-MOV-X836	HHSI PUMP DISCHARGE TO ALT RCS COLD LEGS
X-SI-MOV-X863A/B	LHSI PUMP TO HHSI PUMP ISOLATION
2-SI-MOV-2860A/B	LHSI CONTAINMENT SUMP ISOLATION
X-SI-MOV-X867A/B	HHSI PUMP DISCHARGE TO RCS COLD LEGS (BIT INLET)
X-SI-MOV-X867C/D	HHSI PUMP DISCHARGE TO RCS COLD LEGS (BIT OUTLET)
X-SI-MOV-X869A/B	HHSI PUMP DISCHARGE TO RCS HOT LEGS

Quench Spray System

X-QS-MOV-X01A/B	QUENCH SPRAY PUMP DISCHARGE
X-QS-MOV-X02A/B	REFUELING WATER CHEMICAL ADD TANK ISOLATION

Reactor Coolant System

X-RC-MOV-X535	PRESSURIZER PORV BLOCK VALVE
X-RC-MOV-X536	PRESSURIZER PORV BLOCK VALVE

Recirculation Spray System

X-RS-MOV-X00A/B	CASING COOLING DISCHARGE VALVES

Residual Heat Removal System

X-RH-MOV-X700	RHR INLET ISOLATION
X-RH-MOV-X701	RHR INLET ISOLATION
X-RH-MOV-X720A	RHR OUTLET ISOLATION
X-RH-MOV-X720B	RHR OUTLET ISOLATION

Control Room Air Conditioning Chilled Water System

X-HV-MOV-X11A/B/C	CHILLER OUTLET ISOLATION
X-HV-MOV-X13A/B/C	CONDENSER OUTLET ISOLATION

SURRY POWER STATION UNITS 1/2

Chemical Volume and Control System

X-CH-MOV-X115B/D	REFUELING WATER STORAGE TANK ISOLATION
X-CH-MOV-X350	EMERGENCY BORATE ISOLATION

Safety Injection System

X-SI-MOV-X890C	LHSI PUMP DISCHARGE TO RCS COLD LEGS
X-SI-MOV-X890A/B	LHSI PUMP DISCHARGE TO RCS HOT LEGS
X-SI-MOV-X864A/B	LHSI PUMP DISCHARGE TO RCS COLD LEGS
X-SI-MOV-X842	HHSI PUMP DISCHARGE TO ALT RCS COLD LEGS
X-SI-MOV-X863A/B	LHSI PUMP TO HHSI PUMP ISOLATION
X-SI-MOV-X860A/B	LHSI CONTAINMENT SUMP ISOLATION
X-SI-MOV-X869A/B	HHSI PUMP DISCHARGE TO RCS HOT LEGS

Auxiliary Feedwater System

X-FW-MOV-X60A/B	AUXILIARY FEEDWATER CROSS CONNECT

Containment Spray System

X-CS-MOV-X02A/B	REFUELING WATER CHEMICAL ADD TANK ISOLATION

Reactor Coolant System

X-RC-MOV-X535	PRESSURIZER PORV BLOCK VALVE
X-RC-MOV-X536	PRESSURIZER PORV BLOCK VALVE

Residual Heat Removal System

X-RH-MOV-X700	RHR INLET ISOLATION
X-RH-MOV-X701	RHR INLET ISOLATION
X-RH-MOV-X720A	RHR OUTLET ISOLATION
X-RH-MOV-X720B	RHR OUTLET ISOLATION

VALVES REQUIRING FURTHER ANALYSIS

The potentially susceptible valves which were identified after the **component screening criteria** were then reviewed using the **system screening criteria** for pressure locking and thermal binding. The following are the valves determined to be potentially susceptible following the completion of the **system screening criteria** review:

North Anna Power Station:

X-SI-MOV-X867A/B HHSI PUMP DISCHARGE TO RCS COLD LEGS (BIT INLET)

The valves were determined to be potentially susceptible to hydraulic pressure locking under very specific conditions. In the SI standby mode, the upstream side of the valves are exposed to HHSI pump discharge pressure and the downstream side is exposed to the boron injection tank (BIT) operating pressure. During a loss of power concurrent with a LOCA, HHSI pressure could be trapped in the bonnet of these valves. However, upon restoration of emergency power, the HHSI pumps start quickly and will equalize pressure across the upstream disc of the valve creating a bonnet vent path prior to the valves reaching their respective thermal overload settings. Hence, the valves will operate as required, no modifications are required and the valves are determined to be not susceptible.

X-SI-MOV-X867C/D HHSI PUMP DISCHARGE TO RCS COLD LEGS (BIT OUTLET)

The valves were determined to be potentially susceptible to hydraulic pressure locking. In the SI standby mode, the upstream side of the valves are exposed to BIT pressure and downstream the valves have the potential to see RCS pressure as a result of downstream check valve backleakage. Therefore, during a loss of power concurrent with a LOCA, these valves are potentially capable of having RCS pressure locked in the bonnet due to a depressurized RCS. However, upon restoration of emergency power, the HHSI pumps start quickly and will equalize pressure across the upstream disc of the valves creating a bonnet vent path prior to the valves reaching their respective thermal overload settings. Hence, the valves will operate as required, no modifications are required and the valves are determined to be not susceptible.

2-SI-MOV-2860A/B LHSI CONTAINMENT SUMP ISOLATION

Unit #2 LHSI containment sump valves were determined to be potentially susceptible to thermally induced pressure locking. However, further evaluation determined that the containment sump at North Anna Unit #2 is maintained in a water filled condition. This condition provides a thermal barrier to prevent rapid heating of the fluid remaining in the bonnets of the normally closed containment sump isolation valves (2-SI-MOV-2860A/B) in the event of a LOCA. Therefore,

these valves are not susceptible to thermally induced pressure locking.

X-RH-MOV-X700/X701 RHR SYSTEM ISOLATION
X-RH-MOV-X720A/B

These valves were determined to be potentially susceptible to pressure locking. However, there has been no history of problems with these valves that can be attributed to pressure locking or thermal binding. Since, North Anna Power Station is licensed to achieve hot shut down, these valves are determined to be outside the scope of Generic Letter 95-07. This distinction was stated at the NRC Workshop on Pressure Locking/Thermal Binding, Public Meeting, Region I, on November 2, 1995.

X-RC-MOV-X535/X536 PORV BLOCK VALVES

These valves were determined to be potentially susceptible to pressure locking and thermal binding because of the potential of a loop seal forming due to condensed steam upstream of the valves when closed. In the event of a Steam Generator Tube Rupture (SGTR), this condensed steam has the potential of being trapped in the bonnet of the closed PORV block valve. An analysis of the operator capability at the degraded voltage condition during this event has demonstrated that the valves have adequate margin to open against the postulated pressure locked condition and to overcome any thermal binding. In addition, the valves are flexible wedge valves which makes them less susceptible to thermal binding.

Surry Power Station:

X-SI-MOV-X890A/B LHSI PUMP DISCHARGE TO RCS HOT LEGS

Valves X-SI-MOV-X890A/B were determined to be susceptible to pressure locking. These valves isolate the LHSI system from the RCS hot legs. The valves are not opened during the injection phase or cold leg recirculation phase of a LOCA but are remote manually opened when switching over to hot leg recirculation. During normal operation, it can be postulated that the valve's downstream disc is moved off its seat allowing RCS fluid into the bonnet. During a LOCA, it is postulated that as the RCS is depressurizing, RCS fluid is trapped in the valve bonnet. Therefore, it has been determined that these valves have the potential to become pressure locked.

Proposed Corrective Action

In order to remove these valves from susceptibility, a modification to valves X-SI-MOV-X890A/B will be accomplished. The valves have a capped connection on the valve body to facilitate the installation of a bonnet cavity pressure equalization line.

Corrective Action Schedule

The modifications to valve 1-SI-MOV-1890A/B will be accomplished during the 1997 Unit 1 refueling outage. The modification to valves 2-SI-MOV-2890A/B will be accomplished during the 1997 Unit 2 refueling outage.

Justification for Corrective Action Schedule

Since valves X-SI-MOV-X890A/B function to provide an alternate path (via the RCS hot legs) for LHSI, the safety significance of these valves not opening when called upon is reduced. These valves have been evaluated for risk significance based on the August 1991 PSA model used in the Individual Plant Examination (IPE) and the valves were determined to be ranked as a low risk (Fussel-Vesely risk, $< 1E-3$ but $\geq 1E-4$). In addition, the valves were evaluated for actuator capability at the pressure locked condition assuming degraded voltage and found to have the following margins: 1-SI-MOV-1890A / 20% margin, 1-SI-MOV-1890B / 20% margin, 2-SI-MOV-2890A / 23% margin and 2-SI-MOV-2890B / 20% margin. Finally, these valves are also called upon to open approximately 10 hours after a LOCA. During this period, some leakage past the discs, sufficient to significantly reduce the bonnet pressure is expected.

X-SI-MOV-X860A/B LHSI CONTAINMENT SUMP ISOLATION

These valves were determined to be potentially susceptible to pressure locking. However, currently the containment sumps at Surry Power Station are maintained in a water filled condition to provide a thermal barrier to prevent rapid heating of the fluid remaining in the bonnets of the normally closed containment sump isolation valves. Therefore the valves are not susceptible to pressure locking.

X-RH-MOV-X700/X701 RHR SYSTEM ISOLATION
X-RH-MOV-X720A/B

These valves were determined to be potentially susceptible to pressure locking. However, there has been no history of problems with these valves that can be attributed to pressure locking or thermal binding. Since, Surry Power Station is licensed to achieve hot shut down, these valves are determined to be outside the scope of Generic Letter 95-07. This distinction was stated at the NRC Workshop on Pressure Locking/Thermal Binding, Public Meeting, Region I, on November 2, 1995.

X-RC-MOV-X535/X536 PORV BLOCK VALVES

These valves were determined to be potentially susceptible to thermal binding. However, the upstream disc is exposed to saturated steam from the pressurizer which reduces the cooldown of the valve. Additionally, an analysis of the operator capability at degraded voltage condition demonstrated that the valves have adequate margin to open against the postulated thermally bound case. Finally, the valves are flexible wedge valves which makes them less susceptible to thermal binding.