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REPLY TO
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February 8, 1996
BVY 96-07

United States Nuclear Regulatory Commission
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References: (a) License No. DPR-28 (Docket No. 50-271)
(b) NRC Generic Letter 95-07, NVY 95-110, dated August 17, 1995
(c) Letter, VYNPC to USNRC, BVY 95-107, dated October 10, 1995

Enclosure: Vermont Yankee Power Operated Valve Pressure Locking/Thermal Binding Evaluation

Subject: Response to NRC Generic Letter 95-07, "Pressure Locking and Thermal Binding of Safety Related Power-Operated Gate Valves"

This letter transmits the 180-day response required by Generic Letter 95-07, Reference (b). Vermont Yankee has completed the evaluations requested in Reference (b) to identify safety-related, power-operated gate valves that may be susceptible to pressure locking or thermal binding. Four (4) potentially susceptible valves have been identified. Operability assessments, administrative controls, and procedural changes have been completed to assure operability of these valves until the required valve modifications are completed.

Enclosed is a summary of the valves evaluated for pressure locking and thermal binding. This summary includes the criteria used to determine that a valve is considered susceptible to pressure locking or thermal binding, the bases for considering operable those valves found to be susceptible and the schedule for performing the required valve modifications.

We trust that the information provided is satisfactory; however, should you have any questions or desire additional information, please do not hesitate to contact us.

Sincerely,

VERMONT YANKEE NUCLEAR POWER CORPORATION

Jay K. Thayer

Jay K. Thayer
Vice President, Engineering

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Enclosure

c: USNRC Regional Administrator, Region 1
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SALLY A. SANDSTRUM NOTARY PUBLIC WINDHAM COUNTY, VERMONT

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Then personally appeared before me, Jay K. Thayer, who being duly sworn, did state that he is Vice President, Engineering, of Vermont Yankee Nuclear Power Corporation, that he is duly authorized to execute and file the foregoing document in the name and on the behalf of Vermont Yankee Nuclear Power Corporation, and that the statements therein are true to the best of his knowledge and belief.

Sally A. Sandstrum

Sally A. Sandstrum — Notary Public
My Commission Expires — February 10, 1999

Enclosure
BVY 96-07

VERMONT YANKEE

GENERIC LETTER 95-07

POWER OPERATED VALVE

PRESSURE LOCKING/THERMAL BINDING

EVALUATION SUMMARY

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I. SUMMARY

NRC Generic Letter (GL) 95-07 required that licensees perform a screening evaluation of all safety-related power operated gate valves to identify valves potentially subject to pressure locking or thermal binding.

GL 95-07 also requires that within 180 days of issuance, licensees evaluate the operational configuration of safety related power operated gate valves. There are no safety-related air-operated or electro-hydraulically operated gate valves at Vermont Yankee. Therefore, this issue is for valves in the GL 89-10 MOV scope. This summary documents the results of the evaluations performed on these valves to determine if they are susceptible to pressure locking or thermal binding.

The following valves are potentially subject to pressure locking and/or thermal binding:

HPCI Injection Test Valve	V23-20
RCIC Injection Test Valve	V13-20
RHR Drywell Spray Valve	V10-26A
HPCI Steam Admission Valve	V23-14

Operability assessments, administrative controls or procedural changes have been completed to assure operability of these valves until modifications can be completed.

Section V contains a summary of each valve in the scope of GL 95-07.

II. BACKGROUND

In the past year a number of Information Notices related to pressure locking/thermal binding of motor-operated gate valves have been issued. Additionally, the NRC held a Public Workshop on November 2, 1995 on GL 95-07 where they provided guidance and answered licensee questions on this issue. This recent guidance adversely affects a number of valves given the scenarios postulated by the NRC.

As a result of this concern, discussions during the recent NRC inspection at VY and the latest NRC guidance, a review of the VY criteria used for valve heat-up or cooldown was performed.

III. EVALUATION CRITERIA

The following criteria were used to determine if a valve is susceptible to either pressure locking or thermal binding which can prevent the valve from meeting its safety function:

1. Pressure locking and thermal binding is only applicable to gate valves. Any valve that is not a gate valve is excluded from any further evaluation for susceptibility to pressure locking or thermal binding.

2. Pressure locking and/or thermal binding of a gate valve only occurs when the valve is closed and the valve is required to open to perform its safety function. Valves that must only be closed to perform their safety function are not required to be evaluated for pressure locking or thermal binding.

3. Double-disc parallel-seat gate valves are not subject to thermal binding due to their disc design. The wedging mechanism between the double discs collapses as the stem rises. This permits the parallel discs to move inward and be raised regardless of the change in system temperature.

4. Solid wedge gate valves are not subject to pressure locking since the disc does not contain a cavity at the seating surfaces that can be pressurized, and simultaneous leak tightness of both disc sealing surfaces cannot be reliably achieved.

5. Gate valves that perform beyond design basis event opening or recovery from mispositioning only are excluded from this evaluation.

Utilizing the criteria above, GL 95-07 valves were identified that were considered to be susceptible to pressure locking or thermal binding.

IV. EVALUATION METHOD

Utilizing the above criteria, each of the valves in the GL 89-10 program have been screened for susceptibility to pressure locking and thermal binding. No further evaluation was required for each valve eliminated based on one of the above screening criteria.

The following are the conditions that must occur before the valve is required to open for pressure locking or thermal binding to potentially exist:

Thermal Binding

Thermal binding of a valve could occur if a valve is closed when hot and then cools down appreciably before it is required to open. The valve body and seats contract a greater amount than the disc causing the seats to bind the disc more tightly, increasing the force required to open the valve, possibly exceeding the capabilities of the motor operator. Vermont Yankee's analysis assumes a temperature change of 50°F as a bounding criteria for all valves except V23-14, a flexible wedge valve, for which 150°F is assumed. These temperature assumptions were presented at the November 1995 Public Workshop by another BWR and are considered appropriate for Vermont Yankee.

Pressure Locking

1. Pressure locking could occur if a valve is closed in a system that operates at or is pressurized. The bonnet cavity and the area between the valve discs fill with pressurized water, equalizing with system pressure over time. Subsequently, before the valve is required to open, the system pressure suddenly drops and the higher pressure fluid is trapped in the bonnet area and the area between the valve discs. The

pressurized fluid forces the discs even tighter against the seats, trapping the pressurized fluid and preventing it from leaking by the discs. When the valve is required to open, the extra force required to open the valve due to the discs being pressed against the valve seats could potentially exceed the capability of the motor operator.

2. Hydraulic locking is a sub-set of pressure locking and could occur if a valve is closed in a system that is normally filled and slightly pressurized. The bonnet cavity and the area between the valve discs fill with water, equalizing with line pressure over time. (Note that the head of water from a filled tank can provide enough pressure to fill the valve internals.) Subsequently, before opening, the valve is heated by hotter fluid on either side of the valve disc or by an external heat source. Heating of the water in the bonnet and disc cavity results in the thermal expansion of the trapped fluid, increasing the sealing force of the valve discs against the seats. When the valve is required to open, the extra force required to open the valve due to the discs being pressed against the valve seats could potentially exceed the capability of the motor operator.

All areas in the plant have an allowable range of normal temperatures during nonaccident/transient conditions. Seasonal temperature swings of up to 20 to 40°F can be expected. Overnight variations are also expected. These variations take place over relatively long periods of time which allow bonnet pressure to equalize with system pressure. For this reason these variations are not considered in this evaluation.

Vermont Yankee is using a 10°F temperature rise in fluid temperature in the valve bonnet as the criteria for determining the onset of pressure locking due to heatup of trapped water in the valve bonnet. The 10°F, temperature rise is also the basis for determining when an area becomes harsh per the EQ Program. Discussions with NRC representatives during the Question and Answer period of the November 1995 Public Workshop indicated that a 10°F rise would be appropriate. This is much more conservative than the 50°F rise previously used.

Where the potential for either pressure locking or thermal binding exists, the valve is identified as being subject to pressure locking and/or thermal binding.

V. EVALUATION RESULTS

The following GL 95-07 Valves are motor-operated globe valves which are not subject to thermal binding or pressure locking:

V10-27A, RHR LPCI Injection Valve
V10-27B, RHR LPCI Injection Valve
V10-34A, RHR Torus Cooling Discharge Inboard
V10-34B, RHR Torus Cooling Discharge Inboard
V10-38A, RHR Torus Spray Discharge Inboard
V10-38B, RHR Torus Spray Discharge Inboard
V10-65A, RHR Heat Exchanger Bypass

V10-65B, RHR Heat Exchanger Bypass
V10-89A, RHR Heat Exchanger Service Water Outlet
V10-89B, RHR Heat Exchanger Service Water Outlet
V13-27, RCIC Minimum Flow Isolation
V13-30, RCIC CST Test Return
V13-131, RCIC Steam Admission Valve
V13-132, RCIC Turbine Accessory Cooling Water
V14-26A, Core Spray Full Flow Test Valve
V14-26B, Core Spray Full Flow Test Valve
V23-21, HPCI CST Test Return
V23-25, HPCI Minimum Flow Isolation
V70-257A, Service Water SFPCS Heat Exchanger Throttle
V70-257B, Service Water SFPCS Heat Exchanger Throttle
VG-22A, CAD Drywell Throttle Vent Isolation
VG-22B, CAD Torus Throttle Vent Isolation

The remaining GL 95-07 valves were evaluated for thermal binding or pressure locking. The following are the results/conclusions of this evaluation and potential corrective actions for these valves:

Valve Number: V2-43A,B

Results/Conclusions: These double disk valves are normally open and do not have a safety function to open or close.

Corrective Actions: None Required.

Valve Number: V2-53A,B

Results/Conclusions: These double disk valves are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V2-54A,B

Results/Conclusions: These double disk valves are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V2-74

Results/Conclusions: This solid wedge valve is not subject to thermal binding or pressure locking which can prevent it from performing its safety function to close.

Corrective Actions: None Required.

Valve Number: V2-77

Results/Conclusions: This solid wedge valve is not subject to thermal binding or pressure locking which can prevent it from performing its safety function to close.

Corrective Actions: None Required.

Valve Number: V10-16A,B

Results/Conclusions: These solid wedge valves are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V10-13A,B,C,D

Results/Conclusions: These solid wedge valves are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V10-15A,B,C,D

Results/Conclusions: These solid wedge valves are not subject to thermal binding or pressure locking which can prevent them from performing their safety function to close.

Corrective Actions: None Required.

Valve Number: V10-16A,B

Results/Conclusions: These solid wedge valves are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V10-17

Results/Conclusions: This flexible wedge valve is not subject to thermal binding or pressure locking which prevents it from performing its safety function to close.

Corrective Actions: None Required.

Valve Number: V10-18

Results/Conclusions: This double disk valve is not subject to thermal binding or pressure locking which prevents it from performing its safety function to close.

Corrective Actions: None Required.

Valve Number: V10-25A,B

Results/Conclusions: These normally open flexible wedge valves are not subject to thermal binding. Prior to issuance of Generic Letter 95-07 these valves were identified as being potentially susceptible to pressure locking in the event of excessive check valve back-leakage during surveillance testing of V10-27A,B. Plant procedures were revised to prevent pressure locking the valve in the event of excessive check valve back-leakage during this surveillance test.

Corrective Actions: None required.

Valve Number: V10-26A

Results/Conclusions: This double disk valve is not subject to thermal binding. This valve could be subject to pressure locking.

Corrective Actions: V10-26A will be modified during the 1996 Refueling Outage.

Valve Number: V10-26B

Results/Conclusions: This solid wedge valve is not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V10-31A,B

Results/Conclusions: These double disk valves are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V10-39A,B

Results/Conclusions: These solid wedge valves are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V10-57, 66

Results/Conclusions: These solid wedge valves are not subject to thermal binding or pressure locking which can prevent them from performing their safety function to close.

Corrective Actions: None Required.

Valve Number: V10-183, 184

Results/Conclusions: These solid wedge valves are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V12-15, 18

Results/Conclusions: These flexible wedge valves are not subject to thermal binding or pressure locking which can prevent them from performing their safety function to close.

Corrective Actions: None Required.

Valve Number: V13-15, 16

Results/Conclusions: These solid wedge valves are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V13-18

Results/Conclusions: This solid wedge valve is not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V13-20

Results/Conclusions: This flexible wedge valve is not subject to thermal binding. It could be subject to pressure locking during surveillance testing.

Corrective Actions: This valve will be modified during the 1998 refueling outage.

Valve Number: V13-21

Results/Conclusions: This flexible wedge valve was modified by drilling a hole in the feedwater side disk and is not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V13-39, 41

Results/Conclusions: These solid wedge valves are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V14-5A,B

Results/Conclusions: These solid wedge valves are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V14-7A,B

Results/Conclusions: These solid wedge valves are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V14-11A,B

Results/Conclusions: These flexible wedge valves were modified by drilling a hole in the reactor side disk and are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V14-12A,B

Results/Conclusions: These flexible wedge valves were modified by drilling a hole in the reactor side disk and are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V19-220, 221

Results/Conclusions: These double disk valves are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V23-14

Results/Conclusions: This flexible wedge valve is potentially subject to thermal binding during reactor cooldown and pressure locking during reactor heatup.

Corrective Actions: Procedures have been changed to address the potential thermal binding concern during reactor cooldown. V23-14 will be modified during the 1996 refueling outage.

Valve Number: V23-15, 16

Results/Conclusions: These flexible wedge valves are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V23-17

Results/Conclusions: This solid wedge valve is not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V23-19

Results/Conclusions: This flexible wedge valve was modified by drilling a hole in the feedwater side disk and is not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V23-20

Results/Conclusions: This flexible wedge valve is not subject to thermal binding. It could be subject to pressure locking during surveillance testing.

Corrective Actions: V23-20 will be modified during the 1996 refueling outage.

Valve Number: V23-57, 58

Results/Conclusions: These solid wedge valves are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V70-19A,B

Results/Conclusions: These solid wedge valves are not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V70-20

Results/Conclusions: This solid wedge valve is not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

Valve Number: V70-117

Results/Conclusions: This solid wedge valve is not subject to thermal binding or pressure locking.

Corrective Actions: None Required.

VI. BASIS FOR OPERABILITY SUMMARY

A. RCIC Injection Valve V13-20 and HPCI Injection Valve 23-20

Based on current NRC guidance, unless a system is made inoperable in accordance with the appropriate Technical Specification, the system needs to remain operable during testing. This requires verification that normally open valves, which have a safety function to open, are not susceptible to pressure locking or thermal binding while closed for testing. These valves may be subject to pressure locking via back leakage through a leaking check valve or due to sudden depressurization if a loss of feedwater or LOCA occurred. Even though the testing takes only a few minutes, the valves may be susceptible to pressure locking and in accordance with the current NRC guidelines presented at the NRC Public Workshop and this susceptibility to pressure locking needs to be addressed by one of the following:

1. Declare the system/valve inoperable prior to testing per applicable tech spec.

2. Modify valves to prevent pressure locking.

3. Modify testing procedure to verify that there is no check valve back-leakage. Note, if there is back leakage testing cannot be performed and appropriate actions must be taken.

4. Modify testing procedures to relieve any pressure increase due to back leakage.

5. Analyze valve actuator to ensure sufficient thrust/torque margin to overcome the potential double disk drag forces caused by pressure locking.

These normally open valves are closed briefly during quarterly IST surveillance of the normally closed injection valves in series with them. As a conservative measure, therefore, these systems are declared inoperable during the surveillance testing. HPCI Injection Valve V23-20 will be modified during the 1996 refueling outage. RCIC Injection Valve V13-20 will be modified during the 1998 refueling outage.

B. Lower Drywell Spray Outboard Isolation Valve V10-26A

V10-26A is a double disk gate valve which is potentially susceptible to pressure locking if water is trapped within the bonnet without air pockets and the bonnet is subsequently heated or pressure is locked in the bonnet during surveillance testing following RHR pump operation. The valve has not been analyzed to overcome the double disk drag forces created if the valve becomes pressure locked.

The valve may be subject to branch line heat up because of the close proximity of the valve to the torus cooling piping. In this situation the valve would be exposed to

water at the RHR heat exchanger outlet temperature which is estimated to be approximately 35°F higher than the valve temperature in a LOCA scenario. The valve would be exposed to this increased temperature for about 20 minutes before the valve would be opened to initiate drywell spray.

The following factors compensate for the potential pressure locking of this valve:

1. Valve V10-26A is installed in a horizontal line with its stem horizontal. A significant volume of air would be trapped in the bonnet even if there was stem leakage. Another BWR has performed testing which shows that 1-2% air volume precludes pressure locking. We estimate that approximately 5-10% of the bonnet volume is trapped air.

2. Valve V10-26A is not subject to pressure locking due to sudden depressurization except during surveillance testing following operation of a Residual Heat Removal (RHR) pump. Procedural/administrative controls have been established to prevent valve opening if RHR pumps have been run within the previous 24 hours unless a pump is currently running.

3. Valve V10-26A was replaced during the 1993 outage. There has been no indication of pressure locking during the quarterly IST valve surveillances. Additionally, the valve actuator can deliver 115% above the required force to overcome differential pressure. The pressure locking scenario of high surveillance line pressure versus low line pressure when the valve is required to open would yield a small amount of additional force to open, well within the current capability of the actuator.

4. The differential temperature causing the heatup of the valve is based on design SW inlet temperature and the RHR heat exchanger at its design fouling factor. Actual conditions are expected to be more favorable.

5. Only one train of drywell spray is credited for in the analysis. If both RHR trains are available as designed following a LOCA, adequate drywell spray is provided.

6. The redundant RHR loop valve (V10-26B) has a solid wedge and is not susceptible to pressure locking. Therefore, common mode failure due to pressure locking is not a concern. Additionally, both the A and B valves have been evaluated for susceptibility to thermal binding with no concerns identified.

7. Failure of all drywell spray has no effect on the IPE core damage frequency.

This valve will be modified during the 1996 refueling outage.

C. HPCI Steam Admission Valve V23-14

V23-14 is in the HPCI steam line and is installed in a horizontal line with the stem approximately 45 degrees below horizontal. It is normally closed and is required to open to allow HPCI turbine operation. Pressure locking of V23-14 is a potential operating concern during heatup of the HPCI turbine steam supply piping until the valve is cycled at normal temperature and pressure.

During system heatup, the valve orientation lends itself to the potential for water to collect in the piping near the valve seat and the water eventually makes its way into the valve bonnet. Once the bonnet is full, further heatup of the piping and valve could potentially result in pressure locking.

In order to ensure that the valve is not pressure locked during plant heatup, the valve must be cycled once normal operating temperature has been established. Additionally, V23-14 is cycled monthly in accordance with station Technical Specifications.

Pressure locking is not a concern during plant cooldown. Thermal binding is a concern during cooldown and is adequately addressed by plant procedures. The procedures now require the valve to be cycled following every 10°F increase in steam dome temperature to ensure valve availability during plant heatup.

This valve will be modified during the 1996 refueling outage. In the interim, procedural changes are sufficient to prevent thermal binding.