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SUBJECT: Responds to RAI re GL 95-07,"Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves."

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L-96-194

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

Re: Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251
Response to Request for Additional Information
Generic Letter 95-07,
Pressure Locking and Thermal Binding of
Safety-Related Power-Operated Gate Valves

By letter dated August 17, 1995, the NRC issued Generic Letter (GL) 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," requesting licensees to perform, or confirm that they performed, (1) evaluations of operational configurations of safety related, power operated gate valves for susceptibility to pressure locking and thermal binding and (2) further analyses, and any needed corrective actions, to ensure these valves are capable of performing their intended safety functions. By letter L-96-026 dated February 9, 1996, Florida Power and Light Company (FPL) provided its response to GL 95-07 for Turkey Point Units 3 and 4.

On June 26, 1996, the NRC issued a Request for Additional Information (RAI) regarding FPL's response to GL 95-07. In accordance with the NRC request, attached is FPL's response to the RAI for Turkey Point Units 3 and 4.

Should there be any questions concerning this response, please contact us.

Very truly yours,

R. J. Hovey
Vice President
Turkey Point Plant

OIH

cc: S. D. Ebneter, Regional Administrator, Region II, USNRC
T. P. Johnson, Senior Resident Inspector, USNRC, Turkey Point Plant

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ATTACHMENT TO L-96-194

Response to NRC Request for Additional Information
Generic Letter 95-07, "Pressure Locking and
Thermal Binding of Safety-Related Power-Operated Gate Valves"
Turkey Point Units 3 and 4

1. **The licensee's submittal discusses the susceptibility of valves MOV-3/4-744A/B, Low Head Safety Injection Isolation, and MOV-3/4-535&536, PORV Block Valves, to depressurization induced (hydraulic effects) pressure locking. The licensee's submittal discusses the valve manufacturer's design experience and testing results. The NRC staff believes that more detailed information is required to provide assurance of the capability of these valves to perform their safety functions. Please provide calculations, analysis, and/or testing, that has been performed to demonstrate the actuators' capability to overcome these potential depressurization induced pressure locking scenarios.**

FPL Response

The Low Head Safety Injection Isolation valves (MOV-3/4-744A/B) and the PORV block valves (MOV-3/4-535 & 536) were manufactured by the VELAN Valve Company. MOV-3/4-744A/B are 10x8x10 inch flex wedge gate valves and MOV-3/4-535 and 536 are 3 inch flex wedge gate valves. VELAN has performed testing to determine the effects hydraulic pressure locking would have on flex wedge gate valves of this design. The testing results showed that, for sufficiently rigid flex wedge gate valves similar in design to the Low Head Safety Injection Isolation valves (MOV-3/4-744A/B) and the PORV block valves (MOV-3/4-535 & 536), the effect of pressure locking was confined to the unbalanced load on the wedge due to the seat angle. Both valve designs are sufficiently rigid such that additional loads due to double disc drag do not have to be considered.

VELAN has developed an algorithm to predict the additional forces required to overcome hydraulic pressure locking. This analytical methodology and testing results were presented by VELAN Valve Corporation at the NRC sponsored "Workshop on Gate Valve Pressure Locking and Thermal Binding" held in New Orleans, LA on February 4, 1994. The VELAN presentation is documented in NUREG/CP-0146.

The additional opening thrust due to pressure locking is:

$$\text{Thrust} = A \tan 5^\circ (2P_B - P_U - P_D)$$

where: A equals the valve seat area
P_B equals the bonnet pressure
P_U equals the valve upstream pressure
P_D equals the valve downstream pressure

This additional pressure locking load has been conservatively added to the thrust required to open the subject valves under the maximum design basis differential pressure condition determined in accordance with the Turkey Point Generic Letter (GL) 89-10 MOV program. Since both MOV-3/4-744A/B and MOV-3/4-535 and 536 are considered to be non-testable valves, the design basis

differential pressure opening thrusts have been calculated using the EPRI MOV Performance Prediction Program software. The total opening thrust (differential pressure opening thrust plus pressure locking opening thrust) has been compared to the MOV actuator capability. It has been confirmed that each valve actuator has sufficient pullout torque to open the valves, even when reduced voltage conditions are considered.

2. **The licensee's submittal discusses the susceptibility of valves MOV-3/4-535&536, PORV Block Valves, to thermal binding. The licensee's submittal states that, following the closure of a PORV block valve to isolate a leaking PORV, the evaluation determined that significant cooling of the PORV block valve would not occur due to the close proximity of the PORV block valves to the pressurizer. The NRC staff believes that more detailed information is required to provide assurance that these valves are not susceptible to thermal binding. Please address the potential susceptibility of these valves to thermal binding in a case where they are closed to isolate a leaking PORV and, following plant cooldown, are required to open for low temperature overpressure protection.**

FPL Response

Thermal binding can occur when a flex wedge or solid wedge gate valve is closed at high temperature and the valve is subsequently cooled down. Thermal contraction of the valve body can increase the seating force on the valve disc such that the valve cannot be reopened.

MOV-3/4-535 & 536 operate in conjunction with the PORVs to provide overpressure protection to the RCS during low temperature operation (Overpressure Mitigating System). The PORV block valves are required to be open during this mode of operation.

During power operation, the PORV block valves are exposed to the pressurizer steam space conditions. Since the PORV block valves and associated upstream piping are insulated, the valve body and internals are considered to be at equilibrium temperature conditions. If a PORV block valve is closed at power and the plant is subsequently cooled down, the PORV block valve's exposure to the pressurizer steam space and the insulation are considered to keep the valve body and internals at equilibrium temperature during the cooldown. Also, since the valve body and wedge are made of the same material, there is no differential thermal contraction.

Plant operating history indicates that closing a PORV block valve at operating temperature to isolate a leaking PORV has been performed in the past. Subsequent to valve closure, the PORV block valves have been successfully opened at low temperatures when bringing the plant to cold shutdown, thus confirming that thermal binding did not occur. Also, in 1991 the original PORV block valve Limitorque SMB-000 actuators were replaced with SMB-00 actuators equipped with a larger motor and a higher rated spring pack which more than doubled the actuator output torque capability. Since plant operating history confirms that thermal binding of the PORV block valves was not experienced prior to the 1991 actuator replacement, thermal binding would not be expected

with an installed actuator of more than double the output torque capability. Therefore, the plant operating history and actuator replacement performed in 1991 support the conclusion that the PORV block valves are not susceptible to thermal binding.

3. **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 or thermal binding during surveillance testing. 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 system or train, the licensee should perform one of the following within the scope of GL 95-07:**

    1. **Verify that the valve is not susceptible to pressure locking or thermal binding while closed,**

    2. **Follow plant technical specifications for the train/system while the valve is closed,**

    3. **Demonstrate that the actuator has sufficient capacity to overcome these phenomena, or**

    4. **Make appropriate hardware and/or procedural modifications to prevent pressure locking and thermal binding.**

    The staff stated that normally open, safety-related power-operated gate valves which are closed for test or surveillance but must return to the open position should be evaluated within the scope of GL 95-07. Please discuss if valves which meet this criterion were included in your review, and how potential pressure locking or thermal binding concerns were addressed.

    FPL Response

    As part of the review performed in response to NRC GL 95-07, normally open, safety-related power-operated gate valves that could be closed for testing or surveillance but must return to the open position were evaluated for susceptibility to pressure locking or thermal binding. Those power-operated valves potentially susceptible to pressure locking or thermal binding cannot be closed without entering plant Technical Specification Limiting Conditions for Operation. The PORV block valves (MOV-3/4-535 and 536) are the one exception since the plant Technical Specifications allow these valves to be closed during power operation. However, evaluations have been performed which conclude that the PORV block valves are not susceptible to pressure locking or thermal binding when closed.

4. **Through review of operational experience feedback, the staff is aware of instances where licensees have completed design or procedural modifications to preclude pressure locking or thermal binding which may have had an adverse impact on plant safety due to incomplete or incorrect evaluation of the potential effects of these modifications. Please describe evaluations and training for plant personnel that have been conducted for each design or procedural modification completed to address potential pressure**

locking or thermal binding concerns.

FPL Response

The physical modifications that have been made to eliminate the potential for gate valve pressure locking or thermal binding were reviewed as part of the design process for potential adverse impact on plant operations. The design process includes reviews by plant engineering, operations and maintenance personnel. No adverse impacts were identified for the proposed modifications during the design review process. In addition, these physical modifications have been in place for several years and no adverse operational impact has been experienced.

Operating procedure and surveillance testing procedure changes were recommended as a result of the reviews performed for GL 95-07. These recommended procedure changes were reviewed by the Plant Operations Department and the System Performance Group, responsible for the testing of valves in accordance with ASME Section XI Code. No adverse operational impact was identified during the procedure change review process. The appropriate training has been conducted in accordance with plant procedures.

Plant Piping and Instrumentation Diagrams, valve drawings, maintenance procedures and standard work descriptions were revised as a result of the Turkey Point evaluation to address NRC GL 95-07. These revisions were done to ensure the design features which eliminate the potential for gate valve pressure locking are maintained throughout the life of the plant.