May 8, 2002

TO: FILE

FROM: John G. Lamb, Project Manager, Section 1 ***/RA/***
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

SUBJECT: DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3 - SAFETY EVALUATION OF LOW PRESSURE COOLANT INJECTION VALVES (TAC NOS. MA3956 AND MA3957)

By letter dated January 4, 1999, Nuclear Regulatory Commission (NRC) discussed NRC Inspection Reports 50-237/98022(DRS); 50-249/98022(DRS) and notice of violation. Contained in the letter was a discussion of DEV 50-237/92036-01; 50-249/92036-01 regarding the failure to implement manual closing of low-pressure coolant injection (LPCI) valves which was a noted deviation to the Systematic Evaluation Program (SEP).

The NRC staff completed the review of this item.

Attached is our safety evaluation.

This completes the NRC staff's effort for TAC Nos. MA3956 and MA3957.

Docket Nos. 50-237, 50-249

Enclosure: Safety Evaluation

cc: See next page

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cc: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

LOW PRESSURE COOLANT INJECTION VALVES

DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3

EXELON GENERATION COMPANY

DOCKET NOS. 50-237 AND 50-249

1.0 INTRODUCTION

By letter dated January 4, 1999, Nuclear Regulatory Commission (NRC) discussed NRC Inspection Reports 50-237/98022(DRS); 50-249/98022(DRS) and notice of violation. Contained in the letter was a discussion of DEV 50-237/92036-01; 50-249/92036-01 regarding the failure to implement manual closing of low-pressure coolant injection (LPCI) valves which was a noted deviation to the Systematic Evaluation Program (SEP).

2.0 BACKGROUND

In 1977, the NRC initiated the SEP to review the designs of older nuclear reactor plants in order to reconfirm and document their safety. The SEP review provided: (1) an assessment of the significance of differences between current technical positions on safety issues and those that existed when a particular plant was licensed, (2) a basis for deciding on how these differences should be resolved in an integrated plant review and (3) a documented evaluation of plant safety. As part of the SEP review, the NRC issued Technical Report NUREG 1403, "Safety Evaluation Report [SER] related to the full-term operating license for Dresden Nuclear Power Station," dated September 21,1990, where the NRC staff concluded, subject to favorable resolution of the items discussed in the report, that the facility could continue to operate without endangering the health and safety of the public. This SER in combination with NUREG-0823, "Integrated Plant Safety Assessment Evaluation Program," dated February 1983 and Supplement 1, dated October 1989, provided the primary basis for the issuance of a full-term operating license to Dresden Nuclear Power Station (DNPS), Unit 2.

During the SEP review, a number of issues were resolved with commitments made by the licensee to complete specific plant modifications or procedural changes. These commitments were documented in NUREG-0823, Supplement 1 and NUREG-1403, where the status (i.e., open, partial or complete) for each commitment was updated with each subsequent document. Following issuance of NUREG-1403, some of the commitments were identified as open, which

required confirmation during future inspections by NRC staff that the commitments had been completed. These items were identified in Section 2, “Systematic Evaluation Program,” Table 2.1, “Items for confirmation by NRC Region III Office.”

In Inspection Reports 50-237/92026(DRP); 50-249/92026(DRP), the NRC inspectors attempted to confirm the completion of Item No. 17, “Confirm that the leakage conditions under which the remote manual isolation valves on the LPCI and core spray systems should be isolated are incorporated into emergency procedures.” The licensee stated that LPCI valves 2(3)-1501-22A(B), could not be manually isolated due to an electrical interlock. The inspectors concluded that the emergency operating procedures, in general, addressed the manual isolation of the LPCI and core spray valves. However, further confirmation and review of the electrical interlock’s effect on the SEP commitment was necessary and the inspectors considered the matter an unresolved item (URI) pending further review by the NRC (URI 50-237/92026(DRP); 50-249/92026(DRP)). The inspectors considered the system configuration, while not meeting the SEP commitment, as not presenting an immediate safety concern.

In Inspection Reports 50-237/92036(DRP); 50-249/92036(DRP), the NRC inspectors determined that the NRC Technical Report NUREG-0823, required the LPCI valves 2(3)-1501-22A(B) and the core spray injection valves 1402-25A(B) be capable of being remote manually closed following an accident. In addition, prior licensee correspondence (i.e., SEP open item response dated April 14, 1984) stated that a modification to the valves logic circuitry was underway and would resolve the electrical interlock concern. As a result, the inspectors concluded that failure to implement manual closure of the LPCI injection valves was a deviation from the SEP commitment and issued this deviation.

In the licensee’s response to the deviation dated March 26, 1993, the licensee stated that DNPS inadvertently and inappropriately referenced modifications to the LPCI and core spray injection valves 1501-22A(B) and 1402-25A(B) instead of the intended LPCI and core spray pump suction valves 1501-5A, B, C, D and 1402-3A(B). The licensee stated that while core spray injection valve logic allowed closure with an injection signal present, the LPCI injection logic was never designed with this capability. The licensee stated that the SEP open item response was a commitment intended to address the NRC’s SEP requirement that the leakage conditions under which the LPCI and core spray injection valves should be isolated be incorporated in the emergency procedures. The licensee considered the addition of leakage conditions to the DNPS Emergency Operating Procedure 300-1 to be sufficient to meet the procedural requirement of the SEP item.

Region III closed this item since NRC Nuclear Reactor Regulation (NRR) staff were pursuing this issue under TAC Numbers MA3956 and MA3957.

3.0 LICENSEE'S DETERMINATION

The licensee responded to the deviation in a letter dated March 26, 1993. The licensee stated that the following:

> For the normal containment isolation function of the LPCI injection valves, Dresden has always maintained remote manual closure capability from the control room. Following a LPCI initiation signal, however, the selected loop

injection valve automatically opens and is interlocked open. Selected loop injection valve logic prevents the injection valve from being closed until the LPCI injection signal clears.

Dresden Station is not required to design for two concurrent passive failures. LPCI pipe is safety-related, seismic, and exposed to pressures less than 350 psi. A Design Basis [Loss-of-Coolant Accident] LOCA and subsequent LPCI line break and check valve failure is not a credible accident. In the unlikely event of LPCI pump seal leakage following a LOCA, other LPCI valves may be closed to isolate leaks:

Testable check valve 1501-25, located between the motor-operated check valve and the recirculation loop, would isolate the leak. This valve is Local Leak Rate tested in accordance with 10 CFR 50, Appendix J and therefore can be credited as a containment isolation valve.

Motor-Operated flow control valve 1501-21 is also available to isolate a leak if other means fail. This valve is not Local Leak Rate tested, but it is powered from a safety-related power supply.

Also, the LPCI pump discharge check valve 1501-63 is available to isolate a leak.

Finally, pump seal leakage might be adequately controlled by sump pumps.

4.0 NRC STAFF EVALUATION

4.1 Design Bases of the LPCI Subsystem

The design bases of the LPCI subsystem are as follows:

1. A LPCI subsystem is provided to ensure adequate core cooling for various postulated LOCAs for a range of failure sizes from those for which the core is adequately cooled by the high pressure coolant injection subsystem up to and including the design basis accident (DBA).

2. The LPCI subsystem provides reactor core cooling for a large spectrum of LOCAs in conjunction with either core spray subsystem. The LPCI subsystem is completely independent of the core spray subsystems.

3. The LPCI subsystem is provided with redundancy in critical components to meet reliability requirements.

4. The LPCI subsystem operates without reliance upon external sources of power.

5. The LPCI subsystem is designed so that each component can be tested and inspected periodically to demonstrate availability of the subsystem.

In addition to its emergency core cooling system (ECCS) design bases, the LPCI subsystem also provides the capability to achieve cold shutdown. During the SEP review of SEP topic

VII-3, the NRC determined that General Design Criteria (GDC) 19 and 34 require the capability of achieving cold shutdown from normal operating conditions using safety grade systems. The containment cooling service water system and pressure relief system are used in conjunction with the LPCI subsystem to provide this capability.
The LPCI subsystem includes the equipment for coolant injection and containment cooling. The LPCI subsystem is further subdivided into two functional loops. The LPCI subsystem includes two heat exchangers, four containment cooling service water pumps, four LPCI pumps, two drywell spray headers, and a suppression chamber spray header.

4.2 LPCI Subsystem

The LPCI subsystem operates in conjunction with the high-pressure coolant injection (HPCI) and core spray subsystems to achieve its core cooling function. During a LOCA, coolant is lost from the core with a corresponding decrease in reactor vessel pressure. The HPCI subsystem operates initially during the high-pressure phase of the accident to supply a small amount of coolant at high pressure.

As the pressure in the reactor vessel decreases, the HPCI subsystem flow ceases and the core spray and LPCI subsystems automatically begin operation to take over the core cooling function. When the pressure in the reactor vessel equals the pressure in the suppression chamber, the LPCI subsystem is capable of delivering maximum capacity. LPCI delivers rated flow with reactor pressure equal to 20 psid (differential pressure between the reactor vessel dome and the drywell). After the core has been flooded to two-thirds height, only one LPCI pump is required to maintain this level.

The LPCI subsystem is required to inject sufficient makeup water to reflood the vessel to the appropriate core height to provide adequate core cooling and is later required to maintain the level at two-thirds core height. Although redundancy is provided in that only three of the four LPCI pumps are required to deliver full capacity LPCI flow, the DBA LOCA analyses take credit for a maximum of two operable LPCI pumps. These analyses also require operation of at least one core spray subsystem to ensure adequate core cooling. The pump head characteristic was selected such that sufficient but less than rated flow is provided before the HPCI turbine is tripped by low vessel pressure. This approach provided core cooling over the complete spectrum of breaks up to the design basis break.

4.3 Injection Valves (MO-1501-21A/B, MO-1501-22A/B)

The injection valves are arranged in-series in the LPCI line prior to penetrating the containment. The normally open outboard valve (21A/B) is a globe valve and is used to throttle LPCI flow to the reactor vessel when necessary. The inboard valve (22A/B) is a normally closed gate valve and is used to isolate the system from the reactor vessel during normal plant operation.

The 21A/B valves are located just below the 517 foot elevation of the reactor building. The valve operators extend up through the floor. The valves are located with 21A east and 21B west. The 22A/B valves are located just above the Torus east and west sides with the 22A valve east and the 22B valve west. The 21A and 22A valves are powered from motor control center (MCC 28-7 (38-7) and the 21B and 22B valves are powered from MCC 29-7 (39-7).

4.4 Evaluation

During the SEP review, a number of issues were resolved with commitments made by the licensee to complete specific plant modifications or procedural changes. These commitments were documented in NUREG-0823, Supplement 1 and NUREG-1403, where the status (i.e., open, partial or complete) for each commitment was updated with each subsequent document. Following issuance of NUREG-1403, some of the commitments were identified as open, which required confirmation during future inspections by NRC staff that the commitments had been completed. These items were identified in Section 2, "Systematic Evaluation Program," Table 2.1, "Items for confirmation by NRC Region III Office." Region III noted a deviation to Item No. 17, "Confirm that the leakage conditions under which the remote manual isolation valves on the LPCI and core spray systems should be isolated are incorporated into emergency procedures."

In the licensee's response to the deviation dated March 26, 1993, the licensee stated that DNPS inadvertently and inappropriately referenced modifications to the LPCI and core spray injection valves 1501-22A(B) and 1402-25A(B) instead of the intended LPCI and core spray pump suction valves 1501-5A, B, C, D and 1402-3A(B). This caused confusion regarding the licensee SEP open item response dated April 14, 1984. However, the licensee clearly stated in the March 26, 1993, letter that DNPS inadvertently and inappropriately referenced modifications to LPCI and core spray injection valves instead of the intended LPCI and core spray pump suction valves.

The licensee stated that while core spray injection valve logic allowed closure with an injection signal present, the LPCI injection logic was never designed with this capability. Therefore, requiring the licensee to remove the interlock on the LPCI injection valves would be considered a backfit. Although a formal backfit analysis has not been performed, it appears that a backfit would not be justified because there would not be a substantial increase in the overall protection to the public health and safety or the common defense and security derived from the backfit. In a letter to the licensee dated January 4, 1999, the NRC staff stated, "The inspectors considered the system configuration, while not meeting the SEP commitment, as not presenting an immediate safety concern."

The NRC staff finds acceptable the licensee's addition of leakage conditions to the DNPS Emergency Operating Procedure 300-1 to be sufficient to meet the requirement of the SEP item to address the leakage conditions under which the LPCI and core spray injection valves should be isolated are incorporated in the emergency procedures.

5.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the operation in the proposed manner will not be inimical to the common defense and security or to the health and safety of the public.

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