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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Three Mile Island Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR-50
NRC Docket No. 50-289

Subject: Response to Request for Additional Information Regarding Generic Letter 2008-01

References:

1. NRC Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," dated January 11, 2008
2. Letter from K. R. Jury (Exelon Generation Company, LLC/AmerGen Energy Company, LLC) to U.S. NRC, "Three Month Response to Generic Letter 2008-01," dated April 11, 2008
3. Letter from K. R. Jury (Exelon Generation Company, LLC/AmerGen Energy Company, LLC) to U.S. NRC, "Nine-Month Response to Generic Letter 2008-01," dated October 14, 2008
4. Letter from P. Bamford (U.S. NRC) to C. Pardee (Exelon Nuclear), "Three Mile Island Nuclear Station, Unit 1 – Request for Additional Information Regarding Generic Letter 2008-01, (TAC No. MD7888)," dated October 6, 2009

The NRC issued Generic Letter (GL) 2008-01 (i.e., Reference 1) to request that each licensee evaluate the licensing basis, design, testing, and corrective action programs for the Emergency Core Cooling, Decay Heat Removal, and Containment Spray systems, to ensure that gas accumulation is maintained less than the amount that challenges operability of these systems, and that appropriate action is taken when conditions adverse to quality are identified.

References 2 and 3 provided the responses to NRC GL 2008-01 for Three Mile Island Nuclear Station. In Reference 4, the NRC requested additional information that is required to complete the review. In response to this request, Exelon Generation Company, LLC is providing the attached information.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this letter, please contact Mr. Kenneth M. Nicely at (630) 657-2803.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 19th day of November 2009.

Respectfully,

Patrick R. Simpson
Manager – Licensing

Attachment: Response to Request for Additional Information

cc: NRC Regional Administrator – Region I
Senior Resident Inspector – Three Mile Island Nuclear Station

NRC Request 1

The licensee has stated that "TMI [Three Mile Island] is currently performing initial fill ultrasonic testing [UT] checks, post-maintenance fill UT checks, and periodic UT checks for the HPI [high pressure injection], DH [decay heat removal], and BS [building spray] systems." What is the meaning of "periodic?" Are "checks" the same as "surveillances" and, if not, what is the difference? Are these checks to be continued until Technical Specification (TS) changes are addressed in response to industry resolution of the gas accumulation TS issues is obtained via the Technical Specifications Task Force (TSTF) effort that is underway in response to GL 2008-01?

Response

TMI performs periodic UT checks for the HPI, DH, and BS systems every 182 days. Additionally, TMI performs UT checks as part of each fill and vent procedure. There are no requirements in the TMI TS to perform periodic venting or void verification checks, thus there are no requirements to perform these UT checks as surveillances. They are scheduled, performed, and documented as preventive maintenance (PM) recurring task work orders which allow a +/-25% grace period on the completion frequency.

Procedural controls require Issue Reports (IRs) to be initiated in the Corrective Action Program (CAP) if voids are discovered during periodic and post fill UT checks. The void size is also documented, and the IRs and UT results are reviewed and trended by Engineering personnel.

The performance of these PMs will continue until TS changes are addressed in response to industry resolution of the gas accumulation TS issues. Resolution will be obtained via the TSTF effort that is underway in response to Generic Letter (GL) 2008-01.

NRC Request 2

Provide the following information, for TMI-1:

a. A broad identification of surveillance locations and methods with identification and justification of excluded locations.

b. A description of void volume determination methods.

c. A brief description of the process for re-performance of UT/venting at locations where gas may accumulate during venting at other locations to: (1) verify gas was removed after venting; and, (2) to ensure gas was not transported into a high point that was previously found to be gas-free.

Response

UT checks are performed at multiple high points on the Makeup and Purification (MU) system (i.e., the portion that performs or affects the HPI function), the DH system (i.e., including the Low Pressure Injection (LPI) function), and the BS system. These include source water supply lines, pump suction headers, pump suctions, pump discharges, system cross-connects, and injection lines at Reactor Building penetrations. There are 33 UT points on DH and BS, and 13 UT points on HPI. The injection lines inside the Reactor Building are not routinely checked, but have been evaluated for potential voids, and were UT checked during the fall 2009 refueling outage. In general, the MU, DH, and BS system piping along the active flowpath with sufficiently high Froude numbers is assured of being swept clear during periodic system testing or system restoration testing prior to being declared operable.

The void volume determinations are computed by using UT measurement data. This includes void arc length, length, and shape.

Complete system UT checks per PM are performed after proceduralized venting is complete. Venting is performed under static conditions for MU pumps and the HPI lines. For the DH system, venting is first static, then the system is operated for at least ten minutes, and after shutdown for at least 10 minutes the static venting is repeated. BS pumps have common suction with the DH pumps and are vented with the DH system. BS discharge headers are maintained drained. For each system, after venting is complete, UT checks for all PM points verify the system is sufficiently full.

NRC Request 3

The response, for TMI-1, does not identify how gas movement is assessed with respect to operating conditions. The GL requests information for systems required to support all operating modes and all accident conditions. Please provide a response that addresses all the considerations implicit in the GL request.[2]

[2] For example, realistic response to a large break loss-of-coolant accident would not generally involve loss of a pump or a train whereas the single failure criterion applies to the design basis. Flow rates and gas entrainment behavior will likely be different. The assessment should cover both realistic responses and assumed design basis conditions. Further, the GL request includes concerns with operation all operating modes, from power operations through refueling shutdown.

Response

A technical evaluation assessing the air void movement and the entrainment potential to safety injection pumps (i.e., DH, BS, and MU) has been completed. This evaluation reviewed the operating modes with respect to system potential air void locations as well as the potential to transport to the safety related pump. The system mode review included accident mitigation modes as well as normal operation and shutdown modes. Each system is addressed separately below.

BS Pumps

The BS pumps have only one accident mitigation mode and no normal operating mode. These pumps do not rely on operator action to throttle flow. Any potential air void locations are analyzed consistent with the accident basis design flow. Each pump and associated piping is independent from the parallel train consistent with the single failure criterion, so air void impact is assessed for each pump separately.

DH Pumps

To assess the worst case air void fraction, an evaluation was completed which shows the maximum air void fractions at the DH pumps occur under high flow conditions. This assessment is completed at different flow rates up to the design basis high flow rate for a given air void at the pump suction. Thus the air void transport for the high flow rate condition is conservatively applied given a specific system lineup. The system lineups include the following normal and design basis configurations and an assessment as to the timing of the lineup relative to a precursor lineup (i.e., Reactor Building sump recirculation only occurs after borated water storage tank (BWST) drawdown):

- DH pump recirculation mode,
- DHR operating mode,
- LPI injection - BWST drawdown mode,
- LPI injection - Reactor Building sump recirculation,
- LPI to HPI piggyback mode, and
- Pressurizer spray.

MU Pumps

The system lineups analyzed include normal ES Standby where one MU pump (i.e., usually MU-P-1B) provides normal makeup while MU-P-1A and MU-P-1C are in standby mode. Other operating modes included normal HPI from the BWST or from DH via piggyback mode.

During event mitigation, there can be up to three MU pumps operating in parallel to provide HPI flow. Typically, the HPI flow rate is a strong function of the RCS backpressure, so the pump(s) operate at a flow rate specific to the nature of the event. An evaluation was completed showing higher flow rates result in a higher air void fraction at the worst case pump suction. The high pump flow rate condition bounds the air void fraction computations for lower flow rates and single pump operations. Conservative void fraction allowance was used to account for different pump performance characteristics.

NRC Request 4

Summarize the corrective action program (CAP) aspects and/or procedures that address vortex formation for the decay heat removal (DHR) pumps during suction from the reactor coolant system hot legs, for TMI-1.

Response

During DH pump suction from the Reactor Coolant System (RCS), vortex formation is procedurally prevented. The procedures for control of DH train A and B flow and temperatures each contain guidance for throttling DH flow. Each train is normally throttled to less than 3500 gallons per minute (gpm). If RCS level is less than 50 inches, then an equation/graph for

DH flow, based on the minimum height of water required to avoid vortex formation, is used. A violation of this curve would prompt increased scrutiny of pump parameters and result in an IR being initiated in the CAP.

NRC Request 5

Summarize the post-surveillance activities, such as gas volume trending and procedural checks to periodically identify leakage through check valves that separate the subject systems from higher pressure locations and the response actions in procedures and the CAP if such leakage is identified, for TMI-1. Include in-series check valves that could be exposed to a higher pressure if the "first off" check valves were to leak.

Response

TMI has been monitoring the GL 2008-01 subject systems since 2006, and there have been no gas voids detected during periodic UT checks. A few very small voids were detected and removed during fill and vent procedures during system restorations. Other very small voids were found during fill and vent activities and were evaluated as acceptable. They were subsequently absorbed into solution as verified by follow on UT checks.

Procedural controls require IRs to be initiated in the CAP if voids are discovered during periodic and post fill UT checks. The void size is also documented. The IR is then evaluated and dispositioned to determine the cause and identify appropriate corrective actions. Additionally, IRs and UT results are reviewed and trended by Engineering personnel. Entries are also made in the PM material history and non-destructive examination (NDE) report.

Back-leakage from high pressure systems was evaluated for HPI and DH. TMI has experienced no void formation via this mechanism. This has been validated through UT checks at the first potential void formation locations outside the Reactor Building.

The MU system, normally providing Reactor Coolant pump seal injection and normal makeup, is pressurized above RCS pressure by one of the three running MU pumps. This will additionally be aligned with and pressurize one train of HPI. There is no potential for RCS back-leakage to the running MU pump and the HPI train to which it is aligned. The other HPI train is potentially at a lower pressure, but the RCS would have to leak back through two check valves and a closed HPI control valve. UT examinations are performed on all four injection lines at the high points after the HPI control valves and prior to the Reactor Building penetration. These locations would show the first indications of back-leakage through two inline check valves per train.

DH injects into the RCS via the Core Flood (CF) system connection to the reactor vessel. CF is a passive injection system pressurized to 600 psig with nitrogen. This has the potential to leak back to the DH system through two in series containment isolation valves. There is a closed check valve inside the Reactor Building and closed gate valve outside the Reactor Building.

Periodic UT examinations are performed between the closed injection path gate valves and the Reactor Building penetration. If CF water was to leak back through the check valve and the nitrogen came out of solution, the UT examinations at this location would be the first indication outside the Reactor Building. During the periodic TS surveillance for the Engineering Safeguards Actuation System, the injection valves are cycled. This allows the depressurization of the lines and potential void formation if leakage were present.

Historically there has not been leakage from CF to DH that caused voiding. CF tank level and pressure are monitored and alarmed in the Control Room, and additions to the CF tank are trended. Procedure enhancements are being made such that if CF fill is required and the leakage path is not known, UT examinations would be performed for the DH points at the Reactor Building injection penetrations.

NRC Request 6

Summarize the measures used to guard against gas intrusion because of inadvertent draining, system realignments, incorrect maintenance procedures, or other evolutions, for TMI-1.

Response

Exelon Generation Company, LLC (EGC) relies on a competent, trained, qualified, and attentive staff to continuously monitor, assess, and control system configuration. Upon recognition of a human performance error or equipment failure, IRs are initiated in the CAP. The CAP and procedures that address GL 2008-01 issues provide suitable guidance for the mitigation and disposition of the event.

NRC Request 7

Discuss the control and revision of work packages due to change in maintenance work scope, including review and reauthorization of the package and any new temporary procedures as it relates to preventing gas intrusion into the systems that are the subject of this GL, for TMI-1.

Response

Any work package that requires draining of a system within the GL 2008-01 scope has an activity generated for Operations to drain the system. This is procedurally performed. After maintenance that had the potential for void introduction, there would be an activity for Operations to fill and vent the system by procedure, which requires the UT examinations to be performed. An activity is created for the UT performance. If there is a work package change, or a new temporary procedure requiring draining, there would also be a procedurally controlled fill and vent that requires UT examinations to be performed. In addition, the procedure that governs the modification process has been revised to include an evaluation of the potential for gas accumulation.

NRC Request 8

Discuss the monitoring of pump operation in all modes and specialized monitoring of appropriate plant parameters during shutdown operation, including reduced inventory and mid-loop operation, for TMI-1.

Response

Suitable administrative measures (i.e., clearance and tagging) combined with existing system operating procedures and routine performance monitoring conducted by plant operations personnel are adequate to ensure measures are in place to verify systems are sufficiently full prior to their restoration and return to service. The pumps of the subject systems are monitored from the control room. They are routinely observed on pump start locally and monitored locally on rounds. In the control room there are many indications that are checked closely during pump start and then routinely on rounds. These indications include motor amps for all pumps, bearing and stator temperatures (HPI and DH), oil pressures (HPI), vibrations (DH), and flow indications for each injection path (HPI and DH). During shutdown operations these indications continue to be monitored. Additionally as detailed in the response to NRC Request 4, during reduced inventory operations, the DH flow may be reduced. Each train is normally throttled to less than 3500 gpm. If RCS level is less than 50 inches, then an equation/graph for DH flow, based on the minimum height of water required to avoid vortex formation, is used. A violation of this curve would prompt increased scrutiny of pump parameters and result in an IR being initiated in the CAP.

NRC Request 9

Provide a table that lists the current incomplete items and the completion schedule for TMI-1.

Response

All corrective actions to address GL 2008-01 that were discussed in the GL 2008-01 responses for TMI are complete, with the exception of the Regulatory Commitments documented in the tables provided in Attachment 2I of Reference 1, and Attachment 20 of Reference 2. The committed dates for these actions remain unchanged.

NRC Request 10

Training was not identified in the GL but is considered by the NRC to be a necessary part of applying procedures and other activities when addressing the issues identified in the GL. Briefly discuss the training aspects of the issues described by this GL at TMI-1.

Response

GL 2008-01 did not require discussion of training to satisfy the 10 CFR 50.54(f) request; therefore, none was provided in the GL response for TMI. However, when any station procedure is modified, an assessment for training needs and change management is required in accordance with procedure AD-AA-101, "Processing of Procedures and T&RMs." The determination is typically a function of the nature of the change and the perceived impact on the organization. If the assessment concludes training is required, the training is generally accomplished prior to, or in parallel with, issuance of the procedure. PM activities which direct the periodic examination of selected piping for the presence of air draw upon pre-existing processes that provide guidance for the UT inspection of piping to verify that it is full of water. Training of personnel performing UT inspection is in accordance with corporate procedure ER-AA-335-001, "Qualification and Certification of Nondestructive Examination (NDE) Personnel."

EGC is an active participant in the NEI Gas Accumulation Team, which is currently directing the Institute of Nuclear Power Operations (INPO) in the development of generic training modules for gas accumulation and management. These training modules target the Engineering, Operations, and Maintenance disciplines. Based on this active participation, EGC plans to evaluate these training modules following completion for applicability to EGC, and may conduct training based upon modules tailored to meet EGC's needs.

References

1. Letter from K. R. Jury (Exelon Generation Company, LLC/AmerGen Energy Company, LLC) to U.S. NRC, "Three Month Response to Generic Letter 2008-01," dated April 11, 2008

2. Letter from K. R. Jury (Exelon Generation Company, LLC/AmerGen Energy Company, LLC) to U.S. NRC, "Nine-Month Response to Generic Letter 2008-01," dated October 14, 2008