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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Three Mile Island Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR-50
NRC Docket No. 50-289

Subject: Submittal of TMI White Paper – TMI BWST Cleanup Path Issue

This letter transmits the attached enclosure titled "TMI BWST Cleanup Path Issue" that was written as a white paper and provided to the TMI NRC Resident Inspectors. The intent of the white paper was to explain our logic for concluding the BWST cleanup operation is part of the Three Mile Island, Unit 1 (TMI-1) licensing basis. This submittal is provided at the request of the NRC to place the white paper on the formal TMI-1 docket.

There are no regulatory commitments contained in this letter.

If you have any questions with this correspondence, please contact Mr. David Atherholt, TMI Regulatory Assurance Manager (717) 948-8364.

Respectfully,

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Enclosure

cc: USNRC, Regional Administrator, Region I
USNRC, Senior Resident Inspector, TMI Unit 1

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TMI BWST Cleanup Path Issue

Historical Summary:

TMI had recirculated and cleaned up the BWST since original licensing. **IN 2012-01**¹ was issued titled "Seismic Considerations-Principally Involving Tanks." The IN talked about Shearon Harris² recirculating a seismically qualified RWST (refueling water storage tank) through non-seismic fuel pool piping purification system piping causing the RWST to be made inoperable. TMI stopped the practice of recirculation on 10/03/12 to conduct a further review. A 50.59 screening³ was written and the practice recommenced on 06/01/13. TMI was subsequently cited and given a traditional violation⁴. The inspectors reviewed the 50.59 screening and the BWST licensing basis and determined that aligning the BWST to non-seismically qualified pipe is contrary to the licensing basis function as described in the FSAR 5.1.1⁵. The NRC concern with the BWST cleanup process at TMI is based on their conclusion that the process was in conflict with TMI licensing basis requirements for an earthquake.

Original Licensing Criteria for BWST:

The TMI design presented in the FSAR was approved by NRC via SER issued in July 1973. **FSAR section 1.4.2**⁶ presents the **AEC draft General Design Criterion 2** which set the design standard for external events including earthquakes. The standard addresses the severity of the hazard and the performance standard for reactor safety in such events.

Those systems and components of Reactor Building facilities which are essential to the prevention of accidents, which could affect the public health and safety or to mitigation of their consequences shall be designed, fabricated, and erected to performance standards that will enable the facility to withstand, without loss of the capability to protect the public, the additional forces that might be imposed by natural phenomena such as earthquakes, tornados, flooding conditions, winds, ice, and other local site effects. The design bases so established shall reflect: (a) appropriate consideration of the most severe of these natural phenomena that have been recorded for the site and the surrounding area, and (b) an appropriate margin for withstand forces greater than those recorded to reflect uncertainties about the historical data and their suitability as a basis for design.

The question about the design adequacy of the BWST cleanup process piping was initiated by review of IN 2012-01. In that IN, a plant licensed to the General Design Criteria in 10CFR50 Appendix A was cited for a procedure change which authorized cleanup of the RWST through non-seismic piping when the RWST was required to be operable IAW Tech Specs. The cleanup process through non-seismic piping and operator action to isolate leakage from BWST are the same as used at TMI.

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The difference between the IN case and TMI is the licensing basis. 10CFR50 Appendix A GDC 2 (not TMI-1 licensing basis) sets a more conservative standard by requiring that all safety related SSC be protected from external events such that the safety function of the SSC can be achieved after an external event.

Criterion 2—Design bases for protection against natural phenomena. Structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunamis, and seiches without loss of capability to perform their safety functions. The design bases for these structures, systems, and components shall reflect: (1) Appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena and (3) the importance of the safety functions to be performed.

In the case of a non-Appendix A plant (TMI-1 licensing basis), the requirements for evaluating the performance of a safety function also apply.

The TMI license was approved with a design which relied upon non-seismic piping for BWST cleanup. This is completely consistent with the AEC draft GDC 2. **Operator action was credited to satisfy this requirement (see additional material provided below).**

To understand how “without loss of the capability to protect the public” was interpreted, it is helpful to review the design capability approved for some of these external events. Several design considerations which are clearly described in the FSAR are as follows:

- The BWST could not be relied upon after a tornado or aircraft impact.
- The Diesel Generator building could not withstand an aircraft impact, but the design met this standard and was approved.
- The diesel fuel supply (FO-T-1) was flood protected however it was not designed for an earthquake¹⁴

TMI Original FSAR specific material for BWST cleanup licensing basis

The BWST is cleaned up and recirculated through BWST piping, spent fuel system piping and the waste disposal liquid piping. Each of the respective FSAR sections must be understood to obtain a complete understanding of the cleanup licensing basis.

TMI was licensed as a pre-GDC 2 design criteria plant with the BWST and spent fuel pools characterized as Class 1 systems. **FSAR pages 5-2 through 5-4⁷**

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The liquid waste disposal system (providing precoat filters and cation demineralizers for BWST cleanup) is described in the original FSAR as having been housed in Class 1 structures and characterized as providing **operating service functions** to the primary system and spent fuel pools. **FSAR 11-3⁹**

These operating service functions are described **on FSAR pages 11-3 and 11-4⁹**. They include clean-up of spent fuel water, processing spent fuel water for re-use or disposal, and processing primary coolant and refueling water for re-use and disposal. The operating service system flow diagrams are referenced in this section and provided in the FSAR. **FSAR Figure 11-2¹⁰** contains the precoat filters and cation demineralizers used in the cleanup process for the BWST and spent fuel pools.

Since portions of the spent fuel pool system are integral to cleanup and reuse for the spent fuel pool system and cleanup and reuse of BWST water as an operating service function, the FSAR section on the fuel pool is important. **Section 9.4 on page 9-16⁸** states cleanup of the spent fuel pool as being accomplished by diverting part of the flow through filters and/or demineralizers of the liquid waste disposal system. This section of the FSAR also states that the system function is to circulate refueling water through clean up equipment and references during storage in the BWST. **FSAR page 9-17⁸**.

The FSAR then defines how this process is controlled. Under **Section 9.4.5⁸** Method of Operation, the spent fuel pool cooling functions are monitored and controlled from the main control room. All other functions of the spent fuel cooling system are **accomplished by local manipulation and control of equipment**.

TMI has used the operating service functions since original operation to cleanup the spent fuel pools and the BWST as described in the FSAR using the precoat filters and/or the cation demineralizers.

After original licensing as a pre-GDC plant, the seismic capability for pre-GDC 2 plants was questioned. The USI A-46 process was established to resolve the issue.

In the process of USI A-46 TMI considered the original FSAR application of the BWST recirculation process path and further considered the spent fuel pools (although not required by the USI A-46 process). **Three Mile Island USI A-46 Report Seismic Verification Data Sheets Page 28 contains components for the BWST recirculation path¹¹.**

An NRC **SER (Page 11)¹²** was provided to GPU Nuclear for the SQUG process. The staff verified that the licensee had considered its operator training programs and verified that training was sufficient to ensure those actions specified in the procedures could be accomplished by the operating crews. The procedure in use was the earthquake emergency procedure¹³ that contained an action to isolate the BWST if on cleanup as a defense in depth action. These are the same valves used to locally align the cleanup path part of the original licensing basis. This is a prudent defense in depth action.

Safety Considerations: For a Safe Shutdown Earthquake (SSE), TMI-1 plant licensing basis does not include a concurrent seismic event and LOCA that would require the BWST contents. Only a small fraction of the contents are required for some RCS leakage and inventory shrinkage to hot shutdown (TMI-1 SSEL Report for Resolution of USI A-46, dated 09/29/1994). The BWST cleanup recirculation

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piping and filters were designed incorporating Operating Basis Earthquake (OBE) loads as were the majority of Liquid Radwaste Systems. Furthermore, this cleanup recirculation piping and filters were walked down and successfully evaluated as a seismic safe shutdown path, documented in the response to the NRC, and accepted per the associated SER.

Recently, several large piping sections of the BWST Cleanup path were successfully evaluated against SSE loads (2X OBE loads) for pipe stress to prove margin in the existing design. Existing procedural alarm response for earthquake uses a manual valve closure for the cleanup path, which was addressed in the original licensing, and remains a prudent defense-in-depth action.

As a result, it is clear the original license consideration of a local controlled cleanup process does not pose an unacceptable risk to nuclear safety.

Conclusion: The original FSAR recognized the need to clean-up the BWST and the spent fuel pools and described the operating service functions necessary to maintain the water quality function through the precoat filters and/or the demineralizers. The piping for the cleanup path was housed in seismic Class 1 structures and the clean-up function was recognized to be accomplished through local manipulations and control of equipment. This cleanup path is recognized and acceptable within the original (and current) TMI licensing basis and does not pose an unacceptable risk to nuclear safety.

References cited:

1. IN 2012-01
2. NRC Inspection Report - Shearon Harris
3. 50.59 screening to procedure OP-TM-212-501
4. NRC Inspection Report – TMI
5. UFSAR Section 5.1.1
6. FSAR (Red Book) Section 1.4.2
7. FSAR (Red Book) pgs 5-2 thru 5-4
8. FSAR (Red Book) pgs 9-16 thru 9-17
9. FSAR (Red Book) pgs 11-3 thru 11-4
10. FSAR (Red Book) Figure 11-2
11. TMI USI A-46 Report Screening Verification Data Sheets
12. NRC SER TMI SQUG Process 12Aug98
13. Earthquake procedure revision 26
14. FSAR (Red Book) pgs 2-28a thru 2-29a