Millstone Power Station Unit 3 (MPS3) Alternative Request for Containment Recirculation Spray System (RSS) Pump Periodic Verification Test

August 9, 2022

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Alternative RSS Pump Flow Testing

AGENDA

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- Issue
- Proposed Resolution
- Technical Justification
- Conclusions
- Schedule

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Background

- Per the American Society of Mechanical Engineers (ASME) Operations & Maintenance (OM) Code, Mandatory Appendix V, a *pump periodic verification* (PPV) test shall be performed at least once every two years for pumps that have a design basis flow rate credited in safety analysis.
  - The MPS3 RSS pumps are in the scope of this requirement per the Inservice Testing (IST) Program, because all four pumps inject from the containment sump to the recirculation spray headers for containment heat removal during a Loss Of Coolant Accident (LOCA).
  - The PPV test verifies that a pump can meet the required (differential or discharge) pressure as applicable, at its highest design basis accident flow rate (V-2000).

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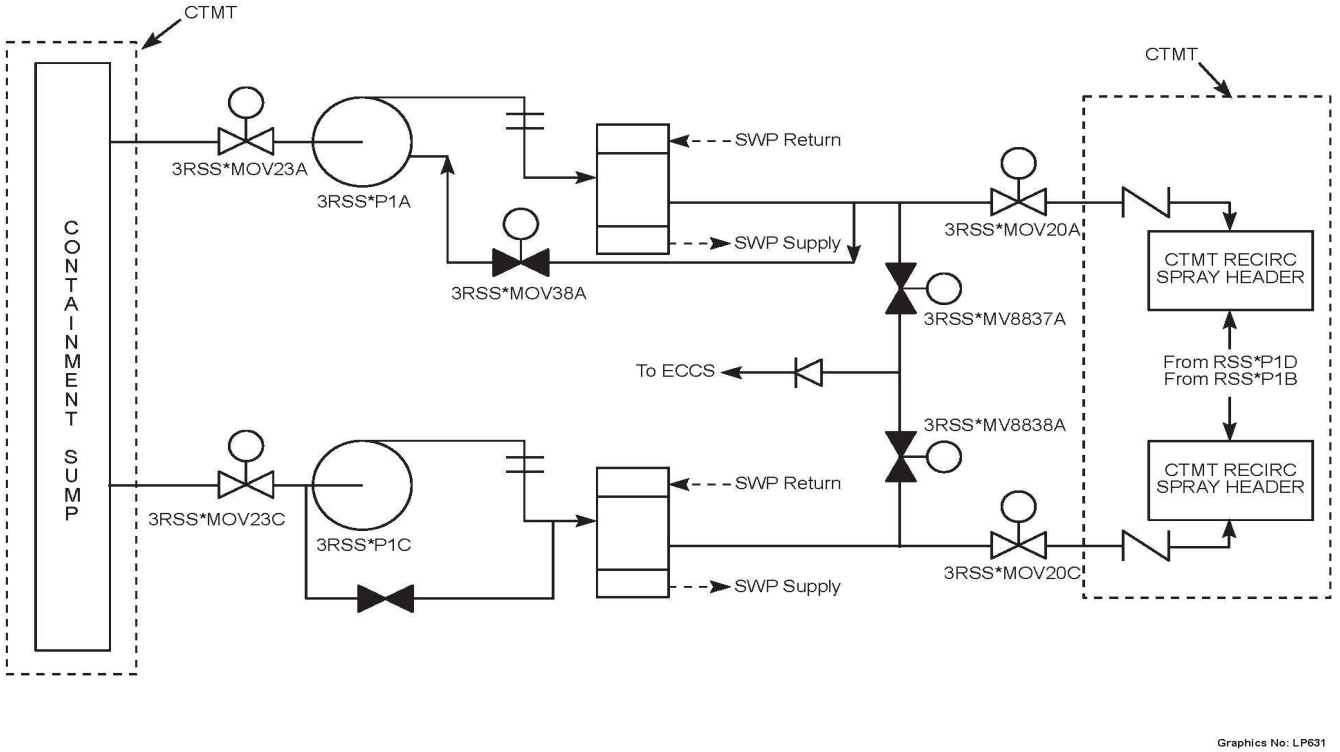

CONTAINMENT RECIRCULATION SYSTEM TRAIN 'A'
(Train 'B' Similar)

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Issue

- Due to the system configuration, performance of the RSS pump flow tests required by the ASME OM Code make the associated residual heat removal (RHR) pump unavailable and limit the capability of the other RHR pump.
  - Testing any RSS pump requires isolating associated RHR pump to establish the test flow path (RSS pumps A & C are connected to RHR train A and RSS pumps B & D are connected to RHR train B).
  - The valve alignment to provide a flow path from the tested RSS pump to the refueling water storage tank (RWST) only permits the RHR pump associated with the available (i.e., not tested) RSS train to supply flow to two cold legs.
  - The testing requirements of the OM Code cannot be met using the installed recirc lines, because the design basis flow rate required for PPV cannot be achieved.

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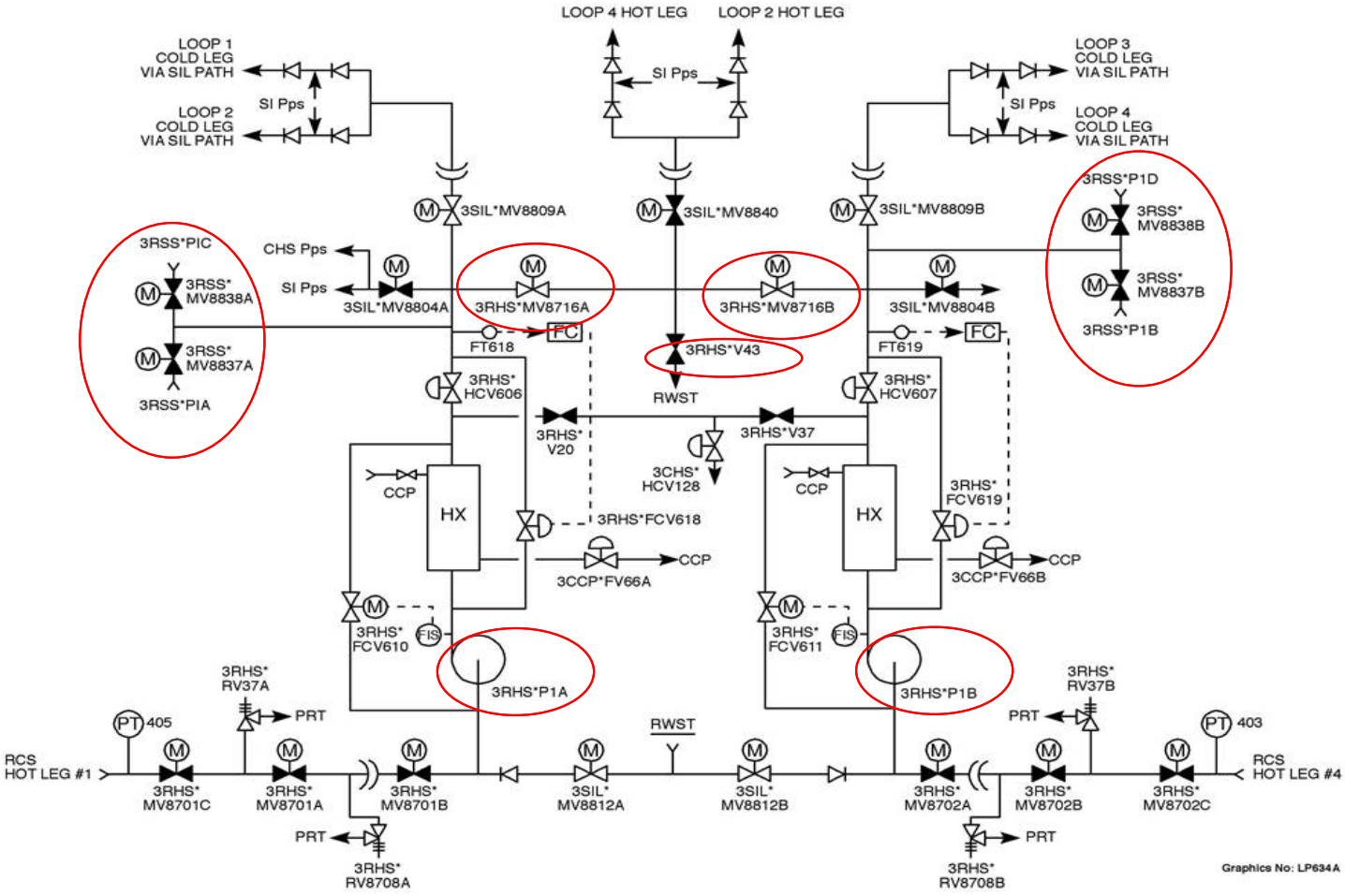

RESIDUAL HEAT REMOVAL SYSTEM

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Issue (continued)

- Performing the test in modes 1-4 would violate existing Technical Specification (TS) 3.5.2/3.5.3 requirements, by making both RHR pumps inoperable and thereby placing the unit in Limiting Condition for Operation (LCO) 3.0.3.
  - The RHR pump only delivering flow to two RCS cold legs is considered inoperable (per TS 3.5.2/3.5.3), since a rupture is assumed to occur in one of the two cold legs.
- Therefore, all four RSS pumps are currently tested each refueling outage to comply with the applicable ASME OM Code/IST Program and TS requirements.
- However, performing this testing during refueling outage shutdown modes can present challenges for MPS3 due to the RSS/RHR shared piping configuration.
  - In modes 5 and 6, RSS pump testing must be sequenced to maintain one RHR pump available for its decay heat removal function.
  - RSS pump testing is a competing priority with work on RHR trains and/or its support systems in modes 5 and 6 or when the unit is defueled (mode 0).
  - These considerations, combined with protected train windows, can cause RSS pump testing activities to be on or near outage critical path.

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Proposed Resolution

- DENC proposes a request for alternative for the current IST interval to the provisions of Mandatory Appendix V (V-2000) for PPV testing of the applicable pumps as defined below:
  - Testing shall be performed at the highest design basis accident flow rate (using a flow path to the RWST through RHR piping) for two RSS pumps in one train, and at reduced flow rate (using pump recirc lines) for the two RSS pumps in the opposite train during the 24-month interval AND
  - The two pumps tested at reduced flow in a given 24-month interval shall be tested at design basis flow in the subsequent 24-month interval.
- The alternative request will demonstrate that the proposed testing program would provide reasonable assurance that the RSS pump will continue perform its safety function and would therefore provide an acceptable level of quality and safety in accordance with 10 CFR 50.55a(z)(1).

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Technical Justification – Maintenance & Monitoring

- The RSS pumps are typically only operated for testing purposes, thus expected pump wear would be limited.
- RSS piping is drained when not in use to minimize corrosion.
- Foreign material intrusion is controlled through containment cleanliness program and associated surveillances (including inspections of pump suction piping).
- Results of past ASME Code-required RSS pump flow tests have shown consistent pump performance with no signs of mechanical or hydraulic degradation.
- In addition to the requirements of the ASME OM Code, the RSS pumps are subject to predictive monitoring techniques, including:
  - Vibration spectrum analysis,
  - Monitoring of motor electrical parameters,
  - Periodic mechanical seal replacement, and
  - Periodic oil replacement.

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Technical Justification – Operation on Recirc

- Recirc lines are provided for each of the four RSS pumps.
  - Lines were used for previously applicable IST testing at power.
  - Operating the pumps on recirc does not affect RHR pump availability.
  - Recirc lines for RSS pumps A & B include installed orifices.
- A flow rate of approximately 45% of the design basis flow rate for RSS pumps A & B, and approximately 90% for RSS pumps C & D, can be achieved while on recirc.
  - Testing at reduced flow rate is still expected to detect pump degradation because the pump curve is well sloped in this region.
- Operating the pumps in either a full flow or recirc alignment will continue to ensure the leak tightness of RSS piping (including pump suction and discharge) is verified in accordance with MPS3 TS 6.8.4.a.
- Comprehensive testing (per ASME OM Code ISTB-3430) will also be performed at these flow rates, which includes verification of acceptable vibration levels.

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Technical Justification – Summary

- Per TS 3/4.6.2.1 TS Bases, “The minimum requirement for the RSS to adequately perform this function [containment heat removal during a LOCA] is to have at least one subsystem (i.e., train) available.”
  - Each outage, performance capability will continue to be demonstrated at design basis (PPV) flow for the pumps in one train and will be demonstrated at sufficient flow to detect potential degradation/failures for the pumps in the other train.
- The proposed alternative would support elimination of a safety train swap in the timeframe between the two decreased RCS inventory windows in the baseline MPS3 refueling outage and would allow one train of RHR to remain dedicated for decay heat removal.
- Thus, the proposed alternative testing program would be beneficial for RFO planning and would improve RHR availability, while continuing to provide adequate indication of RSS pump performance.

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Conclusions

- Operation and maintenance of the RSS pumps preserves pump performance, as validated by the successful past RSS pump testing.
- Continued testing of the RSS pumps at either design basis or reduced flow on a refueling interval maintains the ability to detect potential degradation and failures.
- In addition to testing, the RSS pumps are also subject to predictive monitoring techniques.
- Therefore, the proposed alternative is expected to provide an acceptable level of quality and safety.

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Schedule

- Facility Safety Review Committee (FSRC) is targeted for end of August 2022.
- Alternative Request submittal is targeted for mid-September 2022.
- NRC approval will be requested one year after submittal, to support implementation by 3R22 (fall 2023) outage.

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Questions?

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