VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

October 12, 2023

10 CFR 50.55a

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

| | |
|---|---|
| Serial No. | 23-198 |
| NRA/GDM | R3 |
| Docket Nos. | 50-280 |
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| License Nos. | DPR-32 |
| | DPR-37 |

**VIRGINIA ELECTRIC AND POWER COMPANY**
**SURRY POWER STATION UNITS 1 AND 2**
**INSERVICE TESTING PROGRAM FOR PUMPS AND VALVES**
**SIXTH INTERVAL UPDATE AND ASSOCIATED RELIEF AND ALTERNATIVE REQUESTS**

Pursuant to 10 CFR 50.55a(f)(4)(ii), Virginia Electric and Power Company (Dominion Energy Virginia) hereby submits proposed relief and alternative requests for pumps and valves included in the Surry Power Station (SPS) Units 1 and 2 Inservice Testing (IST) Program for the sixth IST interval. 10 CFR 50.55a(a)(1)(iv)(C) refers to the ASME Code for Operation and Maintenance (OM) of Nuclear Power Plants and includes the 2020 Edition. The ASME OM Code reference became effective on November 28, 2022 and applies to the sixth IST interval for SPS Units 1 and 2. The SPS Units 1 and 2 IST Programs for the sixth IST interval will be updated to comply with the appropriate edition of the ASME OM Code. The sixth IST interval starts on August 10, 2024 for both units.

For SPS Unit 1 and 2, two relief requests (P-1 and P-2) are submitted pursuant to 10 CFR 50.55a(f)(5)(iii) due to impracticality, two alternative requests for pumps (P-3 and P-4) are submitted pursuant to 10 CFR 50.55a(z)(1) as providing an acceptable level of quality and safety, and one alternative request for valves (V-1) is submitted pursuant to 10 CFR 50.55a(z)(2) due to hardship without a compensating increase in quality and safety. A summary of the requests is provided in Attachment 1, and requests P-1 through P-4 and V-1 are included in Attachment 2 of the Enclosure.

Pursuant to 10 CFR 50.55a(f)(6)(i) and 10 CFR 50.55a(z), the proposed requests require Nuclear Regulatory Commission (NRC) review and approval prior to implementation. Dominion Energy Virginia requests NRC approval of the SPS Units 1 and 2 Sixth Interval IST Program relief and alternative requests by July 10, 2024. The remaining portions of the IST Programs are within the provisions of the Code and therefore do not require NRC approval for implementation.

If you have any questions or require additional information, please contact Mr. Gary D. Miller at (804) 273-2771.

Respectfully,

James E. Holloway
Vice President – Nuclear Engineering and Fleet Support

Commitments contained in this letter: None

Enclosure: Surry Power Station Units 1 and 2 Inservice Testing Programs, Proposed Relief and Alternative Requests for the Sixth Inservice Testing Interval

Attachment 1 Summary of Proposed Relief and Alternative Requests for the Sixth IST Interval

Attachment 2 Proposed Relief and Alternative Requests for the Sixth IST Interval

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# ENCLOSURE

## SURRY POWER STATION UNITS 1 AND 2 INSERVICE TESTING PROGRAMS

## PROPOSED RELIEF AND ALTERNATIVE REQUESTS FOR THE SIXTH INSERVICE TESTING INTERVAL

**Attachment 1** **Summary of Proposed Relief and Alternative Requests for the Sixth IST Interval**

**Attachment 2** **Proposed Relief and Alternative Requests for the Sixth IST Interval**

**Virginia Electric and Power Company**
**(Dominion Energy Virginia)**

**Attachment 1**

# SURRY POWER STATION UNITS 1 AND 2 INSERVICE TESTING PROGRAMS

## SUMMARY OF PROPOSED RELIEF AND ALTERNATIVE REQUESTS FOR THE SIXTH INSERVICE TESTING INTERVAL

**Virginia Electric and Power Company**
**(Dominion Energy Virginia)**

| Surry Power Station Unit 1 and Unit 2<br>Inservice Testing Program<br>Summary of Proposed Relief and Alternative Requests for the Sixth IST Intervals | | | | |
|---|---|---|---|---|
| **$6^{th}$ IST Interval Relief / Alternative Requests SPS 1 and 2** | **Relief / Alternative Request Code Case Description** | **Unit 1 $5^{th}$ 10-yr. IST Interval Relief Request** | **Unit 2 $5^{th}$ 10-yr. IST Interval Relief Request** | **Comments** |
| None | Relief to use Code Case OMN-20 which provides scheduling grace on IST surveillances. | G-1 | G-1 | General program relief to use OMN-20, which allows for the application of a 25% grace period when scheduling tests. Code Case OMN-20 has been incorporated into the 2020 edition of the ASME OM Code, ISTA-3170; therefore, relief is no longer required. |
| None | Smooth Running Pumps - Relief to use Code Case OMN-22 which allows alternate acceptance criteria on vibration reference values of ≤0.05 inches per second (ips). | P-1 | P-1 | Code Case OMN-22 has been approved for use in RG 1.192 and allows for vibration values <0.05 ips to use specific acceptance criteria equivalent to P-1; therefore, relief is no longer required. |
| P-1 | Relief from Group A quarterly test requirement for Residual Heat Removal (RHR) pumps. The Comprehensive Pump Test (CPT) will be performed every cold shutdown (CSD) or refueling outage (RFO). | P-2 | P-2 | RHR pumps cannot be tested online. Resubmit alternative request (AR) noting these pumps do not perform an accident mitigation function for any accidents in the safety analysis and request an alternative from ISTB-3400-1, “Inservice Test Frequency,” to allow testing of the RHR pumps every CSD or RFO frequency rather than every 3-months. |

**Surry Power Station Unit 1 and Unit 2**
**Inservice Testing Program**
**Summary of Proposed Relief and Alternative Requests for the Sixth IST Intervals**

| 6th IST Interval Relief / Alternative Requests SPS 1 and 2 | Relief / Alternative Request Code Case Description | Unit 1 5th 10-yr. IST Interval Relief Request | Unit 2 5th 10-yr. IST Interval Relief Request | Comments |
|---|---|---|---|---|
| P-3 | Boric Acid Pump Inlet Instrumentation Accuracy and Range | P-3 | P-3 | The relief request has been updated to be applicable to instrument range requirements only and applies to the Group A and CPT. |
| P-4 | Component Cooling Water to Charging (CH) Pump Inlet Instrumentation Range | P-4 | P-4 | The relief request has been updated to be applicable to instrument range requirements only and applies to the Group A and CPT. |
| P-2 | Containment Spray Pump Flow Rate | P-5 | None | Relief request was previously written for the CPT flow rate. Due to a change in the ASME Code, a relief request will now be written for the pump periodic verification (PPV) test for both units. |
| None | Allowance of 1.06% on upper acceptance criteria for hydraulic parameters | P-6 | P-5 | Relief will not be needed for the sixth IST interval because the allowance of 1.06% on upper acceptance criteria has been incorporated into the 2020 edition of the ASME OM Code. |
| None | Emergency Service Water Pumps using Code Case OMN-16 | P-7 | None | Relief will not be needed for the sixth IST interval because OMN-16 is now approved for use in RG 1.192. OMN-16 is currently used for the Group B and CPTs. |

| **Surry Power Station Unit 1 and Unit 2<br>Inservice Testing Program<br>Summary of Proposed Relief and Alternative Requests for the Sixth IST Intervals** | | | | |
|---|---|---|---|---|
| **6th IST Interval Relief / Alternative Requests SPS 1 and 2** | **Relief / Alternative Request Code Case Description** | **Unit 1 5th 10-yr. IST Interval Relief Request** | **Unit 2 5th 10-yr. IST Interval Relief Request** | **Comments** |
| None | Main Control Room (MCR) Chiller pumps using Code Case OMN-16 | P-8 | None | Relief will not be needed for the sixth IST interval because OMN-16 is now approved for use in RG 1.192. OMN-16 is currently used for the Group A and CPTs. |
| None | Component Cooling Pumps using Code Case OMN-16 | P-9 | P-6 | Relief will not be needed for the sixth IST interval because OMN-16 is now approved for use in RG 1.192. OMN-16 is currently used for the Group A and CPTs. |
| None | Chemical Volume and Control System (CVCS) Pumps using Code Case OMN-16 | P-10 | P-7 | Relief will not be needed for the sixth IST interval because OMN-16 is now approved for use in RG 1.192. OMN-16 is currently used for the Group A Pump Test. |
| V-1 | Mechanical agitation of Pressure Isolation Valve (PIV) 1-SI-241 and deferral of maintenance to the next RFO | V-01 | None | The currently approved AR only applies to 1-SI-241 and expires at the end of Unit 1 refueling outage 1R32 in spring 2024. AR V1 for the sixth interval will address the Category A TS PIVs. |

**Attachment 2**

# SURRY POWER STATION UNITS 1 AND 2
# INSERVICE TESTING PROGRAM

# PROPOSED RELIEF AND ALTERNATIVE REQUESTS FOR THE SIXTH INSERVICE TESTING INTERVAL

**Virginia Electric and Power Company**
**(Dominion Energy Virginia)**

# SURRY POWER STATION UNITS 1 AND 2
# RELIEF REQUEST P-1

## Request for Relief in Accordance with 10 CFR 50.55a(f)(5)(iii)
## - Impractical IST Requirements -

## 1. ASME Code Components Affected

| Component ID | Component Description | ASME Class | Group |
|---|---|---|---|
| 1-RH-P-1A | Unit 1 Residual Heat Removal Pump 1A | 2 | A |
| 1-RH-P-1B | Unit 1 Residual Heat Removal Pump 1B | 2 | A |
| 2-RH-P-1A | Unit 2 Residual Heat Removal Pump 1A | 2 | A |
| 2-RH-P-1B | Unit 2 Residual Heat Removal Pump 1B | 2 | A |

**Function:**

The Residual Heat Removal (RHR) pumps remove decay heat from the reactor core and the Reactor Coolant System (RCS) during plant cool down. The RHR pumps are not required to mitigate any accidents in the plant safety analysis.

## 2. Applicable Code Edition and Addenda

American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code) 2020 Edition.

## 3. Applicable Code Requirements

ISTB-3400, "Frequency of Inservice Tests," states: "An inservice test shall be run on each pump as specified in Table ISTB-3400-1."

Table ISTB-3400-1, "Inservice Test Frequency," requires an inservice test be run on each Group A pump nominally every 3 months.

## 4. Reason for Request

The RHR pumps are located inside the containment. The pumps are low pressure (600 psig design pressure) pumps that take suction from and discharge to the RCS. The RCS is maintained at 2235 psig, and the containment atmosphere is maintained at sub-atmospheric pressure during normal operation. The RHR motor-operated suction and discharge isolation valves are interlocked with an output signal from RCS pressure transmitters which prevent the valves from being opened. The motor-operated valves are closed whenever the RCS pressure and temperature exceed approximately 450 psig and 350 ºF, respectively. Therefore, testing the RHR pumps during normal operation is impractical.

## 5. Proposed Alternative and Basis for Use

The RHR pumps will be tested every cold shutdown and reactor refueling outage unless the pumps have been tested within the previous three months. For a cold shutdown or reactor refueling outage that extends longer than three months, the pumps will be tested every three months in accordance with ISTB 3400-1.

Using the provisions of this relief request as an alternative to the specific requirements of Table ISTB-3400-1 identified above, which have been determined to be impractical, will provide adequate indication of pump performance. The RHR pumps will be tested by comprehensive test parameters biennially. These pumps are not subjected to pump periodic verification testing requirements since there are no specific design basis accident flow rates credited in the safety analyses for these pumps. Therefore, the quarterly Group A test will not be performed.

Therefore, pursuant to 10 CFR 50.55a(f)(5)(iii), Relief Request P-1 identifies these quarterly test requirements as impractical and requests relief from the specific ISTB Code requirements identified in this relief request.

## 6. Duration of Proposed Alternative

The proposed alternative described in Relief Request P-1 will be used for the Surry Power Station Units 1 and 2 Sixth IST Interval.

## 7. Precedents

A similar relief request for the Surry Unit 1 Fifth Ten-Year IST Interval was approved by the NRC in their safety evaluation entitled, "Safety Evaluation by the Office of Nuclear Reactor Regulation, Relief Request No. P-2 Regarding Residual Heat

Removal Pumps," included in the letter from the US NRC to Virginia Electric and Power Company dated April 25, 2014, "Surry Power Station, Units 1 and 2 - Relief from the Requirements of the ASME Code (TAC Nos. MF1813 and MF1814)" (ML14113A346).

The following relief requests for other plants that are similar to Relief Request P-2 were also approved by the NRC:

- Pump Relief Request P-2 for North Anna Power Station, Unit Nos. 1 and 2, Fifth IST interval was approved by the NRC by letter dated September 23, 2020 (ML20252A004).

- Pump Relief Request PRR7 for Beaver Valley Power Station Unit 1 was approved by the NRC by letter dated September 27, 2007 (ML072420376).

# SURRY POWER STATION UNITS 1 AND 2
# RELIEF REQUEST P-2

## Request for Relief in Accordance with 10 CFR 50.55a(f)(5)(iii)
## - Impractical IST Requirements -

1. <u>ASME Code Components Affected</u>

| Component ID | Component Description | ASME Class | Group |
|---|---|---|---|
| 1-CS-P-1A | Unit 1 Containment Spray Pump | 2 | B |
| 1-CS-P-1B | Unit 1 Containment Spray Pump | 2 | B |
| 2-CS-P-1A | Unit 2 Containment Spray Pump | 2 | B |
| 2-CS-P-1B | Unit 2 Containment Spray Pump | 2 | B |

**Function:**

The Containment Spray (CS) pumps provide a cooled, chemically treated, borated spray to reduce containment pressure following a loss of coolant accident (LOCA). The CS System, in conjunction with the Recirculation Spray (RS) System, depressurizes the containment following an accidental release of high energy fluids inside containment and helps remove iodine from the containment atmosphere following a LOCA. These functions minimize the total radioactive leakage from the containment atmosphere to the environment, thus reducing radiation exposure.

2. <u>Applicable Code Edition and Addenda</u>

American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code) 2020 Edition.

3. <u>Applicable Code Requirements</u>

ISTB-2000 Supplemental Definitions: “pump periodic verification test: a test that verifies a pump can meet the required (differential or discharge, as applicable) pressure at its highest design basis accident flow rate.”

ISTB-3310 Effect of Pump Replacement, Repair, and Maintenance on Reference Values: requires determination of whether the pump periodic verification test is required.

ISTB-3400 Frequency of Inservice Tests: "For those pumps identified in ISTB-1400(d), a pump periodic verification test shall be performed biennially in accordance with this Subsection. The Owner is not required to perform a pump periodic verification test if the design basis accident flow rate in the Owner's safety analysis is less than or equal to the comprehensive pump test flow rate or Group A test flow rate."

ISTB-5110(a) Baseline Testing: If practicable, these points shall be from pump minimum flow to at least the comprehensive pump test flow rate, or, if a pump periodic verification test is required per ISTB-3400, the pump design basis accident flow rate in the credited Owner's safety analysis, whichever is higher.

ISTB-5124 Periodic Verification Test: Tests shall be performed for pumps identified via ISTB-1400(d). If the required flow and differential pressure cannot be achieved, then the pump is in the action range, and corrective actions shall be taken in accordance with ISTB-6200(b).

ISTB-6200(b) *Action Range*: If the pump periodic verification test flow or pressure parameter is not met or a measured test parameter value falls within the required action range of Table ISTB-5121-1, Table ISTB-5221-1, Table ISTB-5321-1, or Table B-5321-2, as applicable, the pump shall be declared inoperable until either the cause of the deviation has been determined and the condition is corrected, or an analysis of the pump is performed in accordance with (c).

## 4. Reason for Request

The test loop for the CS pumps is shown in Figure P-2.1. The CS pumps take suction from the Refueling Water Storage Tank (RWST) and discharge back to the RWST. With this test loop, it is not possible to achieve the design basis accident flow rate required for the pump periodic verification (PPV) test. The PPV flow rate has been identified as 2605 gpm. Therefore, relief from the Code requirement is requested for Surry Units 1 and 2.

Pump Design Basis Accident Flow Rate Basis

Surry has determined the CS pump design basis accident flow rate is 2605 gpm based on the plant safety analyses. This value represents the minimum flow rate that a single pump will flow under the lowest resistance pressure boundary conditions.

Specifically, a single pump will produce a minimum of 2605 gpm when the static pressure due to the RWST (the CS suction source) level is 10 psi greater than the containment pressure.

Initially, when the CS pumps start, the RWST is full and the containment is at the design pressure of 45 psig. As containment pressure decreases during a design basis accident following spray actuation, the CS pump total developed head (TDH) will decrease and the flow will increase as the pump operating point moves out on the pump curve. The pump response along the pump curve, as modeled in the accident analysis, is for a degraded pump. The actual pump head performance at 1600 gpm (the approximate test flow rate) is well above the corresponding head of the accident analysis degraded pump curve requirement.

The Code requires that any pumps with specific design basis accident flow rates in the Owner's credited safety analysis be included in a pump periodic verification test program. The average test flow rate for tests conducted since 2004 is 1590 gpm for Unit 1 and 1676 gpm for Unit 2. The CS system is a fixed resistance system, and the test flow rates tend to vary several gpm based on initial RWST level.

Pre-Operational Testing

During the construction period, the CS headers were fitted with blind flanges that allowed the connection of temporary drain lines for initial testing of the subsystem. After the subsystem was completely installed, temporary connections between the spray headers were made using blind flanges on the spray headers, and pipe plugs were placed in the spray nozzle sockets. The CS pumps were started and operated over a range of flows, circulating water through the spray header supply line to the spray headers, out the temporary drain connections and to the opposite spray headers. The water was then directed to the RWST through the 4" recirculation line. Although the pre-operational test did not produce full flow conditions, it provided a full-system capability test and demonstrated that the pumps were operating on the manufacturer pump curve. It also flushed the system to remove any particulate matter that could plug the spray nozzles at a future time. At the completion of this test, the temporary drain connections were removed, the blind flanges replaced, the pipe plugs removed, the nozzle pipe nipple inspected, and the spray nozzles installed.

Surry Predictive Maintenance Program

In addition to the testing described above, the CS pumps are included in the Surry Predictive Maintenance Program. For the CS pumps, this program employs predictive monitoring techniques, such as vibration monitoring and analysis beyond that required by ISTB, and oil sampling and analysis.

If the measured parameters are outside the normal operating range or are determined by analysis to be trending toward an unacceptable degraded state, appropriate actions are taken that may include:

- increased monitoring to establish rate of change,
- review of component specific information to identify cause, and
- removal of the pump from service to perform maintenance.

Detection of Pump Degradation

Testing the CS pumps at or near 1600 gpm will detect degradation in performance and verify the pumps are operating acceptably. The 1600 gpm point (50% of the point of best efficiency of approximately 3200 gpm) is in a portion of the pump curve where degradation will be detected. Also, there is significant margin available above the minimum acceptable pump curve when testing the pump on the test loop. A decrease in the available margin is detectable before pump performance becomes unacceptable. The margin available for the four pumps ranges from 8.7 psid to 9.8 psid when averaging the last three test results for each of the four pumps as shown in Figure P-2.2. These pumps are normally not in operation and only placed in service for testing; therefore, no significant changes to the running clearances are expected over time. There are no degrading trends on any of the four pumps, and review of test history going back to 2004 shows the measured differential pressure has not had any noticeable change in measured results.

Figure P-2.2 shows the minimum design basis accident pump curve for 2-CS-P-1B, a typical test point for each pump, and the corresponding minimum design basis accident test point. Anything below each pump's minimum test point is considered unacceptable performance.

## 5. Proposed Alternative and Basis for Use

A comprehensive pump test (CPT) reference flow rate has been established for each of the four pumps at approximately 60% of the pump design basis accident flow rate. This CPT will follow the guidance in ISTB-5123, Comprehensive Test Procedure, and will be performed on a quarterly basis.

The CS pumps will be subject to additional testing, trending, and diagnostic analysis per the Surry Predictive Maintenance Program.

Using the provisions of this relief request as an alternative to the specific requirements of ISTB identified for Pump Periodic Verification (identified above) will provide adequate indication of pump performance and continue to provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(f)(5)(iii), Surry Power Station requests relief from the specific ISTB Code requirements identified in this relief request.

## 6. Duration of Proposed Alternative

The proposed alternative described in Relief Request P-2 will be used for the Surry Power Station Units 1 and 2 Sixth IST Interval.

## 7. Precedents

A similar relief request was approved by the NRC in their safety evaluation entitled, "Safety Evaluation by the Office of Nuclear Reactor Regulation Relief Request Nos. P-1, P-3, P-4, P-5 and P-6 for Unit 1 and P-1, I P-3, P-4, and P-5 for Unit 2 Regarding ASME OM Code Requirements for the Surry Fifth 10-Year Inservice Test Program Interval," dated May 9, 2014 (ML14125A471).

The following relief requests for other plants that are similar to portions of P-2 were also approved by the NRC:

- Pump Relief Request P-5 for North Anna Power Station, Unit Nos. 1 and 2, was approved by the NRC by letter dated September 23, 2020 (ML20252A004).
- Pump Relief Request PRR11 for Beaver Valley Power Station Unit 1 was approved by the NRC by letter dated September 27, 2007 (ML072420376).

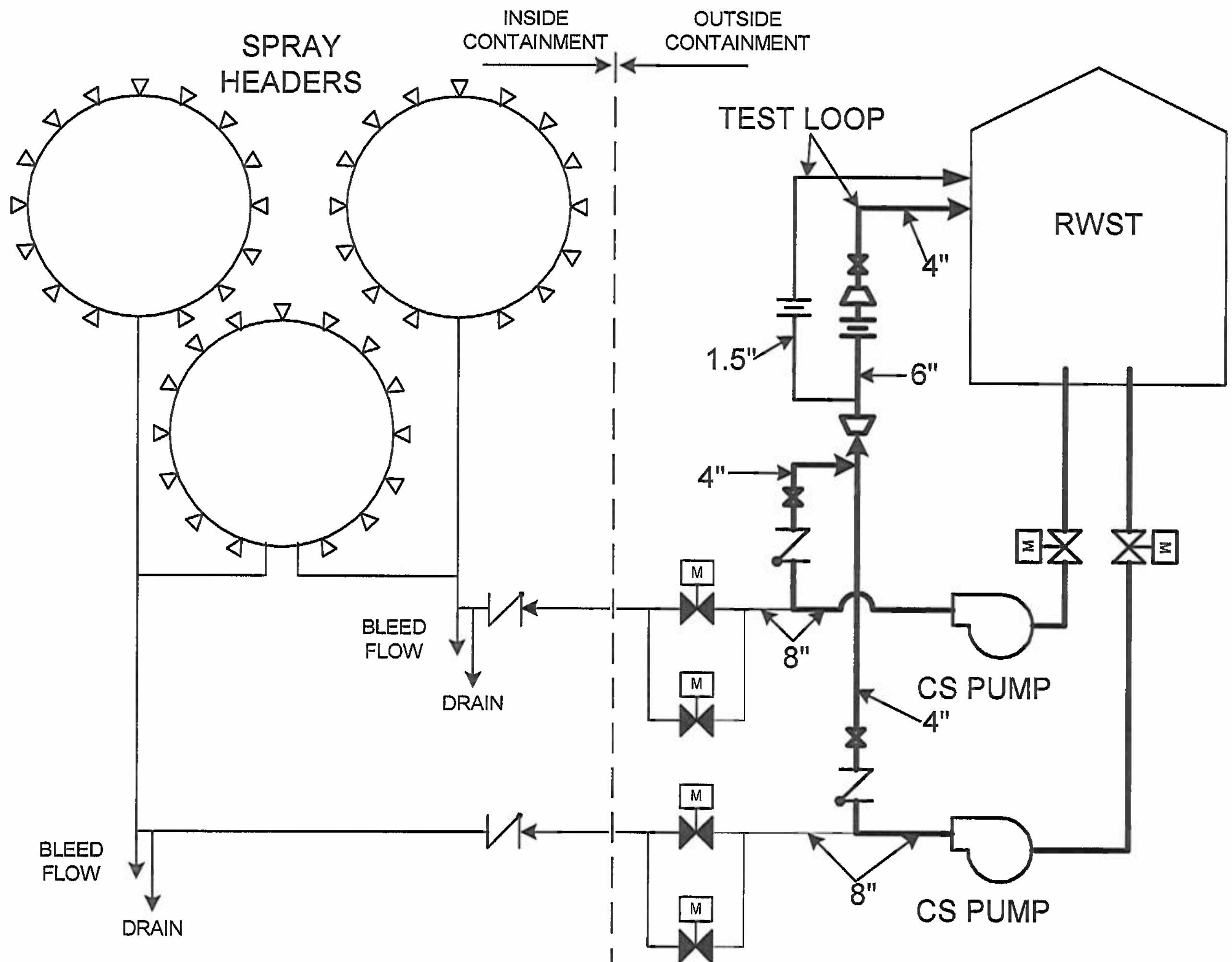
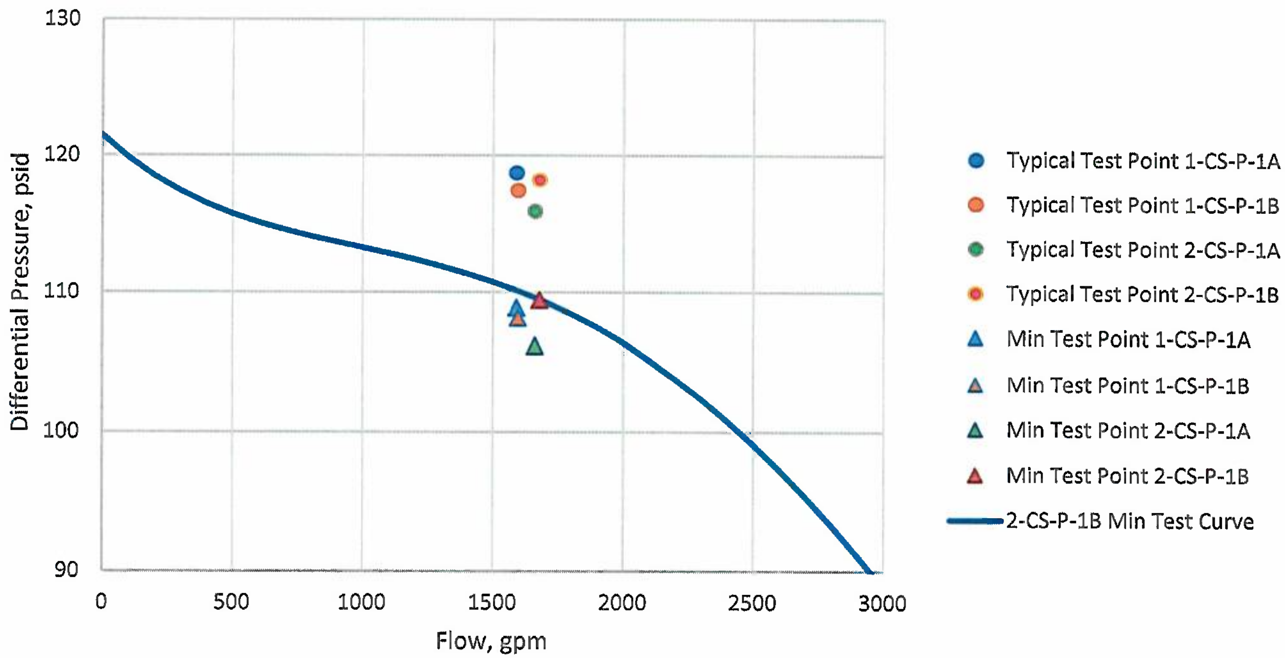



Figure P-2.1 Containment Spray System

Figure P-2.2
CS Pump Test Data



## ALTERNATIVE REQUEST P-3

**Proposed Alternative in Accordance with 10 CFR 50.55a(z)(1)**
**- Provides an Acceptable Level of Quality and Safety -**

1. **ASME Code Components Affected**

| Component ID | Component Description | ASME Class | Group |
|---|---|---|---|
| 1-CH-P-2A | Boric Acid Transfer Centrifugal Pump | 2 | A |
| 1-CH-P-2B | Boric Acid Transfer Centrifugal Pump | 2 | A |
| 1-CH-P-2C | Boric Acid Transfer Centrifugal Pump | 2 | A |
| 1-CH-P-2D | Boric Acid Transfer Centrifugal Pump | 2 | A |

**Function:**

The boric acid transfer pumps supply boric acid to the suction of the charging pumps for emergency boration.

2. **Applicable Code Edition and Addenda**

American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code) 2020 Edition.

3. **Applicable Code Requirement**

ISTB-3510(b)(1) requires that the full-scale range of each analog instrument shall be not greater than three times the reference value.

4. **Reason for Request**

The installed inlet pressure gauges for the Group A and Comprehensive Pump Tests have a full-scale range of 0 to 15 psig. These instruments were sized by evaluating the static pressures present at the suction side of the pumps and applying the three times rule of ISTB-3510(b)(1). When the pumps are started, the pressure at the suction side of the pumps drops to approximately 2 psig; therefore, the inlet pressure gauges do not meet the three times rule for dynamic inlet pressure. Using a lower range temporary gauge on a quarterly basis presents a hardship because the process fluid contains boric acid and is contaminated. The gauges could also be exposed to an over range condition (static pressures in excess of 6 psig) which may damage the lower range temporary instruments.

The difference in the error between the 0 to 15 psig gauges and gauges that would meet the three times full-scale rule are so small that the 0 to 15 psig gauges can be considered equivalent in terms of accuracy for determining differential pressure. Some historical readings show a suction pressure as low as 0.5 psig which would lead to a range of 0-1.5 psig to meet the three times rule. A 0.5% accuracy for the 1.5 psig gauge translates to an error of 0.0075 psig. A 0.5% accuracy for the 15 psig gauge translates to an error of 0.075 psig. The difference in error of 0.0675 psig is insignificant when determining the differential pressures for these pumps which range between 90 and 110 psid. Therefore, the gauges can be considered equivalent in terms of accuracy for determining differential pressure.

## 5. Proposed Alternative and Basis for Use

Inlet pressure for the Group A and Comprehensive Pump Tests will be measured with gauges that have a full-scale range of 0 to 15 psig.

Using the provisions of this request as an alternative to the specific requirements of ISTB-3510(b)(1) identified above will provide adequate indication of pump performance and continue to provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(z)(1), approval is requested to use the proposed alternative to the specific ISTB Code requirements identified in this request.

## 6. Duration of Proposed Alternative

The proposed alternative described in Alternative Request P-3 will be used for the Surry Power Station Sixth Inservice Testing Interval.

## 7. Precedents

A similar request was approved by the NRC in their safety evaluation entitled, "Safety Evaluation by the Office of Nuclear Reactor Regulation, Relief Request Nos. P-1, P-3, P-4, P-5 and P-6 for Unit 1 and P-1, P-3, P-4, and P-5 for Unit 2 Regarding ASME OM Code Requirements for the Surry Fifth 10-Year Inservice Test Program Interval," dated May 9, 2014 (ML14125A471).

The following request similar to portions of P-3 was also approved by the NRC:

Pump Relief Request PR-05 for the St. Lucie Plant, Unit Nos. 1 and 2, was approved by NRC letter dated January 26, 2018 (ML18018A033).

# ALTERNATIVE REQUEST P-4

## Proposed Alternative in Accordance with 10 CFR 50.55a(z)(1)
## - Provides an Acceptable Level of Quality and Safety -

### 1. ASME Code Components Affected

| Component ID | Component Description | ASME Class | Group |
|---|---|---|---|
| 1-CC-P-2A | Unit 1 Component Cooling Water Charging Pump Centrifugal Pump | 3 | A |
| 1-CC-P-2B | Unit 1 Component Cooling Water Charging Pump Centrifugal Pump | 3 | A |
| 2-CC-P-2A | Unit 2 Component Cooling Water Charging Pump Centrifugal Pump | 3 | A |
| 2-CC-P-2B | Unit 2 Component Cooling Water Charging Pump Centrifugal Pump | 3 | A |

**Function:**

The charging pump cooling water pumps supply cooling water to transfer heat from the charging pump mechanical seals coolers.

### 2. Applicable Code Edition and Addenda

American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code) 2020 Edition.

### 3. Applicable Code Requirement

ISTB-3510(b)(1) requires that the full-scale range of each analog instrument shall be not greater than three times the reference value.

### 4. Reason for Request

Installed inlet pressure gauges used for the Group A and Comprehensive Pump Tests have a full-scale range of 0 to 3.5 psig. Readings from these inlet pressure gauges over the past year indicate that the dynamic pressures fall within the bottom third of full-scale. However, the difference in the error between the 0 to 3.5 psig gauges and gauges that would meet the three times full-scale rule are so small that the 0 to 3.5 psig gauges can be considered equivalent in terms of accuracy for determining differential pressure.

For example, inlet pressures as low as 0.65 psig have been recorded for pump 1-CC-P-2B. A gauge that meets the three times full-scale rule would have a full-scale of 0 to 1.95 psig or less. A 0.5% accuracy for the 1.95 psig gauge translates to an error of 0.00975 psig. A 0.5% accuracy for the 3.5 psig gauge translates to an error of 0.0175 psig. The difference in error of 0.00775 psig is insignificant when determining the differential pressures for these pumps which range between 50 and 60 psid. Therefore, the gauges can be considered equivalent in terms of accuracy for determining differential pressure.

## 5. Proposed Alternative and Basis for Use

Inlet pressure for the Group A and Comprehensive Pump Tests will be measured with gauges that have a full-scale of 0 to 3.5 psig.

Using the provisions of this request as an alternative to the specific requirements of ISTB-3510(b)(1) identified above will provide adequate indication of pump performance and continue to provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(z)(1), approval is requested to use the proposed alternative to the specific ISTB Code requirements identified in this request.

## 6. Duration of Proposed Alternative

The proposed alternative described in Alternative Request P-4 will be used for the Surry Power Station Sixth Inservice Testing Interval.

## 7. Precedents

A similar relief request was approved by the NRC in their safety evaluation entitled, "Safety Evaluation by the Office of Nuclear Reactor Regulation Relief Request Nos. P-1, P-3, P-4, P-5 and P-6 for Unit 1 and P-1, P-3, P-4, and P-5 for Unit 2 Regarding ASME OM Code Requirements for the Surry Fifth 10-Year Inservice Test Program Interval," dated May 9, 2014 (ML14125A471).

The following relief request for another plant that is similar to portions of P-4 was also approved by the NRC:

Pump Relief Request PR-05 for the St. Lucie Plant, Unit Nos. 1 and 2, was approved by NRC letter dated January 26, 2018 (ML18018A033).

# SURRY POWER STATION UNITS 1 AND 2
# ALTERNATIVE REQUEST V-1

## Proposed Alternative in Accordance with 10 CFR 50.55a(z)(2)
## - Hardship Without a Compensating Increase in Quality and Safety -

## 1. ASME Code Components Affected

| Component ID | Component Description | ASME Class | Group |
|---|---|---|---|
| 1/2-SI-79 | RCS Cold Leg SI Admission Check Valve | 1 | AC |
| 1/2-SI-82 | RCS Cold Leg SI Admission Check Valve | 1 | AC |
| 1/2-SI-85 | RCS Cold Leg SI Admission Check Valve | 1 | AC |
| 1/2-SI-241 | Low Head SI to RCS Cold Leg Isolation Check Valve | 1 | AC |
| 1/2-SI-242 | Low Head SI to RCS Cold Leg Isolation Check Valve | 1 | AC |
| 1/2-SI-243 | Low Head SI to RCS Cold Leg Isolation Check Valve | 1 | AC |

**Function:**

The Category AC valves have an open safety function to provide a flow path for borated water injection and recirculation from the High Head Safety Injection (HHSI) and Low Head Safety Injection (LHSI) pumps to the Reactor Coolant System (RCS) cold legs. Safety Injection (SI) is required for Condition III Event Small Break Loss of Coolant Accidents (SBLOCA), Condition IV Events Large Break Loss of Coolant Accidents (LBLOCA), Main Steam Line Breaks (MSLB), and Steam Generator Tube Ruptures (SGTR). These valves also have a safety function in the closed position. The normally closed check valves remain closed to isolate the LHSI low pressure piping from the RCS and the HHSI injection headers. These valves are also designated as Pressure Isolation Valves (PIVs) per Technical Specification (TS) 3.1.C.5.a. 1/2-SI-241, 242 and 243 are also considered Containment Isolation Valves (CIVs) but are not leak tested per the 10 CFR 50 Appendix J Program.

## 2. Applicable Code Edition and Addenda

American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code) 2020 Edition.

## 3. Applicable Code Requirements

ASME OM Code, Subsection ISTC-3630, "Leakage Rate for Other Than Containment Isolation Valves," states, "Valve closure before seat leakage testing shall be by using the valve operator with no additional closing force applied."

ASME OM Code, Subsection ISTC-3630(a), requires Category A leakage rate testing to be conducted at least once every two years.

ASME OM Code, Subsection ISTC-3630(f), "Corrective Action," states, "Valves or valve combinations with leakage rates exceeding values specified by the Owner per ISTC-3630(e) shall be declared inoperable and either repaired or replaced."

ASME OM Code, Subsection ISTC-5221(a)(1), "Valve Obturator Movement," states, "Check valves that have a safety function in both the open and closed directions shall be exercised by initiating flow and observing that the obturator has traveled to either the full open position or to the position to perform its intended function(s) (see ISTA-1100), and verify on cessation or reversal of flow, the obturator has traveled to the seat."

ASME OM Code, Subsection ISTC-5224, "Corrective Action," states, "If a check valve fails to exhibit the required change of obturator position, it shall be declared inoperable. A retest showing acceptable performance shall be run following any required corrective action before the valve is returned to service."

## 4. Reason for Request

Surry Power Station (SPS) Units 1 and 2 have requirements for leakage rate testing of PIVs in the TS and the IST Program.

- TS Requirements - SPS TS 3.1.C, "RCS Operational Leakage," has the following requirements related to PIVs:

  5.a. *Prior to going critical all primary coolant system pressure isolation valves listed below shall be functional as a pressure isolation device, except as* *specified in 3.1.C.5.b. Valve leakage shall not exceed the amounts indicated.*

| *Description* | *Unit 1* | *Unit 2* | *Max. Allowable Leakage (see note (a) below)* |
|---|---|---|---|
| *Loop A, Cold Leg* | *1-SI-79, 1-SI-241* | *2-SI-79, 2-SI-241* | *≤ 5.0 gpm for each valve* |
| *Loop B, Cold Leg* | *1-SI-82, 1-SI-242* | *2-SI-82, 2-SI-242* | |
| *Loop C, Cold Leg* | *1-SI-85, 1-SI-243* | *2-SI-85, 2-SI-243* | |

b. *If Specification 3.1.C.5.a cannot be met, an orderly shutdown shall be initiated and the reactor shall be in HOT SHUTDOWN within 6 hours and in COLD SHUTDOWN within the following 30 hours.*

*Note (a):*

1. *Leakage rates less than or equal to 1.0 gpm are considered acceptable.*
2. *Leakage rates greater than 1.0 gpm but less than or equal to 5.0 gpm are considered acceptable if the latest measured rate has not exceeded the rate determined by the previous test by an amount that reduces the margin between measured leakage rate and the maximum permissible rate of 5.0 gpm by 50% or greater.*
3. *Leakage rates greater than 1.0 gpm but less than or equal to 5.0 gpm are considered unacceptable if the latest measured rate exceeded the rate determined by the previous test by an amount that reduces the margin between measured leakage rate and the maximum permissible rate of 5.0 gpm by 50% or greater.*
4. *Leakage rates greater than 5.0 gpm are considered unacceptable.*

Item 19 in TS Table 4.1-2A, "Minimum Frequency for Equipment Tests," provides the testing frequency for the PIVs as follows: "Periodic leakage testing on each valve listed in Specification 3.1.C.5.a shall be accomplished prior to entering POWER OPERATION after every time the plant is placed in COLD SHUTDOWN for refueling, after each time the plant is placed in COLD SHUTDOWN for 72 hours if testing has not been accomplished in the preceding 9 months, and prior to returning the valve to service after maintenance, repair or replacement work is performed."

The proposed alternative request does not affect the above TS requirements.

<u>ASME OM Code Requirements</u> - The SPS Units 1 and 2 IST Programs implement the ASME OM Code as required by SPS TS 6.4.I, "Inservice Testing Program," and 10 CFR 50.55a(f). As previously noted, the Code of Record for SPS Units 1 and 2 is the ASME OM Code 2020 Edition, which requires the following:

- OM Code, Subsection ISTC-3630, requires Category A testing to verify seat leakages are within acceptable limits and states, "Valve closure before seat leakage testing shall be by using the valve operator with no additional closing force applied."

- OM Code, Subsection ISTC-3630(a), requires Category A leakage rate testing to be conducted at least once every two years.

- OM Code, Subsection ISTC-3630(b)(4), allows testing to be performed at reduced differential test pressure if the leakage result is correlated to leakage at an RCS pressure. SPS calculates this acceptance criterion by taking the square root of the ratio between the test and functional pressure and multiplies it by the TS leakage limit of 1 gpm as prescribed by this paragraph. Currently, the reduced pressure acceptance criterion is set to 0.259 gpm for each Low Head SI to RCS Cold Leg Isolation check valve, and the leakage for all three valves must be less than 0.450 gpm. The RCS Cold Leg SI Admission check valves are limited to a leakage of 0.366 gpm.

- The leakage testing requirement of ISTC-3630 is used to satisfy the requirements of ISTC-5221(a)(1) and ISTC-5224.

Historically, TS PIVs have been leak tested during startup from RFOs (and certain other non-RFOs) at lower differential test pressures (starting around 150 psi). Leak testing of the LHSI to RCS Cold Leg Isolation valves is accomplished by using pressure from a partially pressurized SI Accumulator at the check valve and collecting and measuring leakage over time at an upstream low pressure drain valve. The leak testing of the RCS Cold Leg SI Admission Check Valves is performed with RCS pressure between 300 and 365 psig.

Most PIVs tested at the lower pressures meet the leakage rate acceptance criteria when correlated to RCS pressure. However, some PIVs have required higher test pressures (up to nominal RCS pressure) to achieve acceptable leakage results, and test procedures allow testing at low or higher pressures. In certain cases, mechanical agitation has been used to seat the valve to achieve an acceptable leakage rate. Dominion Energy Virginia recognizes that mechanical agitation is a troubleshooting activity rather than a repair method and also recognizes that OM Code ISTC-3630(f) requires valves with leakage rates that exceed their acceptance criteria to be declared inoperable and either repaired or replaced, followed by a re-test to confirm acceptable operation prior to being returned to service. Dominion Energy Virginia is also aware of a recent precedent where the NRC approved an IST alternative request for the Tennessee Valley Authority (TVA) Sequoyah Nuclear Plant (SQN) to use mechanical agitation as a PIV leakage test troubleshooting tool, and for deferring repair or replacement of certain PIVs to the following RFO. Also, the NRC recently approved an emergency Alternative Request to use mechanical agitation for PIV 1-SI-241 during the Surry Unit 1 fall 2022 RFO in the 5th ten-year IST Interval.

## 5. Proposed Alternative

Dominion Energy Virginia is requesting an alternative to the ISTC-3630 requirements as they relate to use of additional closing force to achieve PIV closure before seat leakage testing; ISTC-3630(f) requirements as they relate to corrective action following a failed seat leakage test; ISTC-5221(a)(1) requirements as they relate to demonstrating that a PIV check valve disc travel to its seat following cessation of flow; and ISTC-5224 requirements as they relate to retesting following any required corrective action before the valve is returned to service. The proposed alternative is applicable to the valves listed in Section 1 of this AR.

Seat leakage testing for the TS PIVs occurs at low pressures to expedite unit startup activities following an RFO. When seat leakage testing does not meet the acceptance criteria, the following actions will be taken:

- Each PIV that does not meet the leakage test acceptance criteria will be declared inoperable in accordance with the applicable TS, and the failed PIV will be entered into the site corrective action program, which will allow the provisions of this alternative to be invoked.

- Rather than performing an ASME Code repair or replacement, the check valve may be mechanically agitated in accordance with the guidance provided in Section 6.B of this alternative.

- After mechanical agitation, the valve will be retested using normal test procedures. The incremental agitation and testing process may be repeated until seat leakage or closure test acceptance criteria are met, or if it is determined that corrective action is required.

    - If the seat leakage or closure test meets the acceptance criteria, then the PIV will be declared operable.

    - If the seat leakage or closure test does not meet the acceptance criteria, the PIV will be repaired or replaced during the outage of discovery.

- If a PIV needs to be mechanically agitated and subsequently passes the seat leakage or closure test, it will be repaired or replaced during the next affected unit's RFO.

- When the PIV is either repaired or replaced during the next outage, it must pass post-maintenance tests (including seat leakage test, as applicable) before being declared operable.

Using the provisions of this request as an alternative to the specific requirements of ISTC-3630, ISTC-3630(f), ISTC-5221(a)(1) and ISTC-5224, which have been identified as a hardship without a compensating increase in quality and safety pursuant to 10 CFR 50.55(z)(2), will provide adequate indication of the function and operability of these PIVs.

## 6. Basis for the Proposed Alternative

The proposed alternative is based on the following factors:

- The PIVs are a standard design check valve model for RCS system conditions and typically perform well until operation eventually results in degradation of the seating surfaces.

- Back-leakage testing requires pressure from either the RCS below 365 psig or the SI Accumulators below 300 psig. To test back-leakage characteristics, any leakage is measured from drain valves upstream of the check valves which would demonstrate quantifiable leakage past the check valves. Unless there is a significant pressure differential across the seat, the disc may not be pushed into the seat with enough force to achieve full contact. The discs are slightly inclined so gravity does not help keep the disc closed to the extent that it would for a vertically mounted check valve.

- SPS has experienced problems achieving consistent pressure differential across the seats due to numerous connections and branches involved in the configuration. SPS has been able to achieve the required pressure differential through valve realignment and venting and cycling of valves but only after extensive troubleshooting and procedure changes. However, a failed test for these valves would require the emergent activities discussed previously to effect repair or replacement.

- Once the check valves are closed with an acceptable seat leakage rate, the valves would not be required to open unless a LBLOCA occurred and would not be required to perform the PIV or closure function again following a LBLOCA. Should a LBLOCA occur, the plant would be shut down for an extended period of time, which would allow the maintenance planned for the next RFO to be performed prior to startup following the LBLOCA.

A) Review of Maintenance History for Valves in Section 1

**Table V-1.1**
**History of Leakage Testing Results of Unit 1 PIVs (gpm)**

| Outage | 1-SI-79 | 1-SI-82 | 1-SI-85 | 1-SI-241 | 1-SI-242 | 1-SI-243 |
|---|---|---|---|---|---|---|
| 1R31 (Fall 2022) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1R30 (Spring 2021) | 0.0 | 0.0 | 0.0 | Initially >25; 0.0 after agitation | 0.0 | 0.0 |
| 1R29 (Fall 2019) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1R28 (Spring 2018) | 0.0 | 0.0 | 0.0 | 0.0164 | 0.0 | 0.0 |
| 1R27 (Fall 2016) | Initially 1.0; 0.0 after agitation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1R26 (Spring 2015) | Initially >1.83; 0.0 after agitation | 0.0 | 0.0 | 0.0 | 0.0 | 0.012 |
| 1R25 (Fall 2013) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1R24 (Spring 2012) | Initially 22; 0.0 after agitation | 0.0 | 0 | 0.009 | 0.002 | 0.0 |
| 1R23 (Fall 2010) | 0.0 | 0.0 | 0.0 | 0.016 | 0.005 | 0.008 |
| 1R22 (Spring 2009) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1R21 (Fall 2007) | 0.0 | 0.0 | 0.0 | 1.82/1.6/0/0 | 0.0 | 0.0 |
| 1R20 (Spring 2006) | 0.16 | 0.0 | 0.0 | Initially > 5; 0.0159 after agitation | 0.0 | 0.0053 |

Table V-1.1 shows that in the spring of 2006 1-SI-241 was mechanically agitated after leakage testing due to measured seat leakage >5 gpm. Following agitation, the as-left leakage rate was found to be 0.0159 gpm. A work order was generated after the agitation, and the valve was worked in the fall of 2007. A vendor was brought in due to difficulties returning the valve to service which is the reason for the four test results during RFO 1R21 noted in Table V-1.1. The vendor provided additional direction to improve maintenance practices and procedural guidance for rebuilding the 6" Velan swing check valves. Since that time, test results have consistently been approximately zero until the leakage test performed in 2021. 1-SI-79 required agitation in 1R24, 1R26, and 1R27. The valve was opened and inspected in 1R28, and the seating surfaces were found to be satisfactory, but the internals of the valve were out of alignment. The valve was rebuilt and passed the leakage test with zero back leakage.

**Table V-1.2**
**History of Leakage Testing Results of Unit 2 PIVs (gpm)**

| Outage | 2-SI-79 | 2-SI-82 | 2-SI-85 | 2-SI-241 | 2-SI-242 | 2-SI-243 |
|---|---|---|---|---|---|---|
| 2R31 (Spring 2023) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2R30 (Fall 2021) | 0.0 | 0.0 | 0.023 | 0.0 | 0.0 | 0.0 |
| 2R29 (Spring 2020) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2R28 (Fall 2018) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2R27 (Spring 2017) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2R26 (Fall 2015) | 0.0 | 0.0 | 0.0 | 0.005 | 0.0 | 0.0 |
| 2R25 (Spring 2014) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2R24 (Fall 2012) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2R23 (Spring 2011) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2R22 (Fall 2009) | 0.0 | 0.0 | 0.00016 | 0.0 | 0.0 | 0.0 |
| 2R21 (Spring 2008) | 0.0 | 0.0 | 0.250 | Initially >10.0; 0.125 After agitation | 0.220 | 0.0 |
| 2R20 (Fall 2006) | 0.0 | 0.0 | 0.048 | Initially 15.0; 0.211 after agitation | 0.132 | 0.0 |

Table V-1.2 shows that Unit 2 has not had any recent need to mechanically agitate the subject valves. 2-SI-241 was mechanically agitated in 2R20 and 2R21. The valve was opened and inspected during 2R21, and the valve internals were rebuilt. The valve then passed the seat leakage test with zero back leakage.

B) Requirements for Application of Mechanical Agitation to Seat PIVs

Similar to the TVA and SPS Unit 1 precedents discussed in Section 4 above and referenced in Section 7 below, for this proposed alternative, Dominion Energy Virginia has performed an engineering evaluation that determined using a 15-pound hammer in accordance with the following instructions to mechanically agitate the check valves will not cause internal damage or degradation to the valves:

- To avoid preconditioning the check valves, obtain as-found test results and declare the valve(s) inoperable as required. Use other methods to try to seat the valve prior to use of mechanical agitation such as variance of pressure or venting.

- Visually inspect the valve body prior to the use of mechanical agitation and record any pre-existing damage, markings, or defects.

- Mechanical agitation of the check valve is to be performed by tapping the valve body using a 15-pound (maximum) rubber or dead blow hammer swung approximately 120 degrees about the elbow WITHOUT excessive use of the body to accelerate the hammer head.

- The surface to be mechanically agitated shall NOT include valve bolting or flanges.

- The valve shall be visibly inspected after the application of mechanical agitation to ensure no physical external damage to the check valve has occurred.

- The valve shall be scheduled for disassembly during the next RFO following the application of mechanical agitation to inspect the valve for damage and determine whether the agitation caused an adverse effect on valve performance.

- If the mechanically agitated check valve subsequently passes its seat leakage test, it shall be repaired or replaced during the next RFO.

Because mechanical agitation is not a repair or replacement activity, this alternative is needed to avoid potential unnecessary emergent demands on plant equipment, resources, and personnel. An evaluation of the mechanical agitation process is provided in the attachment to this alternative request.

C) Design of the Safety Injection Check Valves

Failure of a check valve disc to open (stuck closed), or detachment of the disc from valve internals, is normally due to service conditions and/or process fluid. Most failures are associated with carbon steel valves in raw water systems where the disc is closed for long periods of time, thereby allowing corrosion to bond the disc to other parts of the valve internals. Another failure mechanism is when the disc operates long-term in a less than full open position, thus allowing hinge pin wear in a raw water environment.

The process fluid for the PIVs at SPS is RCS water, which is maintained within strict chemistry and cleanliness standards. The valves are designed for service in a boric acid solution and are comprised of stainless-steel materials. Because the conditions for corrosion are not present by design, and open position occurs a small percentage of the time, it is unlikely that the disc will fail to open or become detached when flow is required.

D) Description of PIV and Check Valve Open Exercise Testing

The PIVs are tested in the open direction during Comprehensive Pump Testing of the LHSI pumps with design basis accident flow rates. Flow through the LHSI piping branches is monitored by temporary flow instrumentation each RFO. There have been no valve failures during this testing.

SUMMARY:

The proposed alternative would permit continued startup if any of the valves listed in Section 1 of this Alternative Request can demonstrate acceptable seat leakage following mechanical agitation during the sixth IST Interval. If any valve passes the seat leakage test after mechanical agitation is applied, SPS will perform corrective maintenance on the valve(s) during the next RFO. The valve(s) would only be acceptable for normal operation for one additional cycle, and only if the final seat leakage test meets the TS leakage acceptance criteria.

Should any of the valves in Section 1 fail to meet the TS and OM Code leakage requirements, the valve(s) shall be declared inoperable.

Should any of the valves fail to meet any TS and OM Code leakage test requirements, mechanical agitation will be used to assist in trouble shooting the failure.

Mechanical agitation assists in ascertaining the condition of the valve seat. Prior to using mechanical agitation, SPS will obtain as-found test results and apply other measures, where possible, such as varying pressure or venting, to seat the check valve.

An engineering evaluation has been performed that provides a reasonable determination that the mechanical agitation process will not create damage to the valve. Mechanical agitation may be performed by tapping the valve body using a 15-pound (maximum) rubber mallet or soft-faced dead blow mallet swung at a maximum of approximately 120 degrees about the elbow, without excessive use of the body to accelerate the hammer head. The surface to be agitated will not include any bolting or flanges. The valve will be visibly inspected prior to and after the mechanical agitation to ensure that no physical external damage to the check valve has occurred.

During the next RFO, any valve that required mechanical agitation to pass its seat leakage test will be disassembled and inspected and will be repaired and replaced as necessary. Post maintenance testing will be performed in accordance with ASME OM requirements.

## 7. Duration of Proposed Alternative

The proposed alternative described in Alternative Request V-1 will be used for the Surry Power Station Units 1 and 2 Sixth IST interval.

## 8. Precedents

By letter dated December 8, 2022, as supplemented by letters dated December 9, 2022 and February 22, 2023 (ML22342B248, ML22343A000, and ML23054A192, respectively), Dominion Energy Virginia submitted a similar alternative request V-01 for the Surry Unit 1 Fifth Ten-Year IST interval for PIV 1-SI-241. The NRC approved this alternative pursuant to 10 CFR 50.55a(z)(2) on the basis of being a hardship without a compensating increase in quality and safety. The NRC safety evaluation is provided in NRC letter dated April 25, 2023 (ML23102A283).

A similar relief request was also submitted by TVA for the Sequoyah Nuclear Plant, Unit Nos. 1 and 2, Relief Request RV-02, dated March 15, 2022, supplemented June 28, 2022 (ML22074A315 and ML22179A357, respectively), and approved by the NRC by letter dated September 29, 2022 (ML22263A375).

# SURRY POWER STATION UNITS 1 AND 2
# ALTERNATIVE REQUEST V-1

## Attachment

## ENGINEERING ASSESSMENT OF MECHANICAL AGITATION PROCESS FOR SIX INCH VELAN PRESSURE ISOLATION VALVES

**Virginia Electric and Power Company**
**(Dominion Energy Virginia)**

# ENGINEERING ASSESSMENT OF MECHANICAL AGITATION PROCESS FOR SIX INCH VELAN PRESSURE ISOLATION VALVES

## SURRY POWER STATION UNITS 1 AND 2

### Purpose

The purpose of this assessment is to evaluate the use of mechanical agitation for seating Pressure Isolation Valves (PIV) following failed leak tests, as well as the structural impact from mechanical agitation using methods that are consistent with those previously approved by NRC Safety Evaluations [5] & [7]. Once approved for use at Surry Power Station (SPS), this mechanical agitation methodology could be used when necessary for leak testing of PIVs identified in the site's Technical Specifications.

### Design Inputs and Assumptions

Assumptions made regarding past use of a 20-pound maul per References [3] & [4] are reasonable and conservative.

Inputs for this assessment are captured within the References section. The 6" Class 1500 Velan swing check valves investigated herein for SPS are bounded by the 6" Velan swing check valves included within the TVA relief request [5].

### Methodology

Existing documented bases from SPS as to why the use of a 20-pound maul for purposes of mechanically agitating PIVs is reviewed and augmented by additional assessment herein. Specifically, to evaluate force imparted by use of the 20-pound maul during the last application of mechanical agitation to seat 1-SI-241 on May 21, 2021 (as documented within [4] and [7]), a similar methodology as was used by Tennessee Valley Authority (TVA) to estimate stresses induced in the body of the valves for supporting their Alternative Request RV-02 for the Sequoyah Nuclear Plant [5] is used. The TVA method estimates induced impact force and localized stress using an equation for a pendulum. Employing Section 16.4 of Roark's Formulas for Stress and Strain [6], the method assumes the stress resulting from the impact of the falling hammer as two times the stress produced by its weight applied as static load. This implies a dynamic load factor of two; for conservatism; however, a factor of four is used to account for probable variations in hammer velocity. Localized stress induced in the valve wall is estimated (ignoring any dampening effects), also using Roark's Formulas [6], Table 11.2, Case 17, assuming a circular flat plate using a radius of the valve length and the thickness equal to a conservatively assumed wall thickness with an applied force. Again, this approach was submitted to the NRC and concluded to provide reasonable assurance that use of mechanical agitation won't damage the impacted check valves [5] & [7].

Recommendations herein are based on NRC-approved methods documented in the revised NRC Safety Evaluation for Sequoyah Nuclear Plant [5] and the NRC Safety Evaluation for SPS PIV 1-SI-241 [7]. SPS PIVs are reviewed against the valves included within the TVA alternate request to confirm applicability.

## Discussion

A previous engineering evaluation for mechanical agitation using a 20-pound maul for the Units 1 and 2 TS primary coolant system PIVs was reviewed, and it was confirmed that these valves are all 6" Velan inclined vertical seat swing check valves (as shown on Velan Drawing 78704). The valve material is Type 316 Stainless Steel, and wall thickness can be conservatively estimated as 0.6", which is consistent with TVA in their Engineering Work Request, which was audited by the NRC as part of the TVA alternate request [5]. Assuming similar parameters as TVA in [5], the force imparted using the same load increase factor is only about 115 lbs. For conservatism, this force is doubled since the guidance in [3] is limited and relies on "common sense".

| | | |
|---|---|---|
| Mass of the hammer (m): | 20 | lbm |
| Length of the pendulum (L): | 3 | ft |
| Angle of translation (α =120° - 90°): | 30 | deg |
| Arc length (A = π*L*[90°+α]/180°) | 6.283 | ft |
| Height hammer falls (h = L + Lsinα) | 4.5 | ft |
| Gravitational constant (g) | 32.3 | lbm-ft/lbf-$s^2$ |
| Hammer velocity at impact (v = [2*g*h]0.5) | 17.024 | fps |
| | 204.282 | ips |
| Est. time to make contact (t = A/v) | 0.369 | s |
| Acceleration at impact (a = v/t) | 553.477 | in/$s^2$ |
| Max Force @ contact (F = 4 x m * a) | **114.7103** | lbf |

Using a maximum force of 230 lbf (conservative, see above), a contact radius (r) of 0.25 inch (which should be conservative for a 20-pound maul), a valve length of a = 22" (consistent with TVA), and a Poisson's Ratio of v = 0.3, the moment applied using Roark's Formulas for Flat Circular Plates of Constant Thickness (Table 11.2) is estimated to be:

Moment = $(Force^1/4\pi) * (1+v) * \ln(a/r)$ = 106.532 lbf / in

Based on the above moment, calculated induced stress is:

Stress = (6 * Moment) / $t^2$ = 1.78 ksi << Allowable Stress @ 600°F for SA-182, F316 (17 ksi)

Therefore, conservatively assuming a large 230-pound force imparted to the valve body over a limited area, stresses in the valve body remain very low, which is a good indicator that no damage would be expected.

A previous engineering evaluation further reinforces why no damage would be expected using a 20-pound maul to agitate the valve for purposes of seating the disc. That evaluation documents that Velan was contacted and expressed no concern for damaging the valve as a consequence of this practice. SPS operating history also corroborates lack of damage. It is also noted that guidance provided in [3] is intended to minimize the potential to damage the valve. Guidance recommends striking the thickest portion of the valve body while avoiding point contact and, if practical, the use of second piece of metal plate to distribute the impact force. Guidance is also provided to avoid striking the bonnet.

**Requirements for Application of Mechanical Agitation to Seat PIVs**

Following approval of the Dominion Energy Virginia SPS Alternative Request V-01 [2], guidance for applying mechanical agitation to the PIVs has to be consistent with the NRC-reviewed and approved guidance. Moving forward, the following changes will be implemented, which results in different guidance than that provided within the previous engineering evaluation and historically used.

*Mechanical Agitation Requirements*[2]

- To avoid PRECONDITIONING the check valves, obtain as-found test results, or declare the valve inoperable. Use other methods to try to seat the valve prior to use of mechanical agitation, such as varying pressure or venting.
- Visually inspect the valve body prior to the use of mechanical agitation and record any pre-existing damage, markings, or defects.
- Mechanical agitation of the check valves is to be performed by tapping the valve body using a 15-pound (maximum) soft-faced dead blow mallet, rubber mallet, or against a block of wood with a 15-pound (maximum) steel mallet, swung approximately 120 degrees about the elbow WITHOUT excessive use of the body to accelerate the hammer head.
- The surface to be mechanically agitated shall NOT include valve bolting or flanges.
- The valve shall be visibly inspected after the application of mechanical agitation to ensure no physical external damage to the check valve has occurred.
- The valve shall be scheduled for disassembly during the next refueling outage

following application of mechanical agitation to inspect the valve for damage and determine whether or not the agitation caused any adverse effects on valve performance.

- If a PIV is mechanically agitated and subsequently passes its seat leakage test, the PIV shall be repaired or replaced during the next refueling outage.

## Conclusions

Past mechanical agitation of PIVs has been evaluated using the NRC approved methodology in [5] & [7], and it is concluded that previous methods used, consistent with the 1995 engineering evaluation [3], would not have damaged the valves.

Future mechanical agitation of PIVs shall be consistent with the methodology evaluated and approved by the NRC for the TVA Sequoyah Nuclear Plant [5].

## References

[1] Condition Report CR1214749, Prior NRC Approval Needed for Testing Methodology on 1-SI-241.
[2] Alternative Request: Letter Serial No. 22-374, Virginia Electric and Power Company, Surry Power Station Unit 1, "ASME OM Code Inservice Testing Program, Request for Approval of Alternative Request V-01, Use of Mechanical Agitation Process for Pressure Isolation Valve 1- SI-241."
[3] Engineering Transmittal S-95-0455, Revision 0, "Mechanical Agitation of Check Valves."
[4] Engineering Technical Evaluation ETE-SU-2021-0034, Revision 0, "Engineering Evaluation for Mechanical Agitation of 1-SI-241."
[5] NRC ADAMS Accession Number ML22304A186 (12/1/22) – Revised Safety Evaluation by the Office of Nuclear Reactor Regulation for Alternative Request RV-02 Related to the Fourth 10-year Inservice Testing Program Interval, Tennessee Valley Authority, Sequoyah Nuclear Plant, Units 1 and 2, Docket Numbers 50-327 and 50-328 (EPID No. L-2022-LLR-0034).
[6] Roark's Formulas for Stress and Strain, 7th Edition, Warren C. Young and Richard G. Budynas, McGraw-Hill 2002.
[7] NRC ADAMS Accession Number ML23102A283 (04/25/23) – "Surry Power Station, Unit 1 - Proposed Alternative Request V-01 - Use of Mechanical Agitation Process for Pressure Isolation Valve 1-SI-241 Seat Leakage Testing (EPID L-2022-LLR-0084)."

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[1] Conservative to use calculated force (assumed per unit length) vs. using "W" as would be calculated using Roark, Table 11.2, Case 17.

[2] Consistent with TVA Sequoyah NP RV-02 Safety Evaluation [5].