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August 31, 2016
L-16-200

10 CFR 50.55a

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Beaver Valley Power Station, Unit Nos. 1 and 2
Docket No. 50-334, License No. DPR-66
Docket No. 50-412, License No. NPF-73
Proposed Alternatives and Relief Requests Associated With
The Inservice Testing Program 10-Year Update

Pursuant to 10 CFR 50.55a, FirstEnergy Nuclear Operating Company (FENOC) requests approval of proposed alternatives and relief requests associated with the fifth and fourth 10-year intervals of the Beaver Valley Power Station (BVPS) Unit No. 1 and Unit No. 2 inservice testing program for pumps and valves, respectively.

Twenty-eight (28) requests are provided in the enclosure. The first page of the enclosure presents a list of the requests.

The fifth 10-year inservice testing interval for BVPS Unit No. 1 commences on September 20, 2017. The fourth 10-year inservice testing interval for BVPS Unit No. 2 was to commence on November 18, 2017; however, this interval start date will be moved to September 20, 2017 to coincide with the BVPS Unit No. 1 interval start date. This ensures that the same edition and addenda of the American Society of Mechanical Engineers, Code for Operation and Maintenance of Nuclear Power Plants will be applied to both units. FENOC requests NRC approval of the proposed alternatives and relief requests by September 15, 2017 to support implementation of the fifth and fourth interval 10-year inservice testing programs for BVPS Unit No. 1 and BVPS Unit No. 2, respectively.

There are no regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at 330-315-6810.

Sincerely,

Marty L. Richey

Enclosure:
Proposed Alternatives and Relief Requests

cc: NRC Region I Administrator
NRC Resident Inspector
NRC Project Manager
Director BRP/DEP
Site BRP/DEP Representative

Enclosure
L-16-200

Proposed Alternatives and Relief Requests
(109 Pages Follow)

Request Number	Type of Request	Similar to Approved Request[1]
BVPS-1, PR1 and VR1	10 CFR 50.55a(z)(2), Proposed Alternative	New
BVPS-1, PR2	10 CFR 50.55a(z)(1), Proposed Alternative	Similar
BVPS-1, PR3	10 CFR 50.55a(z)(1), Proposed Alternative	New
BVPS-1, PR4	10 CFR 50.55a(z)(1), Proposed Alternative	Similar
BVPS-1, PR5	10 CFR 50.55a(f)(5)(iii), Notification[2]	Similar
BVPS-1, PR6	10 CFR 50.55a(f)(5)(iii), Notification[2]	Similar
BVPS-1, PR7	10 CFR 50.55a(f)(5)(iii), Notification[2]	Similar
BVPS-1, PR8	10 CFR 50.55a(z)(1), Proposed Alternative	Similar
BVPS-1, PR9	10 CFR 50.55a(z)(2), Proposed Alternative	Similar
BVPS-1, PR10	10 CFR 50.55a(z)(2), Proposed Alternative	Similar
BVPS-1, PR11	10 CFR 50.55a(z)(2), Proposed Alternative	Similar
BVPS-1, PR12	10 CFR 50.55a(z)(2), Proposed Alternative	Similar
BVPS-1, PR13	10 CFR 50.55a(z)(1), Proposed Alternative	Similar
BVPS-1, PR14	10 CFR 50.55a(z)(1), Proposed Alternative	New
BVPS-1, VR2	10 CFR 50.55a(z)(1), Proposed Alternative	New
BVPS-1, VR3	10 CFR 50.55a(z)(1), Proposed Alternative	Similar
BVPS-2, PR1 and VR1	10 CFR 50.55a(z)(2), Proposed Alternative	New
BVPS-2, PR2	10 CFR 50.55a(z)(1), Proposed Alternative	Similar
BVPS-2, PR3	10 CFR 50.55a(z)(1), Proposed Alternative	New
BVPS-2, PR4	10 CFR 50.55a(z)(1), Proposed Alternative	Similar
BVPS-2, PR5	10 CFR 50.55a(f)(5)(iii), Notification[2]	Similar
BVPS-2, PR6	10 CFR 50.55a(z)(1), Proposed Alternative	Similar
BVPS-2, PR7	10 CFR 50.55a(f)(5)(iii), Notification[2]	Similar
BVPS-2, PR8	10 CFR 50.55a(z)(1), Proposed Alternative	Similar
BVPS-2, PR9	10 CFR 50.55a(f)(5)(iii), Notification[2]	Similar
BVPS-2, PR10	10 CFR 50.55a(z)(1), Proposed Alternative	New
BVPS-2, VR2	10 CFR 50.55a(z)(1), Proposed Alternative	Similar
BVPS-2, VR3	10 CFR 50.55a(z)(1), Proposed Alternative	Similar

Notes:

1. Beaver Valley Power Station Unit No. 1 (BVPS-1) and Unit No. 2 (BVPS-2) pump requests (PR) and valve requests (VR) are identified as "Similar" with respect to the requests approved for the previous 10-year interval Inservice Test (IST) Program at the same unit. The similar requests have been updated to propose alternatives to American Society of Mechanical Engineers Operations and Maintenance Code (2004 Edition through 2006 Addenda) requirements where code requirement numbers have changed. Other requests are identified as "New."

2. Relief request involving notification of impractical IST code requirements.

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

Pumps and valves specified in American Society of Mechanical Engineers (ASME) Operations and Maintenance (OM) Code, Division 1, Section IST, 2004 Edition through OMb-2006 Addenda of the ASME OM Code. This includes pumps and valves within the Beaver Valley Power Station, Unit No. 1 Inservice Test (IST) Program scope.

2. Applicable Code Edition and Addenda

ASME OM Code, 2004 Edition with Addenda through OMb-2006.

3. Applicable Code Requirements

This request applies to the frequency specifications of the ASME OM Code for all pump and valve testing contained within the IST Program scope. The applicable ASME OM Code sections include the following.

Table ISTB-3400-1, “Inservice Test Frequency,” lists two frequencies, quarterly and biennially.

ISTB-3430, “Pumps Lacking Required Fluid Inventory,” states in part that: “Group B pumps lacking the required fluid inventory (e.g., pumps in dry sumps) shall receive a comprehensive test at least once every 2 years except as provided in ISTB-3420.”

ISTB-6200, “Corrective Action,” part (a) states that: “If the measured test parameter values fall within the alert range of Table ISTB-5121-1, Table ISTB-5221-1, Table ISTB-5321-1, or Table ISTB-5321-2, as applicable, the frequency of testing specified in ISTB-3400 shall be doubled until the cause of the deviation is determined and the condition is corrected.”

ISTC-3510, “Exercising Test Frequency,” states in part that: “Active Category A, Category B, and Category C check valves shall be exercised nominally every 3 months, . . .”

ISTC-3540, “Manual Valves,” states in part that: “Manual Valves shall be full-stroke exercised at least once every 2 years, . . .”

ISTC-3630, “Leakage Rate for Other Than Containment Isolation Valves,” part (a), “Frequency,” states that: “Tests shall be conducted at least once every 2 years.”

ISTC-3700, “Position Verification Testing,” states in part that: “Valves with remote position indicators shall be observed locally at least once every 2 years to verify that valve operation is accurately indicated.”

ISTC-5221(c)(3) states that: “At least one valve from each group shall be disassembled and examined at each refueling outage; all valves in a group shall be disassembled and examined at least once every 8 years.”

Appendix I, I-1320, “Test Frequencies, Class 1 Pressure Relief Valves,” part (a) states in part that: “Class 1 pressure relief valves shall be tested at least once every 5 years . . .”

Appendix I, I-1350, “Test Frequency, Classes 2 and 3 Pressure Relief Valves,” part (a) states in part that: “Classes 2 and 3 pressure relief valves, with the exception of PWR main steam safety valves, shall be tested every 10 years, . . .”

Appendix I, I-1390, “Test Frequency, Classes 2 and 3 Pressure Relief Devices That Are Used for Thermal Relief Application,” states in part that: “Tests shall be performed on all Classes 2 and 3 relief devices used in thermal relief application every 10 years, . . .”

4. Reason for Request

Test period requirements for pumps and valves set forth in specific ASME OM Code documents present a hardship without a compensating increase in quality and safety. ASME OM Code Case OMN-20, “Inservice Test Frequency,” was approved and is proposed to be used as an alternative to the test periods specified in the ASME OM code.

Operational flexibility is needed when scheduling pump and valve tests to minimize conflicts between the ASME OM Code specified test interval, plant conditions, and other maintenance and test activities. Lack of a frequency tolerance applied to ASME OM Code testing places a hardship on the plant when scheduling pump and valve tests.

Code Case OMN-20 is not referenced in the latest revision of Regulatory Guide 1.192, “Operation and Maintenance Code Case acceptability, ASME OM Code” (August 2014), as an acceptable OM Code Case to comply with 10 CFR 50.55a(f) requirements as allowed by 10 CFR 50.55a(b)(6).

5. Proposed Alternative and Basis for Use

The proposed alternative is OMN-20, "Inservice Test Frequency," which addresses testing periods for pumps and valves specified in ASME OM Division 1, Section IST, 2009 Edition through OMa-2011 Addenda, and all earlier editions and addenda of ASME OM Code.

This request is being made in accordance with 10 CFR 50.55a(z)(2), in that the existing requirements are considered a hardship without a compensating increase in quality and safety for the following reasons:

1) For testing periods up to and including two years, Code Case OMN-20 provides an allowance to extend the testing periods by up to 25 percent. The period extension is to facilitate test scheduling and considers plant operating conditions that may not be suitable for performance of the required testing (for example, performance of the test would cause an unacceptable increase in the plant risk profile due to transient conditions or other ongoing surveillance, test or maintenance activities). Period extensions are not intended to be used repeatedly merely as an operational convenience to extend test intervals beyond those specified. Use of the test period extension has been a practice in the nuclear industry for many decades and not applying an extension would be a hardship when there is no evidence that the period extensions affect component reliability.

2) For testing periods of greater than two years, OMN-20 allows an extension of up to six months. The ASME OM Committee determined that such an extension is appropriate. The six-month extension will have a minimal impact on component reliability considering that the most probable result of performing any inservice test is satisfactory verification of the test acceptance criteria. As such, pumps and valves will continue to be adequately assessed for operational readiness when tested in accordance with the requirements specified in 10 CFR 50.55a(f) with the frequency extensions allowed by Code Case OMN-20.

Section IST of Division 1 of the ASME OM Code, which is incorporated by reference in 10 CFR 50.55a(a), specifies component test frequencies based either on elapsed time periods (for example, quarterly, or two years) or on the occurrence of a plant condition or event (for example, cold shutdown, or refueling outage). ASME Code Case OMN-20 has been approved for use by the ASME OM committee as an alternative to the test frequencies for pumps and valves specified in ASME OM Division 1, Section IST, 2009 Edition through OMa-2011 Addenda, and all earlier editions and addenda of ASME OM Code.

Based on the foregoing, the proposed alternative test periods provide reasonable assurance that pumps and valves within the scope of the Beaver Valley Power Station, Unit No. 1, IST Program are operationally ready.

6. <u>Duration of Proposed Alternative</u>

The proposed alternative is requested for use during the fifth 10-year IST interval.

7. Precedent

The NRC approved the use of OMN-20 for Fort Calhoun on February 19, 2016 (NRC Agencywide Documents Access and Management System Accession Number ML16041A308).

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(1)

-- Alternative Provides Acceptable Level of Quality and Safety--

1. **ASME Code Components Affected**

   1CC-P-1A, -1B, and -1C, Reactor Plant Component Cooling Water (CCR) Pumps, (Class 3)

   1FW-P-2, Steam Driven Auxiliary Feedwater (AFW) Pump, (Class 3)

   1FW-P-3A, and -3B, Motor Driven AFW Pumps, (Class 3)

2. **Applicable Code Edition and Addenda**

   American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) (Code) – 2004 Edition, with Addenda through OMb-2006.

3. **Applicable Code Requirement**

   ISTB-3510(b)(1), “Range,” states:

   > The full-scale range of each analog instrument shall be not greater than three times the reference value.

4. **Reason for Request**

   Certain Instruments used when testing the affected pumps do not meet the requirements of ISTB-3510(b)(1); however, the accuracy of the instruments used is more conservative than the requirements of ISTB-3510(a), “Accuracy,” and Table ISTB-3510-1, "Required Instrument Accuracy," for Group A and Group B tests and comprehensive tests. The combination of higher range and better accuracy for each instrument yields a reading at least equivalent to the reading achieved from instruments that meet ISTB-3510(b)(1).

5. **Proposed Alternative and Basis for Use**

   The instruments listed in the attached table may be used as long as the combination of the higher range and better accuracy for each instrument yields a reading at least equivalent to the reading achieved from instruments that meet ISTB-3510(b)(1).

   NUREG-1482, “Guidelines for Inservice Testing at Nuclear Power Plants,” Revision 2, Section 5.5.1, “Range and Accuracy of Analog Instruments,” states:

   > When the range of a permanently installed analog instrument is greater than three times the reference value, but the accuracy of the instrument is more conservative than that required by the Code, the staff may grant relief when the combination of the range and accuracy yields a reading that is as at least equivalent to that achieved using instruments that meet the Code requirements (i.e., up ±6 percent for Group A and B tests, and

±1.5 percent for pressure and differential pressure instruments for Preservice and Comprehensive tests).

The instruments identified in the attached table satisfy the guidance provided in NUREG-1482, Section 5.5.1. Additional basis for use and the applicable test type are provided in the attached table.

Using the provisions of this relief request as an alternative to the requirements of ISTB-3510(b)(1) provides an acceptable level of quality and safety since their use yields a reading that is as at least equivalent to that achieved using instruments that meet the ASME OM Code requirements as described in NUREG-1482, Section 5.5.1.

6. Duration of Proposed Alternative

The proposed alternative is requested for use during the Beaver Valley Power Station, Unit No. 1, fifth 10-year inservice test interval.

7. Precedent

A similar request was approved for the Beaver Valley Power Station, Unit No. 1, fourth 10-year inservice test interval. The Nuclear Regulatory Commission staff letter authorizing the request is referenced below.

Beaver Valley Power Station, Unit No. 1, Docket No. 50-334, Safety Evaluation of Relief Request PRR2 for the Fourth 10-Year Inservice Testing Program, dated September 27, 2007 (ADAMS Accession No. ML072420376).

IST PUMP INSTRUMENTATION			
Pump ID	**Instrument ID**	**Condition Requiring Relief**	**Basis for Relief/Alternate Test**
1CC-P-1A 1CC-P-1B 1CC-P-1C (Group A, Class 3)	PI-1CC-100A PI-1CC-100B PI-1CC-100C	The range of the gauges is slightly greater than three times the reference pressure during quarterly testing.	These gauges are the discharge pressure gauges for the CCR pumps. The range of the gauges is 0 to 400 pounds per square inch gauge (psig). Typical pressure readings are slightly lower than one third the range, and vary between 115 and 123 psig due to the use of a pump curve. The calibration accuracy is 1.0 percent, which would yield a reading more accurate than Code requirements. The use of these pressure instruments is applicable to Group A tests only since the combination of range and accuracy yields a reading of plus or minus (±) 3.5 percent which is less than the ±6 percent required by Code for the Group A test. During comprehensive testing, temporary pressure instrumentation will be used having a calibrated accuracy of at least ±0.5 percent of full scale with a sufficient range to satisfy the ±1.5 percent required by the Code for the comprehensive test.

IST PUMP INSTRUMENTATION			
Pump ID	**Instrument ID**	**Condition Requiring Relief**	**Basis for Relief/Alternate Test**
1CC-P-1A 1CC-P-1B 1CC-P-1C (Group A, Class 3) Continued	FI-1CC-117	The range of [FI-1CC-117] is greater than three times the reference flow.	This flow indicator is in a branch line of the component cooling water system. It is only used if the installed pressure differential indicators (PDIs) are over-ranged. In that case, the typical flow expected would be enough to meet Code requirements, except for flow indicator FI-1CC-117, which could be placed in service with a flow as low as 4000 gallons per minute (gpm). Flow indicator FI-1CC-117 is sized for all flow conditions with a range of 0 to 14,000 gpm and a loop accuracy of 1.58 percent. It is in the 24-inch river water CCR header supplying the cooling loads inside containment. When the residual heat removal (RHR) system is in operation, the flow through this line is significantly higher. The calibration accuracy of this gauge would yield a reading more accurate than Code requirements. This flow instrument may be used during both the Group A tests and comprehensive tests since the combination of range and accuracy yields a reading of ±5.53 percent which is less than the ±6 percent required by Code.

IST PUMP INSTRUMENTATION			
Pump ID	**Instrument ID**	**Condition Requiring Relief**	**Basis for Relief/Alternate Test**
1CC-P-1A 1CC-P-1B 1CC-P-1C (Group A, Class 3) Continued	PDI-1CC-118	The range of the differential pressure (d/p) flow meter is greater than three times the reference flow for normal operations.	This d/p flow meter is in the 8-inch CCR header supplying the cooling loads in the auxiliary building, and has a range of 0-100 inch water column (inwc). Since the use of a pump curve is permitted by ASME OM Code Case OMN-16, the reference flow may not be at a specific flow point. Typical test flow d/p is approximately 18 to 21 inwc. The accuracy of the gauge is 0.5 percent, which would yield a reading more accurate than Code requirements. This flow instrument may be used during both the Group A and comprehensive tests since the combination of range and accuracy yields a reading of $\pm$2.8 percent which is less than the $\pm$6 percent required by Code.
	PDI-1CC-119	The range of the d/p flow meter is greater than three times the reference flow for normal operations.	This d/p flow meter is in the 24-inch CCR header supplying the cooling loads in the auxiliary building, has a range of 0-150 inwc. Since the use of a pump curve is permitted by ASME OM Code Case OMN-16, the reference flow may not be at a specific flow point. Typical test flow d/p is approximately 43 to 51 inwc. The accuracy of the gauge is 0.5 percent, which would yield a reading more accurate than Code requirements. This flow instrument may be used during both the Group A and comprehensive tests since the combination of range and accuracy yields a reading of $\pm$1.74 percent which is less than the $\pm$6 percent required by Code.

IST PUMP INSTRUMENTATION			
Pump ID	**Instrument ID**	**Condition Requiring Relief**	**Basis for Relief/Alternate Test**
1FW-P-3A 1FW-P-3B (Group B, Class 3)	FI-1FW-100A FI-1FW-100B FI-1FW-100C	The range of the flow indicators is greater than three times the reference flow for the Motor-Driven AFW Pumps.	These flow indicators are in the three lines to the steam generators from the AFW pumps. The flow indicators are sized to measure accident flow from the turbine-driven AFW pump as well as the motor-driven AFW pumps, with a range of 0-400 gpm. For the motor-driven AFW pump full-flow tests, each loop measures approximately 110-115 gpm, which is 27.5 percent of the range. The calibration accuracy of the flow meters is 1.2 percent, which would yield a reading more accurate than Code requirements. These flow instruments will be used during both the Group B tests and comprehensive tests since the combination of range and accuracy yields a reading of $\pm$4.36 percent which is less than the $\pm$6 percent required by Code.

IST PUMP INSTRUMENTATION			
Pump ID	**Instrument ID**	**Condition Requiring Relief**	**Basis for Relief/Alternate Test**
1FW-P-2 1FW-P-3A 1FW-P-3B (Group B, Class 3)	PI-1FW-156 PI-1FW-156A PI-1FW-156B	The range of the gauges is greater than three times the reference pressure.	These gauges are the suction pressure gauges for the AFW pumps. In 1991, the existing 0-160 psig gauges were changed to the present 0-60 psig gauges. This range was selected as a compromise between the IST Program requirements and possible accident pressures (that is, river water supplying the AFW pumps). The 0-60 psig range will accommodate the accident pressure and typical test pressure of 10 psig. With a calibration accuracy of 0.5 percent, this results in a reading more accurate than Code requirements. The use of these pressure instruments is applicable to Group B tests only since the combination of range and accuracy yields a reading of ±3.0 percent, which is less than the ±6 percent required by Code for the Group B test. During comprehensive testing, temporary pressure instrumentation will be used having a calibrated accuracy of at least ±0.5 percent of full scale with a sufficient range to satisfy the ±1.5 percent required by the Code for the comprehensive test.

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(1)

-- Alternative Provides Acceptable Level of Quality and Safety--

1. **ASME Code Components Affected**

   1CH-P-1A, B and C, Charging Pumps, (Group A, Class 2)
   1CH-P-2A and B, Boric Acid Transfer Pumps, (Group A, Class 3)
   1RH-P-1A and B, Residual Heat Removal Pumps, (Group A, Class 2)
   1SI-P-1A and B, Low Head Safety Injection Pumps, (Group B, Class 2)
   1CC-P-1A, B, C, Component Cooling Water Pumps, (Group A, Class 3)
   1FW-P-2, Turbine-Driven Auxiliary Feedwater Pump, (Group B, Class 3)
   1FW-P-3A and B, Motor-Driven Auxiliary Feedwater Pumps, (Group B, Class 3)
   1WR-P-1A, B and C, River Water Pumps, (Group A, Class 3)

2. **Applicable Code Edition and Addenda**

   American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. **Applicable Code Requirement**

   ISTB-5123, “Comprehensive Test Procedure,” refers to Table ISTB-5121-1, “Centrifugal Pump Test Acceptance Criteria,” that requires an upper acceptable range limit of 1.03Qr and 1.03ΔPr where Qr is the reference flow rate and ΔPr is the reference differential pressure.

   ISTB-5223, “Comprehensive Test Procedure,” refers to Table ISTB-5221-1, “Vertical Line Shaft Centrifugal Pump Test Acceptance Criteria,” that requires an upper acceptable range limit of 1.03Qr and 1.03ΔPr.

4. **Reason for Request**

   For some pump tests, there has been difficulty implementing the upper acceptable range limit of 3 percent above the established hydraulic parameter reference value for the comprehensive pump test. Industry experience has shown that test results outside the criteria can easily occur when normal data scatter yields (1) a low measured reference value, and (2) high measured values for subsequent inservice tests. In these cases, some of the test data trend high near the upper acceptable range limit and may exceed the upper limit on occasion. The problem can be more severe for pumps with low differential pressures (50 pounds per square inch differential [psid] or less) due to the smaller acceptable range.

   In these cases, the measured values that would exceed the plus 3 percent upper criteria would not represent an actual problem with either the test setup, instrumentation or the pump itself. The scatter induced collectively by the

instrumentation and reference value variance is sufficient to approach or exceed the upper criterion.

ASME OM Code Case OMN-19, "Alternate Upper Limit for the Comprehensive Pump Test," from the 2012 Edition of ASME OM Code, allows a multiplier of 1.06 times the reference value in lieu of the 1.03 multiplier for the comprehensive pump test's upper acceptable range and required action range (high) limits. As described in ASME OM Code Case OMN-19, a required action range high limit of plus 6 percent is a realistic value that should allow any true degradation issues to be identified while alleviating the need to unnecessarily declare pumps inoperable.

5. Proposed Alternative and Basis for Use

For the affected pumps listed above, an upper acceptable range limit of 1.06 times the reference value will be applied to the comprehensive pump test in accordance with ASME OM Code Case OMN-19. Also, a periodic verification test (PVT) at the design basis accident flow rate will be performed for each of these pumps.

The following requirements shall be applied to the PVT.

1) Apply the PVT to the affected pumps listed in this request.
2) Perform the PVT at least once every two years.
3) Determine if a PVT is required before declaring a pump operable following replacement, repair, or maintenance on the pump.
4) Declare the pump inoperable if the PVT flow rate and associated differential pressure cannot be achieved.
5) Maintain the necessary records for each PVT, including the applicable test parameters (for example, flow rate, the associated differential pressure and speed for variable speed pumps) and their basis.
6) Account for the PVT instrument accuracies in the test acceptance criteria.

The upper limit for differential pressure established by the ASME OM Code is not reflective of any possible degradation mechanism, but is rather a means to identify a potentially incorrect test setup. Exceeding this upper limit while testing would require the pump to be considered inoperable, but primarily as a means to investigate the test instrumentation or other potential problems. The use of a plus 6 percent upper criteria rather than the plus 3 percent upper criteria would not mask any actual pump problem and would still function as an adequate trigger to investigate the test setup.

Using the provisions of this request as an alternative to the specific requirements of ISTB-5123 and ISTB-5223, and Tables ISTB-5121-1 and ISTB-5221-1 as described above will provide adequate indication of pump performance and

continue to provide an acceptable level of quality and safety.

6. **Duration of Proposed Alternative**

The proposed alternative is requested for use during the fifth 10-year IST interval.

7. **Precedent**

A similar request was approved by the Nuclear Regulatory Commission staff in their safety evaluation referenced below.

Virginia Electric and Power Company, Surry Power Station, Unit No. 1, Safety Evaluation of Pump Relief Request P-6 Regarding ASME OM Code Requirements for the Fifth 10-Year Inservice Test Program Interval, dated May 9, 2014 (ADAMS Accession No. ML14125A471).

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(1)

-- Alternative Provides Acceptable Level of Quality and Safety--

1. **ASME Code Components Affected**

   1EE-P-1A, B, C and D, Diesel Fuel Oil Transfer Pumps, (Group B, Class 3)

2. **Applicable Code Edition and Addenda**

   American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. **Applicable Code Requirement**

   ISTB-5322, "Group B Test Procedure," states in part that:

   > Group B tests shall be conducted with the pump operating at a specified reference point. The test parameter value identified in Table ISTB-3000-1 shall be determined and recorder as required by this paragraph.

   Table ISTB-3000-1, "Inservice Test Parameters," identifies flow rate as a test parameter, and Note 1 of the table states in part that:

   > For positive displacement pumps, flow rate shall be measured or determined; . . .

4. **Reason for Request**

   The diesel fuel oil transfer pumps transfer fuel oil from the underground emergency diesel generator fuel oil storage tank to the day tank in order to provide continuous operation of the diesel at rated load for up to seven days during an emergency.

   ISTB-5322 requires that the test parameters shown in Table ISTB-3000-1 be determined and recorded during Group B testing. For positive displacement pumps, flow rate is one of the test parameters listed in Table ISTB-3000-1. However, there is no installed instrumentation provided to measure flow rate for these emergency diesel generator fuel oil transfer pumps. A level sight glass does exist on the side of the diesel generator fuel oil day tank, which can be used to measure a change in level over time as the pumps transfer fuel oil from the underground storage tank to the day tank. The reading scale for measuring the level change over time, and the calculation method, yield an accuracy within plus or minus 2 percent as required by Table ISTB-3510-1, "Required Instrument Accuracy."

5. **Proposed Alternative and Basis for Use**

   Flow rate will be calculated by measuring the level change over time in the diesel generator fuel oil day tank, and converting this data into fuel oil transfer pump flow

rate during both the Group B tests and comprehensive tests per emergency diesel generator and fuel oil transfer pump operating surveillance tests.

This proposed alternative is consistent with the guidelines provided in NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," Revision 2, Section 5.5.2, "Use of Tank Level to Calculate Flow Rate for Positive Displacement Pumps." Section 5.5.2 states in part that:

> When flow meters are not installed in the flow loop of a system with a positive displacement pump, it is impractical to directly measure flow rate for the pump. The staff has determined that, if the licensee uses the tank level to calculate the flow rate as described in Subsection ISTB-3550, the implementing procedure must include the calculational method and any test conditions needed to achieve the required accuracy. Specifically, the licensee must verify that the reading scale for measuring the tank level and the calculational method yield an accuracy within ±2 percent for Group A and B tests, and Preservice and Comprehensive Tests. If the meter does not directly indicate the flow rate, the record of the test shall identify the method used to reduce the flow data.

Calculating flow rate by a level change in the day tank is acceptable since the level of accuracy required by Table ISTB-3510-1 (and NUREG-1482 as noted above) is satisfied.

Using the provisions of this relief request as an alternative to the requirements of ISTB-5322 and Table ISTB-3000-1 provides an acceptable level of quality and safety since the alternative provides reasonable assurance of pump operational readiness.

6. Duration of Proposed Alternative

The proposed alternative is requested for use during the fifth 10-year IST interval.

7. Precedent

A similar request was approved for the Beaver Valley Power Station, Unit No. 1 fourth 10-year inservice test interval. The Nuclear Regulatory Commission staff letter authorizing the requested alternative is referenced below.

Beaver Valley Power Station, Unit No. 1, Docket No. 50-334, Safety Evaluation of Relief Request PRR4 for the Fourth 10-Year Inservice Testing Program, dated September 27, 2007 (ADAMS Accession No. ML072420376).

Relief Request In Accordance with 10 CFR 50.55a(f)(5)(iii)

--Inservice Testing Impracticality--

1. ASME Code Components Affected

1EE-P-1A, B, C, and D, Diesel Fuel Oil Transfer Pumps, (Group B, Class 3)

2. Applicable Code Edition and Addenda

American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. Applicable Code Requirement

ISTB-5322, "Group B Test Procedure," Paragraph ISTB-5322(d), states:

> All deviations from the reference values shall be compared with the ranges of Table ISTB-5321-1 or ISTB-5321-2, as applicable, and corrective action taken as specified in ISTB-6200.

ISTB-5323, "Comprehensive Test Procedure," Paragraph ISTB-5323(e), states in part that:

> All deviations from the reference values shall be compared with the ranges of Table ISTB-5321-1 or Table ISTB-5321-2, as applicable, and corrective action taken as specified in ISTB-6200.

4. Impracticality of Compliance

The diesel fuel oil transfer pumps transfer fuel oil from the underground emergency diesel generator fuel oil storage tank to the day tank in order to support continuous operation of the diesel at rated load for up to seven days during an emergency.

Of the two tables referenced in the applicable code requirements, only Table ISTB-5321-1, "Positive Displacement Pump (Except Reciprocating) Test Acceptance Criteria," is applicable to the diesel fuel oil transfer pumps. The Group B and comprehensive test acceptance criteria for reference discharge pressure (P_r) and reference flow (Q_r) given in Table ISTB-5321-1 are as follows:

Group B Tests

Acceptable Range	Alert Range	Required Action Range Low	Required Action Range High
0.90 to 1.10Q_r	None	less than 0.90Q_r	greater than 1.10Q_r

Comprehensive Tests

Acceptable Range	Alert Range	Required Action Range Low	Required Action Range High
0.95 to 1.03Q_r	0.93 to less than 0.95Q_r	less than 0.93Q_r	greater than 1.03Q_r
0.93 to 1.03P_r	0.90 to less than 0.93P_r	less than 0.90P_r	greater than 1.03P_r

These limits are too restrictive for the fuel oil transfer pumps. The baseline discharge pressures for these four affected pumps range from 6.7 pounds per square inch gauge (psig) to 13.0 psig. Applying the acceptable limits from the ASME OM Code for these values, the average allowable degradation from the reference value is only 0.7 psig for the comprehensive test. The discharge pressure has historically varied by as much as 1 psig from one test to the next and between 1 to 2 psig over the course of a year, which is more than the acceptable range for discharge pressure.

The baseline flows for these four pumps range from 9.0 to 13.3 gallons per minute (gpm). The average allowable degradation for flow is therefore only 1.1 gpm for the Group B test and only 0.56 gpm for the comprehensive test. The flow values also vary from test to test and between 1 to 1.5 gpm over the course of a year, which is more than the acceptable range for flow.

The ASME OM Code limits are too restrictive and therefore impractical to apply. Normal historic variation in discharge pressure and flow would require the pumps to enter the alert or required action ranges. An allowable variation larger than 0.7 psig or 0.56 gpm, is needed for both the Group B test and comprehensive test, as applicable, to trend pump performance.

The following expanded ranges for flow during the Group B tests and discharge pressure and flow during the comprehensive tests of the fuel oil transfer pumps are proposed.

Group B Tests

Acceptable Range	Alert Range	Required Action Range Low	Required Action Range High
0.80 to 1.15Q_r	None	less than 0.80	greater than 1.15Q_r

Comprehensive Tests

Acceptable Range	Alert Range	Required Action Range Low	Required Action Range High
0.90 to 1.15Q_r	0.80 to less than 0.90Q_r	less than 0.80	greater than 1.15Q_r
0.80 to 1.20P_r	0.70 to less than 0.80P_r	less than 0.70	greater than 1.20P_r

The function of these pumps is to be able to deliver fuel to the day tank to supply the diesel generator under rated load. The amount of fuel that is required to be delivered is 3.6 gpm, significantly lower than the reference values for all of the pumps. In addition, due to the nature of positive displacement pumps, flow should be the more consistent parameter.

The proposed range for the flow value is more restrictive because the flow rate is the more critical parameter for the system. The high flow limit is based on approximately half of the allowable variation expected in pumps with this rated flow rate, from the Hydraulic Institute Test Standard for Rotary Pumps, 14th edition.

These ranges would only result in an allowed variation of -2.01 psig and +1.34 psig for the lowest reference pressure reading (6.7 psig) of the four pumps, and -1.8 gpm and +1.35 gpm for the lowest reference flow reading (9.0 gpm) of the four pumps. In addition, during discussions with Ingersoll-Dresser Pumps, the pump manufacturer, when questioned about a limiting value for pump performance, the pump manufacturer has stated that as the pump wears and the clearances open, the performance will gradually change. No limiting value for either flow or discharge pressure was provided, and sudden performance degradation is not expected. These expanded ranges will allow degrading conditions to be identified and provide assurance that the fuel oil transfer pumps will be capable of fulfilling their safety function.

5. Burden Caused by Compliance

Extensive hardware changes would be required in order to comply with the requirements of Table ISTB-5321-1 with little or no enhancement or compensating increase to the quality of the tests or the ability to detect pump degradation.

6. Proposed Alternative and Basis for Use

Expanded limits for test acceptance criteria may be used in lieu of the test acceptance criteria specified in Table ISTB-5321-1. Testing will be performed per the diesel generator monthly test procedures using expanded ranges for flow and discharge pressure during the comprehensive tests and for flow during the Group B tests. These expanded ranges will allow degrading conditions to be identified without needlessly declaring the pumps inoperable and provide assurance that the fuel oil transfer pumps will be capable of fulfilling their safety function.

Using the provisions of this relief request as an alternative to the requirements of Table ISTB-5321-1 provides a reasonable alternative to the code requirements and assurance that the pumps are operationally ready.

7. Duration of Proposed Alternative

The proposed alternative is requested for use during the fifth 10-year inservice test interval.

8. Precedent

A similar request was approved for the Beaver Valley Power Station, Unit No. 1 fourth 10-year inservice test interval. The Nuclear Regulatory Commission staff letter authorizing the alternative is referenced below.

Beaver Valley Power Station, Unit No. 1, Docket No. 50-334, Safety Evaluation of Relief Request PRR5 for the Fourth 10-Year Inservice Testing Program, dated September 27, 2007 (ADAMS Accession No. ML072420376).

Relief Request In Accordance with 10 CFR 50.55a(f)(5)(iii)

--Inservice Testing Impracticality--

1. ASME Code Components Affected

1CH-P-2A and B, Boric Acid Transfer Pumps, (Group A, Class 3)

2. Applicable Code Edition and Addenda

American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. Applicable Code Requirement

ISTB-5121, "Group A Test Procedure," states in part that:

> Group A tests shall be conducted with the pump operating at a specified reference point. The test parameters shown in Table ISTB-3000-1 shall be determined and recorded as required by this paragraph.

Table ISTB-3000-1, "Inservice Test Parameters," identifies flow rate as a test parameter, and Note 1 of the table states in part that:

> . . . differential pressure or flow rate shall be measured or determined.

4. Impracticality of Compliance

Testing the boric acid transfer pumps using the emergency boration flow path is impractical during power operation because it would inject water with a higher concentration of boric acid into the reactor coolant system, which would result in a reactivity transient. Therefore, the Code-required quarterly Group A testing is performed using an alternate test loop as shown on Figure 1. The pumps are Group A tested quarterly through RO-CH-ORBA-1(2), the restricting orifices in the minimum flow fixed resistance recirculation lines.

ISTB-5121 requires that the test parameters shown in Table ISTB-3000-1 be determined and recorded during Group A quarterly tests. Flow rate is one of the test parameters listed in Table ISTB-3000-1. However, there are no installed flow instruments in these recirculation lines to measure flow rate as required by ISTB-5121 and Table ISTB-3000-1. Because of the restricting orifices, the flow is assumed to be fixed and at its reference value. Delta-P and vibration are then measured and compared to the acceptance criteria.

NUREG-1482, “Guidelines for Inservice Testing at Nuclear Power Plants,” Revision 2, Section 5.9, “Pump Testing Using Minimum Flow Return Lines With or Without Flow Measuring Devices,” states in part that:

> In cases where only the minimum-flow return line is available for pump testing, regardless of the test interval, the staff’s position is that flow

> instrumentation that meets the requirements of Subsection ISTB-3500 should be installed in the mini-flow return line. Installation of this instrumentation is necessary to provide flow rate measurements during pump testing so that this data can be evaluated with the measured pump differential pressure to monitor for pump hydraulic degradation.

The guidance provided in Generic Letter (GL) 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," Attachment 1, Position 9, "Pump Testing using Minimum-flow Return line With or Without Flow Measuring Devices," still applies. Since a full flow loop exists that can be easily instrumented and utilized only during certain plant operating modes, the guidance provided in GL 89-04, Position 9, for non-instrumented minimum flow paths shall be followed during the quarterly Group A test. Position 9 of GL 89-04 states in part that:

> In cases where flow can only be established through a non-instrumented minimum flow path during quarterly pump testing and a path exists at cold shutdowns or refueling outages to perform a test of the pump under full or substantial flow conditions, the staff has determined that the increased interval is an acceptable alternative to the Code requirements, provided that pump differential pressure, flow rate, and bearing vibration measurements are taken during this testing and that quarterly testing also measuring at least pump differential pressure and vibrations is continued.

In accordance with Position 9 of the GL 89-04, the pumps have been shown capable of being tested through their full-flow recirculation flow paths (through valves HCV-1CH-110 [-105]), at a refueling frequency, and are also capable of being tested on-line at the two-year comprehensive pump test frequency. For the full-flow recirculation test, the flow is measured by a portable ultrasonic flow meter that has been "wet-flow" calibrated to within the plus or minus 2 percent accuracy required by Table ISTB-3510-1.

In order to install the flow meters, however, the insulation on the piping must be removed and the heat trace elements must be moved away from where the transducers and tracks will be installed. Moving the heat trace elements places stresses on them, which increases the probability of failure of the heat trace elements. The heat tracing on the boric acid piping is needed to support system operability. Therefore, it is impractical to test the pumps quarterly and at a cold shutdown frequency in this manner.

A review of past test results has shown that this combination of quarterly Group A testing and refueling or two-year on-line frequency comprehensive pump testing is capable of assessing pump performance and detecting degradation.

5. Burden Caused by Compliance

Use of a portable ultrasonic flow meter and full-flow recirculation flow path was considered for the quarterly test, but was determined to be impractical. Testing quarterly using the temporary ultrasonic flow meter would lead to the increased probability of failure of the heat trace elements.

Also, additional calibrated flow instrumentation would have to be purchased to ensure the availability of equipment. Permanently installing the flow meters would require a design change to the plant and the purchase of additional flow instrumentation. Performing the full-flow test quarterly and during cold shutdowns would not enhance the ability to assess operability of the pumps enough to justify the increased cost of a system design change.

In addition, testing during refueling outages diverts manpower from other refueling tasks. These tests must be scheduled at a time in the outage when the boric acid tanks are not required to be part of the boration flow path and must be coordinated with power supply outages. Even though the actual performance of these tests may be completed in a relatively short time, the set-up and restoration is approximately eight to ten hours for each pump. Removing the tests from the outage schedule would allow a greater focus on other safety-related tasks without impacting the level of quality and safety of the boric acid transfer pumps. In addition, a probabilistic risk assessment evaluation has determined that there is no increase in risk for the performance of this test, whether on-line or during refueling outages. Therefore, it is requested to perform the full-flow test at least once every two years, which satisfies the inservice test frequency of biennially specified in Table ISTB-3400-1 for the comprehensive test. Overall, proper monitoring of pump performance will be maintained via the quarterly Group A testing and full-flow comprehensive testing at least once every two years while on-line or during shutdown conditions.

6. Proposed Alternative and Basis for Use

Perform the quarterly Group A test through a fixed-resistance non-instrumented minimum-flow recirculation line assuming flow to be constant and measuring differential pressure (delta-P) in boric acid transfer pump operational test procedures. Perform the periodic verification test (as described in Mandatory Appendix V, “Pump Periodic Verification Test Program,” of the 2012 ASME OM Code), and full flow comprehensive test at least once every two years.

Separate vibration reference and acceptance criteria values will be used for the different test conditions of the recirculation and full-flow tests.

This proposed alternative is consistent with the guidelines provided in NUREG-1482, Section 5.9 and GL 89-04, Position 9 and provides reasonable assurance of pump operational readiness without causing operational concerns, such as reactivity transients.

Using the provisions of this relief request as an alternative to the requirements of ISTB-5121 provides a reasonable alternative to the Code requirements.

7. Duration of Proposed Alternative

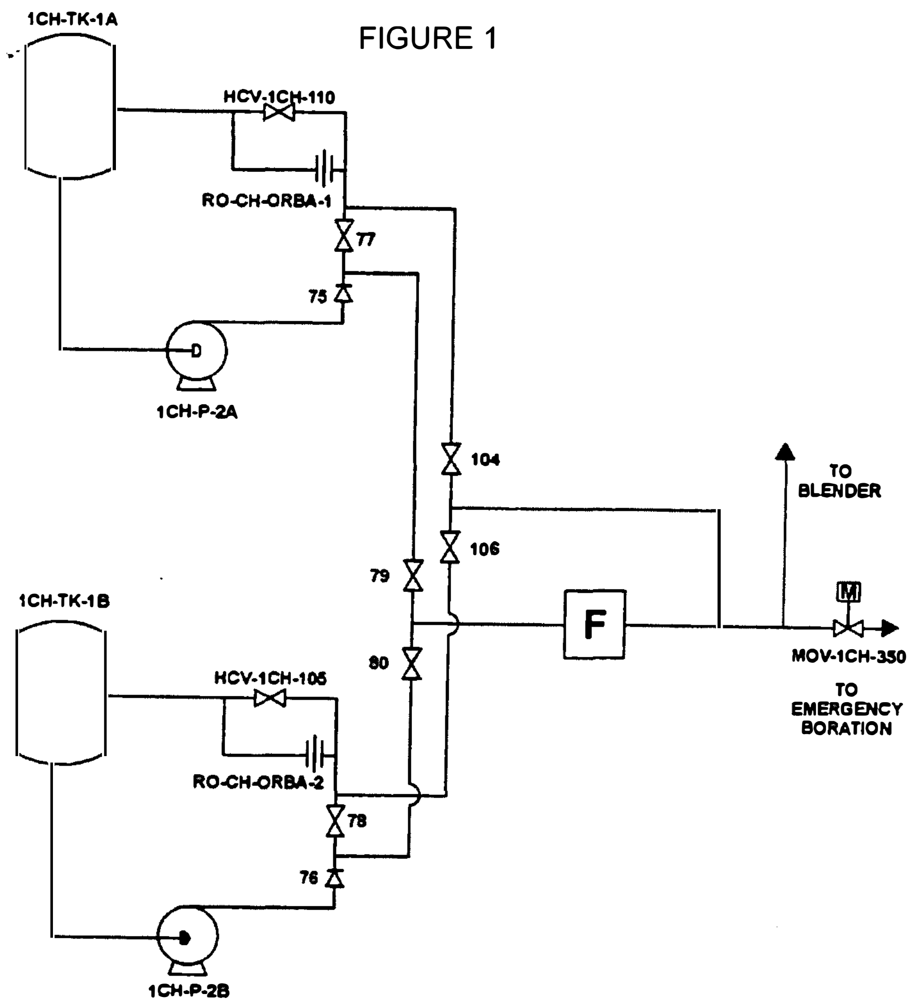
The proposed alternative is requested for use during the fifth 10-year IST interval.

8. Precedent

A similar request was approved for the Beaver Valley Power Station, Unit No. 1 Fourth Ten-Year Inservice Test Interval. The Nuclear Regulatory Commission staff letter authorizing the alternative is referenced below.

Beaver Valley Power Station, Unit No. 1, Docket No. 50-334, Safety Evaluation of Relief Request PRR6 for the Fourth 10-Year Inservice Testing Program, dated September 27, 2007 (ADAMS Accession No. ML072420376).

FIGURE 1



Relief Request In Accordance with 10 CFR 50.55a(f)(5)(iii)

--Inservice Testing Impracticality--

1. **ASME Code Components Affected**

   1RH-P-1A and B, Residual Heat Removal Pumps, (Group A, Class 2)

2. **Applicable Code Edition and Addenda**

   American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. **Applicable Code Requirement**

   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 Group A pumps to be tested on a quarterly frequency.

4. **Impracticality of Compliance**

   The residual heat removal (RHR) pumps are in a standby condition during power operation, and are not required to be in service until the reactor coolant system (RCS) temperature is less than or equal to (≤) 350 degrees Fahrenheit (°F) and RCS pressure is ≤ 430 pounds per square inch gauge (psig). Therefore, they are not exposed to operational wear except when the RCS is at low temperature and pressure and the RHR system is in operation for normal shutdown cooling.

   The RHR pumps have a design pressure of 600 psig. They take suction from the RCS, pass flow through the RHR heat exchangers, and then discharge back to the RCS. The RHR System is considered to be a low pressure system that could be damaged if exposed to the normal operating RCS pressure of approximately 2235 psig. In order to prevent this, the RHR inlet and return isolation valves are interlocked with an output signal from the RCS pressure transmitters, which prevent the valves from being opened when the RCS pressure exceeds 430 psig. In addition, these valves are also maintained shut with their breakers de-energized and administratively controlled. Therefore, testing of the RHR pumps during normal operation is not practicable since there are no alternate supply sources and aligning the RCS to the suction of the RHR pumps, during operation at power, would result in damage to piping and components due to over-pressurization. Major plant and system modifications would be needed to allow quarterly Group A testing of the RHR pumps according to ASME OM Code requirements.

   Based on the above, compliance with the ASME OM Code test frequency requirement for Group A pump tests is impractical.

5. **Burden Caused by Compliance**

Testing is only possible during a surveillance interval frequency of cold shutdown and refueling unless major plant and system modifications are made.

6. **Proposed Alternative and Basis for Use**

These pumps will be tested during cold shutdowns and refueling outages, not more often than once every 92 days, per 1OST-10.1 (Residual Heat Removal Pumps Performance Test). For a cold shutdown or refueling outage that extends longer than three months, the pumps will be tested every three months in accordance with Table ISTB-3400-1. In the instance of an extended outage, a Group A test may be performed; otherwise, a comprehensive test will be performed each refueling outage.

This proposed alternative is necessary to prevent the potential for piping and component damage as a result of over-pressurization.

Using the provisions of this relief request as an alternative to the frequency requirements of Table ISTB-3400-1 provides a reasonable alternative to the Code requirements and assurance that the pumps are operationally ready.

7. **Duration of Proposed Alternative**

The proposed alternative is requested for use during the fifth 10-year inservice test interval.

8. **Precedent**

A similar request was approved for the Beaver Valley Power Station, Unit No. 1 fourth 10-year inservice test interval. The Nuclear Regulatory Commission staff letter authorizing the alternative is referenced below.

Beaver Valley Power Station, Unit No. 1, Docket No. 50-334, Safety Evaluation of Relief Request PRR7 for the Fourth 10-Year Inservice Testing Program, dated September 27, 2007 (ADAMS Accession No. ML072420376).

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(1)

-- Alternative Provides Acceptable Level of Quality and Safety--

1. ASME Code Components Affected

1CH-P-2A and B, Boric Acid Transfer Pumps, (Group A, Class 3)

1RH-P-1A and B, Residual Heat Removal Pumps, (Group A, Class 3)

1SI-P-1A and B, Low Head Safety Injection Pumps, (Group B, Class 2)

1FW-P-3A, and B, Motor-Driven Auxiliary Feedwater Pumps, (Group B, Class 3)

1RW-P-1A, B and C, River Water Pumps, (Group A, Class 3)

1EE-P-1A, B, C, and D, Fuel Oil Transfer Pumps, (Group B, Class 3)

2. Applicable Code Edition and Addenda

American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. Applicable Code Requirement

ISTB-5121, "Group A Test Procedure," and ISTB-5123, "Comprehensive Test Procedure," state in subparagraphs ISTB-5121(e) and ISTB-5123(e):

> All deviations from the reference values shall be compared with the ranges of Table ISTB-5121-1 and corrective action taken as specified in ISTB-6200. Vibration [The vibration] measurements shall be compared to both the relative and absolute criteria shown in the alert and required action ranges of Table ISTB-5121-1. For example, if vibration exceeds either 6Vr, or 0.7 in./sec [inches per second] (1.7 cm/sec) [centimeters per second], the pump is in the required action range.

ISTB-5221, "Group A Test Procedure," and ISTB-5223, "Comprehensive Test Procedure," state in subparagraphs ISTB-5221(e) and ISTB-5223(e):

> All deviations from the reference values shall be compared with the ranges of Table ISTB-5221-1 and corrective action taken as specified in ISTB-6200. Vibration [The vibration] measurements shall be compared to both the relative and absolute criteria shown in the alert and required action ranges of Table-ISTB-5221-1. For example, if vibration exceeds either 6Vr, or 0.7 in/sec (1.7 cm/sec), the pump is in the required action range.

ISTB-5321, "Group A Test Procedure," and ISTB-5323, "Comprehensive Test Procedure," state in subparagraphs ISTB-5321(e) and ISTB-5323(e):

> All deviations from the reference values shall be compared with the ranges of Table ISTB-5321-1 or Table-5321-2, as applicable, and corrective action taken as specified in ISTB-6200. For reciprocating

positive displacement pumps, vibration measurements shall be compared to both the relative criteria shown in the alert and required action ranges of Table ISTB-5321-2 [Table ISTB-5321-1]. For all other positive displacement pumps, vibration measurements shall be compared to both the relative and absolute criteria shown in the alert and required action ranges of Table ISTB-5321-1 [Table ISTB-5321-2]. For example, if vibration exceeds either 6Vr, or 0.7 in/sec (1.7 cm/sec), the pump is in the required action range.

Note: Beaver Valley Power Station (BVPS), Unit No. 1, (BVPS-1) has no reciprocating positive displacement pumps in the Inservice Test (IST) Program. Therefore, Table ISTB-5321-2 is not applicable.

4. Reason for Request

The pumps listed above tend to be smooth running pumps in the BVPS-1 IST Program. Each has at least one vibration reference value (Vr) that is currently less than 0.05 in/sec. A small value for Vr produces a small acceptable range for pump operation. The ASME OM Code acceptable range limit for pump vibrations from Table ISTB-5121-1, Table ISTB-5221-1, and Table ISTB-5321-1 for both the Group A test and comprehensive test is less than or equal to 2.5 Vr. Based on a small acceptable range, a smooth running pump could be subject to unnecessary corrective action if the measured vibration parameter exceeds this limit. ISTB-6200, "Corrective Action," subarticle ISTB-6200(a), "Alert Range," states:

> If the measured test parameter values fall within the alert range of Table ISTB-5121-1, Table ISTB-5221-1, Table ISTB-5321-1, or Table ISTB-5321-2, as applicable, the frequency of testing specified in ISTB-3400 shall be doubled until the cause of the deviation is determined and the condition is corrected.

For very small vibration reference values, flow variations, hydraulic noise, and instrument error can be a significant portion of the reading and affect the repeatability of subsequent measurements. Also, experience gathered by the BVPS Predictive Maintenance (PdM) Group has shown that changes in vibration levels in the range of 0.05 in/sec do not normally indicate significant degradation in pump performance.

In order to avoid unnecessary corrective actions, a minimum value for V_r of 0.05 in/sec is proposed. This minimum value would be applied to individual vibration locations for those pumps with reference vibration values less than 0.05 in/sec. Therefore, the smallest ASME OM Code acceptable range limit for any IST pump vibration measurement location would be no lower than 2.5 times V_r, or 0.125 in/sec, which is within the "fair" range of the "General Machinery Vibration Severity Chart" provided by IRD Mechanalysis, Inc. Likewise, the smallest ASME OM Code alert range limit for any IST pump vibration measurement location for

which the pump would be inoperable would be no lower than 6 times V_r, or 0.300 in/sec.

When new reference values are established per ISTB-3310, ISTB-3320 or ISTB-6200(c), the measured parameters will be evaluated for each location in order to determine if the provisions of this relief request still apply.

In addition to the requirements of ISTB for inservice testing, the pumps in the IST Program are also included in the BVPS PdM Program. The BVPS PdM Program currently employs predictive monitoring techniques such as: vibration monitoring and analysis beyond that required by ISTB, bearing temperature trending, oil sampling and analysis, and thermography analysis, as applicable.

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: initiation of a condition report, increased monitoring to establish a rate of change, review of component specific information to identify the cause of the condition, and removal of the pump from service to perform maintenance.

5. Proposed Alternative and Basis for Use

In lieu of applying the vibration acceptance criteria ranges specified in Table ISTB-5121-1, Table ISTB-5221-1, or Table ISTB-5321-1, as applicable, smooth running pumps with a measured reference value below 0.05 in/sec for a particular vibration measurement location will have subsequent test results for that location compared to an acceptable range limit of 0.125 in/sec and an alert range limit of 0.300 in/sec (based on a minimum reference value 0.05 in/sec). These proposed ranges shall be applied to vibration test results during both Group A tests and comprehensive tests.

In addition to the Code requirements, the affected pumps listed in this request are included in and will remain in the BVPS PdM Program.

Using the provisions of this relief request as an alternative to the specific requirements of ISTB identified above will provide adequate indication of pump performance and continue to provide an acceptable level of quality and safety without unnecessarily imposing corrective action since changes in vibration levels in the range of 0.05 in/sec do not normally indicate significant degradation in pump performance.

Using the provisions of this relief request as an alternative to the vibration acceptance criteria ranges specified in Table ISTB-5121-1, Table ISTB-5221-1, or Table ISTB-5321-1 provides an acceptable level of quality and safety since the alternative provides reasonable assurance of pump operational readiness and the ability to detect pump degradation.

6. <u>Duration of Proposed Alternative</u>

The proposed alternative is requested for use during the fifth 10-year IST interval.

7. <u>Precedent</u>

A similar request was approved by the Nuclear Regulatory Commission staff in their safety evaluation referenced below.

Beaver Valley Power Station, Unit No. 1, Docket No. 50-334, Safety Evaluation of Relief Request PRR8 for the Fourth 10-Year Inservice Testing Program, Dated September 27, 2007 (ADAMS Accession No. ML072420376).

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**

   1FW-P-3A and B, Motor Driven Auxiliary Feed Water Pumps, (Class 2)

2. **Applicable Code Edition and Addenda**

   American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. **Applicable Code Requirement**

   ISTB-5122, "Group B Test Procedure," states in part that:

   > Group B tests shall be conducted with the pump operating at a specified reference point. The test parameter value identified in Table ISTB-3000-1 shall be determined and recorded as required by this paragraph.

   Table ISTB-3000-1, "Inservice Test Parameters," identifies flow rate as a test parameter and Note 1 states in part that:

   > . . . differential pressure or flow rate shall be measured or determined.

4. **Reason for Request**

   Introduction of relatively cold auxiliary feedwater into the steam generators for quarterly testing would produce a potential for thermal shock to both the main feed piping (thermal sleeves) and the secondary side of the steam generators. Although the thermal sleeves and steam generators are designed for thermal shock, exposure to these events is minimized in order to ensure that the benefits of plant life extension can be realized. In addition, feeding the steam generators with a large volume of relatively cold water would also result in a large level transient in the steam generators and could cause a reactor trip.

   Additionally, these pumps receive their suction from the demineralized water storage tank. The water in the demineralized water storage tank is not treated for pH or oxygen; therefore, it could have an impact on the corrosion rates in the steam generators. For this reason, it is preferred to minimize the use of this water while in Modes 1, 2, or 3.

   In order to perform the quarterly Group B test, a recirculation flow path must be used that recirculates the demineralized water storage tank. Although the installed suction flow indicating switch for each pump has a 0 to 350 gallon per minute (gpm) logarithmic scale that is calibrated to an accuracy of plus or minus 1 percent of full scale, the smallest increments between 100 and 200 gpm is 5 gpm. These

increments are too large to read flow accurately at a throttled recirculation flow rate of 200 gpm.

ISTB-5122 requires that the test parameters in Table ISTB-3000-1 be determined and recorded during Group B quarterly tests. Flow rate is one of the test parameters listed in Table ISTB-3000-1. Section ISTB-3510(a) requires that instruments used for testing be accurate within the specifications in Table ISTB-3510-1. Table ISTB-3510-1 requires that the flow rate be accurate to within plus or minus 2 percent of the actual flow rate.

An allowed ASME accuracy of 2.0 percent for flow minus the calibrated accuracy of 1.0 percent for the installed suction flow indicating switches multiplied by the reference flow rate of 200 gpm results in the flow reading needing to be capable of being read to at least plus or minus 2.0 gpm. Being able to accurately read flow half-way between the smallest increments of 5 gpm on the flow indicators yields a reading that is only capable of being read to 2.5 gpm. Therefore, the installed suction flow indicating switches cannot be used for ASME pump testing. The installation of temporary flow instrumentation during the performance of the Group B quarterly test is an undue burden when compared to the limited benefits gained by the results of the quarterly pump tests.

Since an instrumented full flow loop exists that can be utilized during refueling outages, the guidance provided in Generic Letter 89-04, “Guidance on Developing Acceptable Inservice Testing Programs,” Attachment 1, Position 9, “Pump Testing Using Minimum Flow Return Line With or Without Flow Measuring Devices,” for minimum flow paths shall be followed during the quarterly Group B test.

Position 9 of Generic Letter 89-04 states in part that:

> In cases where flow can only be established through a non-instrumented minimum flow path during quarterly pump testing and a path exists at cold shutdowns or refueling outages to perform a test of the pump under full or substantial flow conditions, the staff has determined that the increased interval is an acceptable alternative to the Code requirements, provided that pump differential pressure, flow rate, and bearing vibration measurements are taken during this testing and that quarterly testing also measuring at least pump differential pressure and vibrations is continued.

In accordance with Position 9 of the Generic Letter 89-04, the pumps are capable of being tested through their full-flow paths by injecting flow into the steam generators via flow instrumentation, at a refueling frequency.

5. Proposed Alternative and Basis for Use

As an alternative to the requirements of ISTB-5122 and Table ISTB-3000-1, the quarterly Group B test will be performed using the recirculation flow path while

measuring differential pressure per motor-driven auxiliary feedwater pump tests, with flow assumed to be fixed and at its reference value. The periodic verification test (as described in Mandatory Appendix V, "Pump Periodic Verification Test Program," of the 2012 ASME OM Code) and biennial comprehensive test will be performed during refueling outages when plant conditions permit directing flow to the steam generators. Full flow will be measured using the flow instrumentation in the steam generator supply headers while also measuring differential pressure and vibrations per motor-driven auxiliary feedwater pump check valve and full-flow tests. Separate differential pressure reference and acceptance criteria values will be used for the different test conditions of the recirculation and full-flow tests. Motor-driven auxiliary feedwater pump check valve and full-flow test procedures may be performed in lieu of the quarterly tests, if their scheduled performances coincide.

This proposed alternative is in accordance with the guidelines provided in Generic Letter 89-04, Position 9.

Compliance with the requirements of ISTB-5122 and Table ISTB-3000-1 would require hardware changes and cause a hardship without a compensating increase in the level of quality and safety as previously described.

6. Duration of Proposed Alternative

The proposed alternative is requested for use during the fifth 10-year inservice test interval.

7. Precedent

A similar request was approved for the Beaver Valley Power Station, Unit No. 1 fourth 10-year inservice test interval. The Nuclear Regulatory Commission staff letter authorizing the alternative is referenced below.

Beaver Valley Power Station, Unit No. 1, Docket No. 50-334, Safety Evaluation of Relief Request PRR9 for the Fourth 10-Year Inservice Testing Program, dated September 27, 2007 (ADAMS Accession No. ML072420376).

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**

   1FW-P-2, Turbine Driven Auxiliary Feed Water Pump, (Class 2)

2. **Applicable Code Edition and Addenda**

   American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. **Applicable Code Requirement**

   ISTB-5122, "Group B Test Procedure," states in part that:

   > Group B tests shall be conducted with the pump operating at a specified reference point. The test parameter value identified in Table ISTB-3000-1 shall be determined and recorded as required by this paragraph.

   Table ISTB-3000-1, "Inservice Test Parameters," identifies flow rate as a test parameter and Note 1 states in part that:

   > . . . differential pressure or flow rate shall be measured or determined.

4. **Reason for Request**

   Introduction of relatively cold auxiliary feedwater into the steam generators for quarterly testing would produce a potential for thermal shock to both the main feed piping (thermal sleeves) and the secondary side of the steam generators. Although the thermal sleeves and steam generators are designed for thermal shock, exposure to these events is minimized in order to ensure that the benefits of plant life extension can be realized. In addition, feeding the steam generators with a large volume of relatively cold water would also result in a large level transient in the steam generators and could cause a reactor trip.

   Additionally, this pump receives suction from the demineralized water storage tank. The water in the demineralized water storage tank is not treated for pH or oxygen; therefore, it could have some impact on the corrosion rates in the steam generators. For this reason, it is preferred to minimize the use of this water while in Modes 1, 2, or 3.

   In order to perform the quarterly Group B test, a recirculation flow path must be used that recirculates the demineralized water storage tank. Although the installed suction flow indicating switch has a 0 to 700 gallon per minute (gpm) logarithmic scale that is calibrated to an accuracy of plus or minus 1 percent of full scale, the

smallest increments between 100 and 400 gpm are 10 gpm. These increments are too large to read flow accurately at a throttled recirculation flow rate of 300 gpm.

ISTB-5122 requires that the test parameters in Table ISTB-3000-1 be determined and recorded during Group B quarterly tests. Flow rate is one of the test parameters listed in Table ISTB-3000-1. Section ISTB-3510(a) requires that instruments used for testing be accurate within the specifications in Table ISTB-3510-1. Table ISTB-3510-1 requires that the flow rate be accurate to within plus or minus 2 percent of the actual flow rate.

Based on an allowed ASME accuracy of 2.0 percent for flow minus the calibrated accuracy of 1.0 percent for FIS-1FW-152 multiplied by the reference flow rate of 300 gpm, flow readings need to be capable of being read to at least plus or minus 3.0 gpm. Being able to accurately read flow half way between the smallest increments of 10 gpm on the flow indicator yields a reading that is only capable of being read to 5 gpm. Therefore, the installed suction flow indicating switch cannot be used for ASME pump testing. The installation of temporary flow instrumentation during the performance of the Group B quarterly test is an undue burden when compared to the limited benefits gained by the results of the quarterly pump tests.

Since an instrumented full flow loop exists that can be utilized during refueling outages, the guidance provided in Generic Letter 89-04, “Guidance on Developing Acceptable Inservice Testing Programs,” Attachment 1, Position 9, “Pump Testing Using Minimum Flow Return Line With or Without Flow Measuring Devices,” for minimum flow paths shall be followed during the quarterly Group B test.

Position 9 of Generic Letter 89-04 states in part that:

> In cases where flow can only be established through a non-instrumented minimum flow path during quarterly pump testing and a path exists at cold shutdowns or refueling outages to perform a test of the pump under full or substantial flow conditions, the staff has determined that the increased interval is an acceptable alternative to the Code requirements, provided that pump differential pressure, flow rate, and bearing vibration measurements are taken during this testing and that quarterly testing also measuring at least pump differential pressure and vibrations is continued.

As stated above, Generic Letter 89-04 requires full flow testing during cold shutdowns or refueling outages. Full flow testing of the turbine driven auxiliary feedwater pump can only be performed in Mode 3 because the turbine requires steam from any of the three steam generators to drive the pump. It is not desirable to test the pump during cold shutdown, but rather only in Mode 3 during shutdown or during startup after a refueling outage for the following reasons.

In Mode 3, the introduction of relatively cold auxiliary feedwater into the steam generators produces a potential for thermal shock to both the main feed piping (thermal sleeves) and the secondary side of the steam generators. Although the thermal sleeves and steam generators are designed for thermal shock, the exposure to these events is minimized in order to ensure that the benefits of plant life extension can be realized.

As previously stated, this pump takes suction from the demineralized water storage tank. The water in the demineralized water storage tank is not treated for pH or oxygen; therefore, it could have some impact on the corrosion rates in the steam generators. For this reason, it is preferred to minimize the use of this water while in Modes 1, 2, or 3.

In addition during startup, this test can only be performed once the steam pressure exceeds 600 psig. Testing at this time during startup causes a temperature transient. The turbine draws steam from the steam generators, causing the reactor coolant system to cool down. In addition, the relatively cold auxiliary feedwater is injected into the steam generators, causing the reactor coolant system to cool even more. This cool down delays startup and is critical path time. Thus, any cool down is costly in the amount of time required to heat back up again.

For the reasons stated above, performing a full-flow test of the turbine-driven auxiliary feedwater pump at each cold shutdown is not desired. Testing will be performed in Mode 3 during shutdown or during startup after a refueling outage by injecting flow into the steam generators via flow instrumentation.

5. <u>Proposed Alternative and Basis for Use</u>

As an alternative to the requirements of ISTB-5122 and Table ISTB-3000-1, the quarterly Group B test will be performed using the recirculation flow path while measuring differential pressure per steam-driven auxiliary feedwater pump test, with flow assumed to be fixed and at its reference value. The periodic verification test (as described in Mandatory Appendix V, “Pump Periodic Verification Test Program,” of the 2012 ASME OM Code) and comprehensive test will be performed in Mode 3 during shutdown or during startup after refueling outages when plant conditions permit directing flow to the steam generators. Full flow will be measured using the flow instrumentation in the steam generator supply headers while also measuring differential pressure and vibrations per turbine-driven auxiliary feedwater pump operability test. Separate differential pressure reference and acceptance criteria values will be used for the different test conditions of the recirculation and full-flow tests. The turbine-driven auxiliary feedwater pump operability test procedure will be performed in lieu of the quarterly Group B test, during refueling outages.

This proposed alternative is in accordance with the guidelines provided in Generic Letter 89-04, Position 9.

Compliance with the requirements of ISTB-5122 and Table ISTB-3000-1 would require hardware changes and cause a hardship without a compensating increase in the level of quality and safety as previously described.

6. **Duration of Proposed Alternative**

The proposed alternative is requested for use during the fifth 10-year inservice test interval.

7. **Precedent**

A similar request was approved for the Beaver Valley Power Station, Unit No. 1 fourth 10-year inservice test interval. The Nuclear Regulatory Commission staff letter authorizing the alternative is referenced below.

Beaver Valley Power Station, Unit No. 1, Docket No. 50-334, Safety Evaluation of Relief Request PRR10 for the Fourth 10-Year Inservice Testing Program, dated September 27, 2007 (ADAMS Accession No. ML072420376).

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**

   1RS-P-1A and B; Inside Recirculation Spray Pumps, (Group B, Class 2)

   1RS-P-2A and B; Outside Recirculation Spray Pumps, (Group B, Class 2)

2. **Applicable Code Edition and Addenda**

   American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. **Applicable Code Requirement**

   ISTB-3300, "Reference Values," ISTB-3300(e)(1), requires reference values to be established within plus or minus 20 percent of pump design flow rate for the comprehensive test.

4. **Reason for Request**

   Prior to initial startup, the inside and outside recirculation spray pumps were subject to long term full flow testing. This testing was performed in 1972 as follows:

   a. With the nozzle openings blocked off (195 per header), temporary connections were made between the nozzle headers and containment sumps.
   b. Sufficient water was then added to the containment sump so that a recirculation spray pump could recirculate water up through its respective cooler and header.
   c. The full flow test through the shell side of the cooler initially ensured that the required recirculation spray for containment depressurization was achieved.
   d. Upon completion of the above system test, the water was drained from each recirculation cooler, the pumps, the headers and the sumps. The temporary connections between the header and sumps were removed and the nozzles installed.

   Since the system was left in a dry, ready condition after the initial full flow tests, no further testing with water flow through the shell side of the recirculation spray heat exchangers is deemed necessary to ensure system capability. Further, the spray nozzles are inaccessible without a significant amount of scaffolding. Even if accessibility was not a concern, the plugging of 780 spray nozzles, the installation of temporary piping, the performance of the full flow test and the return of the system to its operable configuration present substantial challenges. The effort would present challenges in terms of complexity of the temporary modifications, labor intensive

nature of the modifications, as well as the controls and post modification testing to ensure that the system is returned to the original configuration.

Re-establishing this full flow test circuit for the purpose of periodic design flow rate testing would require a similar modification every two years. The expensive and time consuming temporary changes described above would be necessary to duplicate the initial full flow tests, and would cause a hardship without a compensating increase in the level of quality and safety. Likewise, replacement of the four-inch recirculation test line with a line of sufficient size to accommodate design flow rate testing would cause a hardship without a compensating increase in the level of quality and safety.

The recirculation spray pumps have a design point and best efficiency flow rate of 3500 gallons per minute (gpm). To be within 20 percent of pump design flow rate on the low end requires a minimum reference flow rate of 2800 gpm. The code requirements that direct the Owner to establish reference values at this flow rate were adopted after the test circuit was installed. Due to the flow restrictions associated with the existing piping configuration, plus or minus 20 percent of the 3500 gpm design flow rate cannot be achieved through the four-inch recirculation test line. A maximum flow rate of approximately 2050 gpm is achievable through the four-inch recirculation test line. Presently, the inservice test reference flow rates are established with the existing test circuit at approximately 2050 gpm. Pages 7 and 8 of 12 present simple diagrams of the inside and outside recirculation spray pump test circuits, respectively.

Reference flow rates are not within the 20 percent of design flow rate required during the comprehensive test. The test flows are lower than the design flow rate as a result of restrictions due to the small four-inch recirculation line. With the recirculation line restrictions, the highest flow rate that can be measured (approximately 2050 gpm) while maintaining stable test conditions is within approximately 41 percent of the pump design point/best efficiency flow rate.

5. <u>Proposed Alternative and Basis for Use</u>

As an alternative to testing within plus or minus 20 percent of the design flow rate during the comprehensive test, as required by ISTB-3300(e)(1), the reference values will be established at approximately 2050 gpm, which is within approximately 41 percent of the design flow rate and to within approximately 38 to 40 percent of the maximum required accident flow rates.

Testing will be conducted as follows:

The test circuits shown in the diagrams on pages 7 and 8 of 12 will be used to satisfy preservice testing requirements.

The inside recirculation spray pumps shall have a 30-inch high temporary dike constructed around the containment sump encompassing the pump suction and

four-inch recirculation test line return. Sufficient inventory will be provided to establish stable flow conditions through the four-inch recirculation test line. Temporary test instrumentation, of required accuracy, shall be installed as required, in the pump test circuit.

The outside recirculation spray pumps shall be tested by establishing the hydraulic test circuit in a solid condition. Flow shall be recirculated through the pump casing while measuring flow with flow indication provided in the four-inch recirculation test line. Temporary pressure instrumentation shall be utilized at the pumps' suction and discharge.

Pump vibration will be measured and recorded in accordance with the criteria specified in the Code. In addition, vibration spectral analysis will also be performed, which is a more accurate method of detecting mechanical degradation or changes than that of the traditional inservice test vibration requirements.

The inside and outside recirculation spray pumps have a design point and best efficiency flow rate of 3500 gpm with varying maximum required accident flow rates. The table below shows the maximum required accident flow rates for each pump and the range of values within which test flows are established.

The reference flow rate for inside recirculation spray pump 1RS-P-1A is within 38 percent of the maximum required accident flow rate of 3320 gpm. This percentage of the maximum required accident flow rate is specified for recirculation spray pump 1RS-P-1A and the other recirculation spray pumps in the table below.

Pump ID	Accident Flow	Test Flow	Percent Within Accident Flow
1RS-P-1A	3320 gpm	2050-2075 gpm	-38 %
1RS-P-1B	3370 gpm	2050-2075 gpm	-39 %
1RS-P-2A	3385 gpm	2040-2060 gpm	-40 %
1RS-P-2B	3340 gpm	2040-2060 gpm	-39 %

Presently, the inservice test reference flow rates are typically established with the existing test circuit in the range of 2040 to 2075 gpm. The low reference flow rates result from restrictions due to the small four-inch recirculation line and the limited volume of water in the test circuit.

With the restrictions described, the highest flow rate that can be measured while maintaining stable test conditions is within approximately 41 percent of the 3500

gpm design flow rate and within approximately 38 to 40 percent of the maximum required accident flow rates.

In the 2040 to 2075 gpm range of the head curve for these pumps, the curve is not flat but well sloped. The pump head curves are shown on pages 9 through 12 of 12. Therefore, as performance degrades due to internal recirculation caused by increasing internal pump clearances, the differential pressure will measurably decrease for a given reference flow rate.

To be within 20 percent of pump design flow rate on the low end requires a minimum reference flow rate of 2800 gpm. To be within 20 percent of the maximum required accident flow rate on the low end would require minimum reference flow rates ranging from 2656 to 2708 gpm, depending on the pump being tested. For the reasons previously stated, reference flow rates are procedurally controlled within a range of 2040 to 2075 gpm, which is not within the 20 percent of the design flow rate required during the comprehensive test.

Testing at near design flow rate conditions is important for pumps with characteristic head-flow curves that are flat or gently sloping in the low flow region (little change in developed head with increasing flow rate). In the low flow region, increasing internal flow rates, as a result of internal wear, are difficult to detect. Pumps with the flat portion of the curve at low flow rates should be tested at or near design conditions to determine if increasing internal recirculation flow rates have degraded pump performance to the point where design performance cannot be met.

This situation does not apply to the inside and outside recirculation spray pumps if they are tested within approximately 41 percent of the design flow rate when considering the slope of the curve. Testing at the proposed reference flow rates will detect degradation since the pump head-curve is well sloped at the point of testing.

These recirculation spray pumps are Group B standby pumps run only for surveillance testing. The pumps do not see prolonged use. The low number of operating hours makes degradation of each pump unlikely. Significant changes in pump operation are not expected when each pump’s run time is typically less than 2 hours once every 18 month cycle.

In order to compensate for testing all four pumps at the reduced flow rates, the inside and outside recirculation spray pumps are included in the Beaver Valley Predictive Maintenance (PdM) Program. All pumps have enhanced vibration monitoring with spectral analysis data obtained each refueling outage. The outside recirculation spray pumps are subject to periodic oil sample analysis. The bearings associated with the inside recirculation spray pumps are grease lubricated. These activities are beyond that required by ISTB and provide further assurance as to the ability to detect pump degradation. Also, as a preventive maintenance activity, the outside recirculation spray pumps’ mechanical seals are replaced every seventh refueling outage.

If measured parameters are outside the normal operating range or are determined by analysis to be trending towards a degraded state, appropriate actions are taken. These actions may include monitoring of additional parameters, review of component specific information to identify cause and removal of the pump from service to perform corrective maintenance.

Compliance with the specific ISTB Code requirements identified in this relief request would require significant temporary modifications or permanent hardware changes and cause a hardship without a compensating increase in the level of quality and safety as previously described. In order to achieve a flow rate near the design point of 3500 gpm, an 8-inch test loop would have to be installed in place of the current 4-inch test loop for each pump. These modifications are estimated to cost approximately 760,000 dollars.

Performing the required temporary modifications used during plant startup testing in 1972 or enlarging the size of the test loops to achieve the required accident flow rates is not warranted since there will be no improvement in our ability to detect pump degradation. Testing the pumps utilizing the current test loops provides for substantial flow testing in a sloped and stable region of the pump curve (that is, at approximately 2050 gpm), well above the minimum continuous flow rate of 1400 gpm specified by the pump manufacturer. Testing the pumps at reference values established in this region of the pump curves will not cause damage to the pumps and will provide meaningful data to assess pump operational readiness. In order to compensate for testing these pumps at a reduced flow rate during the comprehensive pump test, the inside and outside recirculation spray pumps are also included in the predictive maintenance program where enhanced vibration monitoring is done. Testing using the current test loops in conjunction with the additional predictive maintenance technologies will ensure reliable operation of the inside and outside recirculation spray pumps.

Based on the above evaluation, compliance with ISTB-3300(e)(1) reference value requirements for the inside and outside recirculation spray pumps would result in a hardship without a compensating increase in the level of quality or safety. The proposed alternative to the requirements specified in ISTB-3300(e)(1) provides sufficient indication of any potential degradation occurring to the pumps and reasonable assurance that the pumps are operationally ready and able to perform their function.

6. Duration of Proposed Alternative

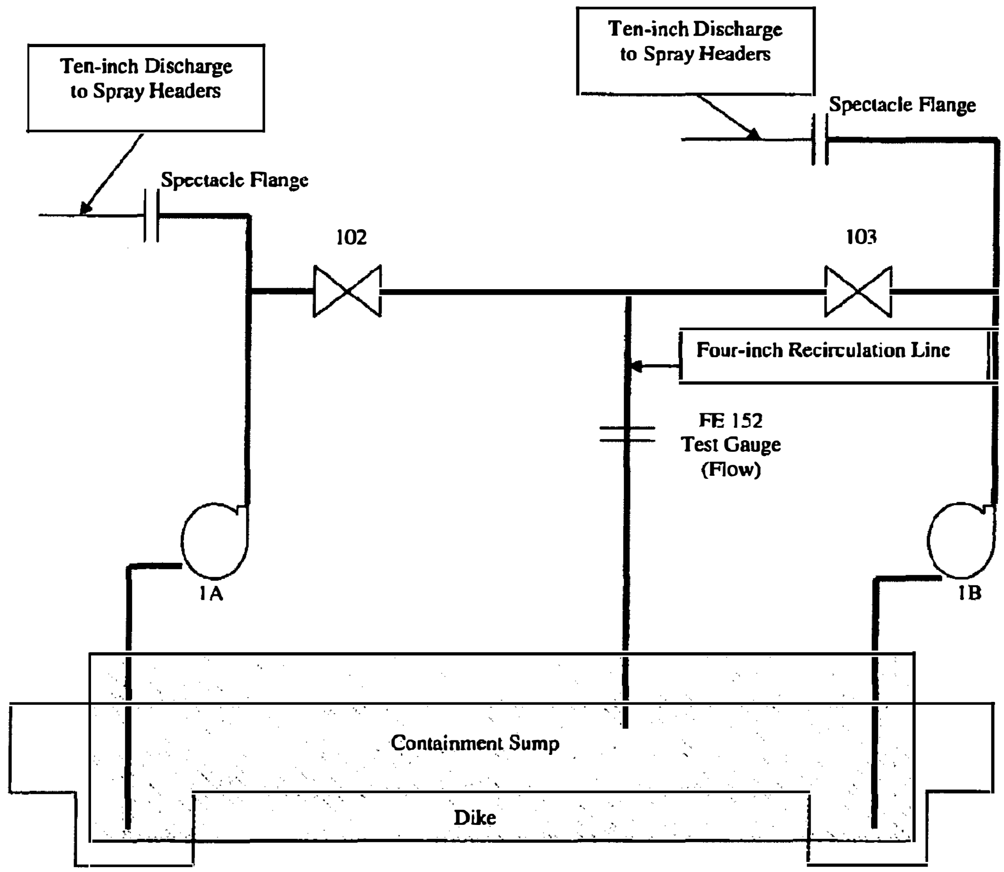
The proposed alternative is requested for use during the fifth 10-year inservice test interval.

7. <u>Precedent</u>

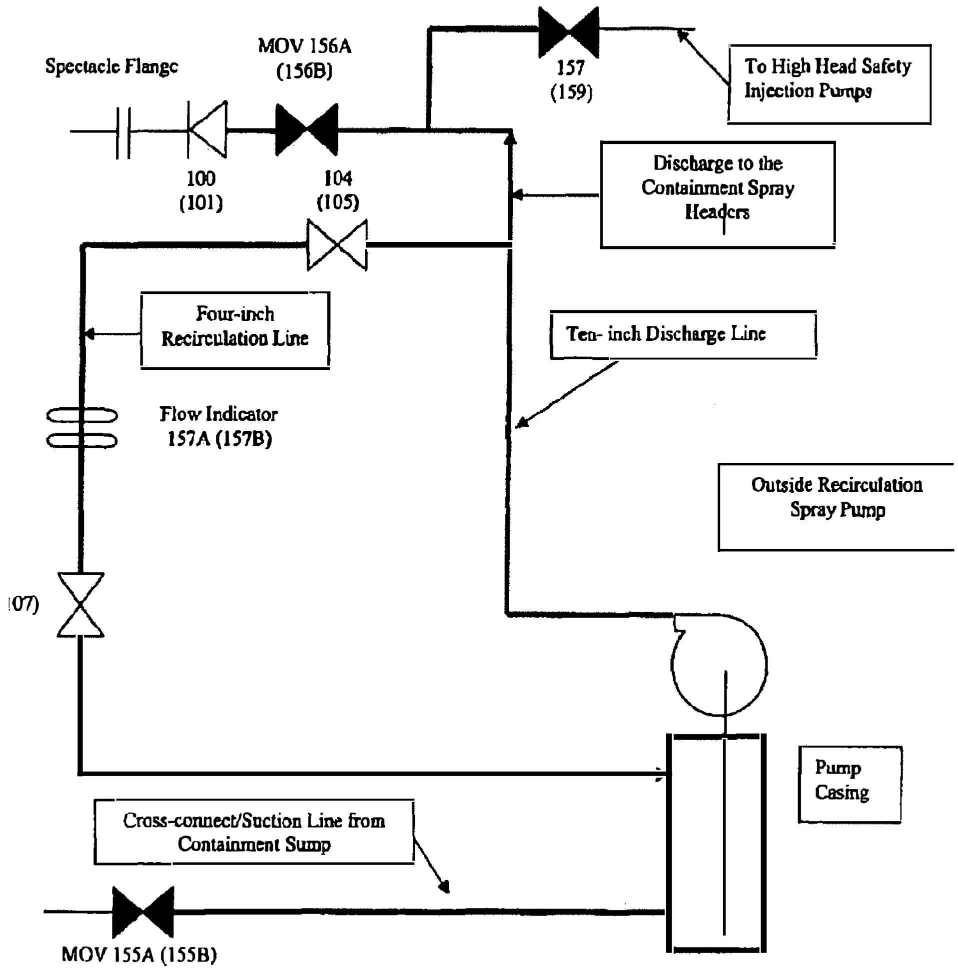
A similar request was approved for Beaver Valley Power Station, Unit No. 1, fourth 10-year inservice test interval. The Nuclear Regulatory Commission staff letter authorizing the alternative is referenced below.

Beaver Valley Power Station, Unit No. 1, Docket No. 50-334, Safety Evaluation of Relief Request PRR11 for the Fourth 10-Year Inservice Testing Program, dated September 27, 2007 (ADAMS Accession Number ML072420376).

Inside Recirculation Spray Pump [1RS-P-1A, 1B] Test Circuit

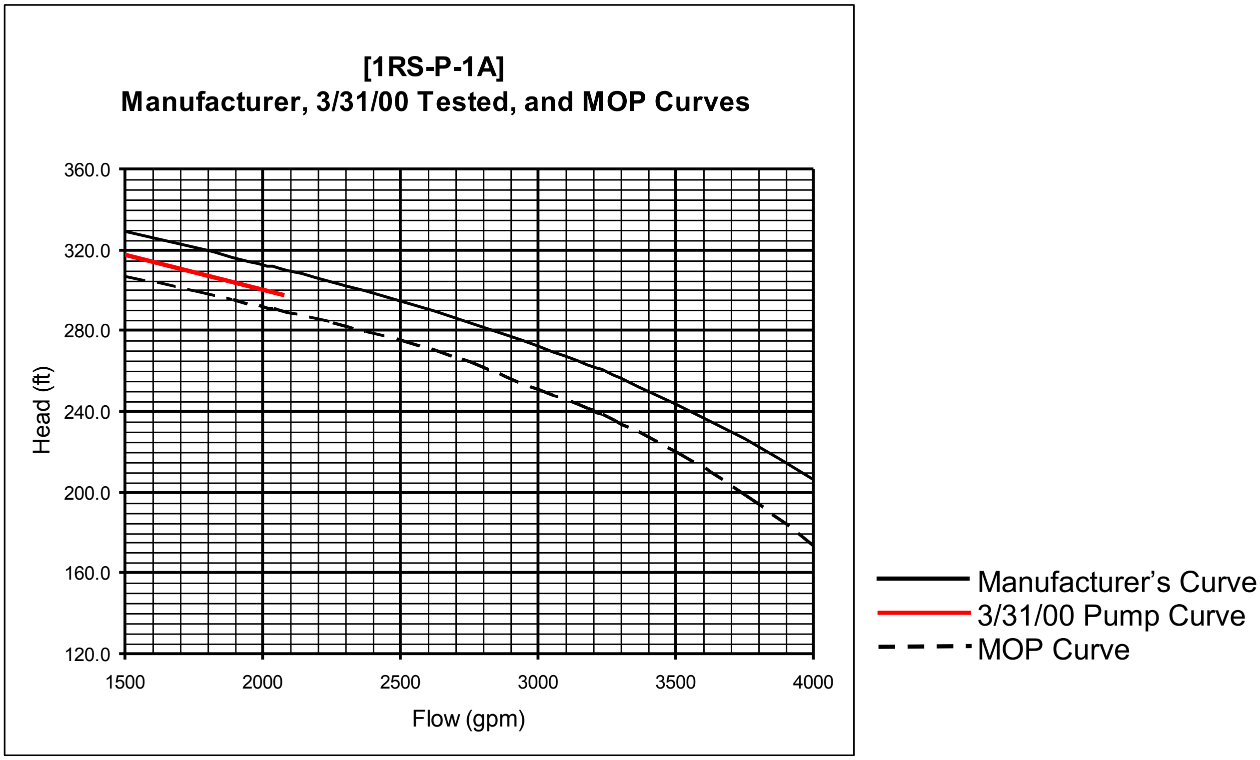


Outside Recirculation Spray Pump [1RS-P-2A, 2B] Test Circuit



MANUFACTURER'S AND MINIMUM OPERATING POINT (MOP) PUMP CURVES

Pump Name: 1A Inside Recirculation Spray Pump Pump Number: 1RS-P-1A

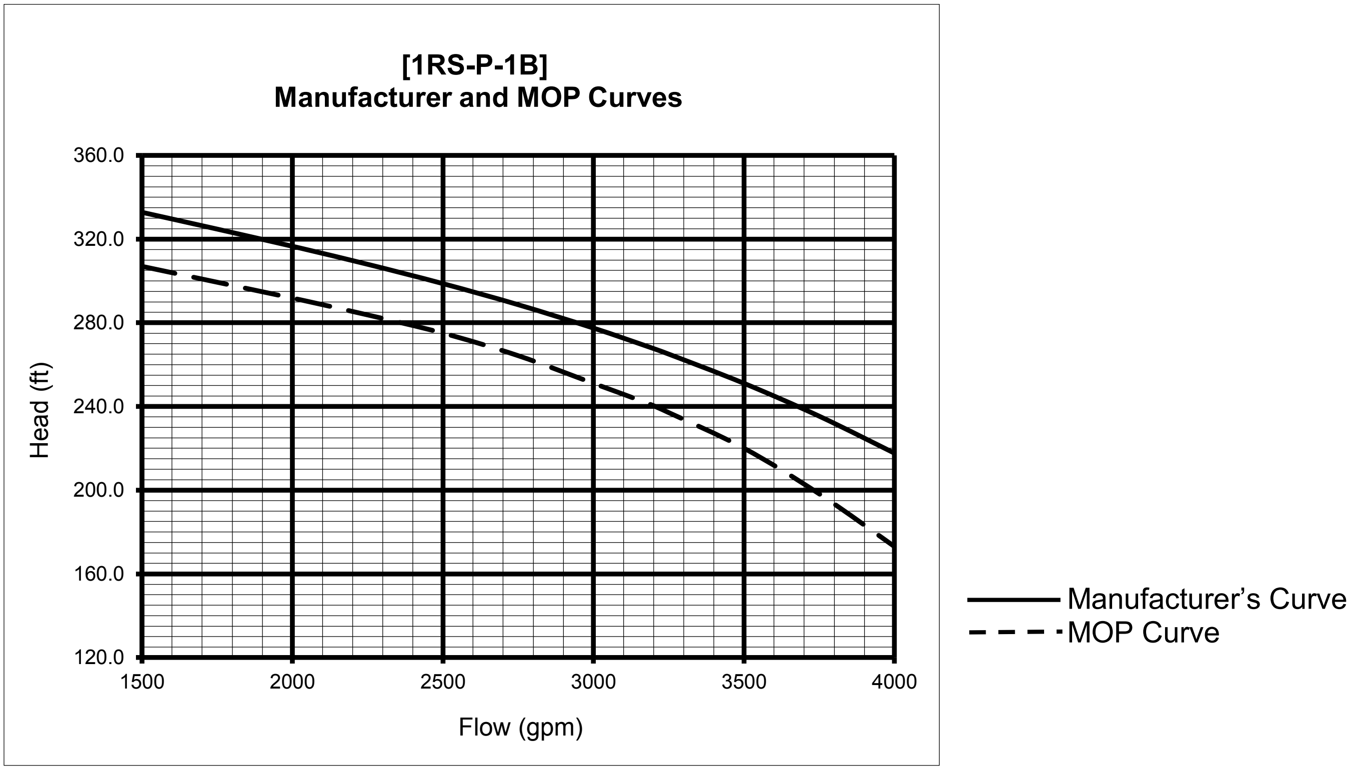


Flow (gpm)	3/31/00 Pump Curve Head (ft)
1376	322.0
1579	317.4
1889	303.5
2065	300.1
2077	297.7

Flow (gpm)	Manufacturer's Curve Head (ft)	MOP Curve Head (ft)
0	393.1	380.0
1500	329.2	306.9
1750	321.0	299.3
2000	312.7	291.7
2050	311.0	290.2
2250	304.0	283.7
2500	294.6	275.0
2750	284.2	264.2
3000	272.4	251.0
3180	263.0	241.4
3250	259.1	237.0
3500	243.8	220.0
3750	226.3	198.2
4000	206.2	173.0

MANUFACTURER'S AND MINIMUM OPERATING POINT (MOP) PUMP CURVES

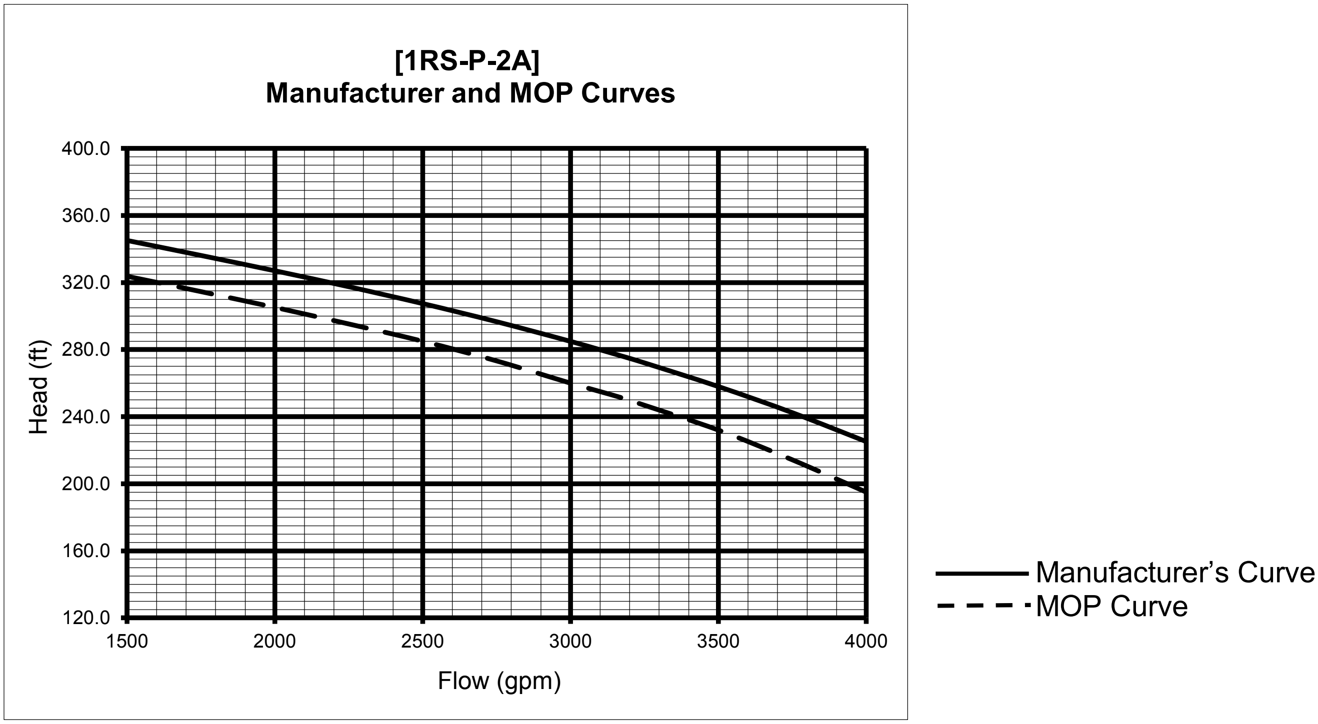
Pump Name: 1B Inside Recirculation Spray Pump Pump Number: 1RS-P-1B



Flow (gpm)	Manufacturer's Curve Head (ft)	MOP Curve Head (ft)
0	389.7	380.0
1500	332.8	306.9
1750	324.8	299.3
2000	316.6	291.7
2050	314.9	290.2
2250	308.0	283.7
2500	298.7	275.0
2750	288.6	264.2
3000	277.5	251.0
3180	268.6	241.4
3250	265.0	237.0
3500	251.0	220.0
3750	235.3	198.2
4000	217.7	173.0

MANUFACTURER'S AND MINIMUM OPERATING POINT (MOP) PUMP CURVES

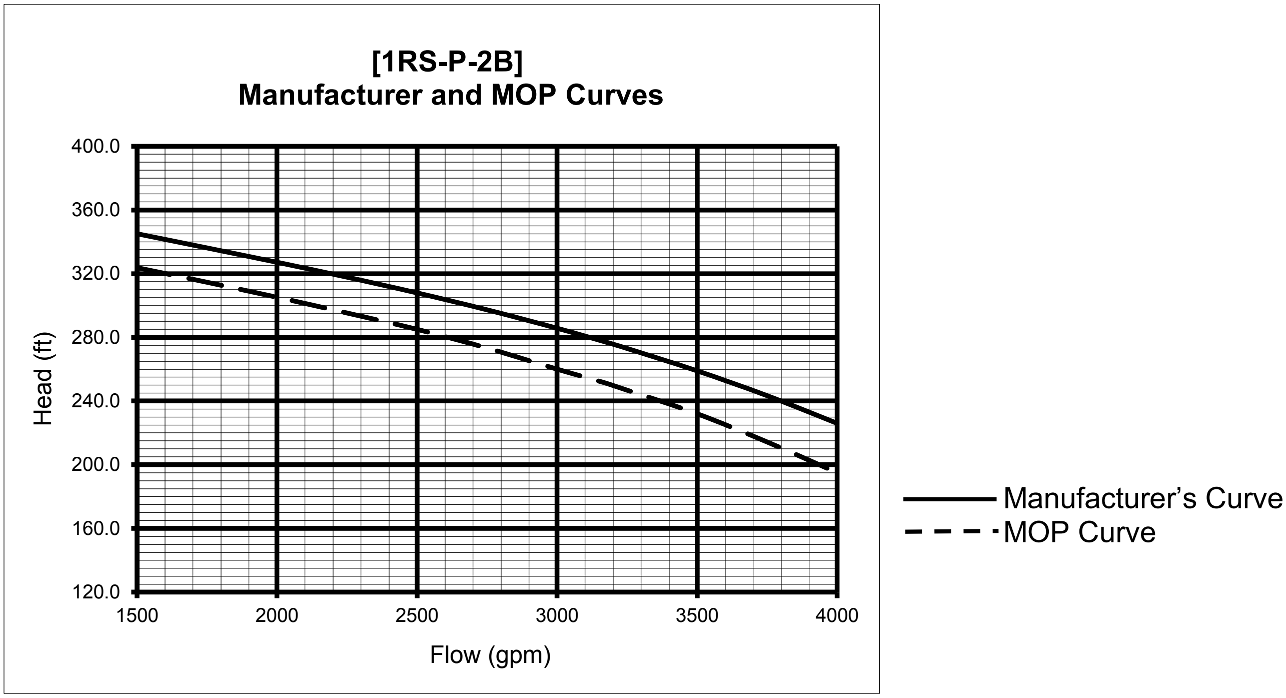
Pump Name: 2A Outside Recirculation Spray Pump Pump Number: 1RS-P-2A



Flow (gpm)	Manufacturer's Curve Head (ft)	MOP Curve Head (ft)
0	404.9	385.0
1500	345.1	323.7
1750	336.2	314.6
2000	327.0	305.2
2040	325.5	303.6
2050	325.2	303.2
2250	317.5	295.3
2500	307.4	285.0
2750	296.6	273.3
3000	284.9	260.0
3165	276.6	251.7
3250	272.1	246.8
3500	258.0	232.0
3750	242.4	214.3
4000	225.1	195.0

MANUFACTURER'S AND MINIMUM OPERATING POINT (MOP) PUMP CURVES

Pump Name: 2B Outside Recirculation Spray Pump, Pump Number: 1RS-P-2B



Flow (gpm)	Manufacturer's Curve Head (ft)	MOP Curve Head (ft)
0	407.0	385.0
1500	345.1	323.7
1750	336.2	314.6
2000	327.2	305.2
2040	325.7	303.6
2050	325.4	303.2
2250	317.9	295.3
2500	308.0	285.0
2750	297.4	273.3
3000	285.8	260.0
3165	277.6	251.7
3250	273.1	246.8
3500	259.1	232.0
3750	243.5	214.3
4000	226.1	195.0

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**

   1QS-P-1A and B; Quench Spray Pumps, (Class 2)

2. **Applicable Code Edition and Addenda**

   American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. **Applicable Code Requirement**

   ISTB-3300, "Reference Values," ISTB-3300(e)(1), requires reference values to be established within plus or minus 20 percent of pump design flow rate for the comprehensive test.

4. **Reason for Request**

   Prior to initial startup, the quench spray pumps were subject to long term full flow testing. Temporary connections were made on the quench spray headers and pipe plugs were placed in the spray nozzle sockets and the header drain lines. The quench spray pumps were started and tested, circulating water through the spray header supply lines to the spray headers and out the temporary test connections. This system capability test was conducted to ensure that the system meets flow requirements. It also provided a complete flush of the system to remove any particulate matter, which could conceivably result in plugging of the spray nozzles at a future time. At the completion of this test, the temporary test connections were removed, the pipe plugs were removed and the spray nozzles were installed. The system was then ready for operation. The spray header piping has no remnants of the temporary test connections used to facilitate preoperational full flow testing.

   Re-establishing this full flow test circuit for the purpose of periodic design flow rate testing would require a similar modification once every two years. The expensive and time consuming temporary changes described above would be necessary to duplicate the initial full flow tests, and would cause a hardship without a compensating increase in the level of quality and safety. Likewise, replacement of the four-inch recirculation test line with a line of sufficient size to accommodate design flow rate testing would cause a hardship without a compensating increase in the level of quality and safety.

   The quench spray pumps have a design point and best efficiency flow rate of 2500 gallons per minute (gpm). To be within 20 percent of pump design flow rate on the low end requires a minimum reference flow rate of 2000 gpm. The code requirements that direct the Owner to establish reference values at this flow rate

were adopted after the test circuit was installed. Due to the flow restrictions associated with the existing piping configuration, plus or minus 20 percent of the 2500 gpm design flow rate cannot be achieved through the four-inch recirculation test line. A maximum flow rate of approximately 1800 gpm is achievable through the four-inch recirculation test line. Presently, the inservice test reference flow rates are established with the existing test circuit at approximately 1800 gpm. Page 5 of 7 has a simple diagram of the quench spray pumps test circuit.

Reference flow rates are not within the 20 percent of design flow rate required during the comprehensive test. The test flows are lower than the design flow rate as a result of restrictions due to the small four-inch recirculation line. With the recirculation line restrictions, the highest flow rate that can be measured (approximately 1800 gpm) while maintaining stable test conditions is within approximately 30 percent of the pump design point/best efficiency flow rate.

5. <u>Proposed Alternative and Basis for Use</u>

As an alternative to testing within 20 percent of the design flow rate during the comprehensive test, as required by ISTB-3300(e)(1), the reference values will be established at approximately 1800 gpm, which is within approximately 28 percent of the design flow rate.

Testing will be conducted as follows:

> The test circuits identified on page 5 of 7 will be used to satisfy testing requirements.
>
> The quench spray pumps shall be tested by establishing a recirculation flow path back to the refueling water storage tank (RWST) via the four-inch recirculation test line. Temporary pressure instrumentation shall be utilized in the pump suction and discharge, and shall have sufficient calibrated accuracy to satisfy ASME OM Code requirements.
>
> Pump vibration will be measured and recorded in accordance with the criteria specified in the Code. In addition, vibration spectral analysis will be performed. Vibration spectral analysis is a more accurate method of detecting mechanical degradation or changes than that of the traditional inservice test vibration requirements.

At approximately 1800 gpm, the head curve for the quench spray pumps is not flat but well sloped (as shown on pages 6 and 7 of 7). Therefore, as performance degrades due to internal recirculation caused by increasing internal pump clearances, the differential pressure will measurably decrease for a given reference flow rate.

Testing at near design flow rate conditions is important for pumps with characteristic head-flow curves that are flat or gently sloping in the low flow region (little change in

developed head with increasing flow rate). In the low flow region, increasing internal flows, as a result of internal wear, are difficult to detect. Pumps with the flat portion of the curve at low flow rates should be tested at or near design conditions to determine if increasing internal recirculation flows have degraded pump performance to the point where design performance cannot be achieved. This situation does not apply to the quench spray pumps if they are tested to within approximately 30 percent of the design flow rate. Testing at the proposed reference flow rates will detect degradation since the pump head-curve is well sloped at the point of testing.

These quench spray pumps are Group B standby pumps run only for surveillance testing once per quarter. The pumps do not see prolonged use. The low number of operating hours makes degradation of each pump very unlikely. Significant changes in pump operation are not expected when each pump's run time is typically less than 1 hour each quarter.

In order to compensate for testing both pumps at the reduced flow rate, the quench spray pumps are included in the Beaver Valley Predictive Maintenance (PdM) Program. The pumps have enhanced vibration monitoring with spectral analysis data obtained each refueling outage and are subject to periodic oil sample analysis. Also, as a preventive maintenance activity, the pumps' bearing oil is changed and their couplings are lubricated every 72 weeks.

If measured parameters are outside the normal operating range or are determined by analysis to be trending towards a degraded state, appropriate actions are taken. These actions may include monitoring additional parameters, review of component specific information to identify cause and removal of the pump from service to perform corrective maintenance.

Compliance with the specific ISTB Code requirements identified in this relief request would require significant temporary modifications or permanent hardware changes and cause a hardship without a compensating increase in the level of quality and safety as previously described. Performing the required temporary modifications used during initial system startup testing or enlarging the size of the test loops to achieve the required accident flow rates is not warranted since there will be no improvement in our ability to detect pump degradation.

Testing the pumps utilizing the current test loops provides for substantial flow testing in a sloped and stable region of the pump curve (that is, at approximately 1800 gpm), and is well above the minimum continuous flow rate of 1350 gpm specified by the pump manufacturer. Testing the pumps at reference values established in this region of the pump curves will not cause damage to the pumps and will provide meaningful data to assess pump operational readiness.

In order to compensate for testing these pumps at a reduced flow rate during comprehensive pump testing, the quench spray pumps are also included in the Predictive Maintenance Program where enhanced vibration monitoring is done.

Testing using the current test loops in conjunction with the additional predictive maintenance technologies will ensure reliable operation of the quench spray pumps.

Based on the above evaluation, compliance with ISTB-3300(e)(1) reference value requirements for the quench spray pumps would result in a hardship without a compensating increase in the level of quality or safety. The proposed alternative to the requirements specified in ISTB-3300(e)(1) provides sufficient indication of any potential degradation occurring to the pumps and reasonable assurance that the pumps are operationally ready and able to perform their function.

6. Duration of Proposed Alternative

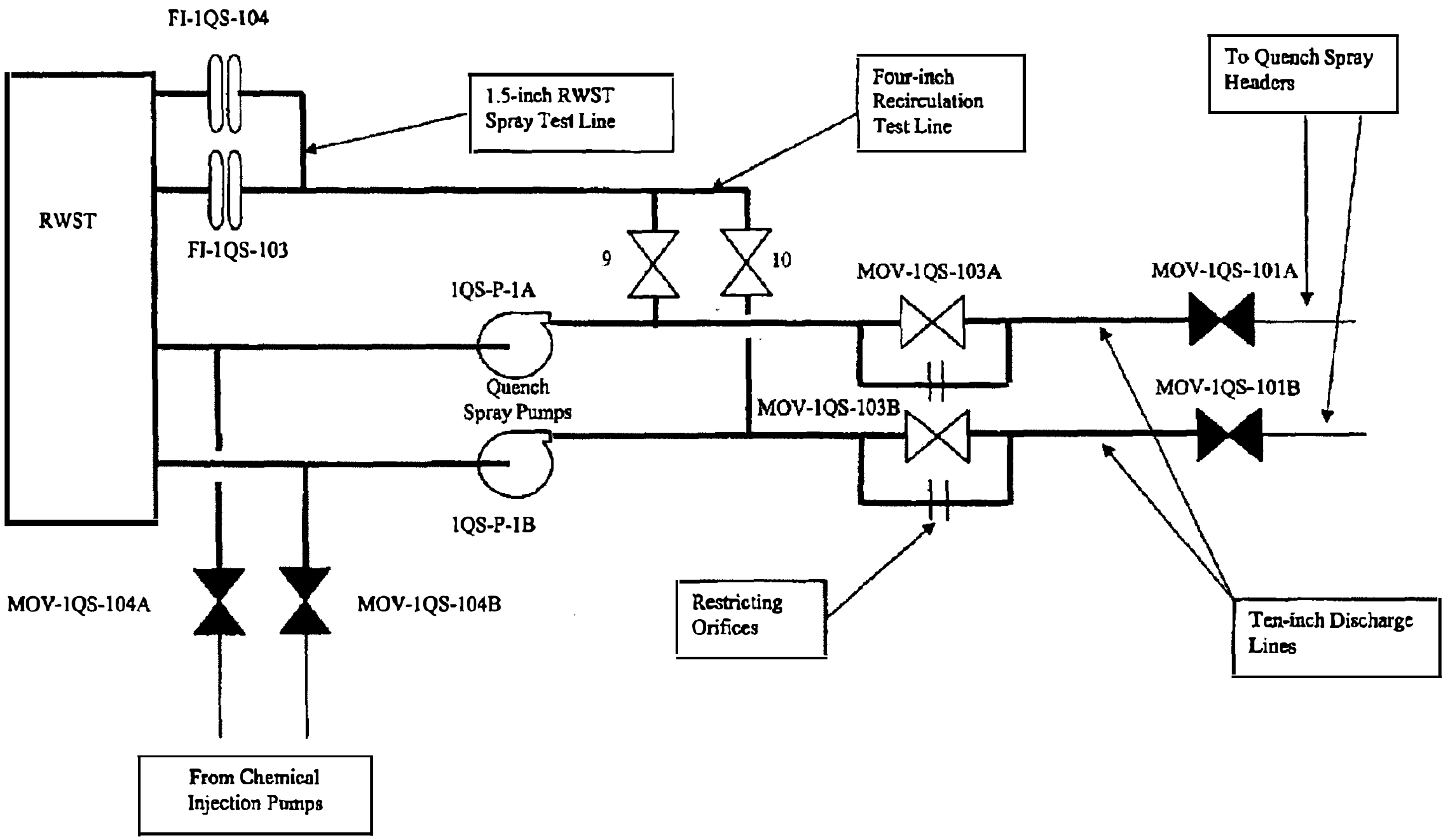
The proposed alternative is requested for use during the fifth 10-year inservice test interval.

7. Precedent

A similar request was approved for the Beaver Valley Power Station Unit No. 1, fourth 10-year inservice test interval. The Nuclear Regulatory Commission staff letter authorizing the alternative is referenced below.

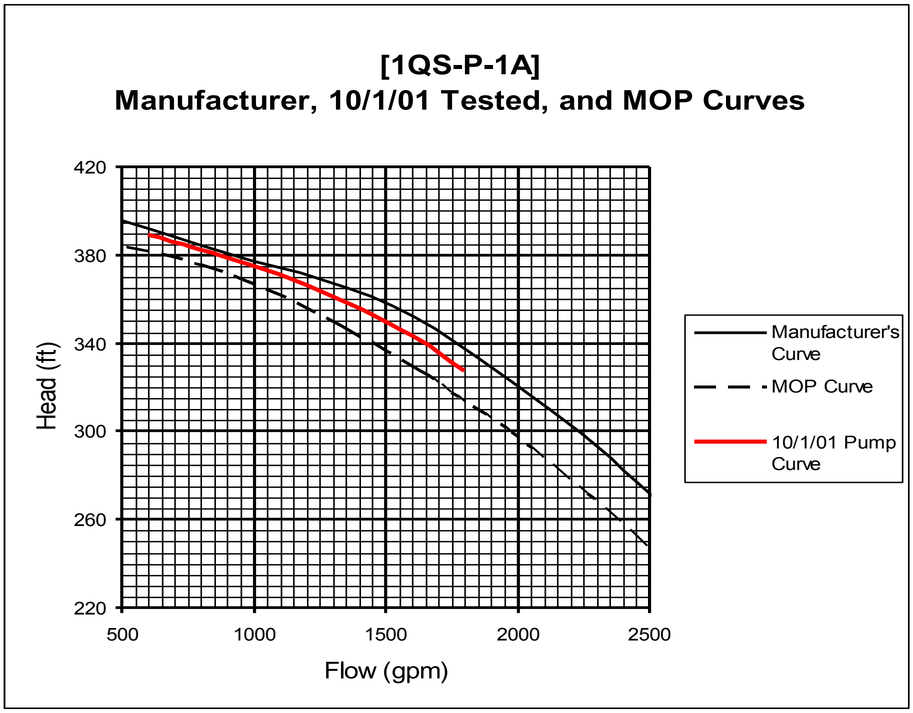
Beaver Valley Power Station, Unit No. 1, Docket No. 50-334, Safety Evaluation of Relief Request PRR12 for the Fourth 10-Year Inservice Testing Program, dated September 27, 2007 (ADAMS Accession Number ML072420376).

Quench Spray Pump [1QS-P-1A, 1B] Test Circuit



MANUFACTURER'S AND MINIMUM OPERATING POINT (MOP) PUMP CURVES

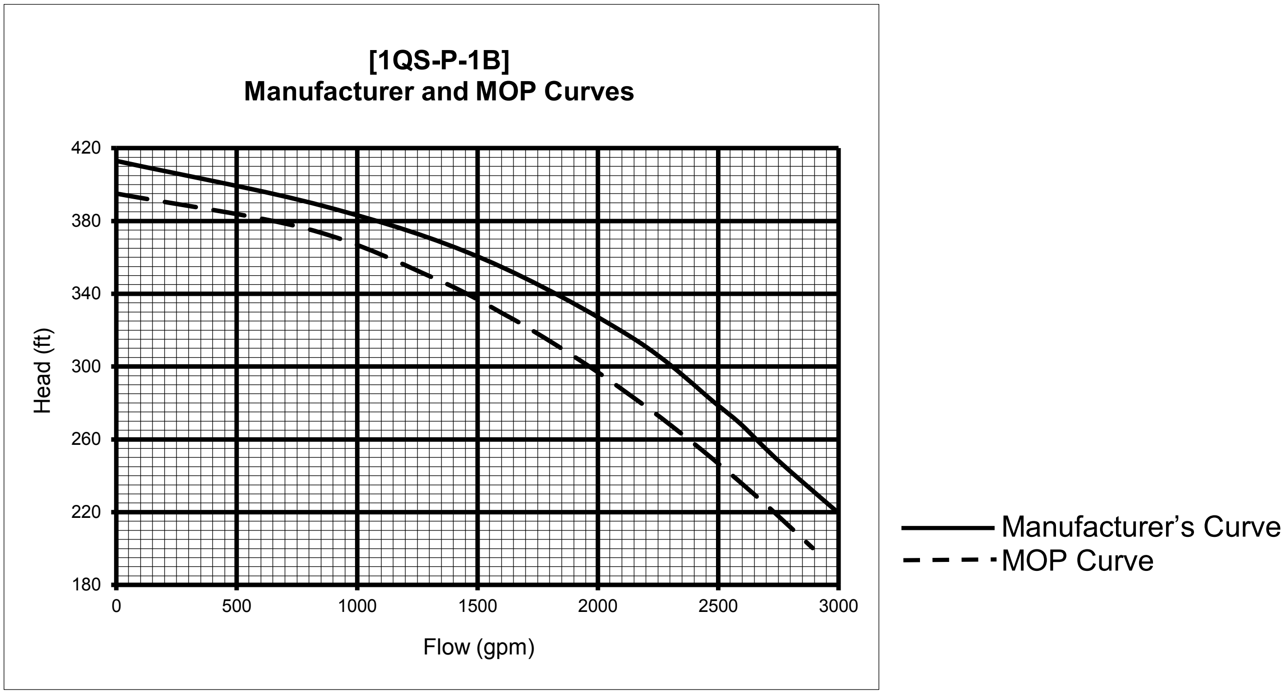
Pump Name: 1A Quench Spray Pump   Pump Number: 1QS-P-1A



Manufacturer's Curve		MOP Curve	
Flow (gpm)	Head (ft)	Flow (gpm)	Head (ft)
0	414	0	395
803	384	800	375
1522	357	1330	348
2119	310	1630	327
2516	270	1712	321
2597	261	1730	320
2769	240	1830	312
3222	191	1930	303
		2030	294
Tested Curve (10/1/01)		2230	275
Flow (gpm)	Head (ft)	2330	265
600	389.0	2430	254
800	382.1	2530	243
1200	366.1	2630	232
1600	343.1	2730	220
1797	327.6	2893	200

MANUFACTURER'S AND MINIMUM OPERATING POINT (MOP) PUMP CURVES

Pump Name: 1B Quench Spray Pump Pump Number: 1QS-P-1B



Manufacturer's Curve		MOP Curve	
Flow (gpm)	Head (ft)	Flow (gpm)	Head (ft)
0	413	0	395
866	388	800	375
1527	359	1330	348
2141	316	1630	327
2496	279	1700	322
2597	268	1730	320
2769	246	1830	312
3181	199	1930	303
		2030	294
		2230	275
		2330	265
		2430	254
		2530	243
		2630	232
		2730	220
		2893	200

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(1)

-- Alternative Provides Acceptable Level of Quality and Safety--

1. ASME Code Components Affected

1WR-P-1A, B and C, River Water Pumps, (Class 3)

2. Applicable Code Edition and Addenda

American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. Applicable Code Requirement

Table ISTB-3510-1, "Required Instrument Accuracy," requires pressure instruments to be calibrated to at least 0.5 percent when used during the comprehensive pump test.

4. Reason for Request

Subsubarticle ISTB-3510(a), "Accuracy," states that:

> Instrument accuracy shall be within the limits of Table ISTB-3510-1. If a parameter is determined by analytical methods instead of measurement, then the determination shall meet the parameter accuracy requirement of Table ISTB-3510-1 (e.g., flow rate determination shall be accurate to within ±2% of actual). For individual analog instruments, the required accuracy is percent of full scale. For digital instruments, the required accuracy is over the calibrated range. For a combination of instruments, the required accuracy is loop accuracy.

The Beaver Valley Power Station, Unit No. 1 (BVPS-1), river water pumps are vertical line-shaft pumps that receive their suction from a pit that communicates with the Ohio River. Differential pressure is calculated using pump discharge pressure indicators and the calculated suction pressure using river water elevation from the Ohio River level recorder. The transmitter associated with the level recorder is calibrated to 1.5 percent of full scale, and the recorder is calibrated to 1.0 percent of full scale resulting in a loop accuracy of 1.8 percent of full scale. The overall loop accuracy exceeds the maximum 0.5 percent required by Table ISTB-3510-1 when performing a comprehensive or preservice test.

Typical Ohio River elevation is between 665 and 666 feet resulting in a small variance between calculated suction pressure when determined by the calculation method provided by the procedure. However, during the spring, river elevations may be higher due to rain. This condition is evaluated with the test results to ensure operational readiness of the pumps.

5. Proposed Alternative and Basis for Use

As an alternative to Table ISTB-3510-1, FENOC proposes to use the installed Ohio River level recorder with a loop accuracy of 1.8 percent (to determine river water pump suction pressure), and a 0 to 100 pounds per square inch gauge (psig), 0.1 percent or better accurate test pressure gauge (to determine river water pump discharge pressure). These instrument readings are used to determine river water pump differential pressure. Differential pressure for the river water pumps is determined by taking the difference between the pump discharge pressure measured in psig, minus the river elevation corrected for elevation in feet back to the floor elevation of the pump and converted to pressure.

Suction pressure for the river water pumps (1WR-P-1A, B and C) is determined by converting a river elevation reading measured by a level recorder to a calculated pressure. This level recorder has a full scale range from 648 feet to 705 feet (which corresponds to river elevation above sea level). Normal river elevation is 665 to 666 feet. The loop accuracy for the level recorder is 1.8 percent. The suction pressure reading over the range of the installed level recorder is accurate to within 0.45 psig. This accuracy is obtained by taking the full scale range of 57 feet, converting it to a pressure ([57 feet] / [2.31 feet/psig] = 25 psig), and multiplying it by 1.8 percent accuracy. The ASME OM Code would require this suction pressure reading to be accurate within 0.125 psig (25 psig x 0.5 percent accuracy).

Discharge pressure for the river water pumps (1WR-P-1A, B and C) is to be obtained from a temporary test pressure gauge with a full scale range of 0 to 100 psig. The ASME OM Code would require this discharge pressure reading to be accurate to 0.5 psig (100 psig x 0.5 percent accuracy). In order to compensate for the 1.8 percent suction pressure loop accuracy not meeting the 0.5 percent accuracy required for comprehensive pump testing, a 0.1 percent accurate temporary test pressure gauge will be used. This temporary test pressure gauge is to be used in place of the installed 0 to 100 psig, 0.5 percent accurate discharge pressure indicators will provide a discharge pressure reading over the range of the instrument with an accuracy of 0.1 psig (100 psig x 0.1 percent). Adding this to the installed 1.8 percent accurate suction pressure instrument reading yields an overall combined reading able to be read within 0.55 psig (0.45 psig plus 0.1 psig) for the combination of instruments.

When the Table ISTB-3510-1 required instrument accuracy of plus or minus (±) 0.5 percent is applied to the river level readings, the suction pressure reading over the range of the instrument is required to be accurate to within 0.125 psig (25 psig x 0.5 percent). When the Table ISTB-3510-1 required instrument accuracy of ±0.5 percent is applied to the pump discharge pressure test gauge readings, the discharge pressure reading over the range of the test instrument is required to be accurate to within 0.5 psig (100 psig x 0.5 percent). Adding these required instrument accuracies together would yield an overall worst case (allowed) error of 0.625 psig (0.125 psig plus 0.5 psig). Therefore, the overall differential pressure

reading, which can be read to within 0.55 psig, is better than the effective 0.625 psig differential pressure reading required by the ASME OM code for comprehensive pump testing.

The proposed alternative, using the 0.1 percent accurate test pressure gauge in place of the installed discharge pressure indicator, will yield an effective differential pressure reading (considering both suction and discharge pressure instrumentation together) that is more accurate than the ±0.5 percent instrument accuracy required by Table ISTB-3510-1 for comprehensive pump testing.

Other activities are implemented at BVPS-1, in addition to those required by the ASME OM Code, that enhance the ability to detect pump degradation. As part of the BVPS-1 Predictive Maintenance Program, spectral analysis is also used to determine the mechanical condition of a pump. Spectral data can provide information to determine if misalignment, unbalance, resonance, looseness or a bearing problem is present. Through a review of the spectral data over a period of time, changes in the condition of the pump may also be determined. Additionally, as part of the BVPS-1 Preventive Maintenance Program, the pump motors are inspected, lubricated, and tested every 144 weeks. The pump and motor are completely overhauled every 312 weeks and every 624 weeks, respectively. This frequency is based on the expected condition of the pumps as a result of historical overhauls and was established to allow overhaul prior to the point of degradation resulting in questionable operational readiness.

The alternative to the accuracy requirements of Table ISTB-3510-1, when performing comprehensive or preservice tests, provides an acceptable level of quality and safety

6. Duration of Proposed Alternative

The proposed alternative is requested for use during the fifth 10-year inservice test interval.

7. Precedent

A similar request was approved for the BVPS-1 fourth 10-year inservice test interval. The Nuclear Regulatory Commission staff letter authorizing this similar alternative is referenced below.

BVPS-1, Docket No. 50-334, Safety Evaluation of Relief Request PRR13 for the Fourth 10-Year Inservice Testing Program, Dated September 27, 2007 (ADAMS Accession No. ML072420376).

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(1)

-- Alternative Provides Acceptable Level of Quality and Safety--

1. ASME Code Components Affected

1CH-P-1A, B and C, Charging Pumps, (Group A, Class 2)
1CH-P-2A and B, Boric Acid Transfer Pumps, (Group A, Class 3)
1RH-P-1A and B, Residual Heat Removal Pumps, (Group A, Class 2)
1SI-P-1A and B, Low Head Safety Injection Pumps, (Group B, Class 2)
1RS-P-1A and B, Inside Recirculation Spray Pumps, (Group B, Class 2)
1RS-P-2A and B, Outside Recirculation Spray Pumps, (Group B, Class 2)
1FW-P-2, Turbine-Driven Auxiliary Feedwater Pump, (Group B, Class 3)
1FW-P-3A and B, Motor-Driven Auxiliary Feedwater Pumps, (Group B, Class 3)
1WR-P-1A, B and C, River Water Pumps, (Group A, Class 3)

2. Applicable Code Edition and Addenda

American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. Applicable Code Requirement

ISTB-5121, “Group A Test Procedure,” ISTB-5121(b) states in part that:

> The resistance of the system shall be varied until the flow rate equals the reference point.

ISTB-5122, “Group B Test Procedure,” ISTB-5122(c) states:

> System resistance may be varied as necessary to achieve the reference point.

ISTB-5123, “Comprehensive Test Procedure,” ISTB-5123(b) states in part that:

> For centrifugal and vertical line shaft pumps, the resistance of the system shall be varied until the flow rate equals the reference point.

ISTB-5221, “Group A Test Procedure,” ISTB-5221(b) states in part that:

> The resistance of the system shall be varied until the flow rate equals the reference point.

ISTB-5222, “Group B Test Procedure,” ISTB-5222(c) states:

> System resistance may be varied as necessary to achieve the reference point.

ISTB-5223, “Comprehensive Test Procedure,” ISTB-5223(b) states in part that:

> The resistance of the system shall be varied until the flow rate equals the reference point.

4. Reason for Request

There is difficulty in adjusting system throttle valves with sufficient precision to achieve an exact flow reference value during pump testing. Paragraphs ISTB-5121(b), ISTB-5122(c), ISTB-5123(b), ISTB-5221(b), ISTB-5222(c) and ISTB-5223(b) do not allow for a variance in flow rate from a fixed reference point for pump testing.

5. Proposed Alternative and Basis for Use

When pump flow rate is required to be throttled for the pumps listed above, it will be adjusted by plant operators as close as practical to the reference flow value, but within a procedure flow limit of plus 2 percent or minus 1 percent of the reference value in accordance with ASME OM Code Case OMN-21, “Alternate Requirements for Adjusting Hydraulic Parameters to Specified Reference Points,” updated January 29, 2013.

NUREG-1482, “Guidelines for Inservice Testing at Nuclear Power Plants,” Revision 2, Section 5.3, “Allowable Variance from Reference Points and Fixed-Resistance Systems,” states in part that:

> Certain pump system designs do not allow for the licensee to set the flow at an exact value because of limitations in the instruments and controls for maintaining steady flow.

ASME OM Code Case OMN-21 provides guidance for adjusting reference flow to within a specified tolerance during pump testing. The Code Case states:

> It is the opinion of the Committee that when it is impractical to operate a pump at a specified reference point and adjust the resistance of the system to a specified reference point for either flow rate, differential pressure or discharge pressure, the pump may be operated as close as practical to the specified reference point with the following requirements. The Owner shall adjust the system resistance to as close as practical to the specified reference point where the variance from the reference point does not exceed + 2% or -1% of the reference point when the reference point is flow rate, or + 1% or – 2% of the reference point when the reference point is differential pressure or discharge pressure.

Using the provisions of this relief request as an alternative to the specific requirements of Paragraphs ISTB-5121(b), ISTB-5122(c), ISTB-5123(b), ISTB-5221(b), ISTB-5222(c) and ISTB-5223(b) as described above will provide adequate indication of pump performance and continue to provide an acceptable level of quality and safety.

6. **Duration of Proposed Alternative**

   The proposed alternative is requested for use during the fifth 10-year inservice test interval.

7. **Precedent**

   A similar request was approved for the Fort Calhoun Station, Unit No. 1, fifth 10-year inservice test interval. The Nuclear Regulatory Commission staff letter authorizing the alternative is referenced below.

   Fort Calhoun Station, Unit No. 1, Docket No. 50-285, Safety Evaluation of Request for Relief P-2 for the Fifth 10-Year Inservice Testing Program Interval, dated February 19, 2016 (ADAMS Accession No. ML16041A308).

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(1)

-- Alternative Provides Acceptable Level of Quality and Safety--

1. **ASME Code Components Affected**

   RV-1RC-551A, B and C; Pressurizer Safety Valves (Class 1, Category C)

2. **Applicable Code Edition and Addenda**

   American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. **Applicable Code Requirement**

   Mandatory Appendix I, “Inservice Testing of Pressure Relief Devices in Light-Water Reactor Nuclear Power Plants,” Paragraph I-1320, “Test Frequencies, Class 1 Pressure Relief Valves,” Subparagraph (a), “5-Year Test Interval,” states:

   > Class 1 pressure relief valves shall be tested at least once every five (5) years, starting with initial electric power generation. No maximum limit is specified for the number of valves to be tested within each interval; however, a minimum of 20% of the valves from each valve group shall be tested within any 24-month interval. This 20% shall consist of valves that have not been tested during the current 5-year interval, if they exist. The test interval for any individual valve shall not exceed 5 years.

4. **Reason for Request**

   Beaver Valley Power Station Unit No. 1 (BVPS-1) has three pressurizer safety valves installed to protect the reactor coolant system from overpressure. Since BVPS-1 operates on an 18-month fuel cycle, one valve can be tested each refueling outage such that each valve is tested over a four and one-half year period. In order to avoid outage delays due to valve testing, a pressurizer safety valve is replaced during each refueling outage with one of three spare valves that has been pre-tested. The removed valve is refurbished and tested to become a spare valve for installation during a future refueling outage. In order to ensure a spare replacement valve does not exceed the five year test interval limit from test to test, it must be tested within six months prior to installation. Extending the maximum test interval to six years with a six-month grace period would permit the replacement of an installed pressurizer safety valve with a spare pressurizer safety valve without the need to test the spare valve within six months of installation.

   ASME OM Code Case OMN-17, “Alternative Rules for Testing ASME Class 1 Pressure Relief/Safety Valves,” from the 2012 Edition of the ASME OM Code allows a 72-month (six-year) test interval plus an additional six-month grace period coinciding with a refueling outage, in order to accommodate extended shutdown periods.

5. Proposed Alternative and Basis for Use

As an alternative to the ASME OM Code-2004 Edition, Mandatory Appendix I, Paragraph I-1320(a) test interval for pressurizer safety valve testing of at least once every five years, the pressurizer safety valves will be tested at least once every six years plus a six month grace period, if required, in accordance with the periodicity and other requirements of ASME OM Code Case OMN-17. Code Case OMN-17 provisions will not be applied to a valve until the valve is disassembled and inspected as described in Paragraph (e) of Code Case OMN-17.

Paragraph (d) of Code Case OMN-17 requires disassembly and inspection of each valve after as-found set-pressure testing is performed in order to verify that parts are free of defects resulting from time related degradation or service induced wear.

Paragraph (e) of Code Case OMN-17 requires each valve to be disassembled and inspected in accordance with Paragraph (d) prior to the start of the 72-month test interval.

When the proposed alternative is applied to a valve, the valve will be disassembled and inspected, after as-found set pressure testing is performed in accordance with Code Case OMN-17 paragraphs (d) and (e). The initial inspection and ongoing inspections will verify that valve parts are free of defects resulting from time-related degradation or service-induced wear. These inspections will provide additional assurance that the pressurizer safety valves will perform their intended function.

The longer test interval will eliminate the need for a valve test within six months of installation during each refueling outage. Eliminating the test, will in turn, remove the risk of any shipping damage when the valve is returned from the offsite testing facility, and reduce wear on metal valve seats due to steam testing.

The as-found set-pressure acceptance criteria is plus or minus 3 percent of the valve nameplate set pressure in accordance with Paragraph I-1320(c)(1) of ASME OM Code, 2004 Edition, Mandatory Appendix I, for the purpose of determining the need to test additional valves. The as-found set-pressure acceptance criteria is plus or minus 3 percent of valve nameplate set pressure in accordance with BVPS-1 Technical Specification Limiting Condition for Operation 3.4.10 for the purpose of determining pressurizer safety valve operability.

Between the years 2005 and 2007, six new Target Rock model 569C-001-1 relief valves were purchased. All six new valves have been rotated into the three installed locations over the course of the past seven refueling outages with the old valves discarded. Since 2009 (when the first of the new valves was as-found tested), seven as-found set pressure tests have been performed for the six pressurizer safety valves. These tests have been performed at an offsite test facility using saturated steam. The majority of the tests were performed after the valve was installed for three operating cycles. As-found tests were within plus or minus

3 percent of the valve set pressure with the exception of valve RV-1RC-551A, which lifted low (minus 4 percent) in 2015. BVPS-1 Technical Specification Surveillance Requirement 3.4.10.1 requires that following testing, lift settings shall be within plus or minus 1 percent. For three of the seven tests, the valves were found within the as-left tolerance of plus or minus 1 percent. These test results show limited time-related degradation or set point drift and demonstrate that it is acceptable to extend the test interval from four and one-half years (three fuel cycles) to six years (four fuel cycles) with a six-month grace period.

The ability to detect degradation and to ensure the operational readiness of the pressurizer safety valves to perform their intended function is assured based on the valve test history and by performing the required inspection and testing initially and at the proposed alternative frequency. Therefore, test and inspection of the valves in accordance with the proposed alternative demonstrates an acceptable level of quality and safety.

6. Duration of Proposed Alternative

The proposed alternative is requested for use during the fifth 10-year inservice test interval.

7. Precedent

A similar request was approved by the United States Nuclear Regulatory Commission (USNRC) staff in their safety evaluation referenced below.

USNRC Letter, Beaver Valley Power Station Unit No. 2, Docket No. 50-412, Safety Evaluation of Valve Relief Request VRR4 for the Remainder of the Third 10-Year Inservice Testing Interval, dated February 7, 2012 (ADAMS Accession No. ML120330329).

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(1)

-- Alternative Provides Acceptable Level of Quality and Safety--

1. ASME Code Components Affected

SOV-1HY-102A1 and A2, A Hydrogen Analyzer Containment Dome Inlet Flow Sample Valves (Class 2, Category A)

SOV-1HY-102B1 and B2, B Hydrogen Analyzer Containment Dome Inlet Flow Sample Valves (Class 2, Category A)

SOV-1HY-103A1 and A2, A Hydrogen Analyzer Pressurizer Cubicle Inlet Flow Sample Valves (Class 2, Category A)

SOV-1HY-103B1 and B2, B Hydrogen Analyzer Pressurizer Cubicle Inlet Flow Sample Valves (Class 2, Category A)

SOV-1HY-104A1 and A2, A Hydrogen Analyzer Flow Sample Discharge Valves (Class 2, Category A)

SOV-1HY-104B1 and B2, B Hydrogen Analyzer Flow Sample Discharge Valves (Class 2, Category A)

2. Applicable Code Edition and Addenda

American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. Applicable Code Requirement

ISTC-3700, “Position Verification Testing” states in part:

> Valves with remote position indicators shall be observed locally at least once every 2 years to verify that valve position is accurately indicated. . . . Where local observation is not possible, other indications shall be used for verification of valve operation.

4. Reason for Request

The valves listed above are Category A containment isolation valves and are required to be seat leakage tested in accordance with 10 CFR 50 Appendix J (Option B, Type C). Due to the design of the valves, position verification testing is performed in conjunction with the Type C leak test. Each of the listed valves is a solenoid operated valve (SOV) designed such that the coil position is internal to the valve body and is not observable in either the energized or de-energized state.

The subject valves are seat leakage tested using local leakage rate test equipment as part of the Appendix J Type C leak test program. As part of the leakage rate test, the position verification test is also performed. This method involves attempting to

pressurize the containment penetration volume to approximately 45 pounds per square inch gauge (psig) with the valve open as indicated by its remote position lights on the control room bench board. If the attempt to pressurize the containment penetration fails, the valve position is verified to be open. The valve is then closed using the control switch in the control room and the containment penetration volume is pressurized to approximately 45 psig. Being able to maintain pressure in the penetration while the valve is indicating closed by its remote position lights on the control room bench board, verifies the valve is closed. This method satisfies the requirement for position verification testing and ensures that the remote indicating lights in the control room accurately reflect the local valve position in the field.

Position verification testing is required to be performed once every two years and is typically performed during a refueling outage, regardless of whether the containment penetration is due for Type C leakage testing or not. In order to perform Type C leakage testing, piping and valves associated with the individual valve being tested are drained, vented and aligned. Because the position verification test requires the Type C leakage test to be performed, the above actions are completed during each refueling outage.

5. **<u>Proposed Alternative and Basis for Use</u>**

As an alternative to the ISTC-3700 test interval of at least once every two years, it is proposed that the required position verification testing of the valves listed above be performed in conjunction with the Type C seat leakage test at the frequency specified by 10 CFR 50 Appendix J, Option B for the Type C leakage test. This test interval may be adjusted to a frequency of testing commensurate with Option B of 10 CFR 50 Appendix J for Type C seat leakage testing based on valve seat leakage performance. If a valve fails a leak test representing an unacceptable remote position verification, the valve test frequency (including position verification testing) will be adjusted in accordance with 10 CFR 50 Appendix J, Option B.

In addition to position verification testing and seat leakage testing, each of the valves listed above are stroke timed open and closed one at a time on a quarterly frequency. The opening stroke time for each valve is measured from the time the control switch is placed in the open position until the red indicating light is the only indicating light remaining illuminated. The closing stroke time for each valve is measured from the time the control switch is placed in the closed position until the green indicting light is the only indicating light remaining illuminated. The stroke times are compared to a two second limiting time established in accordance with paragraph ISTC-5152(c) of the ASME OM Code. If the stroke time is within the two second limiting time, then the valve is considered to have passed and is operating acceptably.

Option B of 10 CFR 50 Appendix J permits the extension of Type C leakage testing to a frequency based on leakage-rate limits and historical valve performance. Valves whose leakage test results indicate good performance may have their seat

leakage test frequency extended up to 60 months or three refueling outages (based on an 18-month fuel cycle). In order for a valve's seat leakage test frequency to be extended, the individual containment isolation valve must first successfully pass two consecutive as-found seat leakage tests before it can be placed on an extended seat leakage test frequency.

Over the past six refueling outages, the valves listed above have passed the position verification test performed in conjunction with its Type C leakage test. Valve performance data is recorded in a database and trended by the inservice test coordinator. If the leak rate exceeds the allowable limit, the valves are repaired or replaced. Any maintenance performed on these valves that might affect position indication is followed by an applicable post-maintenance test including position verification testing regardless of the Type C test frequency.

Additionally, the SOVs that are required to be stroke-time tested with their stroke times measured and compared to the ASME OM Code acceptance criteria of less than two seconds are exercised on a quarterly test frequency. For the past 10 years, no quarterly stroke time failures have been noted.

Valve exercise testing each quarter and position verification and seat leakage testing in accordance with the frequency specified by 10 CFR 50 Appendix J, Option B, provides an adequate assessment of valve health and therefore an acceptable level of quality and safety.

Based on past performance of the SOVs and the quarterly valve stroking for the valves subject to exercising, coupled with a 10 CFR 50, Appendix J, Option B performance based program to test for leakage and verify valve position indication, the proposed alternative to the ISTC-3700 test interval provides an acceptable level of quality and safety.

6. Duration of Proposed Alternative

The proposed alternative is requested for use during the fifth 10-year inservice test interval.

7. Precedent

A similar request was approved by the United States Nuclear Regulatory Commission (USNRC) staff in their safety evaluation referenced below.

USNRC Letter, Beaver Valley Power Station Unit Nos. 1 and 2, Docket Nos. 50-334 and 50-412, Safety Evaluation of Valve Relief Request VRR3 for the Remainder of the BVPS-1 Fourth 10-Year Inservice Testing Interval and the BVPS-2 Third 10-Year Inservice Testing Interval, dated February 7, 2012 (ADAMS Accession No. ML120270298).

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**

   Pumps and valves specified in American Society of Mechanical Engineers (ASME) Operations and Maintenance (OM) Code, Division 1, Section IST, 2004 Edition through OMb-2006 Addenda of the ASME OM Code. This includes pumps and valves within the Beaver Valley Power Station, Unit No. 2 Inservice Test (IST) Program scope.

2. **Applicable Code Edition and Addenda**

   ASME OM Code, 2004 Edition with Addenda through OMb-2006.

3. **Applicable Code Requirements**

   This request applies to the frequency specifications of the ASME OM Code for all pump and valve testing contained within the IST Program scope. The applicable ASME OM Code sections include the following.

   Table ISTB-3400-1, "Inservice Test Frequency," lists two frequencies, quarterly and biennially.

   ISTB-3430, "Pumps Lacking Required Fluid Inventory," states in part that: "Group B pumps lacking the required fluid inventory (e.g., pumps in dry sumps) shall receive a comprehensive test at least once every 2 years except as provided in ISTB-3420."

   ISTB-6200, "Corrective Action," part (a) states that: "If the measured test parameter values fall within the alert range of Table ISTB-5121-1, Table ISTB-5221-1, Table ISTB-5321-1, or Table ISTB-5321-2, as applicable, the frequency of testing specified in ISTB-3400 shall be doubled until the cause of the deviation is determined and the condition is corrected."

   ISTC-3510, "Exercising Test Frequency," states in part that: "Active Category A, Category B, and Category C check valves shall be exercised nominally every 3 months, . . ."

   ISTC-3540, "Manual Valves," states in part that: "Manual Valves shall be full-stroke exercised at least once every 2 years, . . ."

   ISTC-3630, "Leakage Rate for Other Than Containment Isolation Valves," part (a), "Frequency," states that: "Tests shall be conducted at least once every 2 years."

ISTC-3700, “Position Verification Testing,” states in part that: “Valves with remote position indicators shall be observed locally at least once every 2 years to verify that valve operation is accurately indicated.”

ISTC-5221(c)(3) states that: “At least one valve from each group shall be disassembled and examined at each refueling outage; all valves in a group shall be disassembled and examined at least once every 8 years.”

Appendix I, I-1320, “Test Frequencies, Class 1 Pressure Relief Valves,” part (a) states in part that: “Class 1 pressure relief valves shall be tested at least once every 5 years . . .”

Appendix I, I-1350, “Test Frequency, Classes 2 and 3 Pressure Relief Valves,” part (a) states in part that: “Classes 2 and 3 pressure relief valves, with the exception of PWR main steam safety valves, shall be tested every 10 years, . . .”

Appendix I, I-1390, “Test Frequency, Classes 2 and 3 Pressure Relief Devices That Are Used for Thermal Relief Application,” states in part that: “Tests shall be performed on all Classes 2 and 3 relief devices used in thermal relief application every 10 years, . . .”

4. Reason for Request

Test period requirements for pumps and valves set forth in specific ASME OM Code documents present a hardship without a compensating increase in quality and safety. ASME OM Code Case OMN-20, “Inservice Test Frequency,” was approved and is proposed to be used as an alternative to the test periods specified in the ASME OM code.

Operational flexibility is needed when scheduling pump and valve tests to minimize conflicts between the ASME OM Code specified test interval, plant conditions, and other maintenance and test activities. Lack of a frequency tolerance applied to ASME OM Code testing places a hardship on the plant when scheduling pump and valve tests.

Code Case OMN-20 is not referenced in the latest revision of Regulatory Guide 1.192, “Operation and Maintenance Code Case acceptability, ASME OM Code” (August 2014), as an acceptable OM Code Case to comply with 10 CFR 50.55a(f) requirements as allowed by 10 CFR 50.55a(b)(6).

5. Proposed Alternative and Basis for Use

The proposed alternative is OMN-20, "Inservice Test Frequency," which addresses testing periods for pumps and valves specified in ASME OM Division 1, Section IST, 2009 Edition through OMa-2011 Addenda, and all earlier editions and addenda of ASME OM Code.

This request is being made in accordance with 10 CFR 50.55a(z)(2), in that the existing requirements are considered a hardship without a compensating increase in quality and safety for the following reasons:

1) For testing periods up to and including two years, Code Case OMN-20 provides an allowance to extend the testing periods by up to 25 percent. The period extension is to facilitate test scheduling and considers plant operating conditions that may not be suitable for performance of the required testing (for example, performance of the test would cause an unacceptable increase in the plant risk profile due to transient conditions or other ongoing surveillance, test or maintenance activities). Period extensions are not intended to be used repeatedly merely as an operational convenience to extend test intervals beyond those specified. Use of the test period extension has been a practice in the nuclear industry for many decades and not applying an extension would be a hardship when there is no evidence that the period extensions affect component reliability.

2) For testing periods of greater than two years, OMN-20 allows an extension of up to six months. The ASME OM Committee determined that such an extension is appropriate. The six-month extension will have a minimal impact on component reliability considering that the most probable result of performing any inservice test is satisfactory verification of the test acceptance criteria. As such, pumps and valves will continue to be adequately assessed for operational readiness when tested in accordance with the requirements specified in 10 CFR 50.55a(f) with the frequency extensions allowed by Code Case OMN-20.

Section IST of Division 1 of the OM Code, which is incorporated by reference in 10 CFR 50.55a(a), specifies component test frequencies based either on elapsed time periods (for example, quarterly, or two years) or on the occurrence of a plant condition or event (for example, cold shutdown, or refueling outage). ASME Code Case OMN-20 has been approved for use by the ASME OM committee as an alternative to the test frequencies for pumps and valves specified in ASME OM Division 1, Section IST, 2009 Edition through OMa-2011 Addenda, and all earlier editions and addenda of ASME OM Code.

Based on the foregoing, the proposed alternative test periods provide reasonable assurance that pumps and valves within the scope of the Beaver Valley Power Station, Unit No. 2, IST Program are operationally ready.

6. <u>Duration of Proposed Alternative</u>

The proposed alternative is requested for use during the fourth 10-year IST interval.

7. Precedent

The NRC approved the use of OMN-20 for Fort Calhoun on February 19, 2016 (NRC Agencywide Documents Access and Management System Accession Number ML16041A308).

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(1)

-- Alternative Provides Acceptable Level of Quality and Safety--

1. **ASME Code Components Affected**

2CHS*P21A, B and C, Charging Pumps, (Group A, Class 2)
2CHS*P22A and B, Boric Acid Transfer Pumps, (Group A, Class 3)
2SIS*P21A and B, Low Head Safety Injection Pumps, (Group B, Class 2)
2CCP*P21A, B, C, Component Cooling Water Pumps, (Group A, Class 3)
2EGF*P21A, B, C, D, Diesel Fuel Oil Transfer Pumps, (Group B, Class 3)

2. **Applicable Code Edition and Addenda**

American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) (Code) – 2004 Edition, with Addenda through OMb-2006.

3. **Applicable Code Requirement**

ISTB-3510(b)(1), “Range,” states:

> The full-scale range of each analog instrument shall be not greater than three times the reference value.

4. **Reason for Request**

Certain instruments used when testing the affected pumps do not meet the requirements of ISTB-3510(b)(1); however, the accuracy of the instruments used is more conservative than the requirements of ISTB-3510(a), “Accuracy,” and Table ISTB-3510-1, "Required Instrument Accuracy," for Group A and Group B tests and comprehensive tests. The combination of higher range and better accuracy for each instrument yields a reading at least equivalent to the reading achieved from instruments that meet ISTB-3510(b)(1).

5. **Proposed Alternative and Basis for Use**

The instruments listed in the attached table may be used as long as the combination of the higher range and better accuracy for each instrument yields a reading at least equivalent to the reading achieved from instruments that meet ISTB-3510(b)(1).

NUREG-1482, “Guidelines for Inservice Testing at Nuclear Power Plants,” Revision 2, Section 5.5.1, “Range and Accuracy of Analog Instruments,” states:

> When the range of a permanently installed analog instrument is greater than three times the reference value, but the accuracy of the instrument is more conservative than that required by the Code, the staff may grant relief when the combination of the range and accuracy yields a reading that is as at least equivalent to that achieved using instruments that meet the Code requirements (i.e., up ±6 percent for Group A and B tests, and

±1.5 percent for pressure and differential pressure instruments for Preservice and Comprehensive tests).

The instruments identified in the attached table satisfy the guidance provided in NUREG-1482, Section 5.5.1. Additional basis for use and the applicable test type are provided in the attached table.

Using the provisions of this relief request as an alternative to the requirements of ISTB-3510(b)(1) provides an acceptable level of quality and safety since their use yields a reading that is as at least equivalent to that achieved using instruments that meet the ASME OM Code requirements as described in NUREG-1482, Section 5.5.1.

6. <u>Duration of Proposed Alternative</u>

The proposed alternative is requested for use during the Beaver Valley Power Station, Unit No. 2, fourth 10-year inservice test interval.

7. <u>Precedent</u>

A similar request was approved for the Beaver Valley Power Station, Unit No. 2, third 10-year inservice test interval. The Nuclear Regulatory Commission staff letter authorizing the request is referenced below.

Beaver Valley Power Station, Unit No. 2, Docket No. 50-412, Safety Evaluation of Relief Request PRR2 for the Third 10-Year Inservice Testing Program, dated February 14, 2008 (ADAMS Accession No. ML080140299).

IST PUMP INSTRUMENTATION			
Pump ID	**Instrument ID**	**Condition Requiring Relief**	**Basis for Relief/Alternate Test**
2CHS*P21A 2CHS*P21B 2CHS*P21C (Group A, Class 2)	2CHS-PI151A 2CHS-PI152A 2CHS-PI153A	The range of the gauges is greater than three times the reference pressures during quarterly recirculation flow testing.	These gauges are the suction pressure gauges for the charging pumps. They are sized for all modes of pump operation including accident conditions (that is, can take suction from the recirculation spray pumps) with a range of 0 to160 pounds per square inch gauge (psig). During recirculation flow testing, the suction pressures are approximately 20 to 25 percent of the range or approximately 28 to 39 psig. With a calibrated accuracy of 0.5 percent, this results in a reading more accurate than Code requirements. The use of these pressure instruments is applicable to Group A tests only since the combination of range and accuracy yields a reading of plus or minus (±) 2.86 percent which is less than the ±6 percent required by the Code for the Group A test. During comprehensive testing, temporary pressure instrumentation will be used having a calibrated accuracy of at least ±0.5 percent of full scale with a sufficient range to satisfy the ±1.5 percent required by the Code for the comprehensive test.

IST PUMP INSTRUMENTATION			
Pump ID	**Instrument ID**	**Condition Requiring Relief**	**Basis for Relief/Alternate Test**
2CHS*P22A 2CHS*P22B (Group A, Class 3)	2CHS-PI123A 2CHS-PI123B	The range of the gauges is greater than three times the reference pressures during quarterly testing.	These gauges are the suction pressure gauges for the boric acid transfer pumps. They are sized for all modes of pump operation and boric acid storage tank levels with a range of 0 to 30 psig. During quarterly testing, the suction pressures are approximately 10 to 15 percent of the range or approximately 3 to 5 psig. With a calibrated accuracy of 0.5 percent, this results in a reading more accurate than Code requirements. The use of these pressure instruments is applicable to Group A tests only since the combination of range and accuracy yields a reading of approximately ±3.0 percent to ±5.0 percent, which is less than the ±6 percent required by the Code for the Group A test. During comprehensive testing, temporary pressure instrumentation will be used having a calibrated accuracy of at least ±0.5 percent of full scale with sufficient range to satisfy the ±1.5 percent required by the Code for the comprehensive test.

IST PUMP INSTRUMENTATION			
Pump ID	**Instrument ID**	**Condition Requiring Relief**	**Basis for Relief/Alternate Test**
2SIS*P21A 2SIS*P21B (Group B, Class 2)	2SIS-PI938 2SIS-PI939	The range of the gauges is greater than three times the reference pressures during quarterly recirculation flow testing.	These gauges are the suction pressure gauges for the low head safety injection pumps. They are sized for recirculation and full flow testing with a range of 0 to 160 psig. During recirculation flow testing, the suction pressures are approximately 20 percent of the range or 32 psig. With a calibrated accuracy of 0.5 percent, this results in a reading more accurate than Code requirements. The use of these pressure instruments is applicable to Group B tests only since the combination of range and accuracy yields a reading of approx. ±2.5 percent which is less than the ±6 percent required by the Code for the Group B test. During comprehensive testing, temporary pressure instrumentation will be used having a calibrated accuracy of at least ±0.5 percent of full scale with sufficient range to satisfy the ±1.5 percent required by the Code for the comprehensive test.

IST PUMP INSTRUMENTATION			
Pump ID	**Instrument ID**	**Condition Requiring Relief**	**Basis for Relief/Alternate Test**
2CCP*P21A 2CCP*P21B 2CCP*P21C (Group A, Class 3)	2CCP-PI150A 2CCP-PI150B 2CCP-PI150C	The range of the gauges is greater than three times the reference pressures during quarterly testing.	These are the suction pressure gauges for the component cooling water pumps. They are sized for all modes of pump operation with a range of 0 to 60 psig. The suction pressures vary between 27 and 32 percent of the range or 16 to 19 psig. With a calibrated accuracy of 0.5 percent, this results in a reading more accurate than Code requirements. The use of these pressure instruments is applicable to Group A tests only since the combination of range and accuracy yields a reading of approximately $\pm$ 1.57 to $\pm$ 1.87 percent which is less than the $\pm$6 percent required by the Code for the Group A test. During comprehensive testing, temporary pressure instrumentation will be used having a calibrated accuracy of at least $\pm$0.5 percent of full scale with sufficient range to satisfy the $\pm$1.5 percent required by the Code for the comprehensive test.

IST PUMP INSTRUMENTATION			
Pump ID	**Instrument ID**	**Condition Requiring Relief**	**Basis for Relief/Alternate Test**
2EGF*P21A 2EGF*P21B 2EGF*P21C 2EGF*P21D (Group B, Class 3)	2EGF-PI201A 2EGF-PI201B 2EGF-PI201C 2EGF-PI201D	The range of the gauges is greater than three times the reference pressures during bi-monthly testing.	These are the discharge pressure gauges for the emergency diesel generator fuel oil transfer pumps. They are sized for all modes of pump operation with a range of 0 to 30 psig. During bi-monthly testing, discharge pressures are between 9.5 and 10.5 psig, slightly below one third of the range. With a calibrated accuracy of 1.0 percent, this results in a reading more accurate than Code requirements. The use of these pressure instruments is applicable to Group B tests only since the combination of range and accuracy yields a reading of approximately ±2.85 percent to ±3.15 percent which is less than the ±6 percent required by the Code for the Group B test. During comprehensive testing, temporary pressure instrumentation will be used having a calibrated accuracy of at least ±0.5 percent of full scale with sufficient range to satisfy the ±1.5 percent required by the Code for the comprehensive test.

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(1)

-- Alternative Provides Acceptable Level of Quality and Safety--

1. **ASME Code Components Affected**

2CHS*P21A, B and C, Charging Pumps, (Group A, Class 3)
2CHS*P22A and B, Boric Acid Transfer Pumps, (Group A, Class 3)
2RHS*P21A and B, Residual Heat Removal Pumps, (Group A, Class 2)
2SIS*P21A and B, Low Head Safety Injection Pumps, (Group B, Class 2)
2QSS*P21A and B, Quench Spray Pumps, (Group B, Class 2)
2RSS*P21A, B, C and D, Recirculation Spray Pumps, (Group B, Class 2)
2CCP*P21A, B, C, Component Cooling Water Pumps, (Group A, Class 3)
2FWE*P22, Turbine-Driven Auxiliary Feedwater Pump, (Group B, Class 3)
2FWE*P23A, B, Motor-Driven Auxiliary Feedwater Pumps, (Group B, Class 3)
2SWS*P21A, B and C, Service Water Pumps, (Group A, Class 3)
2EGF*P21A, B, C, D, Diesel Fuel Oil Transfer Pumps, (Group B, Class 3)

2. **Applicable Code Edition and Addenda**

American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. **Applicable Code Requirement**

ISTB-5123, "Comprehensive Test Procedure," refers to Table ISTB-5121-1, "Centrifugal Pump Test Acceptance Criteria," that requires an upper acceptable range limit of 1.03Qr and 1.03ΔPr where Qr is the reference flow rate and ΔPr is the reference differential pressure.

ISTB-5223, "Comprehensive Test Procedure," refers to Table ISTB-5221-1, "Vertical Line Shaft Centrifugal Pump Test Acceptance Criteria," that requires an upper Acceptable Range limit of 1.03Qr and 1.03ΔPr.

4. **Reason for Request**

For some pump tests, there has been difficulty implementing the upper acceptable range limit of 3 percent above the established hydraulic parameter reference value for the comprehensive pump test. Industry experience has shown that test results outside the criteria can easily occur when normal data scatter yields (1) a low measured reference value, and (2) high measured values for subsequent inservice tests. In these cases, some of the test data trend high near the upper acceptable range limit and may exceed the upper limit on occasion. The problem can be more severe for pumps with low differential pressures (50 pounds per square inch differential [psid] or less) due to the smaller acceptable range.

In these cases, the measured values that would exceed the plus 3 percent upper criteria would not represent an actual problem with either the test setup, instrumentation or the pump itself. The scatter induced collectively by the instrumentation and reference value variance is sufficient to approach or exceed the upper criterion.

ASME OM Code Case OMN-19, "Alternate Upper Limit for the Comprehensive Pump Test," from the 2012 Edition of ASME OM Code, allows a multiplier of 1.06 times the reference value in lieu of the 1.03 multiplier for the comprehensive pump test's upper acceptable range and required action range (high) limits. As described in ASME OM Code Case OMN-19, a required action range high limit of plus 6 percent is a realistic value that should allow any true degradation issues to be identified while alleviating the need to unnecessarily declare pumps inoperable.

5. **Proposed Alternative and Basis for Use**

For the affected pumps listed above, an upper acceptable range limit of 1.06 times the reference value will be applied to the comprehensive pump test in accordance with ASME OM Code Case OMN-19. Also, a periodic verification test (PVT) at the design basis accident flow rate will be performed for each of these pumps.

The following requirements shall be applied to the PVT.

1) Apply the PVT to the affected pumps listed in this request.
2) Perform the PVT at least once every two years.
3) Determine if a PVT is required before declaring a pump operable following replacement, repair, or maintenance on the pump.
4) Declare the pump inoperable if the PVT flow rate and associated differential pressure cannot be achieved.
5) Maintain the necessary records for each PVT, including the applicable test parameters (for example, flow rate, the associated differential pressure and speed for variable speed pumps) and their basis.
6) Account for the PVT instrument accuracies in the test acceptance criteria.

The upper limit for differential pressure established by the ASME OM Code is not reflective of any possible degradation mechanism, but is rather a means to identify a potentially incorrect test setup. Exceeding this upper limit while testing would require the pump to be considered inoperable, but primarily as a means to investigate the test instrumentation or other potential problems. The use of a plus 6 percent upper criteria rather than the plus 3 percent upper criteria would not mask any actual pump problem and would still function as an adequate trigger to investigate the test setup.

Using the provisions of this request as an alternative to the specific requirements of ISTB-5123 and ISTB-5223, and Tables ISTB-5121-1 and ISTB 5221-1 as described above will provide adequate indication of pump performance and continue to provide an acceptable level of quality and safety.

6. Duration of Proposed Alternative

The proposed alternative is requested for use during the fourth 10-year IST interval.

7. Precedent

A similar request was approved by the Nuclear Regulatory Commission staff in their safety evaluation referenced below.

Virginia Electric and Power Company, Surry Power Station, Unit No. 1, Safety Evaluation of Pump Relief Request P-6 Regarding ASME OM Code Requirements for the Fifth 10-Year Inservice Test Program Interval, dated May 9, 2014 (ADAMS Accession No. ML14125A471).

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(1)

-- Alternative Provides Acceptable Level of Quality and Safety--

1. ASME Code Components Affected

2CHS*P21A, B, and C, Charging Pumps, (Group A, Class 3)
2CHS*P22A, and B, Boric Acid Transfer Pumps, (Group A, Class 3)
2RHS*P21A, Residual Heat Removal Pumps, (Group A, Class 2)
2FWE*P23A, and B, Motor-Driven Aux Feedwater Pumps, (Group B, Class 3)
2SWS*P21A, B, and C, Service Water Pumps, (Group A, Class 3)
2EGF*P21A, B, C, and D, Diesel Fuel Oil Transfer Pumps, (Group B, Class 3)

2. Applicable Code Edition and Addenda

American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. Applicable Code Requirement

ISTB-5121, “Group A Test Procedure,” and ISTB-5123, “Comprehensive Test Procedure,” state in subparagraphs ISTB-5121(e) and ISTB-5123(e):

> All deviations from the reference values shall be compared with the ranges of Table ISTB-5121-1 and corrective action taken as specified in ISTB-6200. Vibration [The vibration] measurements shall be compared to both the relative and absolute criteria shown in the alert and required action ranges of Table-ISTB-5121-1. For example, if vibration exceeds either 6Vr, or 0.7 in/sec [inches per second] (1.7 cm/sec) [centimeters per second], the pump is in the required action range.

ISTB-5221, “Group A Test Procedure,” and ISTB-5223, “Comprehensive Test Procedure,” state in subparagraphs ISTB-5221(e) and ISTB-5223(e):

> All deviations from the reference values shall be compared with the ranges of Table ISTB-5221-1 and corrective action taken as specified in ISTB-6200. Vibration [The vibration] measurements shall be compared to both the relative and absolute criteria shown in the alert and required action ranges of Table-ISTB-5221-1. For example, if vibration exceeds either 6Vr, or 0.7 in/sec (1.7 cm/sec), the pump is in the required action range.

ISTB-5321, “Group A Test Procedure,” and ISTB-5323, “Comprehensive Test Procedure,” state in subparagraphs ISTB-5321(e) and ISTB-5323(e):

> All deviations from the reference values shall be compared with the ranges of Table ISTB-5321-1 or Table-5321-2, as applicable, and corrective action taken as specified in ISTB-6200. For reciprocating positive displacement pumps, vibration measurements shall be

compared to both the relative criteria shown in the alert and required action ranges of Table ISTB-5321-2 [Table ISTB-5321-1]. For all other positive displacement pumps, vibration measurements shall be compared to both the relative and absolute criteria shown in the alert and required action ranges of Table ISTB-5321-1 [Table ISTB-5321-2]. For example, if vibration exceeds either 6Vr, or 0.7 in/sec (1.7 cm/sec), the pump is in the required action range.

Note: Beaver Valley Power Station (BVPS), Unit No. 2 (BVPS-2), has no reciprocating positive displacement pumps in the Inservice Test (IST) Program. Therefore, Table ISTB 5321-2 is not applicable.

4. Reason for Request

The pumps listed above tend to be smooth running pumps in the BVPS-2 IST Program. Each has at least one vibration reference value (V_r) that is currently less than 0.05 in/sec. A small value for V_r produces a small acceptable range for pump operation. The ASME OM Code acceptable range limit for pump vibrations from Table ISTB-5121-1, Table ISTB-5221-1, and Table ISTB-5321-1 for both the Group A test and comprehensive test is less than or equal to 2.5 V_r. Based on a small acceptable range, a smooth running pump could be subject to unnecessary corrective action if the measured vibration parameter exceeds this limit. ISTB-6200(a), “Corrective Action – Alert Range,” states:

> If the measured test parameter values fall within the alert range of Table ISTB-5121-1, Table ISTB-5221-1, Table ISTB-5321-1, or Table ISTB-5321-2, as applicable, the frequency of testing specified in ISTB-3400 shall be doubled until the cause of the deviation is determined and the condition is corrected.

For very small vibration reference values, flow variations, hydraulic noise and instrument error can be a significant portion of the reading and affect the repeatability of subsequent measurements. Also, experience gathered by the BVPS Predictive Maintenance (PdM) Group has shown that changes in vibration levels in the range of 0.05 in/sec do not normally indicate significant degradation in pump performance.

In order to avoid unnecessary corrective actions, a minimum value for V_r of 0.05 in/sec is proposed. This minimum value would be applied to individual vibration locations for those pumps with reference vibration values less than 0.05 in/sec. Therefore, the smallest ASME OM Code acceptable range limit for any IST pump vibration measurement location would be no lower than 2.5 times V_r, or 0.125 in/sec, which is within the “fair” range of the “General Machinery Vibration Severity Chart” provided by IRD Mechanalysis, Inc. Likewise, the smallest ASME OM Code alert range limit for any IST pump vibration measurement location for which the pump would be inoperable would be no lower than 6 times V_r, or 0.300 in/sec.

When new reference values are established per ISTB-3310, ISTB-3320 or ISTB-6200(c), the measured parameters will be evaluated for each location in order to determine if the provisions of this relief request still apply.

In addition to the requirements of ISTB for inservice testing, the pumps in the IST Program are also included in the BVPS PdM Program. The BVPS PdM Program currently employs predictive monitoring techniques such as: vibration monitoring and analysis beyond that required by ISTB, bearing temperature trending, oil sampling and analysis, and thermography analysis, as applicable.

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: initiation of a condition report, increased monitoring to establish a rate of change, review of component specific information to identify the cause of the condition, and removal of the pump from service to perform maintenance.

5. Proposed Alternative and Basis for Use

In lieu of applying the vibration acceptance criteria ranges specified in Table ISTB-5121-1, Table ISTB-5221-1, or Table ISTB-5321-1, as applicable, smooth running pumps with a measured reference value below 0.05 in/sec for a particular vibration measurement location will have subsequent test results for that location compared to an acceptable range limit of 0.125 in/sec and an alert range limit of 0.300 in/sec (based on a minimum reference value 0.05 in/sec). These proposed ranges shall be applied to vibration test results during both Group A tests and comprehensive tests.

In addition to the Code requirements, the affected pumps listed in this request are included in and will remain in the BVPS PdM Program.

Using the provisions of this relief request as an alternative to the specific requirements of ISTB identified above will provide adequate indication of pump performance and continue to provide an acceptable level of quality and safety without unnecessarily imposing corrective action since changes in vibration levels in the range of 0.05 in/sec do not normally indicate significant degradation in pump performance.

Using the provisions of this relief request as an alternative to the vibration acceptance criteria ranges specified in Table ISTB-5121-1, Table ISTB-5221-1, or Table ISTB-5321-1 provides an acceptable level of quality and safety since the alternative provides reasonable assurance of pump operational readiness and the ability to detect pump degradation.

6. **Duration of Proposed Alternative**

The proposed alternative is requested for use during the fourth 10-year IST interval.

7. **Precedent**

A similar request was approved by the Nuclear Regulatory Commission staff in their safety evaluation referenced below.

Beaver Valley Power Station, Unit No. 2, Docket No. 50-412, Safety Evaluation of Relief Request PRR8 for the Third Ten-Year Interval for Pumps and Valves Inservice Testing Program, Dated February 14, 2008 (ADAMS Accession No. ML080140299).

Relief Request In Accordance with 10 CFR 50.55a(f)(5)(iii)

--Inservice Testing Impracticality--

1. **ASME Code Components Affected**

   2RHS*P21A and B, Residual Heat Removal (RHR) Pumps, (Group A, Class 2)

2. **Applicable Code Edition and Addenda**

   American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. **Applicable Code Requirement**

   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 Group A pumps to be tested on a quarterly frequency.

4. **Impracticality of Compliance**

   The RHR pumps are in a standby condition during power operation and are not required to be in service until the reactor coolant system (RCS) temperature is less than or equal to 350 degrees Fahrenheit (°F) and RCS pressure is less than or equal to 360 pounds per square inch gauge (psig). Therefore, they are not exposed to operational wear except when the RCS is at low temperature and pressure and the RHR System is in operation for normal shutdown cooling.

   The RHR pumps have a design pressure of 600 psig. They take suction from the RCS, pass flow through the RHR heat exchangers, and then discharge back to the RCS. The RHR System is considered to be a low pressure system that could be damaged if exposed to the normal operating RCS pressure of approximately 2235 psig. In order to prevent this, the RHR inlet and return isolation valves are interlocked with an output signal from the RCS pressure transmitters, which prevent the valves from being opened when the RCS pressure exceeds 360 psig. In addition, these valves are also maintained shut with their breakers de-energized and administratively controlled (caution tagged). Therefore, testing of the RHR pumps during normal operation is not practicable since there are no alternate supply sources and aligning the RCS to the suction of the RHR pumps, during operation at power, would result in damage to piping and components due to over-pressurization. Major plant and system modifications would be needed to allow quarterly Group A testing of the RHR pumps according to ASME OM Code requirements.

Based on the above, compliance with the ASME OM Code test frequency requirement for Group A pump tests is impractical.

5. **Burden Caused by Compliance**

Testing is only possible during a surveillance interval frequency of cold shutdown and refueling unless major plant and system modifications are made.

6. **Proposed Alternative and Basis for Use**

These pumps will be tested during cold shutdowns and refueling outages, not more often than once every 92 days. For a cold shutdown or refueling outage that extends longer than 3 months, the pumps will be tested every 3 months in accordance with Table ISTB-3400-1. In the instance of an extended outage, a Group A test may be performed; otherwise, a comprehensive test will be performed each refueling outage.

This proposed alternative is necessary to prevent the potential for piping and component damage as a result of over-pressurization.

Using the provisions of this relief request as an alternative to the frequency requirements of Table ISTB-3400-1 provides a reasonable alternative to the Code requirements and assurance that the pumps are operationally ready.

7. **Duration of Proposed Alternative**

The proposed alternative is requested for use during the fourth 10-year inservice test interval.

8. **Precedent**

A similar request was approved for the Beaver Valley Power Station, Unit No. 2 third 10-year inservice test interval. The Nuclear Regulatory Commission staff letter authorizing the alternative is referenced below.

Beaver Valley Power Station, Unit No. 2, Docket No. 50-412, Safety Evaluation of Relief Request PRR7 for the Third 10-Year Inservice Testing Program, Dated February 14, 2008 (ADAMS Accession No. ML080140299).

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(1)

-- Alternative Provides Acceptable Level of Quality and Safety--

1. ASME Code Components Affected

2EGF*P21A, B, C, and D, Diesel Fuel Oil Transfer Pumps, (Group B, Class 3)

2. Applicable Code Edition and Addenda

American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. Applicable Code Requirement

ISTB-3510(a), "Accuracy," states in part that:

> Instrument accuracy shall be within the limits of Table ISTB-3510-1. If a parameter is determined by analytical methods instead of measurement, then the determination shall meet the parameter accuracy requirement of Table ISTB-3510-1 (e.g., flow rate determination shall be accurate to within ±2% of actual).

4. Reason for Request

There is no installed instrumentation provided to measure flow rate directly for these emergency diesel generator fuel oil transfer pumps. However, a level sight glass does exist on the side of the diesel generator fuel oil day tank, and can be used to measure a change in level over time as the pumps transfer fuel oil from the underground storage tank to the day tank.

5. Proposed Alternative and Basis for Use

Flow rate will be calculated by measuring the level change over time in the diesel generator fuel oil day tank, and converting this data into fuel oil transfer pump flow rate during both the Group B tests and comprehensive tests and periodic verification test per the emergency diesel generator and fuel oil transfer pump test procedures. The periodic verification test is performed as described in Mandatory Appendix V, "Pump Periodic Verification Test Program," of the 2012 ASME OM Code. A restricted reference flow rate (Qr) acceptance criteria will be used as follows:

Group B Tests

Acceptable Range	Alert Range	Required Action Range Low	Required Action Range High
0.91 to 1.09Q_r	None	less than 0.91Q_r	greater than 1.09Q_r

Comprehensive Tests

Acceptable Range	Alert Range	Required Action Range Low	Required Action Range High
0.96 to 1.05Qr	0.94 to less than 0.96Qr	less than 0.94Qr	greater than 1.05Qr

During this test, each pump is operated with a fixed flow path from the underground storage tank (suction) to the day tank (discharge). Suction pressure is nearly constant because of the very small change in storage tank level (approximately 1.5 inch drop in level during pump operation). This results in no more than a 0.05 pounds per square inch gauge (psig) change in suction pressure during pump operation and the change is considered to be negligible. The normal rise in day tank level is approximately 12 inches which corresponds to a quantity of approximately 350 gallons pumped during the 10 minutes of pump operation, resulting in a typical flow rate of approximately 35 gallons per minute (gpm). This small rise in day tank level during pump operation could increase pump discharge pressure by as much as 0.4 psig. The resulting increase in pump differential pressure or head (approximately 1 foot) could also decrease pump discharge flow rate by as much as 2 gpm over the course of pump operation based on the shape of the pump curves at approximately 35 gpm for these centrifugal pumps. Therefore, an initial flow rate of approximately 36 gpm would decrease to approximately 34 gpm as the level in the day tank rises during the course of the test. The calculation method described above determines an average flow rate (approximately 35 gpm) over the course of the test.

Because flow rate can vary by as much as plus or minus (+/-) 1 gpm from the average flow obtained, the corresponding calculated flow rate is only accurate to within +/-2.86 percent. In addition, the level sight glass on the side of the day tank ranges from 12 inches to 47.25 inches and is in 0.125 inch increments for a calibrated accuracy of +/-0.355 percent. The stopwatch used to measure the time the pump is operating and pumping fuel oil is accurate to within +/-0.3 seconds per minute for a calibrated accuracy of +/-0.5 percent. Combining the accuracy of the flow rate reading, level sight glass, and stopwatch, using the square root of the sum of the squares method, results in an overall indicated accuracy of +/-2.93 percent.

Since this does not meet the +/-2 percent accuracy requirements of Table ISTB-3510-1, FENOC proposes to use the restricted flow rate acceptance criteria that is more conservative than the current flow rate acceptance criteria in Table ISTB-5221-1 for both the Group B and comprehensive tests.

The Acceptable Ranges for flow provided in Table ISTB-5221-1 for the Group B test and comprehensive pump test (CPT) are as follows.

Group B Tests

Acceptable Range	Alert Range	Required Action Range	
		Low	High
0.90 to 1.10Q_r	None	less than 0.90Q_r	greater than 1.10Q_r

Comprehensive Tests

Acceptable Range	Alert Range	Required Action Range	
		Low	High
0.95 to 1.03Q_r	0.93 to less than 0.95Q_r	less than 0.93Q_r	greater than 1.03Q_r

The accuracy of the proposed flow rate determination and the restricted flow rate acceptance criteria (both described above) meet the intent of the ASME OM Code required accuracy of 2 percent of actual flow rate, since the restricted flow rate acceptance criteria (that provide a more conservative range of acceptable values) listed above compensate for the 1 percent less accurate flow rate determination.

In addition, because these tests are performed at nearly the same conditions (a day tank level change from approximately 22 inches to 34 inches over 10 minutes) and use a fixed flow path, repeatable results (for trend analysis purposes) are ensured. FENOC has over 20 years of test experience using this test method (day tank level change over time). The method has demonstrated that it provides adequate capability to monitor for a declining trend in pump performance and reasonable assurance of acceptable pump operation.

Although the diesel fuel oil transfer pumps are vertical line shaft centrifugal pumps, the proposed alternative is consistent with the guidelines provided in NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," Revision 2, Section 5.5.2, "Use of Tank Level to Calculate Flow Rate for Positive Displacement Pumps."

Using the provisions of this request as an alternative to the requirements of ISTB-3510(a) provides an acceptable level of quality and safety since the alternative provides reasonable assurance of pump operational readiness.

6. Duration of Proposed Alternative

The proposed alternative is requested for use during the fourth 10-year inservice test interval.

7. Precedent

A similar request was approved by the Nuclear Regulatory Commission staff in their safety evaluation referenced below.

Beaver Valley Power Station, Unit No. 2, Docket No. 50-412, Safety Evaluation of Relief Request PRR6 for the Third Ten-Year Interval for Pumps and Valves Inservice Testing Program, Dated February 14, 2008 (ADAMS Accession No. ML080140299).

Relief Request In Accordance with 10 CFR 50.55a(f)(5)(iii)

--Inservice Testing Impracticality--

1. **ASME Code Components Affected**

   2SWS*P21A, B and C, Service Water Pumps, (Group A, Class 3)

2. **Applicable Code Edition and Addenda**

   American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. **Applicable Code Requirement**

   ISTB-3540(b), “Vibration,” states:

   > On vertical line shaft pumps, measurements shall be taken on the upper motor-bearing housing in three approximately orthogonal directions, one of which is the axial direction.

4. **Impracticality of Compliance**

   Access to the upper motor bearing housing on the vertical line shaft service water pumps for the purpose of measuring vibrations in the axial direction, cannot be obtained due to the presence of a permanently installed non-rigid metal top hat covering the entire top of the motor housing.

5. **Burden Caused by Compliance**

   The service water pumps would require modification to obtain the vibration measurements at the upper motor-bearing housing as required by ISTB-3540(b).

6. **Proposed Alternative and Basis for Use**

   Measure vibrations on the upper motor bearing housing in two orthogonal directions (excluding the axial direction), and measure vibrations on the lower motor bearing housing in three orthogonal directions (including the axial direction) during each quarterly Group A test and biennial comprehensive test per service water pump test procedures.

   Vibration measurements in the axial direction are accessible at the lower motor bearing housing of each pump, which will provide additional information for trending of pump/motor performance. The vibration measurements in the other orthogonal directions (horizontal and vertical) provide another predictor of vibration problems for vertical line shaft pumps.

   The proposed locations for taking vibration measurements should not be subject to dampening effects of non-rigid structural contact that could mask potential degradation. In recognition of inherent deficiencies in the vibration testing for

vertical line shaft pumps, hydraulic performance requirements are more stringent for vertical line shaft pumps than for horizontal centrifugal pumps.

Using the proposed locations for taking vibration measurements and other provisions of this request as an alternative to the requirements of ISTB-3450(b) provides reasonable assurance of operational readiness.

7. Duration of Proposed Alternative

The proposed alternative is requested for use during the fourth 10-year inservice test interval.

8. Precedent

A similar request was approved for the Beaver Valley Power Station, Unit No. 2 third 10-year inservice test interval. The Nuclear Regulatory Commission staff letter authorizing the alternative is referenced below.

Beaver Valley Power Station, Unit No. 2, Docket No. 50-412, Safety Evaluation of Relief Request PRR5 for the Third 10-Year Inservice Testing Program, dated February 14, 2008 (ADAMS Accession No. ML080140299).

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(1)

-- Alternative Provides Acceptable Level of Quality and Safety--

1. ASME Code Components Affected

2SWS*P21A, B and C, Service Water Pumps, (Group A, Class 3)

2. Applicable Code Edition and Addenda

American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. Applicable Code Requirement

Table ISTB-3510-1, “Required Instrument Accuracy,” requires pressure instruments to be calibrated to at least 0.5 percent when used during the comprehensive pump test.

4. Reason for Request

Subarticle ISTB-3510(a), “Accuracy,” states:

> Instrument accuracy shall be within the limits of Table ISTB-3510-1. If a parameter is determined by analytical methods instead of measurement, then the determination shall meet the parameter accuracy requirement of Table ISTB-3510-1 (e.g., flow rate determination shall be accurate to within ±2% of actual). For individual analog instruments, the required accuracy is percent of full scale. For digital instruments, the required accuracy is over the calibrated range. For a combination of instruments, the required accuracy is loop accuracy.

The Beaver Valley Power Station, Unit No. 2 (BVPS-2), service water pumps are vertical line-shaft pumps that receive their suction from a pit that communicates with the Ohio River. Differential pressure is calculated using local pump discharge pressure indicators and the calculated suction pressure using river water elevation from Ohio River level recorder. The transmitter associated with the level recorder is calibrated to 1.5 percent of full scale and the recorder is calibrated to 1.0 percent of full scale resulting in a loop accuracy of 1.8 percent of full scale. The overall loop accuracy exceeds the maximum 0.5 percent required by Table ISTB-3510-1 when performing a comprehensive or preservice test.

Typical Ohio River elevation is between 665 and 666 feet resulting in a small variance between calculated suction pressure when determined by the calculation method provided by the procedure. However, during the spring, river elevations may be higher due to rain. This condition is evaluated with the test results to ensure operational readiness of the pumps.

5. <u>Proposed Alternative and Basis for Use</u>

As an alternative to Table ISTB-3510-1, FENOC proposes to use the installed Ohio River level recorder with a loop accuracy of 1.8 percent (to determine service water pump suction pressure), and a 0-200 pounds per square inch gauge (psig), 0.1 percent or better accurate test pressure gauge (to determine service water pump discharge pressure). These instrument readings are used to determine service water pump differential pressure. Differential pressure for the service water pumps is determined by taking the difference between the pump discharge pressure measured in psig minus the river elevation corrected for elevation in feet back to the pump discharge centerline and converted to pressure.

Suction pressure for the service water pumps is determined by converting a river elevation reading measured by level recorder to a calculated pressure. This level recorder has a full scale range from 648 feet to 705 feet (river elevation above sea level). Normal river elevation is 665 to 666 feet. The loop accuracy for the level recorder is 1.8 percent. The suction pressure reading over the range of the installed level recorder is accurate to within 0.45 psig. This accuracy is obtained by taking the full scale range of 57 feet, converting it to a pressure ([57 feet] / [2.31 feet/psig] = 25 psig), and multiplying it by 1.8 percent accuracy. The ASME OM Code would require this suction pressure reading to be accurate within 0.125 psig (25 psig x 0.5 percent accuracy).

Discharge pressure for service water pumps (2SWS*P21A, B and C) is to be obtained from a temporary test pressure gauge with a full scale range of 0 to 200 psig. The ASME OM Code would require this discharge pressure reading to be accurate within 1 psig (200 psig x 0.5 percent accuracy). In order to compensate for the 1.8 percent suction pressure loop accuracy, a 0.1 percent accurate temporary test pressure gauge will be used. This temporary test pressure gauge (to be used in place of the installed 0 to 160 psig, 0.5 percent accurate discharge pressure indicators will provide a discharge pressure reading over the range of the instrument with an accuracy of 0.2 psig (200 psig x 0.1 percent). Adding this to the installed 1.8 percent accurate suction pressure instrument reading yields an accuracy of 0.65 psig (0.45 psig plus 0.2 psig) for the combination of instruments.

When the Table ISTB-3510-1 required instrument accuracy of plus or minus (±)0.5 percent is applied to the river level readings, the suction pressure reading over the range of the instrument is required to be accurate to within 0.125 psig (25 psig x 0.5 percent). When the Table ISTB-3510-1 required instrument accuracy of ±0.5 percent is applied to the pump discharge pressure test gauge readings, the discharge pressure reading over the range of the test instrument is required to be accurate to within 1.0 psig (200 psig x 0.5 percent). Adding these required instrument accuracies together would yield an overall worst case (allowed) error of 1.125 psig (0.125 psig plus 1.0 psig). Therefore, the overall differential pressure reading, which can be read to within 0.65 psig, is better than the effective 1.125 psig

differential pressure reading required by the ASME OM code for comprehensive pump testing.

The proposed alternative, using the 0.1 percent accurate test pressure gauge in place of the installed discharge pressure indicator, will yield an effective differential pressure reading (considering both suction and discharge pressure instrumentation together) that is more accurate than the ±0.5 percent instrument accuracy required by Table ISTB-3510-1 for Comprehensive pump testing.

Other activities are implemented at BVPS-2, in addition to those required by the ASME OM Code, that enhance the ability to detect pump degradation. As part of the BVPS-2 Predictive Maintenance Program, spectral analysis is also used to determine the mechanical condition of a pump. Spectral data can provide information to determine if misalignment, unbalance, resonance, looseness or a bearing problem is present. Through a review of the spectral data over a period of time, changes in the condition of the pump may also be determined. Additionally, as part of the BVPS-2 Preventive Maintenance Program, the pump motors are inspected, lubricated, and tested every 192 weeks. The pump and motor are completely overhauled every 516 weeks. This frequency is based on the expected condition of the pumps as a result of historical overhauls and was established to allow overhaul prior to the point of degradation resulting in questionable operational readiness.

The alternative to the accuracy requirements of Table ISTB-3510-1, when performing comprehensive or preservice tests, provides an acceptable level of quality and safety

6. <u>Duration of Proposed Alternative</u>

The proposed alternative is requested for use during the fourth 10-year inservice test interval.

7. <u>Precedent</u>

A similar request was approved for the BVPS-2 third 10-year inservice test interval. The Nuclear Regulatory Commission staff letter authorizing this similar alternative is referenced below.

BVPS-2, Docket No. 50-412, Safety Evaluation of Relief Request PRR9 for the Third 10-Year Inservice Testing Program, Dated February 14, 2008 (ADAMS Accession No. ML080140299).

Relief Request In Accordance with 10 CFR 50.55a(f)(5)(iii)

--Inservice Testing Impracticality--

1. ASME Code Components Affected

2SWS*P21A, B, and C, Service Water Pumps, (Group A, Class 3)

2. Applicable Code Edition and Addenda

American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. Applicable Code Requirement

ISTB-5221(e), “Group A Test Procedure,” states in part that:

> All deviations from the reference values shall be compared with the ranges of Table ISTB-5221-1 and corrective action taken as specified in ISTB-6200.

ISTB-5223(e), “Comprehensive Test Procedure,” states in part that:

> All deviations from the reference values shall be compared with the ranges of Table ISTB-5221-1 and corrective action taken as specified in ISTB-6200.

4. Impracticality of Compliance

The service water system operation is dependent on seasonal Ohio River water temperatures. Based on the most recent 10 years of data, pump flow rates vary between approximately 8,500 gallons per minute (gpm) in the cool winter months to approximately 15,000 gpm in the warm summer months. Due to variations in pump flow rate and differential pressure (pump head), a pump curve will be used to compare flow rate with developed pump head at the flow conditions indicated by plant seasonal heat load requirements.

Group A and comprehensive pump test acceptance criteria for differential pressure is provided in Table ISTB-5221-1, “Vertical Line Shaft Centrifugal Pump Test Acceptance Criteria.” The developed head of a pump is calculated by multiplying the differential pressure by 2.31 feet per pounds per square inch gauge (feet/psig). Table ISTB-5221-1 differential pressure acceptance criteria, where ΔP_r is the differential pressure reference value, is as follows:

Group A Tests

Acceptable Range	Alert Range	Required Action Range Low	Required Action Range High
0.95 to 1.10ΔP_r	0.93 to less than 0.95ΔP_r	less than 0.93	greater than 1.10ΔP_r

Comprehensive Tests

Acceptable Range	Alert Range	Required Action Range Low	Required Action Range High
0.95 to 1.03ΔP_r	0.93 to less than 0.95ΔP_r	less than 0.93	greater than 1.03ΔP_r

The service water pumps are typically overhauled in the colder winter months when the demand on the service water system for cooling is less. The reference pump curve is developed during this time period. The service water pump shaft is made from stainless steel and the pump columns are made from carbon steel. As river water temperature increases, the stainless steel shaft expands at a different rate than the carbon steel columns resulting in a net change in the clearance at the impeller.

Because the carbon steel columns grow slightly more than the stainless steel shaft, a wider gap between the impeller and bowl is created. This causes an increase in pump lift, and results in lower hydraulic performance from the reference pump curve. As river water temperature rises above 60 degrees Fahrenheit (°F), pump hydraulic performance decreases, sometimes into the alert range of 0.93 to less than 0.95 ΔP_r.

As river water temperature begins to cool again, pump hydraulic performance tends to return to the original cold weather reference value.

Therefore, the ASME OM Code limits of Table ISTB-5221-1 are exceeded by the service water pumps when river water temperature is above 60°F. An allowable variation larger than these ranges is needed for both the Group A and comprehensive pump tests, as applicable, in order to trend pump performance.

5. **Burden Caused by Compliance**

Historical variations in pump head have caused the pumps to enter the alert range and require double frequency testing of the pumps when real degradation has not occurred.

6. **Proposed Alternative and Basis for Use**

Expanded ranges, as defined below will be used for the service water pumps during the Group A and comprehensive pump tests when the river water temperature is above 60°F in lieu of the acceptance criteria specified in Table ISTB-5221-1. The proposed expanded ranges to be used during both the Group A and comprehensive pump tests, as modified for developed pump head (H), are as follows:

Group A Tests

Acceptable Range	Alert Range	Required Action Range Low	Required Action Range High
0.93 to 1.10H	0.90 to less than 0.93H	less than 0.90	greater than 1.10H

Comprehensive Tests

Acceptable Range	Alert Range	Required Action Range Low	Required Action Range High
0.93 to 1.06H	0.90 to less than 0.93H	less than 0.90	greater than 1.06H

Group A and comprehensive pump testing will be performed in accordance with service water pump test procedures using the expanded ranges when river water temperature is above 60°F. These expanded ranges will still allow degrading conditions to be identified without needlessly placing the pump on double frequency testing and will provide assurance that the service water pumps will be capable of fulfilling their safety function.

Decreasing the acceptable range lower limit to 0.93 and the alert range lower limit to 0.90 is consistent with lower range limits required by the ASME Boiler and Pressure Vessel Code, Section XI, 1983 Edition, Table IWP-3100-2. Currently, there are several feet of margin below the lower required action range limit of 0.90 to the minimum operating point (MOP) curve for each pump. Service water pump 2SWS*P21A has 16.1 feet (6.74 percent) of margin to the MOP curve. Service water pump 2SWS*P21B has 21.5 feet (8.78 percent) of margin to the MOP curve. Service water pump 2SWS*P21C has 20.4 feet (8.38 percent) of margin to the MOP curve. If pump performance were to degrade in the summer months while river water temperature is above 60°F, enough margin exists above the respective pump's MOP curve to take action before challenging the design basis limits. In addition, once river water temperature decreases below 60°F, the more restrictive ASME OM Code limits from Table ISTB-5221-1 would resume, providing additional margin above the MOP curves.

Other activities are in place that enhance the ability to detect pump degradation. In addition to measuring vibrations on the upper motor bearing housing as required by the ASME OM Code, vibrations are also measured on the lower motor bearing housing each quarter. Spectral analysis of the vibrations is a good practice that can be used to determine the mechanical condition of a pump. Spectral data can provide information to determine if misalignment, unbalance, resonance, looseness, or a bearing problem is present. Trending of the spectral data could also determine a change in condition of the pump. Included in the BVPS-2 preventive maintenance program is a motor lube oil analysis that is performed every 48 weeks, and a complete overhaul of pump and motor that is performed every 516 weeks. The overhaul frequency is based on the expected condition of the pumps as a result of historical overhauls and was established to allow overhaul prior to the point of degradation resulting in questionable operational readiness.

Using the provisions of this relief request as an alternative to the requirements of Table ISTB-5221-1 provides reasonable assurance of pump operational readiness.

7. Duration of Proposed Alternative

The proposed alternative is requested for use during the fourth 10-year inservice test interval.

8. Precedent

A similar request was approved for the Beaver Valley Power Station, Unit No. 2 third 10-year inservice test interval. The Nuclear Regulatory Commission staff letter authorizing the similar alternative is referenced below.

Beaver Valley Power Station, Unit No. 2, Docket No. 50-412, Safety Evaluation of Relief Request PRR10 for the Third 10-Year Inservice Testing Program, dated June 30, 2011 (ADAMS Accession No. ML111751776).

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(1)

-- Alternative Provides Acceptable Level of Quality and Safety--

1. **ASME Code Components Affected**

   2CHS*P21A, B and C, Charging Pumps, (Group A, Class 2)

   2CHS*P22A and B, Boric Acid Transfer Pumps, (Group A, Class 3)

   2RHS*P21A and B, Residual Heat Removal Pumps, (Group A, Class 2)

   2SIS*P21A and B, Low Head Safety Injection Pumps, (Group B, Class 2)

   2QSS*P21A and B, Quench Spray Pumps, (Group B, Class 2)

   2RSS*P21A, B, C and D, Recirculation Spray Pumps, (Group B, Class 2)

   2FWE*P22, Turbine-Driven Auxiliary Feedwater Pump, (Group B, Class 3)

   2FWE*P23A, B, Motor-Driven Aux Feedwater Pumps, (Group B, Class 3)

2. **Applicable Code Edition and Addenda**

   American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. **Applicable Code Requirement**

   ISTB-5121, “Group A Test Procedure,” ISTB-5121(b) states in part that:

   > The resistance of the system shall be varied until the flow rate equals the reference point.

   ISTB-5122, “Group B Test Procedure,” ISTB-5122(c) states:

   > System resistance may be varied as necessary to achieve the reference point.

   ISTB-5123, “Comprehensive Test Procedure,” ISTB-5123(b) states in part that:

   > For centrifugal and vertical line shaft pumps, the resistance of the system shall be varied until the flow rate equals the reference point.

   ISTB-5221, “Group A Test Procedure,” ISTB-5221(b) states in part that:

   > The resistance of the system shall be varied until the flow rate equals the reference point.

   ISTB-5222, “Group B Test Procedure,” ISTB-5222(c) states:

   > System resistance may be varied as necessary to achieve the reference point.

   ISTB-5223, “Comprehensive Test Procedure,” ISTB-5223(b) states in part that:

> The resistance of the system shall be varied until the flow rate equals the reference point.

4. Reason for Request

There is difficulty in adjusting system throttle valves with sufficient precision to achieve an exact flow reference value during pump testing. Paragraphs ISTB-5121(b), ISTB-5122(c), ISTB-5123(b), ISTB-5221(b), ISTB-5222(c) and ISTB-5223(b) do not allow for a variance in flow rate from a fixed reference point for pump testing.

5. Proposed Alternative and Basis for Use

When pump flow rate is required to be throttled for the pumps listed above, it will be adjusted by plant operators as close as practical to the reference flow value, but within a procedure flow limit of plus 2 percent or minus 1 percent of the reference value in accordance with ASME OM Code Case OMN-21, "Alternate Requirements for Adjusting Hydraulic Parameters to Specified Reference Points," updated January 29, 2013.

NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," Revision 2, Section 5.3, "Allowable Variance from Reference Points and Fixed-Resistance Systems," states in part that:

> Certain pump system designs do not allow for the licensee to set the flow at an exact value because of limitations in the instruments and controls for maintaining steady flow.

ASME OM Code Case OMN-21 provides guidance for adjusting reference flow to within a specified tolerance during pump testing. The Code Case states:

> It is the opinion of the Committee that when it is impractical to operate a pump at a specified reference point and adjust the resistance of the system to a specified reference point for either flow rate, differential pressure or discharge pressure, the pump may be operated as close as practical to the specified reference point with the following requirements. The Owner shall adjust the system resistance to as close as practical to the specified reference point where the variance from the reference point does not exceed +2% or -1% of the reference point when the reference point is flow rate, or +1% or -2% of the reference point when the reference point is differential pressure or discharge pressure.

Using the provisions of this relief request as an alternative to the specific requirements of Paragraphs ISTB-5121(b), ISTB-5122(c), ISTB-5123(b), ISTB-5221(b), ISTB-5222(c) and ISTB-5223(b) as described above will provide adequate indication of pump performance and continue to provide an acceptable level of quality and safety.

6. **Duration of Proposed Alternative**

   The proposed alternative is requested for use during the fourth 10-year inservice test interval.

7. **Precedent**

   A similar request was approved for the Fort Calhoun Station, Unit No. 1, fifth 10-year inservice test interval. The Nuclear Regulatory Commission staff letter authorizing the alternative is referenced below.

   Fort Calhoun Station, Unit No. 1, Docket No. 50-285, Safety Evaluation of Request for Relief P-2 for the Fifth 10-Year Inservice Testing Program Interval, dated February 19, 2016 (ADAMS Accession No. ML16041A308).

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(1)

-- Alternative Provides Acceptable Level of Quality and Safety--

1. **ASME Code Components Affected**

   2RCS*RV551A, B and C; Pressurizer Safety Valves (Class 1, Category C)

2. **Applicable Code Edition and Addenda**

   American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. **Applicable Code Requirement**

   Mandatory Appendix I, "Inservice Testing of Pressure Relief Devices in Light-Water Reactor Nuclear Power Plants," Paragraph I-1320, "Test Frequencies, Class 1 Pressure Relief Valves," Subparagraph (a), "5-Year Test Interval," states:

   > Class 1 pressure relief valves shall be tested at least once every five (5) years, starting with initial electric power generation. No maximum limit is specified for the number of valves to be tested within each interval; however, a minimum of 20% of the valves from each valve group shall be tested within any 24-month interval. This 20% shall consist of valves that have not been tested during the current 5-year interval, if they exist. The test interval for any individual valve shall not exceed 5 years.

4. **Reason for Request**

   Beaver Valley Power Station Unit No. 2 (BVPS-2) has three pressurizer safety valves installed to protect the reactor coolant system from overpressure. Since BVPS-2 operates on an 18-month fuel cycle, one valve can be tested each refueling outage such that each valve is tested over a four and one-half year period. In order to avoid outage delays due to valve testing, a pressurizer safety valve is replaced during each refueling outage with a spare valve that has been pre-tested. The removed valve is refurbished and tested for installation during the following refueling outage. In order to ensure the spare replacement valve does not exceed the five year test interval limit from test to test, it must be tested within six months prior to installation. Extending the maximum test interval to six years with a six-month grace period would permit the replacement of an installed pressurizer safety valve with the spare pressurizer safety valve without the need to test the spare valve within six months of installation.

   ASME OM Code Case OMN-17, "Alternative Rules for Testing ASME Class 1 Pressure Relief/Safety Valves," from the 2012 Edition of the ASME OM Code allows a 72-month (six-year) test interval plus an additional six-month grace period coinciding with a refueling outage, in order to accommodate extended shutdown periods.

5. **Proposed Alternative and Basis for Use**

As an alternative to the ASME OM Code-2004 Edition, Mandatory Appendix I, Paragraph I-1320(a) test interval for pressurizer safety valve testing of at least once every five years, the pressurizer safety valves will be tested at least once every six years plus a six month grace period, if required, in accordance with the periodicity and other requirements of ASME OM Code Case OMN-17. Code Case OMN-17 provisions will not be applied to a valve until the valve is disassembled and inspected as described in Paragraph (e) of Code Case OMN-17.

Paragraph (d) of Code Case OMN-17 requires disassembly and inspection of each valve after as-found set-pressure testing is performed in order to verify that parts are free of defects resulting from time related degradation or service induced wear.

Paragraph (e) of Code Case OMN-17 requires each valve to be disassembled and inspected in accordance with Paragraph (d) prior to the start of the 72-month test interval.

When the proposed alternative is applied to a valve, the valve will be disassembled and inspected, after as-found set pressure testing is performed in accordance with Code Case OMN-17 paragraphs (d) and (e). The initial inspection and ongoing inspections will verify that valve parts are free of defects resulting from time-related degradation or service-induced wear. These inspections will provide additional assurance that the pressurizer safety valves will perform their intended function.

The longer test interval will eliminate the need for a valve test within six months of installation during each refueling outage. Eliminating the test, will in turn, remove the risk of any shipping damage when the valve is returned from the offsite testing facility, and reduce wear on metal valve seats due to steam testing.

The as-found set-pressure acceptance criteria is plus or minus 3 percent of the valve nameplate set pressure in accordance with Paragraph I-1320(c)(1) of ASME OM Code, 2004 Edition, Appendix I, for the purpose of determining the need to test additional valves. The as-found set-pressure acceptance criteria is plus 1.6 percent or minus 3 percent of valve nameplate set-pressure in accordance with BVPS-2 Technical Specification Limiting Condition for Operation 3.4.10 for the purpose of determining pressurizer safety valve operability.

Since 1989, twenty-one as-found set pressure tests have been performed for the four Crosby Model HB-86-BP pressurizer safety valves (including the spare valve). These tests have been performed at an offsite test facility using saturated steam. The majority of the tests were performed after the valve was installed for three operating cycles. As-found tests were within plus or minus 3 percent of the valve set pressure with the exception of valve 2RCS*RV551C, which lifted low (minus 5.6 percent) in 1989 due to excessive seat leakage. BVPS-2 Technical Specification Surveillance Requirement 3.4.10.1 requires that following testing, lift settings shall

be within plus or minus 1 percent. For 11 of the 21 tests, the valves were found within the as-left tolerance of plus or minus 1 percent. These test results show limited time-related degradation or set point drift and demonstrate that it is acceptable to extend the test interval from four and one-half years (three fuel cycles) to six years (four fuel cycles) with a six month grace period.

The ability to detect degradation and to ensure the operational readiness of the pressurizer safety valves to perform their intended function is assured based on the valve test history and by performing the required inspection and testing initially and at the proposed alternative frequency. Therefore, test and inspection of the valves in accordance with the proposed alternative demonstrates an acceptable level of quality and safety.

6. Duration of Proposed Alternative

The proposed alternative is requested for use during the fourth 10-year inservice test interval.

7. Precedent

A similar request was approved by the United States Nuclear Regulatory Commission (USNRC) staff in their safety evaluation referenced below.

USNRC Letter, Beaver Valley Power Station Unit No. 2, Docket No. 50-412, Safety Evaluation of Valve Relief Request VRR4 for the Remainder of the Third 10-Year Inservice Testing Interval, dated February 7, 2012 (ADAMS Accession No. ML120330329).

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(1)

-- Alternative Provides Acceptable Level of Quality and Safety--

1. **ASME Code Components Affected**

   The following Class 2, Category A valves:

   2HCS*SOV133A, Hydrogen Analyzer A Outlet Inside Containment Isolation

   2HCS*SOV133B, Hydrogen Analyzer B Outlet Inside Containment Isolation

   2HCS*SOV134A, Hydrogen Analyzer A Outlet Outside Containment Isolation

   2HCS*SOV134B, Hydrogen Analyzer B Outlet Outside Containment Isolation

   2HCS*SOV135A, Hydrogen Analyzer B Inlet Inside Containment Isolation

   2HCS*SOV135B, Hydrogen Analyzer B Inlet Outside Containment Isolation

   2HCS*SOV136A, Hydrogen Analyzer A Inlet Inside Containment Isolation

   2HCS*SOV136B, Hydrogen Analyzer A Inlet Outside Containment Isolation

   2HCS*SOV114A, Containment Isolation to Hydrogen Recombiner 21A

   2HCS*SOV114B, Containment Isolation to Hydrogen Recombiner 21B

   2HCS*SOV115A, Backup Containment Isolation to Hydrogen Recombiner 21A

   2HCS*SOV115B, Backup Containment Isolation to Hydrogen Recombiner 21B

2. **Applicable Code Edition and Addenda**

   American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code-2004 Edition, with Addenda through OMb-2006.

3. **Applicable Code Requirement**

   ISTC-3700, “Position Verification Testing” states in part:

   > Valves with remote position indicators shall be observed locally at least once every 2 years to verify that valve position is accurately indicated. . . . Where local observation is not possible, other indications shall be used for verification of valve operation.

4. **Reason for Request**

   The valves listed above are Category A containment isolation valves and are required to be seat leakage tested in accordance with 10 CFR 50 Appendix J (Option B, Type C). Due to the design of the valves, position verification testing is performed in conjunction with the Type C leak test. Each of the listed valves is a solenoid operated valve (SOV) designed such that the coil position is internal to the valve body and is not observable in either the energized or de-energized state.

The subject valves are seat leakage tested using local leakage rate test equipment as part of the Appendix J Type C leak test program. As part of the leakage rate test, the position verification test is also performed. This method involves attempting to pressurize the containment penetration volume to approximately 45 pounds per square inch gauge (psig) with the valve open as indicated by its remote position lights on the control room bench board. If the attempt to pressurize the containment penetration fails, the valve position is verified to be open. The valve is then closed using the control switch in the control room and the containment penetration volume is pressurized to approximately 45 psig. Being able to maintain pressure in the penetration while the valve is indicating closed by its remote position lights on the control room bench board, verifies the valve is closed. This method satisfies the requirement for position verification testing and ensures that the remote indicating lights in the control room accurately reflect the local valve position in the field.

Position verification testing is required to be performed once every two years and is typically performed during a refueling outage, regardless of whether the containment penetration is due for Type C leakage testing or not. In order to perform Type C leakage testing, piping and valves associated with the individual valve being tested are drained, vented and aligned. Because the position verification test requires the Type C leakage test to be performed, the above actions are completed during each refueling outage.

5. <u>Proposed Alternative and Basis for Use</u>

As an alternative to the ISTC-3700 test interval of at least once every two years, it is proposed that the required position verification testing of the valves listed above be performed in conjunction with the Type C seat leakage test at the frequency specified by 10 CFR 50 Appendix J, Option B for the Type C leakage test. This test interval may be adjusted to a frequency of testing commensurate with Option B of 10 CFR 50 Appendix J for Type C seat leakage testing based on valve seat leakage performance. If a valve fails a leak test representing an unacceptable remote position verification, the valve test frequency (including position verification testing) will be adjusted in accordance with 10 CFR 50 Appendix J, Option B.

Valves 2HCS*SOV114A and 115A, and 2HCS*SOV114B and 115B may be remote position verified at the longer test frequency specified above, or remote position verified in conjunction with the testing of containment isolation valves 2CVS*SOV151A and 152A (for Penetration No. 93) and 2CVS*SOV151B and 152B (for Penetration No. 92) in accordance with the frequency specified in the surveillance frequency control program referenced by Technical Specification Surveillance Requirement 3.3.3.3 (currently an 18-month frequency).

In addition to position verification testing and seat leakage testing, the SOVs associated with the hydrogen analyzers are stroke timed open and closed on a quarterly frequency. Because these SOVs are ganged in sets of two valves per control switch, two operators time the valves so that pre-conditioning is avoided by

not cycling the valves more than once. For each valve, the opening stroke time is measured from the time the common control switch is placed in the open position until the red indicating light is the only indicating light remaining illuminated. For each valve, the closing stroke time is measured from the time the common control switch is placed in the closed position until the green indicating light is the only indicating light remaining illuminated. The stroke times are compared to a two second limiting time established in accordance with ISTC-5152(c) of the ASME OM Code. If the stroke time is within the two second limiting time, then the valve is considered to have passed and is operating acceptably.

The SOVs associated with the Train B hydrogen recombiners are not required to be stroke time tested as they are considered to be passive valves.

Option B of 10 CFR 50 Appendix J permits the extension of Type C leakage testing to a frequency based on leakage-rate limits and historical valve performance. Valves whose leakage test results indicate good performance may have their seat leakage test frequency extended up to 60 months or three refueling outages (based on an 18-month fuel cycle). In order for a valve's seat leakage test frequency to be extended, the individual containment isolation valve must first successfully pass two consecutive as-found seat leakage tests before it can be placed on an extended seat leakage test frequency.

Over the past six refueling outages, the valves listed above have passed the position verification test performed in conjunction with its Type C leakage test. Valve performance data is recorded in a database and trended by the inservice test coordinator. If the leak rate exceeds the allowable limit, the valves are repaired or replaced. Any maintenance performed on these valves that might affect position indication is followed by an applicable post-maintenance test including position verification testing regardless of the Type C test frequency.

Additionally, the SOVs that are required to be stroke timed tested with their stroke times measured and compared to the ASME OM Code acceptance criteria of less than two seconds are exercised on a quarterly test frequency. For the past 10 years, no quarterly stroke time failures have been noted.

Valve exercise testing each quarter and position verification and seat leakage testing in accordance with the frequency specified by 10 CFR 50 Appendix J, Option B, provides an adequate assessment of valve health and therefore an acceptable level of quality and safety.

Based on past performance of the SOVs and the quarterly valve stroking for the valves subject to exercising, coupled with a 10 CFR 50, Appendix J, Option B performance based program to test for leakage and verify valve position indication, the proposed alternative to the ISTC-3700 test interval provides an acceptable level of quality and safety.

6. Duration of Proposed Alternative

The proposed alternative is requested for use during the fifth 10-year inservice test interval.

7. Precedent

A similar request was approved by the United States Nuclear Regulatory Commission (USNRC) staff in their safety evaluation referenced below.

USNRC Letter, Beaver Valley Power Station Unit Nos. 1 and 2, Docket Nos. 50-334 and 50-412, Safety Evaluation of Valve Relief Request VRR3 for the Remainder of the BVPS-1 Fourth 10-Year Inservice Testing Interval and the BVPS-2 Third 10-Year Inservice Testing Interval, dated February 7, 2012 (ADAMS Accession No. ML120270298).