ATTACHMENT 2

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TECHNICAL EVALUATION REPORT
PUMP AND VALVE INSERVICE TESTING PROGRAM
ARKANSAS NUCLEAR ONE, UNIT 2

Docket No. 50-368

M. R. Holbrook
C. B. Ransom

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Idaho National Engineering Laboratory
EG&G Idaho, Inc.
Idaho Falls, Idaho 83415

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ABSTRACT

This report presents the results of the evaluation of relief requests for the inservice testing program for safety-related pumps and valves at Arkansas Nuclear One, Unit 2, of Entergy Operations.

PREFACE

This report is part of the "Review of Pump and Valve Inservice Testing Programs for Operating Reactors (III)" program conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Mechanical Engineering Branch, by EG&G Idaho, Inc., Regulatory and Technical Assistance Programs Unit.

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1. INTRODUCTION

This report provides the results of the technical evaluation of certain relief requests from the pump and valve inservice testing (IST) program for Arkansas Nuclear One, Unit 2 (ANO-2), which was submitted by Entergy Operations.

Section 2 presents the Entergy Operations' bases for requesting relief from the requirements for pumps followed by an evaluation and conclusion. Section 3 presents similar information for valves.

Appendix A lists program inconsistencies and omissions, and identifies needed program changes.

1.1 IST Program Description

Entergy Operations submitted Revision 1 of the Arkansas Nuclear One, Unit 2, pump and valve IST program with a letter dated August 9, 1991. This program covers the second ten-year IST interval, which runs from March 1, 1992, to February 28, 2002. Entergy's response to NRC comments on their second ten-year program was forwarded to the NRC by letter dated July 31, 1991. The relief requests pertain to requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (the Code), Section XI, 1986 Edition, and the Code of Federal Regulations (CFR), 10 CFR 50.55a.

1.2 IST Requirements

10 CFR 50.55a(g) states that IST of certain ASME Code Class 1, 2, and 3 pumps and valves will be done per the ASME Code, Section XI, Subsections IWP and IWV, except where relief is granted by NRC in accordance with 10 CFR 50.55a(a)(3)(i), (a)(3)(ii), or (f)(6)(i). Entergy Operations requests relief from the ASME Code testing requirements for specific pumps and valves. Certain of these requests are evaluated in this Technical Evaluation Report (TER) using the acceptance criteria of the Standard Review Plan, Section 3.9.6, NRC Generic Letter No. 89-04 (GL 89-04), "Guidance on Developing Acceptable Inservice Testing Programs," and 10 CFR 50.55a. Other requests in the licensee's IST program that are not evaluated in this TER, may be granted by provisions of GL 89-04.

1.3 Scope and Limits of the Review

The scope of this review is limited to the relief requests addressed in this TER and the cold shutdown justifications submitted with the licensee's IST program. Other portions of the program, such as general discussions, pump and valve test tables, etc., are not necessarily reviewed. Endorsement of these aspects of the program by the reviewer or NRC is not stated or implied. Any deviation from the Code test method, frequency, or other requirement should be identified in the IST program and submitted according to 10 CFR 50.55a for review and approval by NRC prior to implementation.

The evaluations in this TER are applicable only to the components or groups of components identified by the submitted requests. These evaluations may not be extended to apply to similar components that are not identified by the request at this or any other comparable facility without separate review and approval by NRC. Further, the evaluations and recommendations are limited to the requirement(s) and/or function(s) explicitly discussed in the applicable TER section. For example, the results of an evaluation of a request involving testing of the containment isolation function of a valve cannot be extended to allow the test to satisfy a requirement to verify the valve's pressure isolation function, unless that extension is explicitly stated.

Entergy Operations provided several cold shutdown justifications for exercising Category A, B, and C valves during cold shutdowns and refueling outages instead of quarterly. Valves identified to be tested during cold shutdowns need not be tested if testing was performed within three months of the cold shutdown. These justifications were reviewed and found to be acceptable except as noted in Appendix A.

2. PUMP RELIEF REQUEST EVALUATIONS

The following pump relief requests are evaluated against the requirements of the ASME Code, Section XI, 10 CFR 50.55a, and applicable NRC positions and guidelines. A summary and the licensee's basis for each relief request is presented. The evaluation and recommendation follow. The requests are grouped according to topic or system.

2.1 All Pumps in the IST Program

2.1.1 Bearing Temperature Measurement

2.1.1.1 Relief Request PR-1. The licensee requests relief from the bearing temperature measurement requirements of Section XI, Paragraph IWP-4310 for all pumps in the IST program. The licensee proposes to evaluate pump bearing condition using quarterly vibration measurements.

2.1.1.1.1 Licensee's Basis for Requesting Relief--(a) Some of the pumps addressed in this relief request are cooled by their respective process fluid, in the main flow path. Thus, bearing temperature measurements would be highly dependent on the temperature of the cooling medium.

(b) Pump bearing temperature is taken at one-year intervals only, which provides very little data toward determining the incremental degradation of a bearing, nor does it provide any meaningful trend data. Industry experience demonstrates that bearing temperatures typically rise only minutes prior to failure. Any bearing failure predicted by a yearly recording of bearing temperature would be a random event and thus, yearly measurement of bearing temperatures does not increase the level of confidence in component reliability. The expense of adding the additional testing both in component degradation and man-hours expended is, therefore, not justified.

(c) Except for the Service Water Pumps (2P4A, 2P4B, [illegible]) all of which are submerged under water, all pumps addressed in this relief request will be subject to vibration measurements per subsection IWP-4500. Vibration measurements (displacement and velocity) are a significantly more reliable indication of pump bearing degradation than are temperature measurements. Vibration data taken on at least a quarterly basis will be utilized to define pump mechanical condition.

Alternate Testing: Vibration measurements shall be taken on all pumps identified above as required by ASME Section XI Subsection IWP-4500, except as noted on paragraph "c", above. Vibration measurements using velocity as a measured value shall be taken on each pump in lieu of bearing temperature measurements.

2.1.1.1.2 Evaluation--Both vibration measurements and bearing temperature measurements provide indication of bearing condition. However, bearing temperature measurements are affected by factors other than pump bearing condition such as the temperature of the pumped fluid, bearing lubricant temperature, and ambient temperature. A significant temperature rise due to bearing degradation would only be detectable just prior to, or during, catastrophic failure. Consequently, the probability of detecting bearing degradation with annual temperature measurements at the bearing housing is very small. The licensee's proposed alternative would give a

better indication of bearing condition than annual temperature measurements and would, therefore, provide an acceptable level of quality and safety.

Based on the determination that the licensee's proposed alternative would provide an acceptable level of quality and safety, relief should be granted as requested.

2.1.2 Pump Vibration Measurement

2.1.2.1 Relief Request PR-5. The licensee requests relief from measuring pump vibration displacement in accordance with the requirements of Section XI, Paragraph IWP-4500, for all pumps in the IST program and proposes to measure pump vibration in accordance with OM-6 utilizing velocity in lieu of displacement.

2.1.2.1.1 Licensee's Basis for Requesting Relief--Due to improvements in vibration measurement and analysis since Section XI was developed, ANO has utilized measurement of vibration velocity to more fully define the pump mechanical condition. In keeping with the interim approval gained in the previous revision to the test program, as well as the ASME approved OM-6 inservice testing standard for pumps, ANO will utilize measurement of vibration velocity for all bearings presently requiring vibration measurement per Section XI. The acceptance criteria for this parameter will be in accordance with guidance provided in OM-6.

Alternate Testing: The vibration measurements shall be taken in accordance with IWP-4510 utilizing velocity in lieu of displacement.

2.1.2.1.2 Evaluation--Pump bearing degradation results in increased vibration at frequencies several times the rotational speed of the pump. These high frequency bearing noises would not produce a significant increase in pump vibration displacement measurements for pumps with rotational speeds of 600 rpm or greater and could go undetected. However, the high frequency noises would result in relatively large changes in pump vibration velocity measurements which could permit detection of bearing degradation and corrective action prior to catastrophic failure. Because of the high frequencies of the vibrations associated with the bearings of pumps with rotational speeds of 600 rpm or greater, vibration velocity measurements are generally much better than vibration displacement measurements in monitoring the mechanical condition of these pumps and detecting bearing degradation.

The advantages of measuring vibration velocity instead of displacement for monitoring the mechanical condition of pumps, with the exception of low speed pumps, are widely acknowledged in the industry. The use of pump vibration velocity can provide a great deal of information about pump mechanical condition that could not be obtained by using vibration displacement readings. Therefore, pump vibration velocity measurements are generally superior to the Code required testing method.

Section XI does not provide allowable ranges for vibration velocities and since the relationship between displacement and velocity is frequency dependent, a mathematical conversion of the Code displacement ranges is not appropriate. ANSI/ASME OM-6 provides a set of allowable ranges for pump vibration velocity measurements that has been found to be acceptable by the NRC. The licensee indicated that they are using the ranges and limits

specified in ASME OM-6. The licensee further proposed to conduct vibration measurements in accordance with OM-6 for all pumps in their IST program. Measuring pump vibration in velocity units is at least equivalent to the Code requirements and is an acceptable alternative.

Based on the determination the licensee's proposal provides a reasonable alternative to the Code requirements, relief should be granted from the Code requirements as requested provided the licensee complies with all the vibration measurement requirements of OMa-1988, Part 6, which has been approved by NRC as Code Case N465 and by 10 CFR 50.55a(b) rulemaking effective September 8, 1992.

2.2 Service Water

2.2.1 Observe Lubricant Level or Pressure

2.2.1.1 Relief Request PR-2. The licensee requests relief from observing lubricant level or pressure in accordance with the requirements of Section XI, Paragraph IWP-3100, for the service water pumps, 2P4A, 2P4B, and 2P4C, and proposes to verify adequate bearing lubrication by quarterly pump flow testing and vibration velocity measurements.

2.2.1.1 Licensee's Basis for Requesting Relief--The service water pumps are vertical shaft pumps with no external lubricant indication. All of the pump bearings with the exception of the suction bowl bearings are lubricated by the fluid pumped (water). The suction bowl bearing is grease packed. Hence, due to the inaccessibility and design of these bearings, it is impossible to observe lubricant level or pressure.

Alternate Testing: Pump bearing lubrication is assured by quarterly flow testing of the service water pumps. Also, three orthogonal velocity readings are taken on the motor inboard and outboard bearings. These vibration readings should detect pump bearing degradation.

2.2.1.2 Evaluation--The service water pumps are vertical line shaft pumps that are completely submerged in the working fluid. All pump bearings are either lubricated by water or are sealed with grease lubrication. These bearings do not have any lubrication parameter that can be observed or measured, therefore, the Code requirement of observing lubricant level or pressure is impractical and inappropriate for these pumps. Verification that the pumps operate properly during quarterly testing and that there is no significant mechanical degradation provides adequate assurance of pump operational readiness.

Based on the determination that compliance with the Code requirements is impractical and burdensome and considering that the licensee's proposal provides reasonable assurance of pump operational readiness, relief should be granted as requested.

2.3 Chemical and Volume Control

2.3.1 Full-Scale Range of Flow Rate Instruments

2.3.1.1 Relief Request PR-4. The licensee requests relief from the full-scale range requirements of Section XI, Paragraph IWP-4120, for the flow

rate instruments used to test the charging pumps, 2P36A, 2P36B, and 2P36C. The licensee proposes to measure pump flow rate using the installed flow rate instrument with a full-scale range of 150 gpm.

2.3.1.1.1 Licensee's Basis for Requesting Relief--The normal charging pump flow for a single pump is 44 gpm. The flow instrumentation for the charging pumps is in an injection header that all three pumps tie into. The range for this instrumentation is 0-150 gpm. The full-range for this instrumentation is slightly more than the three times reference value. In an emergency boration condition, all three pumps would be operating concurrently, injecting 132 gpm through this common header. Thus, the flow instrumentation is sized correctly for the intended safety function of the charging pumps. The installed instrumentation provides accurate repeatable data and has detected pump degradation. To install flow instrumentation in each charging pump header would constitute a backfit.

Alternate Testing: None.

2.3.1.1.2 Evaluation--The purpose of the instrument quality and full-scale range requirements is to ensure that the test measurements provide information that is sufficiently accurate and repeatable to monitor pump condition and detect degradation. Using instruments that do not meet these requirements may inhibit the detection of pump hydraulic degradation. The licensee has not provided information on the installed instrumentation with the detail necessary to completely evaluate this request for relief. Long term relief should not be granted for instrumentation that may not be sufficiently accurate or repeatable to assess pump condition. To obtain long term relief, it is necessary to specifically address the instrument data (accuracies, reference values, and ranges) and demonstrate that it is adequate to detect pump degradation. Additionally, this relief request should identify the burden of using test or portable instruments that meet the Code requirements. The NRC does not consider that the installation of flow instrumentation is a backfit unless it requires considerable piping modifications.

The licensee has not provided sufficient information to justify granting long term relief from the Code full-scale range requirements, therefore, long term relief should not be granted. Immediate compliance with the Code requirements would be a hardship or the licensee without a compensating increase in the level of quality and safety. Interim relief should be granted for one year or until the next refueling outage, whichever is longer. During this period the licensee should obtain portable or installed instrumentation that meets the Code requirements or submit a request for relief that includes the information necessary to evaluate and grant long term relief. Taking the Code measurements with the installed instruments should be adequate for evaluating pump hydraulic performance during this interim period.

2.4 Safety Injection

2.4.1 Discharge Pressure Gauge Location

2.4.1.1 Relief Request PR-3. The licensee requests relief from measuring pump differential pressure in accordance with the requirements of Section XI, Paragraph IWP-4230, for the high pressure safety injection (HPSI) pumps, 2P89A, 2P89B, and 2P89C and proposes to partially open downstream isolation valves and use discharge pressure instruments located in the injection headers to provide input for differential pressure calculations.

2.4.1.1.1 Licensee's Basis for Requesting Relief--The discharge pressure gauges available for use in testing the high pressure safety injection pumps are downstream of the pump discharge stop-check valves. The test flow path, through the mini-recirc lines, does not pass through these discharge stop-check valves. Therefore, the gauge used for measuring pump discharge pressure is not in the test flow path but is pressurized by pump discharge pressure through the normally open pump discharge stop-check valves. This arrangement meets the intent of IWP-4230.

Alternate Testing: As stated in the Basis for Relief, the alternative testing involves the use of a discharge pressure gauge not in the test flow path. The proposed testing arrangement although appearing not to meet the letter of the Code, does meet the intent of the Code in the acquisition of accurate, repeatable data for assessing pump performance. In order to alleviate concerns that the initial pressure wave created when the pump is started might cause a pressure higher than steady state discharge pressure to be trapped downstream of the pump discharge stop-check valve, downstream valves are cycled after pump start per the test procedure to relieve that condition.

2.4.1.1.2 Evaluation--These pumps discharge to the safety injection headers during accident conditions. Minimum flow recirculation lines are included in the piping system which allow pump testing during power operation without injecting into the reactor coolant system (RCS). The recirculation flow paths have installed flow instruments, but do not have discharge pressure instrumentation. A pump discharge pressure gauge is located in the main flow path downstream of the point where the recirculation line branches off and downstream of stop-check valves in the injection headers.

Section XI, Paragraph IWP-4230 requires that pressure taps be located in a section of the flow path that is used for the pump test. To comply with this Code requirement it would be necessary to install pressure instruments in the pump discharge test flow paths. Performing system modifications to install pressure instruments would be a hardship to the licensee which would not provide a compensating increase in the level of quality and safety. The licensee proposes to use the installed discharge pressure gauges which sense pump discharge pressure through the stop-check valves during testing. The licensee indicated that downstream isolation valves in the main flow path would be cycled during pump testing to allow the release of water trapped at a pressure above pump steady state pressure. This testing should provide data that can be used to evaluate pump hydraulic condition and detect degradation. Therefore, the proposed testing should give assurance of pump operational readiness and be a reasonable alternative to the Code requirements.

Based on the determination that compliance with the Code requirements would be a hardship without a compensating increase in the level of quality and safety and considering that the licensee's proposal provides a reasonable alternative to the Code requirements, relief should be granted as requested.

3. VALVE RELIEF REQUEST EVALUATIONS

The following valve relief requests are evaluated against the requirements of the ASME Code, Section XI, 10 CFR 50.55a, and applicable NRC positions and guidelines. A summary and the licensee's basis for each relief request is presented. The evaluation and recommendation follow. The requests are grouped according to topic or system.

3.1 General Valve Relief Requests

3.1.1 Remote Position Verification

3.1.1.1 Relief Request GR-1. The licensee requests relief from verifying remote position indication in accordance with the requirements of Section XI, Paragraph IWV-3300, for the applicable solenoid operated valves, and proposes to verify remote position indication by monitoring normal system parameters during valve operation.

3.1.1.1.1 Licensee's Basis for Requesting Relief--These enclosed solenoid valves would require disassembly of the actuator components to verify operation.

Alternate Testing: ANO will monitor system parameters to verify an enclosed solenoid valve's safety function. This monitoring will be performed at least once every two years.

3.1.1.1.2 Evaluation--The moving parts of these solenoid valves are totally enclosed and cannot be observed without disassembly of the valve. Disassembly of the valve renders it inoperable which makes it impractical to directly verify the accuracy of its remote position indication. Major valve or system modifications would be necessary to permit compliance with the Code requirements. Performing these modifications would be burdensome to the licensee. System response to valve position changes (e.g., initiation or blockage of flow through the valve or the buildup of a pressure differential across the valve) can accurately reflect valve position. Additionally, IWV-3412(b) permits the use of indirect evidence such as changes in system pressure, flow rate, level, or temperature to reflect valve disk position during exercise testing. Therefore, verifying the position indication for these valves by monitoring system response provides an acceptable level of quality and safety and a reasonable alternative to the Code requirements.

The licensee indicated that system parameters will be monitored to "verify an enclosed solenoid valve's safety function." IWV-3300 requires that these valves be observed "to verify that valve operation is accurately indicated." To meet the Code requirement it is necessary to verify the accuracy of the position indication with the valve in both the open and the closed positions regardless of the valve's safety function. Both the open and closed positions should be verified to be accurately indicated because the licensee may rely on both positions during conduct of normal operation and in response to an accident.

Based on the determination that compliance with the Code requirements is impractical and burdensome and considering that verifying the position indication for these valves during operation utilizing system response provides an acceptable level of quality and safety, relief should be granted

provided the accuracy of the position indication is verified with the valves in both the open and the closed positions.

3.1.2 Criteria for Declaring Components Inoperable

3.1.2.1 Relief Request GR-3. The licensee requests relief from performing component repair prior to plant startup as required by Section XI, Paragraph IWV-3427(b), for all valves in the IST program, and proposes to use the plant startup criteria specified in the ANO Technical Specifications.

3.1.2.1.1 Licensee's Basis for Requesting Relief--The ANO Technical Specifications limiting conditions for operations, and ASME Section XI, provide the controls by which valves and systems are declared inoperative. ANO Technical Specifications also control entry into various operational conditions, which is generally more restrictive. Failure to meet Section XI testing criteria should not, therefore, preclude plant startup with the particular component inoperable, nor should the declaration of component or system inoperability be extended to 24 hours. Plant safety is assured by adherence to ANO Technical Specifications.

Alternate Testing: If the valve can be repaired and retested during startup, then startup will continue provided that LCOs of the Technical Specifications allow startup with the valve inoperable. If a valve requires corrective action and cannot be repaired and retested during plant startup, then it shall be repaired and retested prior to plant startup.

3.1.2.1.2 Evaluation--Section XI, Paragraphs IWV-3417(b) and IWV-3523 require that if a valve fails a Code required exercise or stroke time test, the action to repair the valve should start immediately. If the valve cannot be repaired within 24 hours, then the valve is considered inoperative. In addition, if the test failure occurs during cold shutdown, then repairs must be made prior to startup. The NRC provided guidelines in GL 89-04, Position 8, that as soon as it is recognized that the measured stroke time exceeds the limiting stroke time, the valve is to be declared inoperable.

The Plant Technical Specifications provide the minimum system, subsystem, and component operability requirements for safe operation and have been reviewed and approved by the staff. Compliance with the Plant Technical Specifications would provide an acceptable level of quality and safety provided the Technical Specifications specifically address the valve or its associated system and permit plant startup when the valve is inoperable. Because some safety related valves and their systems are not specifically addressed in the Plant Technical Specifications, the effects of their inoperability may not be considered in an analysis. Therefore, plant operation with these components out of service may be unanalyzed and should not be permitted.

Based on the determination that compliance with the Plant Technical Specification operability requirements should provide an acceptable level of quality and safety regarding plant startup with inoperable valves, relief should be granted provided the Technical Specifications specifically address the valve or its associated system and permit plant startup when the valve is inoperable. Additionally, if corrective action for a valve is deferred under this relief request, prior to entering an operating mode where the valve is required to be operable, the valve should be repaired or replaced and successfully tested.

3.2 Steam Generator Secondary System

3.2.1 Category C Valves

3.2.1.1 Relief Request SGS-1. The licensee requests relief from the test method and frequency requirements of Section XI, Paragraph IWV-3521, for the check valves in the steam supply line to the emergency feedwater pump turbine, 2MS-39A and 2MS-39B, and proposes to verify valve closure utilizing a sample disassembly and inspection program each refueling outage.

3.2.1.1.1 Licensee's Basis for Requesting Relief--Valves 2MS-39A and 2MS-39B are full-stroke exercised open at least every three months during testing of the emergency feedwater pump turbine, but there is no means available to verify the disc in these valves travels promptly to the seat on cessation or reversal of flow.

Alternate Testing: The alternative testing performed on these valves meets GL 89-04, Position 2, requirements. Valves 2MS-39A and 2MS-39B have been disassembled and manually exercise with no discernable degradation. When the valve is disassembled, the valve internals are visually inspected for worn or corroded parts. The closed safety position of these valves is verified by this inspection. One of these valves will be inspected each refueling outage, alternating between the valves. If problems are found repairs will be made and the other valve shall also be inspected unless a common mode failure mechanism can be dismissed.

3.2.1.1.2 Evaluation--These check valves are in the steam supply line to the emergency feedwater pump turbine and perform safety functions open to admit steam to the turbine and closed to prevent reverse flow in case of a steam line rupture or faulty steam generator. The valves are full-stroke exercised open quarterly during testing of the turbine driven emergency feedwater pump. The only practical method of verifying valve reverse flow closure is to leak test or observe differential pressure across the valve in the reverse flow direction. It is impractical to perform this testing because the current system configuration does not have the necessary isolation valves or test taps. The Code required testing could only be performed after significant system modifications. Making significant system modifications to permit this testing would be burdensome for the licensee.

The licensee proposes to sample disassemble and inspect these valves during refueling outages per GL 89-04, Position 2. Disassembly, inspection and manual full-stroke of the valve disk can adequately ascertain a check valve's internal condition. However, disassembly and inspection should be used as a substitute for testing only when testing is impractical. The NRC staff positions regarding check valve disassembly are explained in detail in GL 89-04.

The licensee's program states that disassembly of the alternate valve will be performed if problems are found with the scheduled valve, unless a common mode failure mechanism can be dismissed. Position 2, specifies that if there is binding or failure of the valve internals, the remaining valves in that group must also be disassembled, inspected, and manually full-stroke exercised during the same outage. The licensee's alternative differs with the Generic Letter on this point but should be acceptable if an engineering evaluation is performed. This evaluation should be documented and include

adequate technical justification for not inspecting the remaining valve. If the valves or service conditions of a sampling group differ sufficiently that one valve could suffer a failure that would not be possible (common mode) in another group valve, the sample grouping may not be fully in accordance with the criteria of GL 89-04 and is not appropriate.

Position 2 of the Generic Letter also stipulates that a part-stroke exercise test using flow is expected to be performed after disassembly and inspection is completed, but before the valve is returned to service. This post-inspection testing provides a degree of confidence that the disassembled valve has been reassembled properly and that the disk moves freely. The licensee should exercise these valves with flow following reassembly but before returning them to service in accordance with GL 89-04.

The licensee's disassembly and inspection program, combined with an exercise test after reassembly, should adequately determine valve condition and provide reasonable assurance of operational readiness. However, the NRC staff considers valve disassembly and inspection to be a maintenance procedure with inherent risks which make its routine use as a substitute for testing undesirable when testing methods are possible. The licensee should actively pursue the use of non-intrusive diagnostic techniques such as acoustics or radiography to demonstrate that these valves close when flow through them ceases.

Based on the determination that compliance with the Code requirements is impractical and burdensome and considering that disassembly and inspection followed by a post-inspection exercise of the valve should provide reasonable assurance of valve operational readiness, relief may be granted provided the licensee exercises the valves open with flow after they have been reassembled. The licensee should investigate the use of other techniques, such as non-intrusive valve diagnostics, to verify the reverse flow closure capability of these valves. If another method is developed to verify the reverse flow closure capability of these valves, this relief request should be revised or withdrawn.

3.3 Reactor Coolant System

3.3.1 Category AC Valves

3.3.1.1 Relief Request RC-1. The licensee requests relief from the exercising and leak rate testing frequency requirements of Section XI, Paragraphs IWV-3521 and IWV-3422, for the HPSI to RCS hot leg injection check valves, 2SI-27A, 2SI-27B, 2SI-28A, and 2SI-28B, and proposes to monitor the low pressure side of the valves for leakage at least daily and to full-stroke exercise the valves during refueling outages when the reactor vessel head is removed.

3.3.1.1.1 Licensee's Basis for Requesting Relief--The absence of isolation valves on the downstream side does not allow individual leak rate testing of these valves. The low pressure side of these valves are monitored for back leakage. Furthermore, these valves cannot be full-stroke exercised during power operation because the high pressure injection pumps' maximum discharge pressure is less than the reactor coolant system pressure during normal operation. Full-stroke exercising during cold shutdown is impractical because the reactor coolant system lacks expansion volume to accommodate this

large volume of water, also the reactor vessel pressure-temperature limitations may be exceeded.

Alternate Testing: The alternative flow testing meets the requirements of GL 89-04, Position 1. ANO will monitor the low pressure side of these valves for indication of back leakage by observing pressure indicators 2PI-5105 and 2PI-5106 on a frequency of at least once every 24 hours. Furthermore, these valves will be full-stroke exercised during refueling outages with the reactor vessel head removed.

3.3.1.1.2 Evaluation--These valves are RCS boundary isolation valves that separate the RCS hot leg from the lower pressure HPSI system. Each pair of check valves is in a series configuration and has a safety function in both the open and closed positions. The demonstration of a full-stroke to the open position requires the passage of the maximum required accident flow through these valves. It is impractical to exercise these valves open during power operation because the HPSI pumps do not develop sufficient head to overcome RCS pressure. It is impractical to exercise them during cold shutdowns because there is insufficient expansion volume in the RCS and exercising these valves with flow could cause or contribute to a low temperature overpressurization of the RCS. Extensive system modifications, such as installing a full flow test loop, would be required to comply with the Code specified exercising frequency. Performing these modifications would be burdensome to the licensee. Full-stroke exercising these valves during refueling outages provides a reasonable assurance of the ability of these valves to perform their safety function in the open position.

Based on the determination that it is impractical and burdensome to full-stroke exercise these valves to the open position quarterly or during cold shutdowns, that the proposed testing provides a reasonable alternative to the Code exercising frequency, relief may be granted from the Code exercising frequency requirements for these valves.

These valves perform as boundary valves for the RCS. They are Categorized A/C and are required to be individually leak rate tested in accordance with Paragraphs IWV-3421 through -3427. However, it is impractical to individually leak test these valves because the system design does not include the necessary test connections. The licensee proposes to use an upstream pressure indicator to detect back leakage through these valves. The indicator will be monitored at least once a day. But that testing at its best verifies the reverse closure capability of one valve of the pair and does not quantify the leakage rate. Either of the valves could be stuck open and could go undetected with the proposed testing. The testing does not verify that each of these valves moves promptly to its seat upon cessation or reversal of flow (Category C test requirements) nor does it specifically access the seat leakage limiting capability of either valve (Category A test requirements). This proposal would verify the seat leakage limiting capability of only one valve at this boundary and could not identify a stuck open valve in the pair. Therefore, the proposal does not provide a reasonable alternative to the Code test requirements for closure. Long-term relief should not be granted as proposed.

The effectiveness of the licensee's proposal to monitor for a pressure increase upstream of these valves is predicated on the assumption that there is little or no leakage through the valves upstream of the pressure

instruments. The upstream valves are 2SI26A and 2CV5101-1 for the "A" train and valves 2SI26B and 2CV5102-2 for the "B" train. If significant back-leakage is detected during continuous monitoring, it is an indication of degradation in both valves. In that case, both valves should be declared inoperable and be repaired or replaced prior to their return to service.

The licensee has not demonstrated the impracticality or burden of measuring the combined leak rate for each pair of valves at least once each refueling outage, therefore that test should be done. The licensee's proposal allows an adequate assessment of operational readiness and provides a reasonable alternative to the Code requirements for an interim period provided the leakage rate through the pair is quantified at least each refueling outage. However, the proposal is not an adequate alternative for the long-term. The licensee should actively pursue the use of non-intrusive diagnostic techniques, such as those employing acoustics, magnetics, ultrasonics, or radiography. These techniques should be used to confirm that each of these valves moves promptly to its seat upon cessation or reversal of flow. The licensee should consider leak rate testing other upstream high-pressure line valves, such as 2SI-26A/B, to ensure that two valves are leaktight between the RCS and the lower pressure systems. The system prints show installed taps that could be used to leak rate test those valves. The licensee may also consider installation of test connections or other system modifications.

Based on the determination that immediate compliance with the Code requirements is impractical and burdensome and considering the licensee's proposal, interim relief should be granted for a period of one year or until the next refueling outage, whichever is longer, provided the leakage rate through the pair is quantified at least each refueling outage. By the end of the interim period the licensee should either comply with the Code requirements or implement a method of testing that provides a reasonable alternative to the Code requirements.

3.4 Safety Injection System

3.4.1 Category C and AC Valves

3.4.1.1 Relief Request SI-1. The licensee requests relief from the exercising frequency requirements of Section XI, Paragraph IWV-3521, for the following safety injection valves and proposes to full-stroke exercise the valves during refueling outages when the reactor vessel head is removed.

2SI-7A and -7B	HPSI pump suction check valves
2SI-10A, -10B, and -10C	HPSI pump discharge check valves
2SI-12	HPSI discharge header check valve
2SI-13A, -13B, -13C and -13D	HPSI cold leg injection check valves
2SI-26A and -26B	HPSI hot leg injection check valves

3.4.1.1.1 Licensee's Basis for Requesting Relief--These valves cannot be full-stroke exercised during power operation because the high pressure safety injection pumps maximum discharge pressure is less than the reactor coolant system pressure during normal operation. Full-stroke exercising during cold shutdown is impractical because the reactor coolant system lacks adequate expansion volume to accommodate this large volume of water, also the reactor vessel pressure-temperature limitations may be exceeded.

Alternate Testing: The alternative flow testing performed on these valves meets the requirements of GL 89-04, Position 1. These valves will be full-stroke exercised during refueling outages with the reactor vessel head removed.

3.4.1.1.2 Evaluation--The demonstration of a full-stroke to the open position requires the passage of the maximum required accident flow through these valves. It is impractical to exercise these valves open during power operation because the HPSI pumps do not develop sufficient head to overcome RCS pressure. It is impractical to exercise these valves during cold shutdowns because there is insufficient expansion volume in the RCS and exercising these valves with flow could cause or contribute to a low temperature overpressurization of the RCS. Extensive system modifications, such as installing a full flow test loop, would be required to comply with the Code specified testing frequency. Performing these modifications would be burdensome to the licensee. The proposed testing provides a reasonable assurance of the ability of these valves to perform their safety function in the open position.

Based on the determination that compliance with the Code required testing is impractical and burdensome and considering that the proposed testing provides a reasonable alternative to the Code required testing frequency, relief may be granted as requested.

APPENDIX A
IST PROGRAM ANOMALIES

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Summarized below are inconsistencies and omissions in the IST program noted during this review. The licensee should resolve these items as indicated.

1. PR-4 requests relief from the full-scale range requirements of Section XI for the flow rate instruments used to test the charging pumps. The licensee proposes to measure pump flow rate using the installed flow rate instruments. The purpose of the instrument quality and full-scale range requirements is to ensure that the test measurements provide information that is sufficiently accurate and repeatable to monitor pump condition and detect degradation. The licensee has not provided information on the installed instrumentation with the detail necessary to completely evaluate this request for relief. Long term relief should not be granted for instrumentation that may not be sufficiently accurate or repeatable to assess pump condition. To obtain long term relief, it is necessary to specifically address the instrument data (accuracies, reference values, and ranges) and demonstrate that it is adequate to detect pump degradation. Additionally, this relief request should identify the burden of using test or portable instruments that meet the Code requirements. Immediate compliance with the Code requirements would be a hardship on the licensee without a compensating increase in the level of quality and safety. Interim relief should be granted for one year or until the next refueling outage, whichever is longer. (Refer to Section 2.3.1.1 of this TER)

2. PR-5 requests relief from measuring pump vibration displacement in accordance with the requirements of Section XI for all pumps in the IST program and proposes to measure pump vibration in accordance with OM-6 utilizing velocity in lieu of displacement. Measuring pump vibration in velocity units is at least equivalent to the Code requirements and is an acceptable alternative. ANSI/ASME OM-6 provides a pump vibration testing program and set of allowable ranges for pump vibration velocity measurements that has been found to be acceptable by the NRC. The licensee indicated that they are using the ranges and limits specified in ASME OM-6. The licensee further proposed to conduct vibration measurements in accordance with OM-6 for all pumps in their IST program. Therefore, relief should be granted from the Code requirements as requested provided the licensee complies with all the vibration measurement requirements of OMa-1988, Part 6. (Refer to Section 2.1.2.1 of this TER)

3. GR-1 requests relief from verifying remote position indication in accordance with the requirements of Section XI for the applicable solenoid operated valves, and proposes to verify remote position indication by monitoring normal system parameters during valve operation. System response to valve position changes can accurately reflect valve position. It appears that the licensee is only verifying the indication of these valves in their safety function position. To meet the Code requirement it is necessary to verify the accuracy of the position indication with the valve in both the open and the closed positions regardless of the valve's safety function. Relief should be granted provided the accuracy of the position indication is verified with the

valve; in both the open and the closed positions. (Refer to Section 3.1.1.1 of this TER)

4. GR-3 requests relief from performing component repair prior to plant startup as required by Section XI and proposes to use the plant startup criteria specified in the ANO Technical Specifications. Section XI requires repairs on a valve that fails a Code required exercise or stroke time test to start immediately. As soon as it is recognized that the test measurements exceed the Code limits, the valve is considered inoperative and if the test failure occurs during cold shutdown, the repairs must be made prior to startup. Basing plant startup on the Plant Technical Specifications would provide an acceptable level of quality and safety provided the Technical Specifications specifically address the out of service valve or its associated system and permit plant startup when the valve is inoperable. Relief should be granted provided the Technical Specifications specifically address the valve or its associated system and permit plant startup when the valve is inoperable. Additionally, if corrective action for a valve is deferred under this relief request, prior to entering an operating mode where the valve is required to be operable, the valve should be repaired or replaced and successfully tested. (Refer to Section 3.1.2.1 of this TER)

5. In Relief Requests EFW-1, SGS-1, SW-1, SI-2, CS-1, and CS-2 the licensee proposes to verify the full-stroke capability of the listed valves by sample disassembly, inspection, and manual exercise of the valve disks during refueling outages. Relief is granted by GL 89-04 to use check valve disassembly, inspection, and manual exercise of the disk in lieu of the Code required full-stroke exercise open when it is impractical to perform or verify a full-stroke exercise open by some testing technique. However, the NRC staff considers valve disassembly and inspection to be a maintenance procedure with inherent risks which make its routine use as a substitute for testing undesirable when testing methods are possible. The licensee should actively pursue the use of non-intrusive diagnostic techniques such as magnetics, acoustics, or ultrasonics to demonstrate that these valves are full-stroke exercised with flow.

   To obtain relief to use disassembly and inspection in lieu of testing, the disassembly should be performed in accordance with Position 2 of the Generic Letter. These relief requests indicate that the alternate testing is performed in accordance with Position 2, however, no mention is made of post-inspection exercising of these valves. Position 2 stipulates that a part-stroke exercise test using flow is expected to be performed after disassembly and inspection is completed, but before the valve is returned to service. This post-inspection testing provides a degree of confidence that the disassembled valve has been reassembled properly and that the disk moves freely. The licensee should part-stroke exercise these check valves following reassembly or develop an alternate post-inspection test that provides reasonable assurance that the valves have been reassembled properly.

6. In disassembly and inspection Relief Requests EFW-1, SGS-1, SW-1, CS-1, and CS-2 the licensee states that disassembly of the other group valve(s) will be performed if problems are found with the scheduled valve, unless a common mode failure mechanism can be dismissed. GL 89-04, Position 2, specifies that if there is binding or failure of the valve internals, the

remaining valves in that group must also be disassembled, inspected, and manually full-stroke exercised during the same outage. The licensee's alternative differs with the Generic Letter on this point but should be acceptable if an engineering evaluation is performed. This evaluation should be documented and include adequate technical justification for not inspecting the remaining group valve(s). If the valves or service conditions of a sampling group differ sufficiently that one valve could suffer a failure that would not be possible (common mode) in another group valve, the sample grouping may not be fully in accordance with the criteria of GL 89-04 and may not be appropriate. (Refer to Section 3.2.1.1 of this TER)

7. RC-1 requests relief from the exercise and leak rate test method and frequency requirements of Section XI for the high pressure safety injection to RCS hot leg injection check valves, 2SI-27A, 2SI-27B, 2SI-28A, and 2SI-28B, and proposes to monitor the low pressure side of the valves for leakage at least daily and to full-stroke exercise the valves during refueling outages when the reactor vessel head is removed. Relief should be granted from the Code exercising (open) frequency requirements for these valves.

   These Category AC valves perform as boundary valves for the RCS. The Code requires them to be leak rate tested individually. In this case that is impractical because these valves are paired in series without intermediate test connections. The licensee proposes to use an upstream pressure indicator to detect back leakage through these valves. The indicator will be monitored once a day. But, that testing at its best verifies only the reverse closure capability of one valve of the pair and does not quantify the leakage rate. The series pair should be leak rate tested at least each refueling outage.

   The licensee should actively pursue the use of non-intrusive diagnostic techniques, such as those employing acoustics, magnetics, ultrasonics, or radiography to confirm that each of these valves moves promptly to its seat upon cessation or reversal of flow. Also, regarding the series PIV leak rate testing requirement, the licensee should consider leak rate testing other upstream valves in this high-pressure line, such as 2SI-26A/B, which appear to have existing test taps. The licensee may also consider installation of test connections or other system modifications.

   Interim relief should be granted for one year or until the next refueling outage, whichever is longer, provided the leakage rate through the pair is quantified at least each refueling outage. By the end of the interim period the licensee should either comply with the Code requirements or implement a method of testing that provides a reasonable alternative to the Code requirements for each of these valves. (Refer to Section 3.3.1.1 of this TER)

8. The IST program does not include a description of how the components were selected and how testing requirements were identified for each component. The review performed for this Safety Evaluation (SE)/TER did not include verification that all pumps and valves within the scope of 10 CFR 50.55a and Section XI are contained in the IST program, and did not ensure that all applicable testing requirements have been identified. Therefore, the

licensee is requested to include this information in the IST program. The program should describe the development process, such as a listing of the documents used, the method of determining the selection of components, the basis for the testing required, the basis for categorizing valves, and the method or process used for maintaining the program current with design modifications or other activities performed under 10 CFR 50.59.