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TECHNICAL EVALUATION REPORT
PUMP AND VALVE INSERVICE TESTING PROGRAM
DUANE ARNOLD ENERGY CENTER

Docket No. 50-331

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ABSTRACT

This EG&G Idaho, Inc., report presents the results of our evaluation of the Duane Arnold Energy Center, Inservice Testing Program for pumps and valves whose function is safety-related.

PREFACE

This report is supplied as part of the "Review of Pump and Valve Inservice Testing Programs for Operating Reactors (III)" program being 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 Unit.

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1. INTRODUCTION

This is a technical evaluation of relief requests in the pump and valve inservice testing (IST) program for Duane Arnold Energy Center (DAEC) submitted by Iowa Electric Light and Power Company.

With a letter dated January 5, 1990, Iowa Electric Light and Power Company submitted Revision 9 of the DAEC IST Program. A working meeting with NRC, EG&G Idaho, and Iowa Electric Light and Power Company representatives was conducted August 8, 1990. Based on discussions during the meeting, the licensee submitted revised relief requests by letters dated October 15, 1990 and December 31, 1990. The licensee's IST program covers the second ten-year interval, which runs from February 1, 1985 to February 1, 1995. The relief requests pertain to requirements of the ASME Boiler and Pressure Vessel Code (the Code), Section XI, 1980 Edition through Winter 1981 Addenda and 10 CFR 50.55a.

Iowa Electric Light and Power Company requested relief from the Code testing requirements for specific pumps and valves. These requests were reviewed using the acceptance criteria of 10 CFR 50.55a and NRC Generic Letter No. 89-04 (GL 89-04), "Guidance on Developing Acceptable Inservice Testing Programs."

These TER relief request evaluations are applicable only to the components or groups of components identified by the submitted relief requests. These evaluations may not be extended to apply to similar components that are not identified by the request at this or another comparable facility without separate review and approval by the 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.

Section 2 of this report presents the evaluations and conclusions for the Duane Arnold Energy Center pump testing program relief requests that were submitted, or substantially revised, since the issuance of Generic Letter No. 89-04. Similar information is presented in Section 3 for the valve testing program. The licensee's IST program relief requests that were current on April 3, 1989 were approved by this Generic Letter. These pre-approved relief requests were also reviewed but are not evaluated in this report.

Anomalies noted in the licensee's program during the course of this review, including pre-approved relief requests, are listed in Appendix A. The licensee should resolve these items in accordance with the evaluations, conclusions, and guidelines presented in this report.

The review of the Iowa Electric Light and Power Company justifications for exercising Category A, B, and C valves during cold shutdowns and refueling outages instead of quarterly during power operation found these justifications to be acceptable except as noted in Appendix A.

2. PUMP TESTING PROGRAM

The following relief requests were evaluated against the requirements of the 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. They are grouped according to topic or system.

2.1 Multiple Pumps

2.1.1 Inservice Test Procedure

2.1.1.1 Relief Request. The licensee has requested relief from the pump test procedure requirements of Section XI, Paragraph IWP-3100, for the pumps listed below. The licensee has proposed measuring the flow rate and differential pressure at points above and below the established reference flow rate and determining the corresponding differential pressure using linear interpolation between the two measured values.

Pump Number	Description
1P-117A, B, C, D	River water pumps
1P-221A, B	Core spray pumps
1P-226	Reactor core isolation cooling (RCIC) pump
1P-229A, B, C, D	Residual heat removal (RHR) pumps

2.1.1.1.1 Licensee's Basis For Requesting Relief--Operating experience has shown that flow rate (independent variables during inservice performance testing) for these pumps cannot be readily duplicated with the present flow control systems. Flow control for these systems can only be accomplished through the operation of relatively large gate and globe valves as throttling valves. Because these valves are not generally equipped with position indicators which reflect percent open, the operator must repeatedly "jog" the motor or air operator to try to make adjustments in flow rate. These efforts, to exactly duplicate the reference values, would require excessive valve manipulation which could ultimately result in damage to valves or operators.

The alternative approach calls for the establishment of reference values for flow rate and differential pressure during a reference value test. The reference flow rate (Q_r) and differential pressure (dP_r) define a point on the pump performance curve. If the pump characteristics were to degrade during time, the pump would operate on a different curve. Given that Q_r cannot be duplicated exactly in subsequent tests, inservice tests will be performed by taking two sets of measurements and establishing a dP which corresponds to Q_r for the inservice test as described.

After the pump has run for at least five minutes, a flow rate will be obtained which is lower than the reference flow rate (Q_r) but greater than a specified lower limit as established in the test procedure. When the lower flow rate (Q_l) is established, the suction pressure during testing (P_{il}) and the discharge pressure (P_{dl}) will be measured. The differential pressure (dP_l) corresponding to the lower flow rate is computed by:

$$dP_l = P_{dl} - P_{il}$$

After the test quantities corresponding to Q_l have been recorded, the flow rate is adjusted to a value higher than Q_r but less than a specified upper limit as established in the test procedure. When the higher flow rate (Q_h) is established, the suction pressure and discharge pressure will be measured and the differential pressure (dP_h) corresponding to Q_h will be computed. Two points have been established that define a small portion of the pump curve. By linear interpolation between the two points, a differential pressure corresponding to Q_r can be computed. The general equation at the line between points (Q_l, dP_l) and (Q_h, dP_h) is:

$$dP = a - bQ$$

Writing the above equation in terms of Q_l, dP_l, Q_h, and dP_h and solving for Q_r yields:

$$dP = dP_l + [(dP_l - dP_h)/(Q_h - Q_l)](Q_l - Q_r)$$

Assuming that the pump curve is nearly linear between Q_l and Q_h, this equation gives an accurate value for dP which corresponds to Q_r. The precise value of dP obtained analytically can then be compared to the Alert and Required Action limits which are computed using dP_r.

The major assumption in the approach described above is that the pump curve is nearly linear between Q_l and Q_h. Therefore, values for Q_l and Q_h should fall within a narrow range of Q_r so that the curve in that range approaches linearity. The appropriate flow rate range between the lower and upper procedural limits have been determined on a pump by pump basis.

2.1.1.1.2 Evaluation--Accurately duplicating the independent reference variable during inservice testing for these pumps requires excessive valve manipulation due to the lack of a precise means of throttling the pump flow rate. Jogging these valves in an attempt to set the flow rate or differential pressure reasonably close to the reference value results in excessive valve wear.

The licensee has proposed measuring the flow rate above and below the reference value and calculating the differential pressure corresponding to the reference flow rate. The calculation is based on the assumption that the variation of differential pressure with flow rate is approximately linear if the region bounded by the two measured points is small enough. This assumption is conservative in a stable region of the pump curve because the more curved the line segment is in this region, the closer the calculated differential pressure will be to the Alert or Required Action Ranges.

The licensee's proposed method of calculating differential pressure and their proposed test procedure would be sufficient to detect and trend hydraulic degradation for these pumps and would, therefore, provide an acceptable level of quality and safety. Therefore, relief from the Code Inservice Test procedure requirements may be granted as requested.

2.1.2 Allowable Ranges of Test Quantities

2.1.2.1 Relief Request. The licensee has requested relief from the differential pressure or flow rate allowable range requirements of

Section XI, Paragraph IWP-3200, for the pumps listed below. The licensee has proposed establishing the upper Alert Range at 103 percent of reference and the upper Required Action Range at 105 percent of reference.

Pump Number	Description
1P-117A, B, C, D	River water supply pumps
1P-44A, B	Diesel fuel oil transfer pumps
1P-230A, B	Standby liquid control pumps pump
1P-226	RCIC pump

2.1.2.1.1 Licensee's Basis for Requesting Relief--An analysis of the dependent variable for each of the systems is provided in the following paragraphs. The limits identified will provide adequate detection of pump degradation without unnecessarily causing safety systems to be declared inoperable.

Reactor core isolation cooling: For test results spanning the last four years, over one third of the tests would have been in either the alert status or required action range if the tests had been evaluated using the Code tolerances. Based on a comprehensive review of the test results, the variation in test results is due to data scatter. Detailed evaluations have determined that the pump has always been capable of performing its safety function.

River water supply, diesel fuel oil, standby liquid control: Due to the small values of the dependent variable for these pumps, the Code allowed ranges are a fractional value of 1 psi or 1 gpm. Deviation from the reference value of 2 percent (Alert Range) or 3 percent (pump inoperability) is not necessarily indicative of pump degradation. From a review of pump performance test results spanning the last four years, normal data scatter, while less than two whole units of measure, has frequently exceeded or nearly exceeded the Code tolerances. Note: The test instrumentation used exceeds the Code required accuracy so that small changes can be detected. Use of instrumentation of the Code specified accuracy would not be capable of reliably detecting these small changes.

River water supply: These pumps are the most erratic performers in terms of IST results. Some of the significant data scatter problems associated with the river water pumps are caused by the manner in which they were previously tested. Specifically, these pumps are not operated continuously and are subject to silt buildup around the base of the pump. When started for surveillance testing, the silt buildup is picked up by the pump and may cause performance anomalies if the pump is not allowed to run for a reasonable time period before test data is recorded. Two actions are currently underway to mitigate the effects of silt buildup on the pump surveillance test results. The first action is a revision to the STP to require that the pump be run for at least 30 minutes prior to recording test data. This will allow the silt buildup to be dispersed and the pump performance to stabilize. The second action involves the installation of vanes in the river bed to reduce the silt problems in front of and within the intake structure. When sufficient performance test data has been obtained, these pumps and their acceptance criteria will be reevaluated. Additionally, due to their harsh operating environment, these pumps are in a preventative maintenance program which will require each pump to be pulled, inspected, and refurbished/rebuilt or replace approximately every four years. Therefore, on the average, one pump will be inspected each year.

These pumps will be tested in accordance with Subsection IWP with the following exceptions:

a) The upper Alert Range will be represented by values greater than 103 percent and less than 105 percent of the reference value for the test parameters of flow rate and differential pressure.

b) The upper Required Action Range will be represented by values greater than 105 percent of the reference value for the test parameters of flow rate and differential pressure.

2.1.2.1.2 Evaluation--The upper range limit insures that reference values are not set too low and also identifies instrumentation problems. However, variations in pump test results exceeding the upper allowable range limits of Table IWP-3100-2 may occur, even when using valid reference values and instruments that meet the Code accuracy requirements, due to additional variables such as equipment design and system conditions. If the limits of the Code cannot be met. Paragraph IWP-3210 allows the licensee to specify new range limits. If new range limits are specified, the licensee should demonstrate in their program: (1) that the Code limits cannot be met on a pump specific basis and, (2) that with less conservative ranges a degraded pump hydraulic condition can be detected and appropriate corrective action taken. Therefore, relief from the Code allowable range requirements for flow rate or differential pressure is not required, however, the licensee should document the above information in their IST program.

2.2 Diesel Fuel Oil

2.2.1 Measurement of Pump Vibration

2.2.1.1 Relief Request. The licensee has requested relief from the pump vibration measurement requirements of Section XI, Paragraph IWP-3100, for the diesel fuel oil transfer pumps, 1P-44A and -44B. The licensee has proposed disassembling, inspecting, and rebuilding these pumps every other refueling outage.

2.2.1.1.1 Licensee's Basis for Requesting Relief--The diesel fuel oil pumps and motors are submerged inside the diesel fuel oil tank (1T-35) and thus are inaccessible for the purpose of taking such measurements. The installation of accelerometers on the pumps is deemed impractical due to the environmental conditions involved and the impracticality of removing the pumps periodically to calibrate and/or repair the accelerometers. Additionally, since the accelerometers would be inaccessible, any abnormal indications from the equipment might be related to a hardware problem that could not be verified without the removal of the pump.

The diesel fuel oil transfer pumps are included in the DAEC Preventative Maintenance Program and are removed, disassembled, inspected and rebuilt every other outage. The pumps are inspected for signs of mechanical wear or vibration induced damage. Detailed measurements with a micrometer are taken and the condition of the pump is compared with the manufacturer's tolerances. Any adverse conditions are noted and corrected before the pumps are reassembled and placed back into service. Proper pump operation is verified by conducting the quarterly pump surveillance prior to the pump being declared operable.

The results of the most recent inspection (November 1988) revealed that the pumps are in "like new" condition after more than fourteen years of service.

Bearing vibration measurements are taken to detect (indirectly) evidence of mechanical degradation. Duane Arnold's preventative maintenance activities are tailored to inspect (directly) for evidence of degradation. No additional testing is necessary because Duane Arnold's combination of historical data and preventative maintenance is superior to the indirect test required by the Code. The pumps will be disassembled and inspected in accordance with the DAEC Preventative Maintenance Program.

2.2.1.1.2 Evaluation--These pumps and their motors are inaccessible for vibration measurement because they are submerged in the diesel fuel oil tank. Installing accelerometers on the pumps is not feasible since they would also have to be immersed in oil which could result in equipment malfunction. Further, the pumps would have to be removed from the tank periodically to calibrate the accelerometers and to verify that the accelerometers and wiring were functioning correctly if abnormal indications were received during testing.

Vibration measurements could be obtained for these pumps only after significant system modifications which would be burdensome for the licensee due to the costs involved. The maintenance history of these pumps indicates that very little mechanical degradation has occurred since the pumps were placed in service. The licensee has proposed that these pumps be removed, disassembled, inspected by comparing precise physical measurements to manufacturer's tolerances and repaired if necessary, followed by quarterly pump surveillance testing prior to declaring the pump operable. The licensee's proposed alternative would provide reasonable assurance of operational readiness provided the licensee performs inservice tests to verify the hydraulic performance of these pumps after installation as outlined in IWP-3111.

Based on the determination that the Code required testing is impractical, that the licensee's proposed alternative would provide reasonable assurance of operational readiness, and considering the burden on the licensee if the Code requirements were imposed, relief may be granted provided the licensee performs inservice tests to verify the hydraulic performance of these pumps after installation as outlined in IWP-3111.

2.3 High Pressure Coolant Injection

2.3.1 Test Procedure

2.3.1.1 Relief Request. The licensee has requested relief from the test procedure requirement of Section XI, Paragraph IWP-3100, for the HPCI pump, 1P-226. The licensee has proposed using an empirically derived pump curve as reference values over a limited range of pump operation in lieu of varying the system resistance until the independent variable equals the reference value.

2.3.1.1.1 Licensee's Basis for Requesting Relief--Operating experience has shown that flow rates (independent variables during inservice performance testing) for the HPCI pump cannot be readily duplicated with the present flow control systems. Efforts to exactly duplicate the reference values would require excessive valve manipulation which could ultimately result in damage to valves or operators. In order to perform accurate trending and data analysis, the use of an accurate reference value is very important. The complexities of the flow control systems found within these systems make it extremely difficult to exactly duplicate the reference valves.

Pump differential (discharge) pressure and flow rate will be evaluated using a reference value test derived pump curve. The reference value test pump curve will cover a limited range of pump operation. The reference value test pump curve will be restricted to an operating regime that is representative of accident conditions, or conditions that are the most sensitive indicator of pump degradation.

Based on the reference value test pump curve, a series of "parallel" acceptance criteria curves will be established for Required Action Range and Alert Range limits. Both upper and lower limits will be established.

The reference value curve will be established by measuring five (5) to eight (8) sets of differential pressure/flow data when the equipment is known to be operating acceptably. The measurements will be distributed (as uniformly as possible) across the entire range of potential inservice test conditions.

The reference value curve will be computed using a third order polynomial regression technique that employs a least-squares fit of the data by successive polynomials of order 1 through 3. The standard deviation about the regression line will be evaluated for each case. The resulting reference value curve is expressed as a third order polynomial in the general form:

$$y = a_3x^3 + a_2x^2 + a_1x + a_0$$

where: y = dependent variable
x = independent variable

The Required Action and Alert Range curves will be scaler multiples of the reference value curve:

- 1.075 - Upper Required Action Range limit
- 1.05 - Upper Alert Range limit
- 0.94 - Flow lower Alert Range limit, or
- 0.93 - Differential pressure lower Alert Range limit
- 0.90 - Lower Required Action Range limit

Since the typical curve may be subject to interpretation, a tabular summary of the acceptance criteria will actually be used to evaluate the inservice test results.

The measurements taken during an inservice test will be restricted. Only test measurements within the envelope of reference value test measurements will be acceptable. The inservice test differential pressure/flow will be plotted on the pump curve, noted on the acceptance criteria table, and included in the permanent test records.

Finally, the combined differential pressure/flow test measurement will be evaluated for changes from test-to-test. While the "points" on the curve cannot be trended in a meaningful way, the differential pressure/flow data can be "normalized". The normalized value can be trended across time to determine whether pump hydraulic performance is degrading. The normalized value of differential pressure/flow is defined as the ratio:

$$y_n = y / (a_3x^3 + a_2x^2 + a_1x + a_0)$$

where:

y_n = normalized dependent variable
y = actual test measurement of the dependent variable
x = actual test measurement of the independent variable

2.3.1.1.2 Evaluation--Accurately duplicating the independent reference variable during Inservice Testing for these pumps requires excessive valve manipulation due to the lack of a precise means of throttling the pump flow rate. Jogging these valves in an attempt to set the flow rate or differential pressure reasonably close to the reference value may result in excessive valve wear.

The licensee has proposed using a reference pump curve generated using a third order least-squares fit with five to eight data points over a limited range of pump operation. The example curve provided by the licensee has a 500 gpm range for flow rate and a 350 psig range for differential pressure. Parallel curves representing the lower and upper Alert and Required Action Range limits are multiples of the equation for the reference pump curve. The allowable ranges of flow rate and differential pressure are the same as the Code ranges except that the licensee has proposed using an upper Alert Range limit 5% above the reference value and an upper Required Action limit 7.5% above the reference value.

Using a reference pump curve to compare differential pressure and flow rate for pump inservice testing may provide an acceptable alternative to the Code requirement that one or more fixed sets of readily duplicated reference values be defined for each pump. However, it is important that the reference pump be reverified anytime pump maintenance or repairs are done that could affect the performance of a pump and, since the levels of vibration may vary significantly over the range of pump operation, the licensee should develop a method of assigning vibration reference values and acceptance criteria that would be equivalent to the Code requirements. If new range limits are specified in accordance with IWP-3210, the licensee should demonstrate in their program: (1) that the Code specified limits cannot be met on a pump specific basis and, (2) that with the less conservative ranges a degraded pump condition can be detected and appropriate corrective actions taken.

The licensee's proposed alternative to the Code requirements would be sufficient to detect and trend hydraulic degradation for these pumps and would, therefore, provide an acceptable level of quality and safety. Relief from the Code inservice test procedure requirements may be granted provided the licensee tests this pump as outlined above.

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3. VALVE TESTING PROGRAM

The following relief requests were evaluated against the requirements of the 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. They are grouped according to topic or system.

3.1 General Relief Requests

3.1.1 Relief Valve Testing

3.1.1.1 Relief Request. The licensee has requested relief from the relief valve testing requirements of Section XI, Paragraph IWV-3512, for the safety and relief valves listed below. The licensee has proposed testing these valves in accordance with ANSI/ASME OM-1-1981 in lieu of ASME/PTC 25.3-1976.

PSV-1911	PSV-1952	PSV-1975	PSV-1988
PSV-2043	PSV-2057	PSV-2068	PSV-2102
PSV-2109	PSV-2122	PSV-2129	PSV-2223
PSV-2228	PSV-2301	PSV-2430	PSV-2474
PSV-2501	PSV-2607	PSV-2609	PSV-3221A
PSV-3221B	PSV-3222A	PSV-3222B	PSV-3223A
PSV-3223B	PSV-4336	PSV-4439A	PSV-4439B
PSV-4439C	PSV-4439D	PSV-4439E	PSV-4439F
PSV-4842			

3.1.1.1.1 Licensee's Basis for Requesting Relief--ANSI/ASME OM-1-1981, "Requirements for Inservice Performance Testing of Nuclear Power Plant Pressure Relief Devices," was developed to supercede the requirements of Subsection IWV-3510. This standard is more definitive and better suited to operational testing than is ASME/PTC 25.3-1976 which is referenced in IWV-3512. Safety and relief valves will be tested in accordance with the requirements of ANSI/ASME OM-1-1981.

3.1.1.1.2 Evaluation--In the 1986 Edition of the Code, ANSI/ASME OM-1 replaced ASME/PTC 25.3-1976 as the standard for safety and relief valve testing. ANSI/ASME OM-1 stipulates an upper setpoint drift limit of 3% of the setpoint pressure, but does not address lower setpoint drift.

Experience with safety valves currently used in nuclear power plants indicates that normal expected setpoint drift is within ±3%. Setpoint drift outside this range is generally indicative of mechanical or human error problems. Additionally, if a relief valve's setpoint is found, during testing, to be outside the tolerance of the original construction code the setpoint should be restored to within the specified initial tolerance prior to reinstallation.

With a setpoint drift limit of ±3% of the setpoint pressure and the requirement that the setpoint be restored to within the specified initial tolerance prior to relief valve reinstallation, ANSI/ASME OM-1 would provide an acceptable level of quality and safety. Therefore, relief may be granted provided the licensee incorporates these additional requirements.

3.1.2 Fail-safe Testing

3.1.2.1 Relief Request. The licensee has requested relief from the Section XI, Paragraph IWV-3415, requirement that valves with fail-safe actuators be verified to stroke to their fail-safe positions upon the loss of actuator power. The licensee has proposed that normal stroking to the fail-safe position be considered a fail-safe test for most valves.

3.1.2.1.1 Licensee's Basis for Relief--Solenoid valves which control the air supply to air-operated valves and direct solenoid-operated valves must stroke to their fail-safe position upon interruption of their electric power or air supply (FST). De-energizing the solenoid valve has the same effect as loss of electrical power or loss of control air. Therefore, stroking the valve from the control room (BTO, BTC) to its fail-safe position constitutes a fail-safe test for most valves.

For most configurations, normal stroking (BTO, BTC) to the fail-safe position of valves equipped to fail open or closed constitutes an FST. No additional testing of these valves is necessary.

Where complicated fail-safe configurations exist, or where test solenoids are provided, a separate fail-safe test, utilizing the proper solenoids and/or methods are used to verify true fail-safe operation. The following valves are tested to their fail-safe position by means other than normal stroking:

MSIVs	-	CV-4412, CV-4413, CV-4415, CV-4416, CV-4418, CV-4419, CV-4420, CV-4421
CRD	-	CV-1849, CV-1850
*Service Water	-	CV-4909, CV-4914, CV-4915

*Note: A modification is planned to install necessary controls for the individual fail-safe testing of these valves. This modification will be complete by July 5, 1991.

3.1.2.1.2 Evaluation--The Code specifies that valves with required fail-safe positions be tested quarterly by verifying that they move to their fail-safe positions when the actuator power is removed. If normal stroking to the fail-safe position is not accomplished by use of a valve's fail-safe actuator then a normal stroke would not constitute a fail-safe test. However, if normal stroking of a valve to its fail-safe position has the same effect as the loss of actuator power (e.g. - the control switch denergizes an electrically operated valve or, operates a solenoid valve which isolates and vents the motive gas from a pneumatic operated valve) then a normal exercise test to the fail-safe position would be equivalent to the requirement of IWV-3415.

The licensee's basis for relief lists main steam, control rod drive, and service water valves that are fail-safe tested by means other than normal stroking. The licensee's fail-safe test method and frequency are not specified, therefore, evaluation is not possible and no relief is granted for these valves.

The licensee's proposed testing would provide an acceptable level of quality and safety for those valves for which normal exercising has the same effect as the loss of actuator power and relief may be granted as requested for those valves only.

3.2 Multiple Systems

3.2.1 Category C Valves

3.2.1.1 Relief Request. The licensee has requested relief from the check valve exercising frequency and method requirements of Section XI, Paragraph IWV-3520, for the valves listed below. The licensee has proposed performing disassembly and inspection every refueling outage for individually listed valves and sample disassembly and inspection for groups of identical valves in similar applications:

Valve Group	Function
* V-22-064, V-22-063 V-24-046, V-24-047	HPCI/RCIC vacuum breaker check valves
V-22-021, V-22-028 V-22-029, V-24-012	HPCI exhaust drainpot drain condensate to torus check valve, HPCI/RCIC lube oil cooling water and condensate return check valves
V-22-022	HPCI exhaust drainpot drain check valve
V-24-009	RCIC Barometric condenser check valve
V-24-010	RCIC Barometric condenser check valve
V-25-006	RCIC minimum flow line check valve
* V-23-014	HPCI minimum flow line check valve

3.2.1.1.1 Licensee's Basis for Requesting Relief--Verification of maximum accident required flow to verify stroke-open position is not possible without extensive equipment modification. Disassembly and inspection of these valves, either quarterly during operation or during cold shutdown, would require major system operating restrictions.

All valves, except those indicated by an asterisk (*) will be partial stroke tested by performance of the respective quarterly system surveillance. The asterisked valves have no means to verify partial stroking during performance of quarterly system surveillance testing.

The group of valves, indicated by an asterisk, are sized for maintaining a specified flow so that full flow testing is not possible. For valve V-23-014, the HPCI system response time to attain 3000 gpm is less than 25 seconds and thus does not provide sufficient time to verify operation of this minimum flow check valve before MO-2318, minimum flow isolation, closes.

During refueling outages each of the individually listed valves will be disassembled and inspected in accordance with the requirements of USNRC Generic letter 89-04 for full stroke operability. One valve of each group of identical valves in similar applications will be disassembled and inspected (in rotation) each refueling outage. With eighteen month refueling cycles, all valves in a group of four would be tested approximately every six years. Disassembled valves will be part-stroke exercised and/or reverse flow tested prior to returning them to service following reassembly as indicated in Table 1, which is a summary of the program requirements and the testing that will be performed on each valve.

The use of non-intrusive testing equipment commercially available has been evaluated and a system was found that promises acceptable results. Procurement efforts are under way and implementation of a program using this system will begin by the end of 1991. Upon satisfactory implementation of the program, the current disassembly and inspection program may be phased out.

3.2.1.1.2 Evaluation--The licensee has proposed verifying the full-stroke capability of these check valves using disassembly and inspection. The NRC staff positions regarding check valve disassembly and inspection are explained in detail in GL 89-04. The Minutes of the Public Meetings on Generic Letter 89-04 regarding Position 2, Alternatives to Full Flow Testing of Check Valves, further stipulate that a partial stroke exercise test to the open position 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.

Table 1. Check Valve Testing for Relief Request VR-05I

Valve No.	Code Required	Possible Testing Quarterly	Possible Testing Cold Shtdn	Testing After Disassembly & Insp.	
V-22-021	CT-CC, CT-CO AT-03	CT-PO	CT-CC	AT-03, CT-PO	(1)
V-22-022	CT-CC, CT-CO AT-03	CT-PO	CT-CC	AT-03, CT-PO	(1)
V-22-028	CT-CO	CT-PO	N/A	CT-PO	
V-22-029	CT-CO	CT-PO	N/A	CT-PO	
V-22-063	CT-CC, CT-CO AT-03	N/A	CT-CC, CT-PO	AT-03, CT-PO	(1)
V-22-064	CT-CC, CT-CO AT-03	N/A	CT-CC, CT-PO	AT-03, CT-PO	(1)
V-23-014	CT-CO	N/A	N/A	NONE	
V-24-009	CT-CC, CT-CO	CT-PO	N/A	CT-PO	(1)
V-24-010	CT-CC, CT-CO	CT-PO	N/A	CT-PO	(1)
V-24-012	CT-CC, CT-CO	CT-PO	N/A	CT-PO	
V-24-046	CT-CC, CT-CO AT-03	N/A	CT-CC, CT-PO	AT-03, CT-PO	(1)
V-24-047	CT-CC, CT-CO AT-03	N/A	CT-CC, CT-PO	AT-03, CT-PO	(1)
V-25-006	CT-CO	N/A	N/A	NONE	(1,2)

Legend:
- CT-CC Full exercise closed
- CT-CO Full exercise open
- CT-PO Partial exercise open
- AT-03 Seat leakage test performed during refueling outages

Notes:

(1) These valves were disassembled and inspected during the 1990 refueling outage under the check valve maintenance program. All were found to be in good condition.

(2) The use of ultrasonic flow meters to determine flow is being evaluated and if flow measurements are acceptable, disassembly and inspection of these valves may be discontinued.

GL 89-04 establishes the criteria for sample groups when using sample disassembly and inspection. Each valve of a sample group should have the same design (manufacturer, size, model, and materials of construction), the same service conditions (flow rate, frequency of operation, and environmental conditions), and the same orientation (physical orientation and the same relative orientation to the major components within a system).

Disassembly and inspection, combined with a part-stroke exercise test of the reassembled valves, would 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 other testing methods are possible. It may be possible to verify that these valves move to their fully open position by use of non-intrusive diagnostic testing techniques at least once each refueling outage. Additionally, Position 2 of GL 89-04 addresses the use of disassembly and inspection as an alternative only to forward flow exercising of check valves. The use of disassembly and inspection to verify a check valve's closure capability may be acceptable depending on whether verification by flow or pressure measurements or other means, such as non-intrusive diagnostics, is possible.

For valves V-23-009, -010, and -012 the licensee has proposed using disassembly and inspection to verify their full-stroke capability to both the open and closed positions, combined with a part-stroke exercise test to the open position quarterly and after reassembly. Relief to disassemble and inspect these valves to verify their full-stroke open capability is granted per GL 89-04, Position 2. With the present system design, it is not possible to verify the closure of these valves by leak testing or with reverse flow. An interim period is necessary to give the licensee time to investigate the feasibility of alternatives for verifying the closure capability of these valves. Based on the determination that the licensee's proposed testing would provide an acceptable level of quality and safety in the interim, relief may be granted for one year or until the next refueling outage, whichever is greater. In the interim period, the licensee should actively pursue the use of non-intrusive diagnostic techniques such as acoustics or radiography to demonstrate that these groupes close when subjected to reverse flow conditions.

The licensee has proposed performing only disassembly and inspection for valves V-23-014 and V-25-006 with no post-disassembly testing. Relief to disassemble and inspect these valves to verify their full-stroke open capability is granted per GL 89-04, Position 2 provided the licensee performs a partial flow test of the disassembled valves before they are returned to service.

The licensee's sample disassembly groups appear to combine valves with different orientations, from different systems, and different service conditions. Relief to verify the full-stroke open capability of valves V-22-021, -028, -029, -063, -064, V-24-012, -046, -047 using disassembly and inspection is granted per GL 89-04, Position 2. However, if these valves are disassembled on a sampling basis, the valve sample groups must comply with the criteria outlined in this evaluation.

For all valves, the licensee should actively pursue the use of non-intrusive diagnostic testing techniques to verify their full-stroke open capability.

3.3 High Pressure Coolant Injection

3.3.1 Category C Valves

3.3.1.1 Relief Request. The licensee has requested relief from the check valve exercising frequency and method requirements of Section XI, Paragraph IWV-3520, for the HPCI suction check valve from the suppression pool, V-23-001. The licensee has proposed disassembling and inspecting this check valve during refueling outages and verifying its reverse flow closure capability following reassembly.

3.3.1.1.1 Licensee's Basis for Requesting Relief--As noted in USNRC Generic Letter 89-04, Attachment 1, Position 2, there is no convenient method for verifying the ability of this valve to swing to the full-open or full-closed positions. The system test piping circuits utilize the condensate storage tank (CST) for pump suction rather than the suppression pool. Taking suction from the suppression pool during testing is undesirable because, in so doing, torus water would be transferred to the condensate storage tank. Torus water is not demineralized, thus the entire CST inventory would require processing following each test which would result in additional radioactive waste.

For the reasons noted above, this valve cannot be opened. Therefore, it cannot be stroked from the open to the full closed position (i.e., a close test during quarterly testing could only demonstrate that the valve stayed closed). As a result, full-closed testing also cannot be done quarterly.

Since this valve does not normally see system conditions which cause it to change position, no wear-induced degradation is expected.

In lieu of the Code required full-stroke test, valve operability will be demonstrated by disassembling the valve in accordance with USNRC Generic Letter 89-04, Attachment 1, Position 2. Each refueling outage the valve will be disassembled and the disk will be verified to swing freely to the open and closed positions. A reverse flow closure test of this valve will be conducted following reassembly.

3.3.1.1.2 Evaluation--The only paths for full-stroke exercising this valve with flow are to the reactor vessel or the condensate storage tank. The water in the suppression pool does not meet the chemistry requirements of the condensate storage or the nuclear boiler systems. Full-stroke exercising this valve to the open position using flow from the suppression pool at any frequency would result in contamination of the condensate storage tank or nuclear boiler systems with lower grade water resulting in a loss of chemistry control.

The licensee has proposed verifying the full-stroke open capability of this check valve using disassembly and inspection. The NRC staff positions regarding check valve disassembly and inspection are explained in detail in

GL 89-04. The Minutes of the Public Meetings on Generic Letter 89-04 regarding Position 2, Alternatives to Full Flow Testing of Check Valves, further stipulate that a partial stroke exercise test to the open position 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 investigate methods of part-stroke exercising this check valve to the open position following reassembly. Options the licensee may consider are a part-stroke exercise test using air combined with non-intrusive diagnostic testing to verify disk movement or a part-stroke exercise test using the minimum flow recirculation line.

Disassembly and inspection, combined with a part-stroke exercise test of the reassembled valve, would 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 other testing methods are possible. It may be possible to verify that this valve moves to its fully open position by use of non-intrusive diagnostic testing techniques during a reduced flow test at least once each refueling outage.

Relief to disassemble and inspect this valve to verify its full-stroke open capability is granted per GL 89-04, Position 2 provided the licensee performs a partial flow test of the disassembled valve before it is returned to service. The licensee should actively pursue the use of non-intrusive diagnostic techniques to demonstrate that this valve swings fully open during partial flow testing.

The suppression pool is not used as a suction source for the HPCI pump during normal plant operation. This valve is isolated by motor operated valves on either side, is normally closed during plant operation and HPCI pump testing, and will be exercised open only during refueling outages. Verifying the closure capability of this valve after reassembling and part-stroke exercising it to the open position would provide an acceptable level of quality and safety. Therefore, relief may be granted to exercise this valve to the closed position during refueling outages after partial flow testing.

3.4 Reactor Core Isolation Cooling

3.4.1 Category C Valves

3.4.1.1 Relief Request. The licensee has requested relief from the check valve exercising frequency and method requirements of Section XI, Paragraph IWV-3520, for the RCIC suction check valve from the suppression pool, V-25-001. The licensee has proposed disassembling and inspecting this check valve during refueling outages and verifying its reverse flow closure capability following reassembly.

3.4.1.1.1 Licensee's Basis for Requesting Relief--As noted in USNRC Generic Letter 89-04, Attachment 1, Position 2, there is no convenient method for verifying the ability of this valve to swing to the full-open or full-closed positions. The system test piping circuits utilize the condensate storage tank (CST) for pump suction rather than the suppression pool. Taking suction from the suppression pool during testing is undesirable because, in so doing, torus water would be transferred to the condensate storage tank. Torus water is not demineralized, thus the entire CST inventory would require processing following each test which would result in additional radioactive waste.

For the reasons noted above, this valve cannot be opened. Therefore, it cannot be stroked from the open to the full closed position (i.e., a close test during quarterly testing could only demonstrate that the valve stayed closed). As a result, full-closed testing also cannot be done quarterly.

Since this valve does not normally see system conditions which cause it to change position, no wear-induced degradation is expected.

In lieu of the Code required full-stroke test, valve operability will be demonstrated by disassembling the valve in accordance with USNRC Generic

Letter 89-04, Attachment 1, Position 2. Each refueling outage the valve will be disassembled and the disk will be verified to swing freely to the open and closed positions. A reverse flow closure test of this valve will be conducted following reassembly.

3.4.1.1.2 Evaluation--The only paths for full-stroke exercising this valve with flow are to the reactor vessel or the condensate storage tank. The RCIC pump minimum flow recirculation line, which could be used as a flow path to part-stroke exercise this valve, discharges to the residual heat removal system. However, the water in the suppression pool does not meet the chemistry requirements of the condensate storage, nuclear boiler, or residual heat removal systems. Full- or part-stroke exercising this valve to the open position using flow from the suppression pool at any frequency would result in contamination of the condensate storage tank, nuclear boiler, or residual heat removal systems with lower grade water resulting in a loss of chemistry control.

The licensee has proposed verifying the full-stroke open capability of this check valve using disassembly and inspection. The NRC staff positions regarding check valve disassembly and inspection are explained in detail in GL 89-04. The Minutes of the Public Meetings on Generic Letter 89-04 regarding Position 2, Alternatives to Full Flow Testing of Check Valves, further stipulate that a partial stroke exercise test to the open position 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 investigate methods of part-stroke exercising this check valve to the open position following reassembly. Options the licensee may consider are a part-stroke exercise test using air or an external fluid source combined with non-intrusive diagnostic testing to verify disk movement.

The licensee's proposed alternative, combined with a part-stroke exercise test of the reassembled valve, would 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 other testing methods are possible. It may be possible to verify that this valve moves to its fully open position by use of non-intrusive diagnostic testing techniques during a reduced flow test at least once each refueling outage.

Relief to disassemble and inspect this valve to verify its full-stroke open capability is granted per GL 89-04, Position 2 provided the licensee performs a partial flow test of the disassembled valve before it is returned to service. The licensee should actively pursue the use of non-intrusive diagnostic techniques to demonstrate that this valve swings fully open during partial flow testing.

The suppression pool is not used as a suction source for the RCIC pump during normal plant operation. This valve is isolated by motor operated valves on either side, is normally closed during plant operation and RCIC pump testing, and will be exercised open only during refueling outages. Verifying the closure capability of this valve after reassembling and part-stroke exercising it to the open position would provide an acceptable level of quality and safety. Therefore, relief may be granted to exercise this valve to the closed position during refueling outages after partial flow testing.

3.5 Nuclear Boiler System

3.5.1 Category B and B/C Valves

3.5.1.1 Relief Request. The licensee has requested relief from the valve exercising and stroke time trending requirements of Section XI, Paragraphs IWV-3411 and -3417(a), respectively, for the following automatic depressurization system (ADS), safety relief, and solenoid valves. The licensee has proposed removing, testing, disassembling, inspecting, and rebuilding at least half of these valves every cycle, having the solenoid actuators stroke timed by Wyle Labs. and exercising these valves in situ once every refueling outage during plant startup.

Reactor Relief Valves	Solenoid Valves
PSV-4400*	SV-4400
PSV-4401	SV-4401
PSV-4402*	SV-4402
PSV-4405*	SV-4405
PSV-4406*	SV-4406
PSV-4407	SV-4407

* Automatic Depressurization System (ADS)

3.5.1.1.1 Licensee's Basis for Requesting Relief--These valves can only be tested at very low reactor power levels with primary system pressure greater than 50 psig. The test sequence requires an operator to:

a. Open at least one turbine bypass valve and discharge main steam directly to the condenser,

b. Actuate the relief valve and observe the corresponding closure of the turbine bypass valve (pressure control on the turbine bypass valve is fairly quick to respond, -1-1/2 seconds), and the response of pressure switches and thermocouples downstream of the relief valve.

c. Close the relief valve and observe the corresponding opening of the turbine bypass valve and the response of pressure switches and thermocouples downstream of the relief valves.

Each relief valve actuation produces hydrodynamic loads which are transmitted to the suppression pool (torus). The Duane Arnold Mark I Containment, Plant Unique Analysis Report (PUAR) fatigue evaluation is based on 740 relief valve actuations with normal operating conditions (i.e., 740 actuations for testing purposes). Quarterly testing of the subject valves would result in 4 (quarters) x 40 (years) x 6 (valves) = 960 test actuations, which would exceed the approved design basis.

Finally, the failure of any relief valve to close would cause an uncontrolled rapid depressurization of the primary system (stuck open relief valve transient). The resulting severe thermal gradients in the reactor vessel are not desirable, and should be minimized.

These valves should not be tested during cold shutdowns in order to reduce the number of challenges to safety/relief valves as recommended by NUREG-0737 Item II.K.3.16, Reduction of Challenges and Failures of Relief Valves.

The subject valves are fast acting valves (normally exercise in less than 2 seconds) and they do not have stem/disk position indicators.

At least half of these valves will be removed, tested, disassembled, inspected and rebuilt every cycle in accordance with Technical Specification 4.6.D.1. Stroke timing of the solenoid actuators is performed by Wyle Labs. Comparison to previously measured stroke time will not be performed. The subject valves will be exercised once every refueling outage during plant startup.

3.5.1.1.2 Evaluation--Reactor steam provides the motive force for opening these valves which act both as pneumatic-operated relief valves, in response to a manual or automatic control signal, and as safety valves. As a result, these valves should be tested to both the Category B and C requirements.

Upon actuation, the safety relief valves direct reactor steam to the torus resulting in pressure and temperature stresses. The fatigue evaluation for the Duane Arnold containment is based on 740 relief valve actuations under normal operating conditions. Additionally, the failure of any of these relief valves to close while testing, if performed during power operation, would create a loss of coolant accident (LOCA) resulting in large thermal stresses in the reactor vessel. NUREG-0626, "Generic Evaluation of Feedwater Transients and Small Break Loss-of-Coolant Accidents in GE-Designed Operating Plants and Near Term Operating License Applications," and NUREG-0737, Section II.K.3.16, "Reduction of Challenges and Failures of Relief Valves," recommend the reduction of challenges to relief valves to lessen the risk of small break LOCAs. Therefore, a reduced frequency of testing is appropriate.

These valves are not equipped with direct sensing position indication, therefore, precise stroke time measurement is difficult and trending the stroke times is not meaningful. Since these valves are rapid-acting (normally stroke in less than 2 seconds), the application of Position 6 of Generic Letter No. 89-04 to these valves would provide a reasonable alternative to the Code stroke time trending and corrective action requirements.

The licensee's proposed alternative, to remove, test, disassemble, inspect, and rebuild at least half of these valves every cycle, combined with exercise tests and stroke time measurement in accordance with Generic Letter No. 89-04, Position 6 of all valves each refueling outage would provide an acceptable level of quality and safety. Therefore, relief may be granted as requested.

3.6 Diesel Generator Air Start System

3.6.1 Category B Valves

3.6.1.1 Relief Request. The licensee has requested relief from the stroke time measurement, trending, and corrective action requirements of Section XI, Paragraphs IWV-3413 and -3417, for the diesel generator air start solenoid valves SV-3261A, -3261B, -3262A, and -3262B. The licensee has proposed starting the diesels on the AC valve train monthly and the DC valve train quarterly, both without stroke time measurement. The licensee has further proposed ensuring that the diesels start within the Technical Specification time limit using the DC valve train during a "cold-fast" start every six months.

3.6.1.1.1 Licensee's Basis for Requesting Relief--Relief is requested from the stroke time requirements of Section XI. It is impractical to measure the stroke time of the air start valves directly, since there is no visible stem movement and the valves have no position indicators.

Starting the standby emergency diesel generators using the air start system will be considered demonstration of proper operation of the air start solenoids. Therefore, the air start solenoids will be tested when the diesel generators are tested in accordance with Technical Specification 4.8.A.1.a.1. Technical Specification section 4.8.A.1.a.1 states that the diesel generators shall be manually started using the AC train only. However, no stroke time measurement is taken during this test. Quarterly testing exercises the DC train in a similar manner. Once every six months, the diesel generator is "cold-fast" started, during which time the DC train valve stroke time is indirectly measured by ensuring that the diesel starts within Technical Specification limits. Because the stroke time is indirectly measured, the corrective action requirements of IWV-3417 will not be implemented.

Additionally, efforts are being made to procure replacement valves and spare parts by the end of 1991. When spares are available the solenoid valves will be periodically replaced or refurbished under DAEC's Maintenance Program for Solenoid Valves.

3.6.1.1.2 Evaluation--Stroke timing these rapid-acting solenoid valves using conventional techniques is not practical because they are not equipped with position indication and valve stem movement cannot be observed.

These valves could be tested to the Code requirements only after significant redesign and modifications to the control circuitry for these valves, such as the addition of individual control switches and valve position indication. Modifications to add position indication for these solenoid valves may not be possible due to the valve design. Therefore, addition of valve position indication may also require valve replacement with a design which would make indication of valve position possible. These modifications would be burdensome for the licensee due to the cost involved.

The diesel generator air start system is designed with redundant air start valves and headers. One air start train is capable of successfully starting the diesel generator. The licensee has proposed starting the diesels using the AC train monthly and the DC start train quarterly, both without stroke time measurement. The licensee has further proposed ensuring that the diesels start within the Technical Specification time limit using the DC valve train during a "cold-fast" start every six months without applying the corrective action requirements of IWV-3417. The licensee's proposed monthly and quarterly testing provides no measure of valve degradation and the semi-annual testing involves only the solenoid valves in the DC train. Additionally, the licensee has neither provided a justification for measuring the diesel start times for all valves each quarter nor the corrective action required after valve degradation or failure. Since valve degradation would be evidenced by increased diesel starting time, measuring the diesel start time and verifying that it is less than a maximum limiting start time for each air start train at least quarterly should provide an indication of degradation and reasonable assurance of operational readiness. This maximum start time should be less than or equal to the Technical Specification requirement. If this maximum start time is exceeded due to degradation or failure of the air start solenoid valves, they should be declared inoperable and repaired or replaced.

Based on the determination that compliance with the Code requirements is impractical, and considering the burden on the licensee if the Code requirements were imposed, relief may be granted provided the licensee assigns a maximum limiting diesel start time which is less than or equal to the Technical Specification limit and verifies the operability of the valves in each air start train by measuring the diesel start times each quarter.

3.7 <u>Control Rod Drive Hydraulic System</u>

3.7.1 <u>Category A/C Valves</u>

3.7.1.1 <u>Relief Request</u>. The licensee has requested relief from the check valve exercising frequency requirements of Section XI, Paragraph IWV-3521, to the closed position for the reactor recirculation pump seal water supply check valves from the control rod drive hydraulic system, V-17-083 and -096. The licensee has proposed verifying the closure capability of these valves with Appendix J, Type C, leak rate tests during refueling outages.

3.7.1.1.1 Licensee's Basis for Requesting Relief--These simple check valves cannot be remotely operated. They are located inside primary containment and are not accessible for testing during reactor operation. These valves cannot be exercised by utilizing the outside drywell test lines because air would be introduced into the reactor recirculation pump seals which could cause the pump bearings to be damaged.

These valves cannot normally be manually exercised at cold shutdown because the containment is inerted with nitrogen. In order to conduct a test of these valves, downstream manual block valves inside containment would require closing in order to ensure that air is not introduced into the pump seals. In order to gain access to the drywell, the nitrogen must be vented (normally a 16 - 24 hour operation). The containment must be re-inerted before the plant is restarted (normally a 16 - 24 hour operation). Inerting and de-inerting the drywell solely for the purpose of valve testing is excessively burdensome.

These valves will be exercised during leak testing conducted at refueling in accordance with DAEC Technical Specification 4.7.A.2.C (Appendix J, Type C tests).

3.7.1.1.2 Evaluation--Full-stroke exercising these valves to the closed position quarterly during reactor operation could cause damage to the recirculation pump seals. Further, during power operation the containment atmosphere is required to be maintained with a high concentration of inert gas which reduces the oxygen level sufficiently to make personnel entry a hazard.

Exercising these valves during cold shutdowns is impractical since the containment is often maintained inerted and a containment entry is necessary for test performance. De-inerting the containment to perform valve testing would be burdensome for the licensee due to the material (i.e., nitrogen) costs and the possible delay in the return to power. Verifying the reverse flow closure of these valves using Appendix J, Type C, leak rate testing during refueling outages would provide reasonable assurance of operational readiness.

Based on the determination that it is impractical to verify the closure capability of these valves quarterly or during cold shutdowns, that the proposed testing would provide a reasonable alternative to the Code requirements, and considering the burden on the licensee if the Code requirements were imposed, relief may be granted as requested.

3.8 Containment Atmosphere Monitoring System

3.8.1 Category A Valves

3.8.1.1 Relief Request. The licensee has requested relief from the valve stroke timing and corrective action requirements of Section XI, Paragraphs IWV-3413(b) and -3417(a), respectively, for the following containment atmosphere monitoring system containment isolation valves. The licensee has proposed exercising these valves and verifying their positions quarterly without measuring stroke times.

SV-8101A	SV-8101B	SV-8102A	SV-8102B
SV-8103A	SV-8103B	SV-8104A	SV-8104B
SV-8105A	SV-8105B	SV-8106A	SV-8106B
SV-8107A	SV-8107B	SV-8108A	SV-8108B
SV-8109A	SV-8109B	SV-8110A	SV-8110B

3.8.1.1.1 Licensee's Basis for Requesting Relief--These valves are not provided with individual position indicators and meaningful stroke time measurements cannot be taken.

These valves will be exercised and their positions verified every three months. Stroke times will not be measured.

3.8.1.1.2 Evaluation--These valves are not equipped with position indication, which makes obtaining accurate stroke times for these valves difficult. System modifications might be necessary to directly measure the stroke times of these valves which would be expensive and burdensome to the licensee. However, some method of stroke timing or otherwise adequately evaluating these valves' condition is necessary for determining their operational readiness. The licensee's proposed alternative provides no measure of valve degradation.

The licensee should actively pursue an alternate method for stroke time testing these valves or assessing their condition. Methods employing magnetics, acoustics, ultrasonics, or other technologies should be investigated for their suitability. The licensee's proposal to exercise these valves and verify their position quarterly should be acceptable on an interim basis, but, it does not adequately evaluate the valve condition and does not present a reasonable long term alternative to the Code requirements.

Based on the determination that complying with the Code requirements is impractical and considering the licensee's proposal, relief should be granted for an interim period of one year or until the next refueling outage, whichever is longer. During this period, the licensee should develop a method of measuring the stroke times or some other means to adequately monitor the condition of these valves.

3.9 Emergency Service Water System

3.9.1 Category B Valves

3.9.1.1 Relief Request. The licensee has requested relief from the stroke time corrective action requirements of Section XI, Paragraph IWV-3417(a), for the emergency service water (ESW) return valves from the control building chillers, CV-1956A and -1956B, and the ESW supply valves to the emergency diesel generators, CV-2080 and -2081. The licensee has proposed estimating the stroke times of these valves based on valve stem movement and comparing the test results to a maximum limiting stroke time.

3.9.1.1.1 Licensee's Basis for Requesting Relief--CV-1956A and B are actuated by the starting logic of the associated emergency service water pump, with no individual control handswitch. Also, there are no position indicators for these valves. The test sequence requires an operator to be stationed at the valves, which are physically separated from the pumps, to measure the stroke time of the valve. The operator starts timing upon announcement of the ESW pump start and stops timing based upon the cessation of valve stem movement. For these reasons, precise stroke time measurements are impractical. CV-2080 and CV-2081 do not have position indication. To measure the stroke times of these valves the operator starts timing upon operation of the handswitch for the valve and stops timing based upon cessation of valve stem movement. Thus precise stroke time measurements are impractical.

These valves will be exercised every three months. During this testing, valve operation will be observed, and a stroke time estimated based on valve stem movement. Because the stroke time is estimated, the results of this test will be evaluated with respect to the maximum allowable stroke time but will not be compared to the previous tests per the criteria set forth above or in IWV-3417(a).

3.9.1.1.2 Evaluation--These valves are not equipped with position indication, which makes obtaining accurate stroke times for these valves difficult. Additionally, valves CV-1956A and -1956B open when the ESW pumps are started and are not equipped with individual control switches. System modifications might be necessary to directly measure the stroke times of all these valves which would be expensive and burdensome to the licensee.

The licensee has proposed estimating the stroke times of these valves from the start the ESW pumps (for valves CV-1956A and -1956B) or from the positioning of the handswitch (for valves CV-2080 and -2081) to the cessation of valve stem movement. The licensee has not provided the normal stroke times or the assigned maximum limiting stroke times for these valves. The limiting values of full-stroke time should be based on the valve reference or average stroke time when it is known to be in good operating condition. The limiting stroke time should be a reasonable deviation from this reference value based on the valve size, valve type, and actuator type. The deviation should not be so restrictive that it results in a valve being declared inoperable due to reasonable stroke time variations. However, the deviation used to establish the limit should be such that corrective action would be taken for a valve that may not perform its intended function.

The licensee's proposed alternative would provide reasonable assurance of operational readiness provided the maximum limiting stroke times for these valves are assigned as outlined above.

Based on the determination that compliance with the Code stroke timing requirements is impractical, that the licensee proposed alternative would provide reasonable assurance of operational readiness, and considering the burden on the licensee if the Code requirements were imposed, relief may be granted provided the maximum limiting stroke times for these valves are assigned as outlined in this evaluation.

3.10 Instrument Air System

3.10.1 Category C Valves

3.10.1.1 Relief Request. The licensee has requested relief from the individual check valve exercising requirements of Section XI, Paragraph IWV-3520, for the A side control building HVAC instrument air supply check valves, V-73-006 and -007. The licensee has proposed backflow testing these series valves as a unit quarterly and verifying that the total backleakage through the pair does not exceed a specific maximum amount.

3.10.1.1.1 Licensee's Basis for Requesting Relief--The system is only required to have one isolation valve. Total backflow leakage through the line these valves are on must be limited to a specific amount. The valves are installed with no test connections between the valves so that a pressure decay or leak rate test on the individual valves is not possible. Therefore, testing of the individual valves is not possible without disassembly of the valves. Repeated disassembly of the valve will destroy the brass body and not permit reassembly. These valves have no known failures due to leakage.

These valves will be back flow tested as one unit every three months. A pressure decay test will be performed on the system to verify that total back leakage through these two valves does not exceed a specific maximum amount.

3.10.1.1.2 Evaluation--These check valves have a safety function to close to limit leakage from the backup emergency air supply through the normal supply lines on a loss of normal instrument air. Verifying the closure capability of each series check valve is not practical since there are no test taps in the line to enable individual leak rate testing.

Individual valve testing to demonstrate the closure capability of these valves would require system modifications, such as the addition of test taps to individually leak rate test each valve. These modifications would be burdensome for the licensee due to the costs involved. The licensee has proposed verifying the closure capability of these valves quarterly as a pair by performing a pressure decay test. This alternative would provide reasonable assurance of operational readiness provided the licensee repairs or replaces both check valves if the total back-leakage through the pair of valves exceeds the maximum allowable amount.

Based on the determination that individually verifying the closure capability of these check valves is impractical, that the licensee's proposed alternative would provide reasonable assurance of operational readiness, and considering the burden on the licensee if the Code requirements were imposed, relief may be granted provided the licensee repairs or replaces both check valves if the total back leakage through the pair of valves exceeds the maximum allowable amount.

APPENDIX A
IST PROGRAM ANOMALIES IDENTIFIED DURING THE REVIEW

APPENDIX A

IST PROGRAM ANOMALIES FOUND DURING THE REVIEW

Inconsistencies and omissions in the licensee's program noted during the course of this review are summarized below. The licensee should resolve these items in accordance with the evaluations, conclusions, and guidelines presented in this report.

1. In pump relief request No. 13, the licensee has requested relief from the differential pressure or flow rate allowable range requirements of Section XI, Paragraph IWP-3200. If the limits of the Code cannot be met Paragraph IWP-3210 allows the licensee to specify new range limits. If new range limits are specified, the licensee should demonstrate in their program: (1) that the Code limits cannot be met on a pump specific basis and, (2) that with less conservative ranges a degraded pump hydraulic condition can be detected and appropriate corrective action taken. Therefore, relief from the Code allowable range requirements for flow rate or differential pressure is not required, however, the licensee should document the above information in their IST program. (Reference section 2.1.2.1 of this report.)

2. In pump relief request No. 1, the licensee has requested relief from the pump vibration measurement requirements of Section XI, Paragraph IWP-3100, for the diesel fuel oil transfer pumps. Relief may be granted provided the licensee performs inservice tests to verify the hydraulic performance of these pumps after installation as outlined in IWP-3111. (Reference section 2.2.1.1 of this report.)

3. In pump relief request No. 15, the licensee has proposed using an empirically derived pump curve as reference values over a limited range of operation in lieu of varying the system resistance until the independent variable equals the reference value. Using a reference pump curve to compare differential pressure and flow rate for pump inservice testing may provide an acceptable alternative to the Code requirement that one or more fixed sets of readily duplicated reference values be defined for each pump. However, it is important that the reference pump

curve be reverified anytime pump maintenance or repairs are done that could affect the performance of a pump and, since the levels of vibration may vary significantly over the range of pump operation, the licensee should develop a method of assigning vibration reference values and acceptance criteria that would be equivalent to the Code requirements. If new range limits are specified in accordance with IWP-3210, the licensee should demonstrate in their program: (1) that the Code specified limits cannot be met on a pump specific basis and, (2) that with the less conservative ranges a degraded pump condition can be detected and appropriate corrective actions taken. Relief from the Code inservice test procedure requirements may be granted for the HPCI pump provided testing is performed as outlined above. (Reference section 2.3.1.1 of this report.)

4. In valve relief request No. 5, the licensee has proposed testing the safety and relief valves listed below in accordance with ANSI/ASME OM-1-1981 in lieu of ASME/PTC 25.3-1976. Relief may be granted provided the licensee adopts a setpoint drift limit of ±3% and restores the setpoint to within the specified tolerance of the original construction code prior to relief valve reinstallation. (Reference section 3.1.1.1 of this report.)

PSV-1911	PSV-1952	PSV-1975	PSV-1988
PSV-2043	PSV-2057	PSV-2068	PSV-2102
PSV-2109	PSV-2122	PSV-2129	PSV-2223
PSV-2228	PSV-2301	PSV-2430	PSV-2474
PSV-2501	PSV-2607	PSV-2609	PSV-3221A
PSV-3221B	PSV-3222A	PSV-3222B	PSV-3223A
PSV-3223B	PSV-4336	PSV-4439A	PSV-4439B
PSV-4439C	PSV-4439D	PSV-4439E	PSV-4439F
PSV-4842			

5. In valve relief request No. 17, the licensee lists MSIVs, CRD valves, and service water valves that are fail-safe tested by means other than normal stroking. However, the licensee's fail-safe test method and frequency are not specified and no relief is granted for these valves. (Reference section 3.1.2.1 of this report.)

6. In valve relief request No. 21, the licensee has proposed using

disassembly and inspection to verify the full-stroke open capability of the HPCI suction check valve from the suppression pool, V-23-001, and the RCIC suction check valve from the suppression pool, V-25-001. The licensee should investigate methods of part-stroke exercising these check valves to the open position following reassembly. Options the licensee may consider are a part-stroke exercise test using air or an external fluid source, combined with non-intrusive diagnostic testing to verify disk movement. It may be possible to part-stroke exercise the V-23-001 using the HPCI pump minimum flow recirculation line. 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 other testing methods are possible. The licensee should actively pursue the use of non-intrusive diagnostic techniques to demonstrate that these valves swing fully open during partial flow testing. Relief to verify the full-stroke open capability of these valves using disassembly and inspection is granted per GL 89-04, Position 2 provided the licensee performs a partial flow test of the disassembled valves before they are returned to service. Relief may be granted to exercise these valves to the closed position during refueling outages after partial flow testing. (Reference sections 3.3.1.1 and 3.4.1.1 of this report.)

7. In valve relief request No. 7, the licensee has requested relief from the stroke time measurement, trending, and corrective action requirements of Section XI, Paragraph IWV-3413 and -3417, for the diesel generator air start solenoid valves SV-3261A, -3261B, -3262A, and -3262B. The licensee's proposed monthly and quarterly testing provides no measure of valve degradation and the semiannual testing involves only the solenoid valves in the DC train. Additionally, the licensee has neither provided a justification for measuring the diesel start times for all valves each quarter nor the corrective action required after valve degradation or failure. Since valve degradation would be evidenced by increased diesel starting time, measuring the diesel start time and verifying that it is less than a maximum limiting start time for each air start train at least quarterly should provide an indication of degradation and reasonable assurance of operational readiness. This maximum start time should be

less than or equal to the Technical Specification requirement. If this maximum start time is exceeded due to degradation or failure of the air start solenoid valves, they should be declared inoperable and repaired or replaced. Relief may be granted provided the licensee applies the acceptance criteria and corrective action outlined above. (Reference section 3.6.1.1 of this report.)

8. In valve relief request No. 51, the licensee has proposed performing disassembly and inspection for the following valves in lieu of the Code exercising frequency and method requirements. Position 2 of GL 89-04 addresses the use of disassembly and inspection as an alternative only to forward flow exercising of check valves. For valves V-23-009, -010, and -012 the licensee has proposed using disassembly and inspection to verify their full-stroke capability to both the open and closed positions, combined with a part-stroke exercise test to the open position quarterly and after reassembly. Relief to disassemble and inspect these valves to verify their full-stroke open capability is granted per GL 89-04, Position 2. For the closed position, interim relief may be granted for one year or until the next refueling outage, whichever is greater. In the interim period, the licensee should actively pursue the use of non-intrusive diagnostic techniques such as acoustics or radiography to demonstrate that these valves close when subjected to reverse flow conditions.

The licensee has proposed performing only disassembly and inspection for valves V-23-014 and V-25-006 with no post-disassembly testing. Relief to disassemble and inspect these valves to verify their full-stroke open capability is granted per GL 89-04, Position 2 provided the licensee performs a partial flow test of the disassembled valves before they are returned to service.

The licensee's sample disassembly groups appear to combine valves with different orientations, from different systems, and different service conditions. Relief to verify the full-stroke open capability of valves V-22-021, -028, -029, -063, -064, V-24-012, -046, -047 using disassembly and inspection is granted per GL 89-04, Position 2. However, if these valves are disassembled on a sampling basis, the valve sample groups must comply with the criteria outlined in Section 3.2.1.1 of this report. For all valves, the licensee should actively pursue the use of non-intrusive diagnostic testing techniques to verify their full-stroke open capability.

Valve Group	Function
*V-22-064, V-22-063 V-24-046, V-24-047	HPCI/RCIC vacuum breaker check valves
V-22-021, V-22-028 V-22-029, V-24-012	HPCI exhaust drainpot drain condensate to torus check valve, HPCI/RCIC lube oil cooling water and condensate return check valves
V-22-022	HPCI exhaust drainpot drain check valve
V-24-009	RCIC Barometric condenser check valve
V-24-010	RCIC Barometric condenser check valve
V-25-006	RCIC minimum flow line check valve
*V-23-014	HPCI minimum flow line check valve

9. In valve relief request No. 13, the licensee has requested relief from the valve exercising frequency, stroke time measurement, and corrective action requirements of Section XI, Paragraphs IWV-3411, -3413, and -3417, respectively, for the scram discharge volume vent and drain valves' solenoid valves, SV-1868A, -1868B, -1869A, and -1869B. This relief request was preapproved by Generic Letter No. 89-04. The licensee has proposed testing these solenoid valves with the associated scram discharge volume vent and drain valves during the Mode Switch Placed in Shutdown Test performed each refueling outage. This testing method is acceptable, however, the licensee has not provided a technical justification for not performing this testing during cold shutdowns. The licensee should respond to this staff concern within 90 days.

10. In valve relief request No. 13, the licensee has requested relief from the valve exercising frequency, stroke time measurement, and corrective action requirements of Section XI, Paragraphs IWV-3411, -3413, and -3417, respectively for the following control rod drive hydraulic system air and solenoid operated valves. This relief request was preapproved by Generic Letter No. 89-04. The licensee's proposed testing for all these valves, with the exception of the backup scram valves, is in accordance with Generic Letter No. 89-04, Position 7 and would, therefore, provide an

acceptable level of quality and safety. However, since the backup scram valves, SV-1840A and -1840B, provide a redundant protective function degradation of these valves may not be evidenced by rod insertion times. Verifying only that these solenoid valves energize to vent the scram valve pilot air header also provides no measure of valve degradation. Since these are rapid-acting solenoid valves, the licensee may consider stroke timing these valves as outlined in Generic Letter 89-04, Position 6. The licensee should respond to this staff concern within 90 days.

Valve Number	Function
SV-1840A, -1840B	Scram valve pilot air header vent valves (backup scram valves)
CV-1849	Scram inlet valve from the charging water header
CV-1850	Scram outlet valve to the scram discharge header
SV-1855, -1856	Instrument air vent valves for CV-1859 and CV-1860

11. In valve relief request No. 13, the licensee has proposed exercising the backup scram check valve, V-17-0062, each refueling outage by verifying that the backup scram valves vent air when energized. This check valve can be verified to stroke open by ensuring that both backup scram valves vent air when energized. However, as outlined in Generic Letter 89-04, Position 1, verifying only that both backup scram valves vent air is not sufficient to demonstrate a full-stroke of this check valve. The licensee should investigate and implement a method of verifying the full-stroke capability of this check valve. The licensee should respond to this staff concern within 90 days.

12. In valve relief request No. 32, the licensee has proposed exercising and verifying the position of the below listed containment atmosphere monitoring system valves quarterly without measuring their stroke times. Some method of stroke timing or otherwise adequately evaluating these valves' condition is necessary for determining their operational readiness. The licensee's proposed alternative provides no measure of valve degradation. Relief may be granted for an interim period of one year or until the next refueling outage, whichever is longer. During this period, the licensee should develop a method of measuring the stroke times or some other means to adequately monitor the condition of these valves.

(Reference section 3.8.1.1 of this report.)

SV-8101A	SV-8101B	SV-8102A	SV-8102B
SV-8103A	SV-8103B	SV-8104A	SV-8104B
SV-8105A	SV-8105B	SV-8106A	SV-8106B
SV-8107A	SV-8107B	SV-8108A	SV-8108B
SV-8109A	SV-8109B	SV-8110A	SV-8110B

13. In valve relief request No. 35, the licensee has proposed estimating the stroke times of the ESW return valves from the control building chillers, CV-1956A and -1956B, and the ESW supply valves to the emergency diesel generators, CV-2080 and -2081, based on valve stem movement and comparing the test results to a maximum limiting stroke time. The licensee has not provided the normal stroke times or the assigned maximum limiting stroke times for these valves. Relief may be granted provided the maximum limiting stroke times for these valves are assigned as outlined in section 3.9.1.1 of this report.

14. In valve relief request No. 53, the licensee has proposed backflow testing the series HVAC instrument air supply check valves, V-73-006 and -007, as a unit quarterly and verifying that the total backleakage through the pair does not exceed a specific maximum amount. Relief may be granted provided the licensee repairs or replaces both check valves if the total back leakage through the pair of valves exceeds the maximum allowable amount. (Reference section 3.10.1.1 of this report.)

15. In Appendix E of the licensee's IST program, Technical Position No. 6, the licensee states that some containment isolation valves are leak rate tested in groups with the leak rate limit equal to the limit for the entire group of valves. When individual leak rate testing as required by the Code is impractical, leak rate testing in groups may provide a reasonable alternative to the Code requirements if the assigned limiting leakage rate for each valve group is conservatively established regarding the number of sizes of valves in the group. The assigned maximum group leakage rate should be based on the smallest valve in the group so that corrective actions are taken whenever the leak-tight integrity of any valve of that group is in question. A relief request should be submitted since this testing alternative is a deviation from the Code requirements.