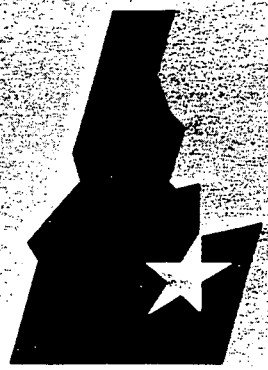

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TECHNICAL EVALUATION REPORT

PUMP AND VALVE INSERVICE TESTING PROGRAM
KEWAUNEE NUCLEAR POWER PLANT, DOCKET NO. 50-305

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Prepared for the
U.S. NUCLEAR REGULATORY COMMISSION

EG&G Idaho

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ABSTRACT

This EG&G Idaho, Inc., report presents the results of our evaluation of the Kewaunee Nuclear Power Plant Inservice Testing Program for safety-related pumps and valves.

FOREWORD

This report is supplied as part of the "Review of Pump and Valve Inservice Testing Programs for Operating Reactors" being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Mechanical Engineering Branch, by EG&G Idaho, Inc., Mechanical Systems Evaluations.

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Docket No. 50-305

TECHNICAL EVALUATION REPORT
PUMP AND VALVE INSERVICE TESTING PROGRAM
KEWAUNEE NUCLEAR POWER PLANT

1. INTRODUCTION

Contained herein is a technical evaluation of the pump and valve inservice testing (IST) program submitted by the Wisconsin Public Service Corporation (WPSC) for their Kewaunee Nuclear Power Plant.

The working session with the Kewaunee representatives was conducted on March 12 and 13, 1985. The licensee's pump and valve IST program resubmittal, dated May 29, 1987, was reviewed to verify compliance of proposed tests of pumps and valves whose function is safety-related with the requirements of the ASME Boiler and Pressure Vessel Code (the Code), Section XI, 1980 Edition through the Winter of 1981 Addenda.

Any IST program revisions subsequent to those noted above are not addressed in this technical evaluation report (TER). Required program changes, such as revised or additional relief requests or the deletion of any components from the IST Program, should be submitted to the NRC under separate cover in order to receive prompt attention, but should not be implemented prior to review and approval by the NRC.

In their IST Program WPSC has requested relief from the ASME Code testing requirements for specific pumps and valves and these requests have been evaluated individually to determine if the required testing is indeed impractical for the specified pumps and valves. This review was performed utilizing the acceptance criteria of the Standard Review Plan, NUREG-0800, Section 3.9.6, and the Draft Regulatory Guide and Valve/Impact Statement titled "Identification of Valves for Inclusion in Inservice Testing Programs." The IST Program testing requirements apply only to component testing (i.e., pumps and valves), and are not intended to provide the basis to change the licensee's current technical specifications for system test requirements.

2. SCOPE

The EG&G Idaho review of the Kewaunee Nuclear Power Plant, inservice testing program for pumps and valves was begun in November of 1984. The program identified the licensee's proposed testing of safety-related pumps and valves in the plant systems listed in Appendix B.

To review the licensee's proposed testing of certain pumps and valves in these systems, they were first located and highlighted on the appropriate system P&IDs. After identifying the components and determining their function in the system, the proposed testing was evaluated to determine if it was in compliance with the ASME Code requirements, based on the component type and function. For pumps, it was verified that each of the seven inservice test quantities of Table IWP-3100-1 is measured or observed as appropriate. For those test quantities that are not being measured or observed quarterly in accordance with the Code, it was verified that a request for relief from the Code requirements had been submitted. If the testing is not being performed in accordance with the Code and a relief request had not been submitted, additional information was requested from the licensee to explain the inconsistency. This request for supplemental information formed the basis for the Request for Additional Information (RAI) document that also served as the agenda for the working meeting between the licensee, the NRC, and the EG&G reviewers which took place following completion of the licensee's IST program review.

The relief requests were individually evaluated to determine if the licensee clearly demonstrated that compliance with the Code required testing is impractical for the identified system components, and to determine if their proposed alternate testing provides a reasonable indication of component condition and degradation. Where the licensee's technical basis or alternate testing was insufficient or unclear, the licensee was requested to supplement or clarify the relief request. The system P&ID was also examined to determine whether the instrumentation necessary to make the identified measurements is available. If, based on the unavailability of adequate instrumentation or the reviewers experience and system knowledge, it was determined that it may not be possible or practical to make the measurements as described by the licensee in his IST program, a question or comment was generated requesting the licensee to clarify his position.

Each check valve was evaluated to determine if the licensee's proposed testing does verify the valve's ability to perform its safety-related function(s). Extensive system knowledge and experience with other similar facilities were used to determine whether the proposed tests will full-stroke the check valve disks open or verify their reverse flow closure capability. If there was any doubt about the adequacy of the identified testing, questions were included in the RAI which required the licensee to address these concerns.

A further evaluation was performed on all valves in the program to determine that the identified testing could practically and safely be conducted as described. If the ability to perform the testing was in doubt, a question was formulated to alert the licensee to the suspected problem.

Safety-related safety valves and relief valves, excluding those that perform only a thermal relief function, were confirmed to be included in the IST program and are tested in accordance with IWV-3510.

After all of the valves in the licensee's IST program had been identified on the P&IDs and evaluated as described above, the P&IDs were examined closely by at least two trained and experienced reviewers to determine if any pumps or valves that may perform a safety-related function were not included in the licensee's program. The licensee was asked to reconcile any valves that were identified by this process and had been omitted from the IST program. Also, the list of systems included in the licensee's program was compared to a system list in the Draft Regulatory Guide and Value/Impact Statement titled, "Identification of Valves for Inclusion in Inservice Testing Programs". Systems that appear in the Draft Regulatory Guide list but not in the licensee's program were evaluated and, if appropriate, questions were added to the RAI concerning safety-related pumps and valves in those systems.

Additionally, if the reviewers suspected a specific or a general aspect of the licensee's IST program based on their past experiences, questions were written for inclusion in the RAI to clarify those areas of doubt. Some questions were included for the purpose of allowing the reviewers to make conclusive statements in this RAI.

3. PUMP TESTING PROGRAM

The Kewaunee Nuclear Power Plant IST program submitted by Wisconsin Public Service Corporation was examined to verify that all safety-related pumps are included in the program and are subjected to the periodic tests required by the ASME Code, Section XI and the NRC positions and guidelines. The reviewers found that, except for those pumps identified below for which specific relief from testing has been requested or as noted in Appendix C, these pumps are tested to the Code requirements. Each Wisconsin Public Service Corporation basis for requesting relief from the pump testing requirements and the EG&G reviewer's evaluation of that request are summarized below.

3.1 Service Water Pumps

3.1.1 Bearing Temperature and Lubricant Level or Pressure

3.1.1.1 Relief Request. The licensee has requested relief from measuring bearing temperature and observing proper lubricant level or pressure as required by Section XI, Paragraph IWP-3100, for service water pumps 1A1, IA2, 1B1, and 1B2.

3.1.1.1.1 Licensee's Basis for Requesting Relief--"Seal injection flow is used for bearing cooling and the water being pumped provides lubrication. The system design does not provide for monitoring the seal injection water and the submerged impeller pump design does not include bearing temperature measuring capability; therefore, bearing temperature and lubricant level cannot be measured. The seal injection low flow alarm, annunciated in the control room, will provide early indication of loss of cooling water."

3.1.1.1.2 Evaluation--The submerged impeller design of these service water pumps does not provide for pump bearing temperature measurement or observing lubricant level or pressure. These bearings are cooled and lubricated by the liquid in the main flowpath. IWP-4310 requires measurement of bearing temperatures only for bearings outside the main flowpath of the pump. Compliance with the Code requirements would only be

3.2 Safety Injection, Residual Heat Removal, Service Water, Auxiliary Feedwater and Internal Containment Spray Pumps

3.2.1 Pump Flow Rate

3.2.1.1 Relief Request. The licensee has requested relief from the flowrate measurements and test frequency as required by Section XI, Paragraphs IWP-3100 and IWP-3400, for the following pumps.

Safety injection pumps 1A and 1B
Residual heat removal pumps 1A and 1B
Auxiliary feedwater pumps 1A, 1B, and 1C
Service water pumps 1A1, 1A2, 1B1, and 1B2
Containment spray pumps 1A and 1B

The licensee has proposed to quarterly test all these pumps in a fixed resistance recirculation flowpath without measuring pump flowrate.

In addition, the safety injection pumps will be tested in a full-flow flowpath during refueling outages that utilizes installed flowrate instrumentation.

The residual heat removal and auxiliary feedwater pumps will be tested in a full-flow flowpath during cold shutdowns that utilizes installed flowrate instrumentation.

The service water and containment spray systems do not have installed flowrate instrumentation to permit this measurement during pump testing.

3.2.1.1.1 Licensee's Basis for Requesting Relief--"As allowed by Paragraph IWP-1400 of the ASME code, a pump can be tested in a bypass loop if its normal path cannot be practically tested. These pumps are operated at least once every 3 months and tested using a fixed resistance recirculation path. In each case the recirculation bypasses the installed system flow instrumentation; therefore, measuring flow rate through the bypass loop is not possible."

removal, and safety injection systems were substantially redesigned. This hardship would not be compensated by the small increase in safety that would result from this redesign. Based on the determination that the Code requirements will result in a hardship without a compensating increase in level of safety, and considering the licensee's proposed alternative for the auxiliary feedwater pumps, residual heat removal pumps, and safety injection pumps, relief may be granted as requested.

However, relief should not be granted for the service water pumps and containment spray pumps since the licensee has not provided sufficient technical justification for Code deviation nor an acceptable alternative to the Code requirements.

3.3 Component Cooling Pumps

3.3.1 Reference Flow Rate

3.3.1.1 Relief Request. The licensee has requested relief from measuring flow rate at a predefined reference flow rate as required by Section XI, Paragraph IWP-3100, for component cooling pumps 1A and 1B and has proposed to make pump performance measurements at a flow condition of nominal flow during power operation plus flow through RHR heat exchanger 1B.

3.3.1.1.1 Licensee's Basis for Requesting Relief--"Component cooling flow will vary depending on plant mode and amount of equipment in service needing cooling. Therefore, a stable flow rate at a predefined reference value cannot be reproduced during each quarterly test."

"Flow measurements are made from a computer point and differential pressures are measured and recorded. The differential pressure is compared to that predicted by the pump curve for the measured flow rate. Action levels have been established based on the deviation from the predicted pump curve values. This method of establishing action levels is consistent with Paragraph IWP-3110."

3.4 Safety Injection Pumps

3.4.1 Bearing Temperature

3.4.1.1 Relief Request. The licensee has requested relief from annually measuring a stabilized bearing temperature as required by Section XI, Paragraphs IWP-3300 and IWP-3500(b), for safety injection pumps 1A and 1B and has proposed to measure the bearing temperature during refueling outages while filling the reactor cavity. If bearing temperatures are not stabilized by the time the cavity is filled, the temperature reached just prior to the cavity becoming full will be utilized.

3.4.1.1.1 Licensee's Basis for Requesting Relief--"The safety injection pumps are limited to a maximum of 30 minutes operation on the mini-flow recirculation line to avoid pump damage; this restriction prevents obtaining stable bearing temperatures during the quarterly pump tests. Lack of adequate expansion volume in the RCS while at cold shutdown prevents obtaining stable bearing temperatures with the plant at cold shutdown."

"The bearing temperatures on these pumps are measured during the refueling outage during filling of the refueling cavity. Stabilization of bearing temperature prior to the refueling cavity becoming full may not always be possible. In addition, the bearing oil cooling system for this pump is cooled by the service water system. The system is not temperature stabilized therefore, meaningful results from the recording of this temperature cannot be expected."

3.4.1.1.2 Evaluation--The continued operation of the safety injection pumps on the mini-flow recirculation line while pump bearing temperature is stabilizing could eventually result in pump damage. Run times in excess of 30 minutes may be required for stabilization of pump bearing temperatures. Performance of an extended pump test during cold shutdowns with pump discharge into the reactor coolant system (RCS) could result in overpressurization of the RCS due to inadequate expansion volume and letdown capability. During refueling outages, however, pump runs can be performed with discharge into the refueling cavity permitting stabilized

be possible only if the residual heat removal system was substantially redesigned. Based on the determination that the Code requirements are impractical and the burden on the licensee if the Code requirements were imposed, relief may be granted as requested.

3.6 Containment Spray Pumps

3.6.1 Inlet Pressure

3.6.1.1 Relief Request. The licensee has requested relief from measuring inlet pressure as required by Section XI, Paragraph IWP-3100, for containment spray pumps 1A and 1B and has proposed to calculate pump inlet pressure from the refueling water storage tank (RWST) level.

3.6.1.1.1 Licensee's Basis for Requesting Relief--"The pump suction is supplied from the RWST with no installed pressure instrumentation capability. Since the RWST level is confined to a very narrow band by the technical specifications and does not change during test performance, the containment spray pump inlet pressure remains at a constant value and is included as a known quantity in the test procedure. The change in pump inlet pressure with and without the pump running is beyond the accuracy of the calculation method; therefore, inlet pressure before pump start is not recorded."

3.6.1.1.2 Evaluation--Since containment spray pump suction pressure cannot be measured directly, the measurement of RWST level and calculation of the pump inlet pressure is a reasonable alternative to measuring pump inlet pressure. As RWST level is essentially maintained constant, measurement both before and after pump start should not be necessary. Because of the lack of installed suction pressure instrumentation, compliance with the Code requirements is impractical and conformance with the Code would be possible only if the containment spray system was redesigned. Based on the determination that the Code requirements will result in a hardship without a compensating increase in level of safety, and considering the licensee's proposed alternative, relief may be granted as requested.

4. VALVE TESTING PROGRAM

The Kewaunee Nuclear Power Plant IST Program submitted by the Wisconsin Public Service Corporation was examined to verify that all valves included in the program are subjected to the periodic tests required by the ASME Code, Section XI, and the NRC positions and guidelines. The reviewer found that, except as noted in Appendix C or where specific relief from testing has been requested, these valves are tested to the Code requirements. Each Wisconsin Public Service Corporation basis for requesting relief from the valve testing requirements and the reviewer's evaluation of that request is summarized below and grouped according to system and valve category.

4.1 General Relief Requests

4.1.1 Leakage Rate Testing of Containment Isolation Valves

4.1.1.1 Relief Request. The licensee has requested relief from the trending requirements of Section XI, Paragraph IWV-3427(b), for the containment isolation valves and has proposed to establish leakage limits for containment isolation valves or groups of containment isolation valves and incorporate associated corrective actions into the leakage test program.

4.1.1.1.1 Licensee's Basis for Requesting Relief--"Individual valves and groups of valves which are required to perform a containment isolation function under postulated accident conditions are leak tested in accordance with Appendix J to 10 CFR 50 and need not be further leak tested in accordance with Section XI, Paragraphs IWV-3421 through IWV-3425."

"Leakage limits for containment isolation valves or groups of containment isolation valves and associated corrective actions have been established in lieu of the trending requirements of IWV-3427(b) of the ASME Code. This method was discussed with the NRC staff during a March 12 and 13, 1985 meeting regarding the Kewaunee Inservice Testing Program."

"For valves which normally exhibit a stroke time of less than 10 seconds, the alert level is defined as the value at which the measured stroke time is less than 50% of the normal stroke time or greater than 150% of the normal stroke time."

"For valves which normally exhibit a stroke time of greater than 10 seconds, the alert level is defined as the value at which the stroke time is less than 75% of the normal stroke time or greater than 125% of the normal stroke time."

"The action level is defined as the value at which the measured stroke time is either less than half of the alert minimum stroke time or greater than twice the alert maximum stroke time."

"Fast acting valves (those that exhibit normal travel times of less than 5 seconds) will not have a lower limit alert or action level. The upper limit alert and action levels will be established using good engineering judgement."

"In all cases if a predefined limit exists (such as FSAR limits, good engineering judgement, etc.) the most limiting of either the predefined limit or the calculated limit will be used."

"The establishment of stroke time ranges meets the intent of the ASME code by providing a method of identifying degradation of valve performance and establishing limits at which corrective action must be taken."

4.I.2.1.2 Evaluation--Substitution of the licensee's proposed alternate testing for power operated valves in lieu of the IWV-3417 requirements has been demonstrated to be equivalent or better to the Code requirements. However, the five second limit for rapid acting valves is not acceptable, as the NRC defines rapid acting valves as those whose normal stroke time is two seconds or less. Based on the determination that the licensee's alternate testing is equivalent to the Code requirements, relief may be granted, provided that the licensee sets the limit for rapid acting valves at two seconds and declares these valves inoperable if their stroke time exceeds two seconds.

should not be granted from the Code full-stroke exercising frequency requirements. Additionally, if fail-safe tested, this valve should be stroke timed during that test.

4.2.1.2 Relief Request. The licensee has requested relief from exercising RCP seal water return isolation valves CVC-211 and CVC-212 as required by Section XI, Paragraph IWV-3412, and has proposed to verify valve operability by full-stroke exercising these valves during cold shutdowns if the reactor coolant pumps are stopped and during refueling outages.

4.2.1.2.1 Licensee's Basis for Requesting Relief--"The safety function of these valves is to provide containment isolation. If the RCP seal return line containment isolation valves were placed in the closed position during power operation it would challenge the seal return relief valve and could cause a loss of RCS water to the pressurizer relief tanks. Therefore closure of these valves during reactor coolant pump operation is not in the best interest of safety."

"If the reactor coolant pumps are stopped during a cold shutdown, these valves will be exercised at that time, otherwise they will be exercised during the refueling outage. This ensures that the valves will be exercised at least on a refueling outage frequency."

4.2.1.2.2 Evaluation--Closing these valves during RCS operation could cause a loss of RCS water during system relief valve lifting or a overpressurization of the seal water piping. The valves should be exercised only when the reactor coolant pumps are not operating as valve failure in the closed position could cause RCP seal damage. Compliance with the Code required testing frequency would be burdensome since this would require quarterly plant shutdown, cooldown, and stoppage of reactor coolant pumps. Based on the impracticality of complying with the Code required testing frequency, and the licensee's proposed alternative testing frequency, relief from the Code requirements may be granted as requested.

4.3.1.1.1 Licensee's Basis for Requesting Relief--"The safeguard function required for these valves is to provide containment isolation. Exercise tests in the closed direction are not performed during plant operation since these lines are required to operate."

4.3.1.1.2 Evaluation--These valves are required to be open during plant operation and full-stroking closed should not be performed during power operation due to loss of pressurizer level control and subsequent plant shutdown. Valve closure, the safety position, can be verified only by leak testing. Compliance with the Code required testing frequency would be burdensome since this would require quarterly plant shutdown and containment entry. Procedures required for leak rate testing during cold shutdown could delay plant startup. Based on the impracticality of complying with the Code required testing frequency, and the licensee's proposed alternative testing, relief from the Code requirements may be granted as requested.

4.3.2 Category B Valves

4.3.2.1 Relief Request. The licensee has requested relief from measuring the stroke time of diesel generator 1A air start valves 1 and 2 and diesel generator IB air start valves 1 and 2 as required by Section XI, Paragraph IWV-3413 and has proposed to verify valve operability by monitoring the diesel generator start times.

4.3.2.1.1 Licensee's Basis for Requesting Relief--"The diesel generator air start valves receive an automatic open signal as part of the diesel generator start sequence. There is no operator action necessary to open these valves nor is there any remote position indication. There is no practical method of performing full stroke exercise timing tests on these valves. Diesel generator air start valves open to supply air to the air start motors on the diesel generator. The valves receive an automatic open signal as part of the diesel generator start sequence. The diesel generators are tested at full load for 4 hours each month. There are two pairs of air start motors per diesel generator which are alternated each test to verify operation of the respective air start valve. This assures that the valves are tested at least once every 3 months. Since no practical method exists to measure the valve full stroke time, the diesel generator

these valves or a specific alternate test method that would monitor stroke time to detect valve degradation. Since the licensee has not demonstrated that the Code requirements are impractical, relief should not be granted.

4.4 Service Water System

4.4.1 Category B Valves

4.4.1.1 Relief Request. The licensee has requested relief from measuring the stroke time of service water return line from the diesel generator coolers air operated valves SW-301A and SW-301B as required by Section XI, Paragraph IWV-3413 and has proposed to verify valve operability by monitoring the diesel generator start times.

4.4.1.1.1 Licensee's Basis for Requesting Relief--"These valves receive an auto open signal based on diesel RPM during diesel generator start. The valves are verified to be in full open position by observing local indication on the top of the valve. Insufficient valve opening will be indicated by inadequate cooling of the diesel generator components (i.e., high bearing lube oil temperature alarm). Monthly testing and monitoring of the diesel generators will verify proper operation of the valves."

4.4.1.1.2 Evaluation--These valves open on an auto open signal based on diesel RPM and have local position indication which might provide a means to stroke time the valves. The licensee's basis did not provide either a sufficient technical justification for not stroke timing these valves or a specific alternate test method that would monitor stroke time to detect valve degradation. Since the licensee has not demonstrated that the Code requirements are impractical, relief should not be granted.

4.6 Reactor Coolant System

4.6.1 Category A/C Valves

4.6.1.1 Relief Request. The licensee has requested relief from exercising nitrogen supply line to the pressurizer relief tank check valve NG-304 and reactor makeup water line to the pressurizer relief tank check valve MU-1011 as required by Section XI, Paragraph IWV-3522 and has proposed verifying closure of these valves, their safety position, at a refueling outage frequency when they are leak rate tested.

4.6.1.1.1 Licensee's Basis for Requesting Relief--"These valves are normally closed check valves whose safety function is to remain closed post accident to provide containment isolation (i.e., passive). Periodic opening of these valves during power operation may be necessary to maintain desired pressurizer relief tank level, temperature and pressure. If these valves are opened during power operation, they are opened for short duration only. Opening of these valves would necessitate recategorizing these valves as active, however, no practical means exist to verify full closure of these check valves following their usage."

"These valves do act as containment isolation valves and will receive leakage tests in accordance with 10 CFR 50, Appendix J during refueling which will verify full closure capability."

4.6.1.1.2 Evaluation--Valves NG-304 and MU-1011 closure, the safety position, can be verified only by leak testing. Compliance with the Code required testing frequency would be burdensome since this would require quarterly plant shutdown and containment entry. Procedures required for leak rate testing during cold shutdown could delay plant startup. Based on the impracticality of complying with the Code required testing frequency, and the licensee's proposed alternative testing, relief from the Code requirements may be granted as requested.

4.6.2.2.1 Licensee's Basis for Requesting Relief--"These valves are the pressurizer and reactor vessel head vent valves. All the affected valves are fast acting solenoid operated valves and are designed with completely enclosed movable plug/valve stem assemblies and position indicating reed switches. This design precludes observation of valve and switch operation for the purpose of verifying remote indication. These valves are tested to verify open flow paths during each performance of the reactor coolant system fill and vent procedure and leak tightness is observed routinely within the scope of RCS leakage monitoring required by Technical Specifications. Problems with the remote position indication for these valves could be identified."

4.6.2.2.2 Evaluation--Observation of valve position indication during valve operation when performing plant fill and vent on a refueling outage frequency should be sufficient to indirectly determine proper remote position indication for the reactor vent isolation valves. Conformance with the Code required testing method is impractical due to system design. Based on the impracticality of complying with the Code required testing method and the licensee's proposed alternative testing, relief from the Code requirements may be granted as requested.

4.7 Sampling System

4.7.1 Category A Valves

4.7.1.1 Relief Request. The licensee has requested relief from remote position verification for RCS hot leg sample isolation valves RC-422 and RC-423 as required by Section XI, Paragraph IWV-3300 and has proposed to verify remote position by monitoring for leakage on a refueling outage frequency.

4.7.1.1.1 Licensee's Basis for Requesting Relief--"These valves are the RCS hot leg sample line isolation valves. All the affected valves are fast acting solenoid operated valves and are designed with completely enclosed movable plug/valve stem assemblies and position indicating reed switches. This design precludes observation of valve and switch operation for the purpose of verifying remote indication. The two RCS hot leg sample

valve configurations will be used to verify that flow exists through check valves ICS-3A(B) and ICS-4A(B). Acceptance criteria based on historical data have been established and predefined corrective actions are implemented as necessary. This method of testing is consistent with the method of Paragraph IWV-3522(b)."

4.8.1.1.2 Evaluation--These valves cannot be full-stroke exercised with flow without spraying water into the containment which could cause damage to equipment.

However, a valve sampling disassembly and inspection utilizing a manual full-stroke exercise of the valve disk is an acceptable method to verify a check valve's full-stroke capability. The sampling technique requires that each valve in the group be of the same design (manufacturer, size, model number and materials of construction) and have the same service conditions. Additionally, at each disassembly it must be verified that the disassembled valve is capable of full-stroking and that its internals are structurally sound (no loose or corroded parts).

A different valve of each group is required to be disassembled, inspected and manually full-stroke exercised at each refueling outage, until the entire group has been tested. If it is found that the disassembled valve's full-stroke capability is in question, the remainder of the valves in that group must also be disassembled, inspected and manually full-stroke exercised during the same outage.

Based on the determination that the Code requirements are not impractical and that a suitable method is available to full-stroke exercise these valves, relief should not be granted as requested.

4.8.1.2 Relief Request. The licensee has requested relief from exercising RHR supply line to the ICS pumps check valves RHR-401A and RHR-401B as required by Section XI, Paragraph IWV-3522 and has proposed to verify valve operability by partial-stroke exercising these valves during the quarterly RHR pump tests.

Based on the determination that the Code requirements are not impractical and that a suitable method is available to full-stroke exercise these valves, relief should not be granted as requested.

4.8.1.3 Relief Request. The licensee has requested relief from exercising ISC discharge line check valves ICS-8A and ICS-8B as required by Section XI, Paragraph IWV-3522 and has proposed to verify valve operability by removing these valves from the piping and physically inspecting them once every five years.

4.8.1.3.1 Licensee's Basis for Requesting Relief--"Introducing flow through these valves would result in water being sprayed into the containment. The valve design does not provide for the use of a mechanical exerciser, therefore neither partial nor full stroke exercising of these valves is possible."

"Removing the valve once every five years is sufficient to identify valve degradation. Results of past inspection have not indicated any need for more frequent disassembly and inspection. More frequent disassembly and inspections would increase the risk of error during reassembly."

"These valves are removed from the piping and physically inspected to observe freedom of disk movement once every five years. The visual inspection includes an evaluation of internal wear, pin wear, spring conditions, seat leakage and freedom of disk movement."

4.8.1.3.2 Evaluation--These valves cannot be full-stroke exercised with flow without spraying water into the containment which could cause damage to equipment.

However, a valve sampling disassembly and inspection utilizing a manual full-stroke exercise of the valve disk is an acceptable method to verify a check valve's full-stroke capability. The sampling technique requires that each valve in the group be of the same design (manufacturer, size, model number and materials of construction) and have the same service conditions. Additionally, at each disassembly it must be verified that the disassembled valve is capable of full-stroking and that its internals are structurally sound (no loose or corroded parts).

4.9.1.1.2 Evaluation--This valve cannot be exercised during power operation because the RCS pressure is greater than the accumulator pressure. The valve should be partial-stroked during cold shutdown provided this testing will not lead to a low-temperature overpressure condition in the RCS.

However, a valve sampling disassembly and inspection utilizing a manual full-stroke exercise of the valve disk is an acceptable method to verify a check valve's full-stroke capability. The sampling technique requires that each valve in the group be of the same design (manufacturer, size, model number and materials of construction) and have the same service conditions. Additionally, at each disassembly it must be verified that the disassembled valve is capable of full-stroking and that its internals are structurally sound (no loose or corroded parts).

A different valve of each group is required to be disassembled, inspected and manually full-stroke exercised at each refueling outage, until the entire group has been tested. If it is found that the disassembled valve's full-stroke capability is in question, the remainder of the valves in that group must also be disassembled, inspected and manually full-stroke exercised during the same outage.

Based on the determination that the Code requirements are not impractical and that a suitable method is available to full-stroke exercise these valves, relief should not be granted as requested.

4.9.1.2 Relief Request. The licensee has requested relief from exercising low pressure safety injection (LPSI) line to the reactor vessel check valves SI-303A and SI-303B and high pressure safety injection (HPSI) and LPSI line to the reactor vessel check valves SI-304A and SI-304B as required by Section XI, Paragraph IWV-3522 and has proposed to verify valve operability by full-stroke exercising these valves on a refueling outage frequency.

4.9.2.1.1 Licensee's Basis for Requesting Relief--"These accumulator discharge check valves cannot be full- or partial-stroke exercised during power operation because the accumulator pressure is less than the RCS pressure. These check valves will be tested during cold shutdowns, however, it is not feasible to exercise these check valves at the design basis LOCA flow rate (approximately 14,000 gpm). Consistent with Paragraph IWV-3522(b), these check valves will be partial flow exercised in a manner demonstrating that the disk moves freely off its seat by comparison of pressure differential and flow rate."

4.9.2.1.2 Evaluation--These valves cannot be exercised during power operation because the RCS pressure is greater than the accumulator pressure. These valves should be partial-stroke exercised during cold shutdowns provided this testing will not lead to a low-temperature overpressure condition in the RCS.

However, a valve sampling disassembly and inspection utilizing a manual full-stroke exercise of the valve disk is an acceptable method to verify a check valve's full-stroke capability. The sampling technique requires that each valve in the group be of the same design (manufacturer, size, model number and materials of construction) and have the same service conditions. Additionally, at each disassembly it must be verified that the disassembled valve is capable of full-stroking and that its internals are structurally sound (no loose or corroded parts).

A different valve of each group is required to be disassembled, inspected and manually full-stroke exercised at each refueling outage, until the entire group has been tested. If it is found that the disassembled valve's full-stroke capability is in question, the remainder of the valves in that group must also be disassembled, inspected and manually full-stroke exercised during the same outage.

Based on the determination that the Code requirements are not impractical and that a suitable method is available to full-stroke exercise these valves, relief should not be granted as requested.

APPENDIX A
VALVES TESTED DURING COLD SHUTDOWNS

APPENDIX A
VALVES TESTED DURING COLD SHUTDOWNS

The following are Category A, B, and C valves that meet the exercising requirements of the ASME Code, Section XI, and are not full-stroke exercised every three months during plant operation. These valves are specifically identified by the owner in accordance with Paragraphs IWV-3412 and 3522 and are full-stroke exercised during cold shutdowns and refueling outages. All valves in this Appendix have been evaluated and the reviewer agrees with the licensee that testing these valves during power operation is not practical due to the valve type, valve location, or system design. These valves should not be full-stroke exercised during power operation. These valves are listed below and grouped according to the system in which they are located.

1. RESIDUAL HEAT REMOVAL SYSTEM

1.1 Category B Valves

RHR suction valves RHR-1A, RHR-1B, RHR-2A and RHR-2B cannot be exercised during power operation because they are interlocked with the RCS pressure and cannot be opened when RCS pressure is above 450 psig. These valves will be full-stroke exercised during cold shutdowns and refueling outages.

RHR injection isolation valve RHR-11 cannot be exercised during power operation as it is required to remain closed during plant operation to isolate the low pressure RHR system from the high pressure reactor coolant system. This valve will be full-stroke exercised during cold shutdowns and refueling outages.

3.2 Category C Valves

Main steam to the turbine drive AFW pump check valves MS101A and MS101B cannot be full-stroke exercised during power operation as the necessary auxiliary feedwater flow would result in thermal shock to the steam generators feedwater nozzles and piping and subsequent possible premature failure of these components. These valves will be partial-stroke exercised quarterly and full-stroke exercised during cold shutdowns and refueling outages.

4. FEEDWATER SYSTEM

4.1 Category B Valves

Feedwater isolation valves FW-12A and FW-12B cannot be full-stroke exercised during power operation as this would result in a loss of feedwater to the steam generators which could cause a plant trip. These valves will be full-stroke exercised during cold shutdowns and refueling outages.

4.2 Category C Valves

Feedwater to steam generators check valves FW-13A and FW-13B cannot be full-stroke exercised during power operation as this would result in a loss of feedwater to the steam generators which could cause a plant trip. These valves will be full-stroke exercised during cold shutdowns and refueling outages.

Auxiliary feedwater to steam generators check valves AFW-1A, AFW-1B, AFW-1C, AFW-4A, and AFW-4B and condensate storage tank to AFW pumps suction check valves MU-311A, MU-311B, MU-311C, and MU-301 cannot be full-stroke exercised during power operation as the necessary auxiliary feedwater flow would result in thermal shock to the steam generators feedwater nozzles and piping and subsequent possible premature failure of these components. These valves will be full-stroke exercised during cold shutdowns and refueling outages.

APPENDIX B
P&ID LIST

APPENDIX B

P&ID LIST

The P&IDs listed below were used during the course of this review.

System	P&ID	Revision
Internal containment spray	M-217 Sh. 1	V
Reactor coolant	X-K100-10	AB
Service water	M-202 M-547	AR
Feedwater	M-205 Sh. 1	AA
Main, auxiliary steam and steam dump	M-203 Sh. 1	DG
Auxiliary coolant	X-K100-18 Sh. 1 X-K100-19 Sh. 2 X-K100-20 Sh. 3	U L M
Chemical and volume control	X-K100-35 Sh. 1 X-K100-36	R X
Safety injection	X-K100-28 Sh. 1 X-K100-29	T L
Reactor and shield building ventilation	M-602	AA
Reactor plant miscellaneous vents, drains and sump pump piping	M-539	G
Reactor building ventilation	M-403	M
Secondary sampling	M-219	V
Miscellaneous gas	M-216	BD
Waste disposal	X-K100-131	AQ
Station and instrument air	M-213	AH
Sampling	X-K100-44 Sh. 1	P

APPENDIX C
IST PROGRAM ANOMALIES IDENTIFIED IN THE REVIEW

APPENDIX C
IST PROGRAM ANOMALIES IDENTIFIED IN 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. The licensee has proposed to measure the auxiliary feedwater and residual heat removal pumps flow rate during cold shutdowns and measure the high head safety injection pumps flow rate during refueling outages when a full-flow instrumented flowpath is available. This alternative testing is acceptable for not measuring flow rate during the quarterly pump tests. However, the flow rate would not be measured during the service water and containment spray pump tests (see Section 3.2.1.1 of this report). The lack of installed instrumentation is not an adequate long-term justification for not measuring flow. The licensee should obtain the necessary instrumentation to measure the pump flow rate for the service water and containment spray pumps in accordance with the requirements of Section XI. Relief for the service water and containment spray pumps in this request should not be granted.

2. The licensee has requested relief from the IWV-3427(b) trending requirements for containment isolation valves (see Section 4.1.1 of this report) but has not provided sufficient technical justification to be granted relief. This relief request should not be granted.

3. The licensee has proposed valve corrective action requirements that are equivalent or better to those of Paragraph IWV-3417 of Section XI (see Section 4.1.2 of this report). Relief may be granted for this request provided that the licensee assigns a limiting value of two seconds for rapid acting power operated valves and declares these valves inoperable if their stoke time exceeds two seconds.

7. The licensee has proposed to partial-stroke exercise check valves ICS-3A, ICS-3B, ICS-4A, and ICS-4B in the internal containment spray system, during the monthly ICS pump tests and has not proposed any method for verifying the full-stroke capability of these valves (see Section 4.8.1.1 of this report). Since sample disassembly/inspection is an acceptable alternative method for verifying the full-stroke capability of check valves, relief should be denied.

8. The licensee has proposed to partial-stroke exercise check valves RHR-401A and RHR-401B in the RHR supply line to the ICS pumps and has not proposed any method for verifying the full-stroke capability of these valves (see Section 4.8.1.2 of this report). Since sample disassembly/inspection is an acceptable alternative method for verifying the full-stroke capability of check valves, relief should be denied.

9. The licensee has proposed to remove check valves ICS-8A and ICS-8B in the ICS discharge line to the spray nozzles and physically inspect them once every five years (see Section 4.8.1.3 of this report). This frequency of inspection is not acceptable and, as sample disassembly/inspection is an acceptable alternative method for verifying the full-stroke capability of check valves, relief should be denied.

10. The licensee has proposed to partial-stroke exercise check valve SI-22B in the accumulator discharge line during cold shutdowns (see Section 4.9.1.1 of this report). Since sample disassembly/inspection is an acceptable alternative method for verifying the full-stroke capability of check valves, relief should be denied.

Since the PORVs have shown a high probability of sticking open and are not needed for overpressure protection during power operation, the NRC has concluded that routine exercising during power operation is "not practical" and therefore not required by IWV-3412(a).

The PORVs' function during reactor startup and shutdown is to protect the reactor vessel and coolant system from low temperature overpressurization conditions and they should be exercised prior to initiation of system conditions for which vessel protection is needed.

The following test schedule is required:

a. Full-stroke exercising should be performed at <u>each</u> cold shutdown or, as a minimum, once each refueling cycle; but not more often than once every three months.

b. Stroke timing should be performed at <u>each</u> cold shutdown or, as a minimum, once each refueling cycle.

c. Fail-safe actuation testing should be performed at <u>each</u> cold shutdown.

17. For Relief Request RR-7, the licensee has identified the internal containment spray pump test as taking place on both a monthly and quarterly frequency (see Section 4.8.1.1.1 of this report). The licensee should correct this inconsistancy.

18. For Relief Request RR-18, the licensee has identified valves PR-45A and PR-45B. According to the Table 2 valve listing, these valves should be RC-45A and RC-45B. The licensee should correct this inconsistancy.

19. For Relief Request RR-4, the last sentence on page B-4 appears to have been added by mistake. The licensee should correct this apparent inconsistancy.

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