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TECHNICAL REPORT

PUMP AND VALVE INSERVICE TESTING PROGRAM, MILLSTONE NUCLEAR POWER STATION, UNIT 2

C. B. Ransom

Prepared for the
U.S. NUCLEAR REGULATORY COMMISSION

EG&G Idaho

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MILLSTONE NUCLEAR POWER STATION, UNIT 2

Docket No. 50-336

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ABSTRACT

This EG&G Idaho, Inc., report presents the results of our evaluation of the Millstone Nuclear Power Station, Unit 2, 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)" 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

Contained herein is a technical evaluation of the pump and valve inservice testing (IST) program submitted by the Northeast Nuclear Energy Company for its Millstone Nuclear Power Station, Unit 2.

The working session with Northeast Nuclear Energy Company and Millstone Nuclear Power Station, Unit 2, representatives was conducted on August 26 and 27, 1987. The licensee's IST program dated October 30, 1987, as amended by their submittal dated August 26, 1988, 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 Winter 1981 Addenda. Any IST program revisions subsequent to those noted above are not addressed in this technical evaluation report (TER). Program changes involving additional or revised relief requests 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. Other IST program revisions should follow the guidance in Section D of Generic Letter No. 89-04, "Guidance on Developing Acceptable Inservice Testing Programs."

In its IST program, Northeast Nuclear Energy Company 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 criteria in 10 CFR 50.55a for granting relief are indeed met for the specified pumps or valves. This review was performed utilizing the acceptance criteria of the Standard Review Plan, Section 3.9.6, the Draft Regulatory Guide and Value/Impact Statement titled, "Identification of Valves for Inclusion in Inservice Testing Programs," and Generic Letter No. 89-04, "Guidance on Developing Acceptable Inservice Testing Programs." 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.

Section 2 of this report presents the scope of this review.

Section 3 of this report presents the Northeast Nuclear Energy Company bases for requesting relief from the Section XI requirements for the Millstone Nuclear Power Station, Unit 2, pump testing program and the reviewer's evaluations and conclusions regarding these requests. Similar information is presented in Section 4 for the valve testing program.

Category A, B, and C valves which are exercised at cold shutdowns and refueling outages and meet the requirements of the ASME Code, Section XI, are addressed in Appendix A.

A listing of P&IDs and Figures used for this review is contained in Appendix B.

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

2. SCOPE

The EG&G Idaho review of the Millstone Nuclear Power Station, Unit 2, inservice testing (IST) program for pumps and valves was begun in March of 1987. The program initially examined was the second ten year inspection interval program, dated June 27, 1985, which identified the licensee's proposed testing of safety-related pumps and valves in the plant systems listed in Appendix B.

The licensee's proposed IST program was reviewed by locating and highlighting the components on the appropriate system P&IDs and determining the function of the components in the system. Then the licensee's proposed testing was evaluated to determine if it was in compliance with the ASME Code, Section XI, requirements and Generic Letter No. 89-04, "Guidance on Developing Acceptable Inservice Testing Programs." During the course of this review, questions and comments were made pertaining to unclear or potential problem areas in the licensee's IST program. These were transmitted to the licensee in the form of a request for additional information (RAI) which served as the agenda for the working meeting between the licensee, the NRC, and the EG&G reviewers.

Each pump and valve relief request was evaluated to determine if the licensee clearly demonstrated that compliance with the Code requirements is impractical or presents a hardship without a compensating increase in safety for the identified system components, and to determine if the proposed alternate testing would provide a reasonable indication of component operability and degradation. When the licensee's technical basis or alternate testing was insufficient or unclear, the licensee was requested to 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 the measurements identified in the licensee's IST program may not be possible or practical, a clarification was requested from the licensee.

For pumps, it was verified that each of the seven inservice test quantities of Table IWP-3100-1 were measured or observed. For those test quantities that were 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 was not being performed in accordance with the Code and a relief request had not been submitted, the licensee was requested to explain the inconsistency.

The review of the proposed testing of valves verified that all appropriate ASME Code testing for each individual valve is performed as required. The proposed testing was evaluated to determined if all valves that were judged to be active category A, B, and/or C, (other than safety and relief valves) are exercised quarterly in accordance with IWV-3410 or 3520. If any active safety-related valve is not full-stroke exercised quarterly as required, then the licensee's justification for the deviation, either in the form of a cold shutdown justification or a relief request, was examined to determine its accuracy and adequacy. The proposed alternate testing was also evaluated to determine if the licensee will be doing everything practical to bring valve testing as close as possible into compliance with Section XI and NRC Generic Letter 89-04 requirements.

Safety and relief valves which are safety-related, 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.

For valves having remote position indication, the reviewer confirmed that the valve remote position indication is verified in accordance with IWV-3300. The reviewer verified that the licensee had assigned limiting values of full-stroke times for all power operated valves in the IST program as required by IWV-3413. For valves having a fail-safe actuator, the reviewer confirmed that the valve's fail-safe actuator is tested in accordance with IWV-3415.

All valves identified by the licensee as category A or A/C were verified to be leak rate tested to either the 10 CFR 50, Appendix J, and Section XI, IWV-3426 and -3427(a) requirements, for those valves that perform a

containment isolation function, or to the Section XI, IWV-3421 through -3427(a), requirements for those valves that perform a pressure boundary isolation function.

Each check valve was evaluated to determine if the proposed testing would verify its ability to perform its safety function(s). Extensive system knowledge and experience with other similar facilities is employed to determine whether the proposed tests would full-stroke exercise 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.

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 licensee's ability to perform the testing was in doubt, a question was formulated to alert the licensee to the suspected problem.

Once all of the components 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 identify any additional pumps or valves that may perform a safety function. The licensee was asked to reconcile any valves that were identified by this process which were not included in 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.

Additionally, if the reviewers suspected a specific or a general aspect of the licensee's IST program, questions were included in the RAI to clarify those areas of doubt. Some questions were included to allow the reviewers to make conclusive statements in this TER.

The information in the licensee's submittals dated August 30, 1985, December 16, 1985, and August 29, 1986, were also evaluated during the review. The review was completed and the RAI was transmitted to the NRC on April 30, 1987. These questions were later used as the agenda for the working meeting with the licensee on August 26 and 27, 1987. At the meeting, each question and comment was discussed in detail and resolved as follows:

a. The licensee agreed to make the necessary IST program corrections or changes to satisfy the concerns of the NRC and their reviewers.

b. The licensee provided additional information or clarification about their IST program that satisfied the concerns of the NRC and their reviewers, and no program change is required.

c. The item remained open for the licensee to further investigate and propose a solution to the NRC.

d. The item remained open for further investigation by the NRC.

e. The item remained open for further investigation and discussion by both the NRC and the licensee.

Several conference calls were held between the licensee, the NRC, and the reviewers to clarify the NRC positions on the open items and discuss the licensee's proposed resolutions.

Changes to and refinements of the licensee's IST program were transmitted from the licensee to the NRC by letter No. B12644, dated September 2, 1987. This transmittal was received by the reviewers and compared to the previous submittal to identify any changes. A conference call was held between the licensee, the NRC, and the reviewers to discuss the open items in the Millstone Nuclear Power Station, Unit 2, IST program.

By letter B12724, dated October 30, 1987, the licensee submitted a new revision of the Millstone Nuclear Power Station, Unit 2, IST program. This revision was received by the reviewers and compared to the previous

submittals to identify any changes. The program changes were compared to the proposed changes from the working meeting and the conference calls.

As a result of the review of the program dated October 30, 1987, an additional RAI was transmitted to the NRC on May 4, 1988. The licensee submitted their responses to this RAI in their submittal dated August 26, 1988. This submittal also contains several revised relief requests and IST program pages. The requests for relief were evaluated and this TER prepared based on this program submittal.

This TER is based on information contained in the submittals, and on information obtained in the meetings and conference calls which took place during the review process.

3. PUMP TESTING PROGRAM

The Millstone Nuclear Power Station, Unit 2, IST program submitted by Northeast Nuclear Energy Company was examined to verify that all pumps that are included in the program are subjected to the periodic tests required by the ASME Code, Section XI, except for those pumps identified below for which specific relief from testing has been requested. Each Northeast Nuclear Energy Company basis for requesting relief from the pump testing requirements and the reviewer's evaluation of that request are summarized below.

3.1 All Pumps in the IST Program

3.1.1 Pump Bearing Temperature Measurements

3.1.1.1 Relief Request. The licensee has requested relief from the bearing temperature measurement requirements of Section XI, Paragraph IWP-3100, for all pumps listed in their IST program and proposed to measure the pump vibration signature as a velocity spectrum quarterly and analyze it to determine pump mechanical condition and detect mechanical degradation.

3.1.1.1.1 Licensee's Basis for Requesting Relief--Bearing metal temperature monitoring can be effective in detecting bearing problems. However, the vibration monitoring program established for Millstone Unit 2 is significantly more effective in identifying bearing degradation than an annual measurement of bearing temperature.

Bearing degradation can be detected at a very early stage by vibration signature analysis. All safety-related pumps are monitored using equipment which is sensitive to low amplitude vibration changes generated by bearing distress. These low amplitude signals are typically less than one percent of the overall vibration amplitude and cannot be detected by a simple amplitude program conforming to IWP minimum requirements. However, these changes are routinely detected in the established Millstone Unit 2 vibration monitoring program.

In addition, many of the safety-related pumps are constructed such that bearing metal temperature changes will be quickly dissipated throughout the relatively massive housings, oil reservoirs, and attached casings. As a result, locations at which bearing temperature could be monitored will respond much less than actual bearing metal temperature, greatly reducing the sensitivity of this method of identifying bearing distress.

Further, bearing temperature changes are frequently very sudden, rise quickly until the bearing wipes, then return quickly to normal or below normal as the bearing oil flow increases in the wiped bearing.

The pump vibration signatures will be recorded and analyzed at least quarterly. Signatures will be measured as a velocity spectrum. Signatures will be compared to reference signatures taken when the pump is known to be operating properly. When comparisons show symptoms of bearing degradation, action as required for a pump in the alert range of Table IWP-3100-2 will be initiated.

3.1.1.1.2 Evaluation--The licensee has indicated that a yearly measurement of pump bearing temperature for these pumps is not a meaningful test for detecting pump bearing degradation. There are several factors such as the temperature of the working fluid, the ambient temperature, and the lubricant temperature that would affect the measured bearing temperature and mask any bearing condition change short of a catastrophic bearing failure. The quarterly pump vibration signature measurement and analysis gives a much more accurate indication of pump bearing condition than annual temperature measurements, and the vibration measurement is not substantially affected by any system parameter or other factor that could mask problems or result in erroneous indications of bearing degradation. A yearly bearing temperature measurement is impractical for these pumps because they do not have temperature sensors installed in the bearings. The burden on the licensee if the Code requirements were imposed would not be justified by the limited information that would be provided about pump mechanical condition.

Based on the impracticality of complying with the Code requirement of taking yearly pump bearing temperature measurements and the level of quality and safety provided by the proposed quarterly pump vibration velocity measurements that will be taken to determine pump mechanical condition and to detect pump bearing degradation, relief should be granted from the Section XI requirement of annually measuring bearing temperature for these pumps.

3.1.2 Pump Vibration Velocity Measurements

3.1.2.1 Relief Request. The licensee has requested relief from the pump vibration amplitude measurement and allowable range requirements of Section XI, Paragraphs IWP-3100 and -3210, for all pumps in the IST program and proposed to measure and analyze vibration velocity signatures quarterly during power operations and to use acceptance criteria based on revision 10 of the ANSI/ASME OM-6 draft.

3.1.2.1.1 Licensee's Basis for Requesting Relief--Experience has shown that measurement of overall vibration amplitude in mils does not provide the desired early warning of pump degradation. Vibration amplitude is adequate for measuring unbalance, misalignment, and other low frequency failures modes. It does not give early warning of bearing degradation since the magnitude of higher frequency vibrations created by such degradation is 10 to 1,000 times lower than the normal pump movements. Experience at Northeast Utilities has shown that monitoring pump vibration velocity (in/sec) provides earlier warning of pump degradation. Collection and review of vibration "signatures" (plots of vibration velocity vs. frequency) over a range from slightly below running frequency to several times running frequency provides optimal early warning of pump degradation.

In lieu of measuring overall amplitude (mils), vibration will be monitored at least quarterly using equipment which collects vibration velocity signatures. For centrifugal pumps, at least two measurements will be taken in a plane perpendicular to the rotating shaft in two orthogonal directions and one measurement taken in the axial direction. For reciprocating pumps, similar measurements will be taken on a bearing housing of the crankshaft. On vertical line shaft pumps, measurements will be taken

on the upper motor bearing housing in three orthogonal directions including one axial direction.

Vibration will be monitored using equipment which collects vibration signatures over a range from less than one-half running speed to at least eight times running speed.

Overall, vibration velocity (in/sec RMS) will be compared to the following acceptance criteria for all but the service water pumps:

NOTE: This acceptance criteria is based on Rev. 10 of OM-6.

Acceptance Range - less than 2.5 times reference velocity

Alert Range - 2.5 to 5 times reference velocity but not greater than 0.325 in/sec. (peak)

Required Action Range - greater than 5 times reference velocity but not greater than 0.70 in/sec. (peak)

Reference Velocity shall be the average overall velocity determined during an inservice test at reference conditions when the pump is known to be operating acceptably.

In addition to the above quantitative analysis of overall vibration levels, vibration signatures will be reviewed at least quarterly to identify potential bearing degradation or other developing faults. When potential faults are identified, action as required for a pump in the Alert Range of vibration will be initiated.

3.1.2.1.2 Evaluation--Pump bearing degradation results in increased vibration at frequencies several times the rotational speed of the pump. These high frequency bearing noises would not produce a significant increase in pump vibration displacement measurements and could go undetected. However, the high frequency noises would result in relatively large changes in pump vibration velocity measurements which could permit

corrective action prior to catastrophic failure of the bearing. Because of the high frequencies of the vibrations associated with the pump bearings, vibration velocity measurements are generally much better than vibration displacement measurements in monitoring the mechanical condition of pumps and detecting pump bearing degradation.

The advantages of measuring vibration velocity instead of displacement for monitoring the mechanical condition of pumps, with the exception of low speed pumps, are widely acknowledged in the industry. The use of pump vibration velocity signatures over a wide frequency range can provide a great deal of information about pump mechanical condition that could not be obtained by using vibration displacement readings. Therefore, the licensee's proposed alternate test method is superior to the Code required testing method.

Section XI does not provide allowable ranges for vibration velocities and since the relationship between displacement and velocity is frequency dependent, a mathematical conversion of the Code displacement ranges is not appropriate. ANSI/ASME OM-6 provides a set of allowable ranges for pump vibration velocity measurements that has been found to be acceptable by the NRC. The licensee has indicated that they are using the ranges and limits specified in draft 10 of OM-6 for all pumps except the service water pumps which are specifically addressed in Section 3.2.1 of this report. The licensee's proposal, for all pumps except the service water pumps, is acceptable if the licensee complies with all of the vibration measurement requirements of ANSI/ASME OM-6. The licensee has agreed to measure vibration velocities for all pumps except the service water pumps in accordance with the requirements of OM-6, draft 10.

Based on the determination that pump vibration velocity measurements provide more information to evaluate pump mechanical condition and to detect bearing degradation than the Code required displacement readings, and considering that the licensee's proposal to measure vibration velocity in accordance with the requirements of draft 10 of ANSI/ASME OM-6 and to use the allowable ranges and limits specified in that document for all pumps except the service water pumps, would provide an acceptable level of quality and safety, relief should be granted from the Code requirements as requested.

SERVICE WATER PUMPS

3.2.1 Pump Vibration Measurements

3.2.1.1 Relief Request. The licensee has requested relief from the pump vibration measurement and allowable range requirements of Section XI, Paragraphs IWP-4500 and 3210, for the service water pumps and proposed to measure vibration velocity on the upper motor bearing and to raise the vibration limits such that these pumps enter the alert range when the vibration measurement reaches or exceeds 0.65 in/sec. and enter the required action range when it is 1.4 in/sec. or above.

3.2.1.1.1 Licensee's Basis for Requesting Relief--Higher maximum limits are appropriate for the Service Water Pumps since the measurements taken at the upper motor bearing housing are significantly affected by the height of the monitoring point above the actual pump, the lack of stiffness in the pump structure, and the fact that the pump natural resonance frequency is within 5 percent of the running frequency. Millstone Unit 2 experience has shown that the pump vibration levels are extremely sensitive to small amounts of unbalance or pump shaft bearing looseness. Inspections have shown minimal pump or motor degradation after extended operation at vibration levels near the proposed maximum allowable levels. Because of these factors, a "service factor" of 2 has been assigned to the vibration limits for these pumps and the maximum allowable vibration adjusted accordingly.

The maximum values for the service water pumps are:

Alert Range - greater than 0.65 in/sec. (peak)

Required Action Range - greater than 1.40 in/sec. (peak)

The following information was included as Attachment 3, of the licensee's submittal dated August 26, 1988:

Service Water Pump (SWP) vibration measurements are taken at the top of the motor rather than on the pump casing as recommended by OM-6 to provide a

more sensitive indicator of overall pump/motor condition. The pump operates at relatively slow speed (900 RPM). The pump casing is solidly mounted to the screen house floor. The pump bearings are (relatively) large clearance water lubricated bearings. These factors make vibration measurements taken on the accessible pump casing less sensitive to overall pump condition.

Because of their unique dynamic characteristics, the Service Water Pumps normally operate at relatively high vibration amplitudes of 0.3 to 0.6 inches/second velocity as measured at the top of the motors. While vibration levels are significantly lower at points on the pump housing, motor vibration levels are routinely monitored to provide early warning of significant pump/motor degradation. Accordingly, a "service factor" has been applied to increase the Alert level from 0.325 to 0.65 inches/second and the Required Action level from 0.7 to 1.4 inches/second.

The service factor recognizes the higher operating vibration levels caused by the unusually tall structure (11' above the foundation), very flexible motor support stand, and lack of external support at the top of the motor housing. The Hydraulic Institute standards for centrifugal pumps allow vibration levels of new, tall, vertical pump units to be almost twice as high as equivalent horizontal pumps. Despite the higher vibration levels, the magnitude of mechanical degradation (i.e. rotor unbalance, misalignment, etc.) will be no greater than for other equipment with normal support flexibility operating at the lower vibration limits. Restated, for a given amount of equipment degradation, upper motor vibration levels will be more than twice the levels of a "standard" pump.

Another significant factor which translates to lower vibration severity for a given vibration amplitude is that the fundamental resonant frequency of the pump structure is only 10 percent away from running speed. This means that any vibratory forces with a frequency coinciding with running speed (the predominant force) will cause over twice as much vibration as compared to the normal pump with 25 percent minimum margin from resonance. No attempt has been made to justify higher vibration limits based on the resonance phenomena.

Reliable operation at the higher vibration levels is further assured by the advanced nature of the Millstone Unit 2 vibration monitoring program which is capable of detecting problems at an early stage, identifying probable causes and monitoring trends such that corrective maintenance can be scheduled well in advance of a serious degradation or failure.

ACTIONS

For additional assurance of reliable operation, in addition to actions required by the ASME Boiler and Pressure Vessel Code the following actions will be implemented:

1. Determine baseline pump shaft vibration level after each pump overhaul.

2. Whenever the pump is operating in the Alert Range:

   a. Verify the upper motor vibration signature is normal (i.e. predominantly running frequency and harmonics of running frequency). Abnormal vibration characteristics such as motor bearing related vibration will be evaluated and corrective action taken to avoid serious degradation or failures.

   b. Check pump shaft vibration during each required pump test.

   c. Remove the pump from service if upper motor vibration exceeds 1.4 inches/second or pump shaft vibration exceeds 30 mils (peak to peak).

3.2.1.1.2 Evaluation--IWP-4510 requires that the vibration measurements be made on the pump bearing housing or its structural support, provided it is not separated from the pump by any resilient mounting. The service water pumps are vertical deep draft pumps that are submerged in water and are inaccessible except for the upper portion of the pump casing. Industry experience has shown that, for this type of pump, vibration measurements made on the pump driver bearing can be representative of pump

mechanical condition. Vibration velocity signatures taken on the upper motor bearing of certain vertical deep draft pumps can provide a reasonable indication of pump mechanical condition and detection of degradation.

Relief request RR-IWP-1, provided the licensee's proposed maximum vibration velocity limits for the service water pumps. The relief request alternate testing doubled the OM-6 maximum limits for both the alert and the required action ranges. The licensee indicated that the normal vibration readings for these pumps vary from 0.3 to 0.6 inches/second, therefore, the alert maximum limit of 0.65 inches/second is considered reasonable since this limit is a sensible value based on historical test data and allows some deviation before requiring an increased testing frequency. However, there is no empirical data provided that supports the licensee's proposed required action limit of 1.4 inches/second. The industry consensus is that pump vibration velocity levels above 0.7 inches/second indicate imminent pump failure or severe pump damage. Although these pumps normally experience high vibration readings, the assignment of 1.4 inches/second as the required action maximum limit does not seem reasonable since the pump is likely to fail prior to reaching this limit. This high limit could allow a seriously degraded pump to remain in service without taking the necessary corrective actions.

The licensee has demonstrated the impracticality of taking the service water pump vibration measurements on the pump housing. They have also demonstrated that the vibration velocity limits of ANSI/ASME OM-6 cannot be practically used because normal data scatter goes above the maximum Alert limit and is near the maximum Required Action limit. However, the licensee has not provided an adequate basis for their proposed Required Action vibration limit.

Based on the determination that it is impractical to take vibration measurements on the service water pump housing, it would be burdensome to require the licensee to comply with the maximum vibration velocity limits specified by ANSI/ASME OM-6, and considering that the proposed alternate testing should provide reasonable assurance of pump operability during the interim period, interim relief should be granted from the Code requirements

for a six month period to permit the licensee to justify the proposed limit or propose and justify a more restrictive limit for these pumps. The licensee should provide empirical vibration test data that supports the selected maximum required action limit and an evaluation that demonstrates that it is possible to reach the proposed or more restrictive limit so that corrective action can be initiated prior to the pump suffering a catastrophic failure.

4. VALVE TESTING PROGRAM

The Millstone Nuclear Power Station, Unit 2, IST program submitted by Northeast Nuclear Energy Company 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 reviewers 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 and established NRC positions. Each Northeast Nuclear Energy Company basis for requesting relief from the valve testing requirements and the reviewer's evaluation of that request are summarized below and grouped according to system and valve category.

4.1 General Valve Relief Requests

4.1.1 Trending Stroke Times for Power Operated Valves

4.1.1.1 Relief Request. The licensee has requested relief from the trending requirements of Section XI, Paragraph IWV-3417(a), for all power operated valves that are identified in the IST program and proposed to follow a plan that is based on deviation from a reference stroke time instead of the previous test stroke time to identify valves for further evaluation and possibly increase their test frequency.

4.1.1.1.1 Licensee's Basis for Requesting Relief--Use of the "previous test" stroke time does not adequately identify slow degradation of valve performance. For example, repeated increases in stroke time of 15 to 24 percent would not require that the valve be considered in "Alert" with attendant additional investigation and testing. The proposed alternative acceptance criteria would identify such valves and require that they be formally evaluated for acceptability or declared inoperable. In instances where the evaluation does not result in a determination of inoperability additional or increased frequency testing may be specified to aid in evaluating valve performance. This criteria provides increased assurance that degrading valves are promptly identified and that such degradation is promptly evaluated for its impact on valve operability.

Test results shall be compared to the reference values of stroke time for each valve.

a. Valves with reference stroke times greater than 10 seconds shall exhibit no more than a 25% change in stroke time when compared to the reference value.

b. Valves with reference stroke times less than 10 seconds shall exhibit no more than a 50% or 1 second (which ever is greater) change in stroke time when compared to the reference value.

c. Valves with reference stroke times of less than 2 seconds shall not exhibit a stroke time in excess of 2 seconds.

Valves with measured stroke times which do not meet the above acceptance criteria shall be immediately retested (or declared inoperable).

Valves which can only be tested during cold shutdowns or refueling outages shall be retested to verify compliance with the acceptance criteria or repaired before plant startup. Evaluation of acceptable degraded performance or increased frequency tests shall not be used to allow continued operability of the valve. The cause of the originally identified degradation shall be documented in the record of the test.

If retested and the second set of data also does not meet the acceptance criteria the data shall be analyzed within 96 hours to verify that the new stroke time represents acceptable valve operation, or the valve shall be declared inoperable. If the analysis indicates the deviation is acceptable, operation of the valve shall be tested monthly until it is repaired or declared inoperable, or until a new reference value is established. If trended test results of a valve which previously did not meet the acceptance criteria indicate the valve will exceed the limiting value of stroke time prior to the next test or that valve operation is unreliable the valve shall be declared inoperable. The evaluation shall be documented in the record of the tests. The basis for changes in reference stroke time shall be documented in the record of tests.

If the second set of data meets the acceptance criteria, the cause of the initial deviation shall be analyzed and the results documented in the record of tests.

Valves for which measured stroke times exceed limiting values for stroke times shall be immediately declared inoperable.

Valves which are declared inoperable shall be readjusted, repaired, or replaced prior to returning the valve to service. A test demonstrating satisfactory valve performance shall be performed prior to returning the valve to service.

4.1.1.1.2 Evaluation--Basing the trending of stroke times for power operated valves on the stroke time measured for a valve during its previous test can permit the gradual degradation of a valve over an extended period of time without taking any action until the limiting value of full-stroke time is exceeded. If the measured stroke time increases at a rate of 24% or less for valves with full-stroke times greater than 10 seconds, or 49% or less for those valves with full-stroke times less than or equal to 10 seconds, then no additional testing or valve evaluation is required until the limiting value of full-stroke time is exceeded. This could result in significant valve degradation before any action is taken.

The licensee's proposed alternate testing of establishing reference stroke times for power operated valves and taking corrective action when the measured stroke time differs from the reference value by approximately 25% for valves whose reference stroke times are greater than 10 seconds, or approximately 50% for valves whose reference values are less than or equal to 10 seconds, is more conservative than the Code requirements because it will not permit the gradual degradation of valves without taking corrective action. If the measured stroke time of a valve varies by more than the allowable 25% or 50%, the valves will be considered in "Alert" and will be evaluated and tested monthly until the valve is declared inoperable, repaired, or has a new reference value assigned.

Stroke time trending using the previous test method could also result in increased testing of a valve that is stroking at its normal time. This could occur if conditions caused a valve's measured stroke time to decrease by nearly 25% below the average value and then in the subsequent test, the stroke time is above the average stroke time due to normal data scatter, but the measurement is greater than 25% above the previous stroke time and the valve is required to be tested more frequently. Using the reference value in this case is desirable since the valve stroking near its normal stroke time indicates proper operation which does not warrant additional testing. The reference value method proposed by the licensee initiates corrective action in this case only if the measured stroke time differs by 25% or more from the reference value.

Generic Letter No. 89-04, Attachment 1, Item 5, provides guidelines for establishing limiting values of stroke time for power operated valves. These guidelines should be followed by the licensee to ensure that reasonable limits are set for these valves. Item 5 also provides a discussion of particular problems associated with motor operated valves (MOVs). The licensee should be aware of these problems and endeavor to conduct MOV testing in a manner that facilitates detection of valve degradation.

Generic Letter No. 89-04, Attachment 1, Item 6, states in part: "Power operated valves with normal stroke times of 2 seconds or less are referred to by the staff as "rapid-acting valves." Relief may be granted from the requirements of Section XI, Paragraph IWV-3417(a) for these valves provided the licensee assigns a maximum limiting value of full-stroke time of 2 seconds to these valves and, upon exceeding this limit, declares the valve inoperable and takes corrective action in accordance with IWV-3417(b)." the licensee's criteria "c" above conforms to this staff position and is, therefore, acceptable.

Based on the determination that the licensee's proposal to compare measured stroke times to reference stroke times is more conservative than the Code required trending of valve stroke times and provides an acceptable level of quality and safety, relief should be granted from the Section XI stroke time comparison requirements of IWV-3417(a) as requested provided that the

licensee assign limiting values of stroke time in accordance with the guidelines of Generic Letter No. 89-04, Attachment 1, Item 5.

4.1.2 Leak Rate Testing of Containment Isolation Valves

4.1.2.1 Relief Request. The licensee has requested relief from the leak rate test requirements of Section XI, Paragraph IWV-3424, for the identified valves that are leak rate tested to verify their containment isolation function, and proposed to leak rate test these valves with other valves at the containment penetration to the requirements of 10 CFR 50, Appendix J and Section XI, Paragraphs IWV-3426 and 3427.

4.1.2.1.1 Licensee's Basis for Requesting Relief--The proposed alternative testing and alternate test technique comply with the requirements of Appendix J in 10CFR50.

Some piping systems are not configured to allow single valve testing. The proposed alternative test provides assurance that total containment leakage remains within limits yet allows trouble shooting to identify individual leaking valves without requiring quantification of leakage through a single valve.

All valves are included in the request for alternate leakage measurement techniques when leakage exceeds standard leakage measurement equipment capabilities.

We propose to Leak Test Category A valves in groups when single valve testing cannot be accomplished. Where multiple valves on a single penetration are tested in a single test, the leakage will be attributed to the penetration not to an individual valve. Analysis of leakage rate and establishment of maximum allowable leak rates for these valves will be based on total penetration leakage. Analysis and corrective action will be in accordance with IWV-3426 and 3427.

Where leakage rates exceed measurement limits of feed rate measuring devices an alternative test based on pressure decay rate between isolation valves will be used.

4.1.2.1.2 Evaluation--The leak test procedures and requirements for containment isolation valves identified by 10 CFR 50, Appendix J, essentially meet the Section XI Code requirements since it incorporates all of the major elements of Paragraphs IWV-3421 through 3425. Appendix J, Type C, leak rate testing adequately determines the leak-tight integrity of these valves. The 10 CFR 50, Appendix J, leak rate testing does not trend or establish corrective actions based on individual valve leakage rates, therefore, the "Analysis of Leakage Rates" and "Corrective Action" requirements of Section XI, Paragraphs IWV-3426 and 3427(a) must be followed and the licensee has committed to meet these requirements.

Where it is not practicable to individually leak rate test containment isolation valves because of system design and lack of appropriate test taps, leak rate testing them as a group by penetration should adequately determine the leak-tight integrity of these valves. However, the "Analysis of Leakage Rates" and "Corrective Action" requirements of Section XI, Paragraphs IWV-3426 and 3427(a) must be followed as closely as practicable. The licensee stated that maximum leakage rates will be assigned to each valve group and not to an individual valve. This test method should provide a reasonable assurance of the leak-tight integrity of these valves as long as the assigned limiting leakage rate for each valve grouping is conservative considering the number and sizes of valves in the group and does not permit excessive leakage through a single valve to go uncorrected.

Based on the equivalency of the Appendix J, Type C, leak rate requirements to the Code leak rate requirements of Paragraphs IWV-3421 through IWV-3425 and considering that the licensee has proposed to comply with the requirements of IWV-3426 and -3427, relief should be granted from the requirements of the Code for containment isolation valves provided the licensee's assigned maximum group leakage rate limits are conservatively based on the smallest valve in the group so that corrective actions are taken whenever the leak tight integrity of any of the listed valves is in question.

4.1.3 Verifying Closure of Valve Operating Accumulator Check Valves

4.1.3.1 Relief Request. The licensee has requested relief from the exercising requirements of Section XI, Paragraph IWV-3520, for the following check valves that are located in the instrument air lines to the accumulators of safety-related air operated valves, and proposed to verify reverse flow closure of these valves by performing a leak test during each refueling outage.

Valve Served	Valve Description
2-AC-15	Containment purge isolation
2-AC-20	Containment purge isolation
2-SI-659	SI minimum flow recirculation isolation
2-SI-660	SI minimum flow recirculation isolation
2-CH-517	Auxiliary spray isolation
2-CH-518	Loop charging isolation
2-CH-519	Loop charging isolation

4.1.3.1.1 Licensee's Basis for Requesting Relief--The licensee failed to provide a basis for not exercising these valves quarterly or during cold shutdowns.

4.1.3.1.2 Evaluation--These are simple check valves which are located in the instrument air supply lines to the air operator accumulators for the identified safety-related valves. Since the instrument air lines are not seismically qualified Code class pipes, these check valves perform a safety function in the closed position to prevent the loss of valve operating air from the accumulators in the event of a loss of the instrument air system. These check valves do not have position indication, therefore, the only practical method of verifying their reverse flow closure is leak testing. The instrument air lines must be isolated and vented to perform the accumulator check valve leak tests. This testing would result in the safety-related air operated valves being inoperable, which could result in a plant shutdown. Performing this testing during cold shutdowns could result in a delay in returning the plant to power. Because of the above reasons, it would be impractical to exercise these valves quarterly during power operations or during cold shutdowns. It would be burdensome to require the licensee to make system modifications to allow quarterly testing of these valves.

Based on the impracticality of complying with the Code requirements, the burden on the licensee if the Code requirements were imposed, and the licensee's proposed alternate testing of verifying valve closure by the performance of leak rate testing during reactor refueling outages, relief should be granted from the exercising interval requirements of Section XI for these valves. The licensee, however, should document the basis for not testing these valves at the Code specified frequencies in their IST program.

4.2 Containment Spray System

4.2.1 Category C Valves

4.2.1.1 Relief Request. The licensee has requested relief from the exercising requirements of Section XI, Paragraph IWV-3520, for 2-CS-5A and 5B, the containment spray header check valves, and proposed to disassemble, inspect, and manually exercise the valve disks on a sampling basis during refueling outages.

4.2.1.1.1 Licensee's Basis for Requesting Relief--Valve operation cannot be verified during reactor operations since the valves are inaccessible during plant operation. Water cannot be used for this test since massive containment wetting would occur if full or partial flow was passed through this valve. Thus the valve cannot be tested with fluid flow under any plant conditions.

One valve will be disassembled, inspected and manually exercised during each refueling outage.

4.2.1.1.2 Evaluation--IWV-3520 requires that check valves be exercised to their safety function position(s) quarterly. Valves 2-CS-5A and 5B cannot be full or partial-stroke exercised with flow during power operations or any plant operating mode, because the only flow path through these valves is into the containment spray rings and establishing flow for testing would result in spraying water inside containment. Flow through the containment spray nozzles would wet down most of the equipment and structures inside containment which could cause damage to equipment and insulation and

require extensive repairs and cleanup. It is not practical to require the licensee to exercise these valves with flow and possibly damage equipment inside containment, therefore, these valves should be verified to full-stroke exercise by some alternate method.

Generic Letter 89-04 states that valve disassembly and inspection can be used as a positive means of determining that a valve's disk will full-stroke exercise open or of verifying closure capability, as permitted by IWV-3522. If possible, partial valve stroking quarterly or during cold shutdowns, or after reassembly must be performed. The staff has established the following positions regarding the use of valve disassembly and inspection as an alternative to the Code testing requirements:

a. During the disassembly process, the valve internals should be visually inspected for worn or corroded parts, and the valve disk should be manually exercised.

b. Due to the scope of this procedure, the personnel hazards involved and system operating restrictions, valve disassembly and inspection may be performed during reactor refueling outages. Since this frequency differs from the Code required frequency, this deviation must be specifically noted in the IST program.

c. Where the licensee determines that it is burdensome to disassemble and inspect all applicable valves each refueling outage, a sample disassembly and inspection plan for groups of identical valves in similar applications may be employed. The NRC guidelines for this plan are explained below:

   The sample disassembly and inspection program involves grouping similar valves and disassembling and inspecting one valve in each group during each refueling outage. The sampling technique requires that each valve in the group be the same design (manufacturer, size, model number, and materials of construction) and have the same service conditions including valve orientation. Additionally, at each disassembly the licensee must verify that the

disassembled valve is capable of full-stroking and that the internals of the valve are structurally sound (no loose or corroded parts). Also, if the disassembly is to verify the full-stroke capability of the valve the disk should be manually exercised.

A different valve of each group is required to be disassembled, inspected, and manually full-stroke exercised at each successive refueling outage, until the entire group has been examined. If the disassembled valve is not capable of being full-stroke exercised or there is binding or failure of valve internals, the remaining valves in that group must also be disassembled, inspected, and manually full-stroke exercised during the same outage. Once this is completed, the sequence of disassembly must be repeated unless extension of the interval can be justified.

Compliance with the Code required testing frequency would be burdensome since it could involve quarterly shutdown and valve disassembly and inspection or disassembly and inspection during cold shutdowns which could cause a delay in returning the plant to power. Disassembly, inspection, and manually exercising the valve disks on a sampling basis during reactor refueling outages should provide an indication of valve mechanical condition and their ability to perform their safety functions.

Based on the impracticality of utilizing the Code required testing method, the burden to the licensee of complying with the Code required testing frequency, and the licensee's proposal of verifying valve operability by disassembly, inspection, and manually exercising the valve disks during reactor refueling outages, relief should be granted from the Code requirements as requested provided the licensee complies with the positions of Generic Letter 89-04, Attachment 1, Item 2.

4.2.1.2 Relief Request. The licensee has requested relief from the exercising requirements of Section XI, Paragraph IWV-3520, for 2-CS-14A and 2-CS-14B, the refueling water storage tank header (RWST) check valves to the containment spray and safety injection pump suctions, and proposed to partial-stroke these valves quarterly and to full-stroke exercise them during refueling outages.

4.2.1.2.1 Licensee's Basis for Requesting Relief--These valves cannot be full-stroke exercised during reactor operation since the only full flow path is into the reactor coolant system. Safety injection pump discharge pressures are not adequate to admit water to the pressurized Reactor Coolant System. The only flow path capable of accepting full design flow is from the Refueling Water Storage Tank into the Reactor Coolant System via the Low Pressure Safety Injection pumps. Use of the containment spray pump would not fully stroke the valve and would result in massive containment wetting and consequent equipment damage. The valves cannot be full-stroked during cold shutdown since over-pressurization of the Reactor Coolant System would result. These valves shall be part-stroke exercised quarterly and full-stroke exercised at each refueling.

4.2.1.2.2 Evaluation--IWV-3520 requires that check valves be exercised to their safety function position(s) quarterly or, if justified, during cold shutdowns. Valves 2-CS-14A and 14B cannot be full-stroke exercised with flow during power operations because the only full flow path through these valves is into the reactor coolant system and the high and low pressure safety injection pumps cannot overcome normal operating reactor coolant system pressure. There is a flow path to establish flow through these valves quarterly during power operations, however, that flow path incorporates small diameter piping that will not permit the passage of sufficient flow to full-stroke exercise these valves. These valves cannot be full-stroke exercised quarterly during power operations unless extensive system modifications, such as installing full flow test loops, are made which permit this testing. It would be burdensome for the licensee to make such modifications because of the cost involved. Additionally, reduced system reliability could result from failures that could divert injection flow away from the RCS or spray flow away from the spray rings.

These valves cannot be exercised by pumping into the RCS with the safety injection pumps during cold shutdowns because there is not an adequate expansion volume and pumping into the RCS could cause or contribute to a low-temperature overpressurization of the RCS. Because of this concern and administrative controls to prevent its occurrence, it is impractical to full-stroke exercise valves 2-CS-14A and 14B during cold shutdowns. The

licensee will full-stroke exercise these check valves during refueling outages while filling the refueling pool when an adequate expansion volume exists to accommodate the flow required to exercise them.

Based on the impracticality of full-stroke exercising valves 2-CS-14A and 14B quarterly or during cold shutdowns, the burden on the licensee if these Code requirements were imposed, and the licensee's proposed alternate testing of partial-stroke exercising these valves quarterly and full-stroke exercising them during reactor refueling outages, relief should be granted from the Section XI requirements as requested.

4.2.1.3 Relief Request. The licensee has requested relief from the exercising requirements of Section XI, Paragraph IWV-3520, for 2-CS-15A and 15B, the check valves in the header from the containment sump to the suction of the containment spray and the safety injection pumps, and proposed to part-stroke exercise them quarterly and to disassemble, inspect, and manually exercise these valves on a sampling basis every 40 month period.

4.2.1.3.1 Licensee's Basis for Requesting Relief--These valves cannot be stroke tested using system fluids. To attempt to do so would require filling the containment to design post-accident water depth and drawing water from the containment with safety-related pumps. This would result in massive spread of radioactive contamination. The proposed alternative, i.e., disassembly, visual examination, and manually stroking the valve through full travel requires that the safety injection suction header be isolated and drained. This creates approximately 15,000 gallons of radioactive liquid waste.

These valves sit in a carefully controlled water environment. They are not subject to wear or other damage mechanisms. When the valves were first visually examined in 1981 after more than seven years of "service" there was no evidence of corrosion or wear which could impact the operation or integrity of the valve. Northeast Nuclear Energy Company considers the more frequent disassembly and inspection of these valves to have a higher potential for adverse impact than the proposed examination schedule. Since no increase in reliability or safety would result from increased

examinations, the costs and personnel exposure as well as the generation of radioactive liquid and solid waste associated with such tests, are considered unwarranted. If degradation is found in the valve examined the other similar valve would also be examined prior to reactor startup.

These valves will be part-stroke exercised every three months. One valve will be disassembled, visually examined, and stroked through full travel each 40-month period.

4.2.1.3.2 Evaluation--IWV-3520 requires that check valves be exercised to their safety function position(s) quarterly or, if justified, during cold shutdowns. Valves 2-CS-15A and 15B are in the suction lines from the containment sump and the only way to establish flow through them is to flood the containment sump and take a suction from the sump with the containment spray or the safety injection pumps. The only full flow path through these valves is into the reactor coolant system, however, flow cannot be established through this path during power operations because the safety injection pumps cannot overcome normal operating reactor coolant system pressure. As explained in Item 4.2.1.1.1 of this report, it is not practical to establish containment spray flow for valve testing because it would wet and possibly damage equipment inside containment. It would be burdensome to require the licensee to flood the containment sump to the design post accident depth for valve testing because filling the sump could damage equipment and could spread radioactive contamination.

These valves cannot be full-stroke exercised by pumping from the containment sump into the reactor coolant system during cold shutdowns because there is inadequate expansion volume in the reactor coolant system and pumping into it could cause or contribute to a low-temperature overpressurization of the reactor vessel or system piping. Containment spray flow should not be initiated for valve testing during cold shutdowns because it would wet and possibly damage equipment inside containment. Because of these concerns, it is impractical to full-stroke exercise valves 2-CS-15A and 15B during cold shutdowns.

The NRC Staff position is that valve disassembly and inspection can be used to meet the exercising requirements of IWV-3520 for check valves which cannot be full-stroke exercised open with system flow. Where the licensee determines that it is burdensome to disassemble and inspect all applicable valves each refueling outage, a sample disassembly and inspection plan for groups of identical valves in similar applications may be employed. The sample disassembly and inspection program involves grouping similar valves and disassembling one valve in each group during each refueling outage and is described in more detail in Attachment 1, Item 2, of Generic Letter 89-04 and Section 4.2.1.1.2 of this report. The licensee has proposed to disassemble one valve from this sample group every 40 months, which is an extension of the sample interval identified in Generic Letter 89-04.

Disassembly of one valve in this group every 40 months could result in a period of 80 months (6 $^{2}/_{3}$ years) in-between evaluating each valve. Extension of the valve exercising interval from that allowed by the Code (quarterly or cold shutdown frequency) to once every 6 $^{2}/_{3}$ years is a substantial change which may not be justified from the standpoint of valve reliability and plant safety. Generic Letter 89-04 provides the following guidelines regarding extension of the sample disassembly interval for check valves:

> Extension of the valve disassembly/inspection interval to one valve every other refueling outage or expansion of the group size above four valves should only be considered in cases of <u>extreme</u> hardship where the extension is supported by actual in-plant data from previous valve maintenance and testing. In order to support extension of the valve disassembly/inspection intervals to longer than once every 6 years, licensees should develop the following information:
>
> a. Disassemble and inspect each valve in the valve grouping and document in detail the condition of each valve and the valve's capability to be full-stroked.
>
> b. A review of industry experience, for example, as documented in NPRDS, regarding the same type of valve used in similar service.

c. A review of the installation of each valve addressing the "EPRI Applications Guidelines for Check Valves in Nuclear Power Plants" for problematic locations.

In its IST program submittal the licensee has not provided sufficient information to support extending the sample disassembly test interval for these valves.

The licensee's proposed disassembly interval does not provide reasonable assurance of valve operational readiness; however, it is impractical to full-stroke exercise valves 2-CS-15A and 15B using system flow during any plant mode, so these valves must be verified to full-stroke exercise open by some other method. Sample disassembly, inspection, and manual exercising the valve disk should provide an indication of the mechanical condition of these check valves and reasonable assurance of their ability to full-stroke open, therefore, relief should be granted from the Code exercising method and frequency requirements provided that the licensee disassembles and inspects these valves in accordance with the positions of Attachment 1, Item 2, of Generic Letter 89-04.

4.3 High Pressure Safety Injection System

4.3.1 Category C Valves

4.3.1.1 Relief Request. The licensee has requested relief from the exercising requirements of Section XI, Paragraph IWV-3520, for the following high pressure safety injection system check valves, and proposed to partial-stroke exercise these valves quarterly and to full-stroke exercise them during refueling outages when the reactor head is removed to provide an adequate expansion volume.

Valve	Description
2-SI-008	HPSI discharge header check valve
2-SI-009	HPSI discharge to RCS Loop 2B check valve
2-SI-010	HPSI discharge to RCS Loop 2A check valve
2-SI-011	HPSI discharge to RCS Loop 1B check valve
2-SI-012	HPSI discharge to RCS Loop 1A check valve

Valve	Description
2-SI-113	HPSI discharge to RCS Loop 1A check valve
2-SI-123	HPSI discharge to RCS Loop 1B check valve
2-SI-133	HPSI discharge to RCS Loop 2A check valve
2-SI-143	HPSI discharge to RCS Loop 2B check valve
2-SI-401	HPSI pump suction check valve
2-SI-405	HPSI pump P-41C discharge check valve
2-SI-410	HPSI pump suction check valve
2-SI-414	HPSI pump P-41B discharge check valve
2-SI-427	HPSI pump P-41A discharge check valve

4.3.1.1.1 Licensee's Basis for Requesting Relief--These valves cannot be full stroke exercised during reactor operations since the only full flow path is into the reactor coolant system. HPSI pumps do not have sufficient discharge pressure (1,200 psi) to overcome reactor coolant pressure (2,250 psi). Valves cannot be full stroke exercised during cold shutdown, since full HPSI flow into the reactor could result in reactor coolant system overpressurization.

Design flow tests will be conducted during reactor refueling with the reactor head removed. These tests are conducted while filling the reactor pool cavity and effectively demonstrate that these check valves do operate properly. Partial stroke exercising will be done quarterly.

4.3.1.1.2 Evaluation--IWV-3520 requires that check valves be exercised to their safety function position(s) quarterly or, if justified, during cold shutdowns. The only path available to establish sufficient flow through these valves to full-stroke exercise them is pumping with the high pressure safety injection pumps into the reactor coolant system. The high pressure safety injection pumps do not produce sufficient head to overcome reactor coolant system pressure during power operations. Therefore, these valves cannot be full-stroke exercised quarterly during power operations unless extensive system modifications, such as installing full flow test loops, are made which permit this testing. It would be burdensome for the licensee to make such modifications because of the cost involved. Additionally, reduced system reliability could result from failures that could divert the injection flow away from the RCS. There is a flow path to establish flow through these valves quarterly during power operations,

however, the flow path incorporates small diameter piping that will not permit the passage of sufficient flow to full-stroke exercise these valves.

These valves cannot be exercised by pumping into the RCS with the high pressure safety injection pumps during cold shutdowns because there is not an adequate expansion volume and pumping into the RCS could cause or contribute to a low-temperature overpressurization of the RCS. Because of this concern and administrative controls to prevent its occurrence, it is impractical to full-stroke exercise these valves during cold shutdowns. The licensee will full-stroke exercise these check valves using high pressure safety injection pump flow during refueling outages when the reactor vessel head is removed providing an adequate expansion volume to accommodate the flow required to exercise them.

Based on the impracticality of full-stroke exercising the above valves quarterly or during cold shutdowns, the burden on the licensee if the Code requirements were imposed, and the licensee's proposed alternate testing of partial-stroke exercising these valves quarterly and full-stroke exercising them during reactor refueling outages, relief should be granted from the Section XI requirements as requested.

4.3.1.2 Relief Request. The licensee has requested relief from the exercising requirements of Section XI, Paragraph IWV-3520, for 2-SI-217, 227, 237, and 247, the check valves in the combined safety injection headers to the reactor coolant system cold legs, and proposed to partial-stroke exercise these valves with flow during refueling outages and either verify that the valve disks are fully open during that testing or disassemble, inspect, and manually exercise the valve disks on a sampling basis every 40 months.

4.3.1.2.1 Licensee's Basis for Requesting Relief--These valves cannot be full stroke exercised during reactor operation or cold shutdown since there is no pressure source able to overcome Reactor Coolant System Pressure which can fully open the valves. Valves cannot be part stroke tested during reactor operation since injection of cold water would result in an unacceptable thermal shock to the safety injection nozzle. Valves cannot be full stroke tested during cold shutdown and refueling since there is no source of water able to provide full design flow.

The licensee stated in Attachment 1 of their August 26, 1988 submittal that high flow testing which, while less than full design flow will be sufficient to fully open the valve and should identify significant maloperation of the valve, would be performed each refueling outage.

Northeast Nuclear Energy Company will continue to explore means to verify, physically, that the valve disk moves to the fully open position under the available test flow conditions. If a practical means of verifying valve disk position can be developed and the available test flow is sufficient to open the valve, Northeast Nuclear Energy Company will full stroke test each valve each refueling.

If each valve cannot be full stroke exercised one valve will be disassembled, examined and manually stroked each forty months.

4.3.1.2.2 Evaluation--IWV-3520 requires that check valves be exercised to their safety function position(s) quarterly or, if justified, during cold shutdowns. The only path available to establish flow through these valves to full or partial-stroke exercise them is into the reactor coolant system. There are no sources that are capable of establishing flow through these valves into the reactor coolant system when it is at normal pressures for power operations. The safety injection tanks are maintained at pressures well below reactor coolant system pressure and the safety injection pumps do not produce sufficient head to overcome reactor coolant system pressure during power operations. Therefore, these valves cannot be full or partial-stroke exercised quarterly during power operations unless extensive system modifications, such as installing full flow test loops, are made which permit this testing. It would be burdensome for the licensee to make such modifications because of the cost involved. Additionally, reduced system reliability could result from failures that could divert the injection flow away from the RCS.

These valves cannot be full-stroke exercised during cold shutdowns because there is not an adequate expansion volume in the reactor coolant system to accommodate the maximum analyzed flow rate through these valves. Establishing that flow rate through these valves could cause or contribute to

a low-temperature overpressurization of the RCS. Because of this concern and administrative controls to prevent its occurrence, it is impractical to full-stroke exercise these valves during cold shutdowns.

The licensee will part-stroke exercise these check valves using safety injection pump flow during refueling outages when an adequate expansion volume exists to accommodate the flow. This flow rate is less than the maximum analyzed flow rate for these valves and while it may fully open the valve disk if the valve is operating freely, it may not open the valve sufficiently to pass the higher analyzed flow if the valve is degraded. In order to use this partial flow test as a full-stroke exercise of these valves, the licensee is attempting to develop a test method to verify that the valve disk moves to the open stop when test flow is established through the valve. If it cannot be verified that the valve disk is fully open during this reduced flow test, the licensee has proposed to disassemble, inspect, and manually exercise these valves on a sampling basis of one valve every 40 months.

Disassembly of one valve in this group every 40 months could result in a period of 160 months (13 $^{1}/_{3}$ years) in-between examining each valve. Extension of the valve exercising interval from that allowed by the Code (quarterly or cold shutdown frequency) to once every 13 $^{1}/_{3}$ years is a substantial change which may not be justified from the standpoint of valve reliability and plant safety. Generic Letter 89-04 states that extension of the valve disassembly/inspection interval or expansion of the group size should only be considered in cases of extreme hardship where the extension is supported by actual in-plant data from previous testing. The licensee has not provided sufficient information to support extending the sample disassembly test interval for these valves.

Based on the impracticality of full or part-stroke exercising these valves quarterly or during cold shutdowns, the burden on the licensee if the Code requirements were imposed, and considering that valve disassembly and inspection can provide reasonable indication of check valve condition and operational readiness, relief should be granted from the Section XI requirements provided the licensee disassembles and inspects these valves in

accordance with the guidelines of Attachment 1, Item 2, of Generic Letter 89-04.

If a method is developed which clearly verifies that the valve disk is fully open during the reduced flow rate testing at refueling outages, a revised relief request describing the test methodology should be submitted to the NRC for review and approval.

4.4 Safety Injection Tanks

4.4.1 Category C Valves

4.4.1.1 Relief Request. The licensee has requested relief from the exercising requirements of Section XI, Paragraph IWV-3520, for 2-SI-215, 225, 235, and 245, the safety injection tank outlet check valves, and proposed to partial-stroke exercise these valves during refueling outages and either verify that the valve disks are fully open during that testing or disassemble, inspect, and manually exercise the valve disks on a sampling basis every 40 months.

4.4.1.1.1 Licensee's Basis for Requesting Relief--These valves cannot be full stroke exercised during reactor operation or cold shutdown since no flow path exists which can accept full flow. Valves cannot be part stroke tested during reactor operation since failure of the test line isolation valve to shut would result in loss of safety injection tank level and consequent plant shutdown. Further, if the valve failed to reset only single valve isolation would exist between the reactor coolant system and the low pressure safety injection tank. The flow rates available through the small diameter test line would not result in significant operation of the valves during operation or cold shutdown.

The licensee stated in Attachment 1 of their August 26, 1988 submittal that high flow testing which, while less than full design flow will be sufficient to fully open the valve and should identify significant maloperation of the valve, would be performed each refueling outage.

Northeast Nuclear Energy Company will continue to explore means to verify, physically, that the valve disk moves to the fully open position under the available test flow conditions. If a practical means of verifying valve disk position can be developed and the available test flow is sufficient to open the valve, Northeast Nuclear Energy Company will full stroke test each valve each refueling.

If unable to full stroke exercise each valve, one valve will be disassembled, examined, and manually stroked each forty months.

4.4.1.1.2 Evaluation--IWV-3520 requires that check valves be exercised to their safety function position(s) quarterly or, if justified, during cold shutdowns. Valves 2-SI-215, 225, 235, and 245 cannot be full- or partial-stroke exercised during power operations because the only flow path through these valves is from the safety injection tanks into the reactor coolant system and the safety injection tanks cannot establish flow into the RCS when at operating pressures. Therefore, these valves cannot be full- or partial-stroke exercised quarterly during power operations unless extensive system modifications, such as installing full flow test loops, are made to permit this testing. It would be burdensome for the licensee to make such modifications because of the cost involved. Additionally, reduced system reliability could result from failures that could divert the injection flow away from the RCS.

These check valves cannot be exercised by discharging the safety injection tanks into the RCS during cold shutdowns because there is not an adequate expansion volume and injecting into the RCS could cause or contribute to a low-temperature overpressurization of the RCS. Because of this concern and administrative controls to prevent its occurrence, it is impractical to full or partial-stroke exercise valves 2-SI-215, 225, 235, and 245 during cold shutdowns. Establishing the maximum analyzed flow through these valves into the RCS during refueling outages when the vessel head is removed to provide an adequate expansion volume is not practical since this could cause hydraulic damage to reactor and core components.

The licensee will part-stroke exercise these check valves using system flow during refueling outages when an adequate expansion volume exists to accommodate this flow rate. This flow rate is less than the maximum analyzed flow rate for these valves and while it may fully open the valve disk if the valve is operating freely, it may not open the valve sufficiently to pass the higher analyzed flow if the valve is degraded. In order to use this partial flow test as a full-stroke exercise of these valves, the licensee is trying to develop a test method to verify that the valve disk moves to the open stop when the test flow is passed through it. If they cannot verify that the valve disk is fully open during this reduced flow test, the licensee has proposed to disassemble, inspect, and manually exercise these valves on a sampling basis of one valve every 40 months.

Disassembly of one valve in this group every 40 months could result in a period of 160 months (13 $^{1}/_{3}$ years) in-between examining each valve. Extension of the valve exercising interval from that allowed by the Code (quarterly or cold shutdown frequency) to once every 13 $^{1}/_{3}$ years is a substantial change which may not be justified from the standpoint of valve reliability and plant safety. Generic Letter 89-04 states that extension of the valve disassembly/inspection interval or expansion of the group size should only be considered in cases of <u>extreme</u> hardship where the extension is supported by actual in-plant data from previous testing. The licensee has not provided sufficient information to support extending the sample disassembly test interval for these valves.

Based on the impracticality of full or part-stroke exercising these valves quarterly or during cold shutdowns, the burden on the licensee if the Code requirements were imposed, and considering that valve disassembly and inspection can provide reasonable indication of check valve condition and operational readiness, relief should be granted from the Section XI requirements provided the licensee disassembles and inspects these valves in accordance with the guidelines of Generic Letter 89-04, Attachment 1, Item 2.

If a method is developed which clearly verifies that the valve disk is fully open during the reduced flow rate testing at refueling outages, a revised relief request describing the test methodology should be submitted to the NRC for review and approval.

4.5 Feedwater System

4.5.1 Category B/C Valves

4.5.1.1 Relief Request. The licensee has requested relief from the exercising requirements of Section XI, Paragraph IWV-3520, for 2-FW-5A and 5B, the check valves in the main feedwater header upstream of the auxiliary feedwater injection points, and proposed to exercise, fail-safe test, and measure the stroke times of the valve operators during cold shutdowns and to disassemble, inspect, and manually full-stroke exercise these valves on a sampling basis during refueling outages.

4.5.1.1.1 Licensee's Basis for Requesting Relief--Exercising these valves during plant operation would require stopping feed flow to the steam generators with consequent plant shutdown. These valves have no part stroke capability. The valve operator is not connected to the obturator. The obturator cannot be exercised during cold shutdown or refueling outages. These valves have no safety function in the open position.

While the valve will normally close during shutdown from power operation, and valve closure can be visually determined, there is no practical method to meet the Code requirement to "prove that the disk travels to the seat promptly on cessation or reversal of flow." Deliberate, abrupt cessation or reversal of flow in the 18-inch diameter feed line is not considered prudent. Such action could result in system damage or undesirable transients in steam generator level.

Northeast Nuclear Energy Company experience indicates that these valves are not subject to rapid wear. This occurred as a result of a valve modification which decreased the internal clearances and caused restriction in valve movement. Examining one valve each refueling outage is considered adequate to assure the operability of these valves.

The proposed testing is to exercise the valve operator, measure stroke times, and fail-safe test during cold shutdown. We also propose to disassemble one valve each refueling outage to verify obturator freedom of movement.

4.5.1.1.2 Evaluation--It would be necessary to isolate feedwater to a steam generator in order to exercise one of these valves closed, and isolating feedwater flow during power operations would result in loss of steam generator level control which could cause a plant trip. Since this testing would cause a plant transient which could lead to a plant trip, it is not considered to be practical during power operations. Since the valve operator is not connected to the obturator and cannot force the obturator in the closed position, the only methods available to verify valve closure during cold shutdowns and refueling outages are leak testing and disassembly and inspection of the valves. The system design makes it so the steam generators would have to be isolated and pressurized in order to leak test these valves which would be impractical during cold shutdowns or refueling outages.

To disassemble these valves, the licensee must first drain the steam generators below the feed nozzle and subsequently drain the main feedwater header. This is an involved evolution that is impractical during cold shutdowns since it could delay plant start-up.

The NRC Staff position is that valve disassembly and inspection can be used to meet the exercising requirements of IWV-3520 for check valves which cannot be verified in their safety position by other means. Where the licensee determines that it is burdensome to disassemble and inspect all applicable valves each refueling outage, a sample disassembly and inspection plan for groups of identical valves in similar applications may be employed. The sample disassembly and inspection program involves grouping similar valves and examining one valve in each group during each refueling outage as described in Generic Letter 89-04, Attachment 1, Item 2. The licensee has proposed to disassemble one valve from this sample group every refueling outage.

Based on the impracticality of complying with the Code requirements, the burden on the licensee if the Code requirements were imposed and considering the licensee's proposal to disassemble and inspect these valves on a sampling basis during refueling outages, relief should be granted from the Section XI requirements provided that the licensee complies with the guidelines presented in Generic Letter 89-04, Attachment 1, Item 2.

4.6 Reactor Building Closed Cooling Water System

4.6.1 Category B Valves

4.6.1.1 Relief Request. The licensee has requested relief from the exercising requirements of Section XI, Paragraph IWV-3410, for 2-RB-30.1A, 30.1B, 37.2A and 37.2B, the containment isolation valves for the reactor building closed cooling water supply and return to cooling loads inside containment, and proposed to exercise these valves during those cold shutdowns when all reactor coolant pumps are stopped and during refueling outages.

4.6.1.1.1 Licensee's Basis for Requesting Relief--Exercising these valves would result in interrupting cooling water to the reactor coolant pump thermal barriers and oil coolers, as well as other loads required during reactor operation. Interruption of cooling water flow to operating reactor coolant pump thermal barriers even for short periods can result in rapid degradation of shaft seals and/or seal failure. Other loads though slightly less sensitive to flow perturbations, could also be adversely affected if a valve failed to fully reopen during testing. Valve design precludes part stroke exercising. These valves will be full stroke exercised on cold shutdown when reactor coolant pumps are not running.

4.6.1.1.2 Evaluation--Exercising these valves would isolate cooling water flow to the reactor coolant pumps which could damage the pumps or the pump seals if the pumps are operating, thereby, causing their premature failure. Pump failure during power operations would result in a plant trip and seal failure results in a small break unisolable LOCA, therefore, it is not practical to exercise these valves quarterly during power operations. The control element drive mechanism coolers are also supplied through these valves and stopping cooling flow could result in failure with resulting dropped control rods.

Exercising these valves during cold shutdowns when one or more reactor coolant pump is operating could damage the pumps which are major plant equipment that are required for plant operation even though they are not

safety-related. Therefore, it is not practical to exercise these valves during those cold shutdowns when one or more reactor coolant pump remains in operation. These valves will be exercised during each refueling outage and during those cold shutdowns when all reactor coolant pumps are stopped.

Based on the impracticality of exercising these valves quarterly or during cold shutdowns when one or more reactor coolant pump is operating, the burden on the licensee if these Code requirements were imposed, and the licensee's proposed alternate testing of exercising and measuring stroke times of these valves during reactor refueling outages and during those cold shutdowns when all reactor coolant pumps are stopped, relief should be granted from the Section XI requirements as requested for valves 2-RB-30.1A, 30.1B, 37.2A and 37.2B.

4.7 Chemical and Volume Control System

4.7.1 Category A Valves

4.7.1.1 Relief Request. The licensee has requested relief from the exercising requirements of Section XI, Paragraph IWV-3410, for 2-CH-198, 505, and 506, the containment isolation valves in the reactor coolant pump seal leak-off line, and proposed to full-stroke exercise these valves during refueling outages and during those cold shutdowns when the reactor coolant pumps are stopped.

4.7.1.1.1 Licensee's Basis for Requesting Relief--These valves are required to be open anytime the reactor coolant pumps are operating to allow seal leak-off flow. Closing these valves could result in seal failure. These valves will be exercised, have their stroke times measured, and be fail-safe tested during cold shutdown when reactor coolant pumps are secured.

4.7.1.1.2 Evaluation--The reactor coolant pump seals serve as a pressure boundary for the reactor coolant system, therefore, seal failure could result in unisolable leakage of reactor coolant from the RCS. Failure of these valves in the closed position during testing would stop seal leak-off flow but would not stop seal water supply to the pump seals.

Isolating leak-off would cause pressure to increase in the seal leak-off line which would challenge the relief valve and overpressurize the seal and system piping if the relief valve failed to open. If the seal water supply is secured to permit testing these valves without overpressurizing the seals and the leak-off line, it could result in excessive pump seal wear and in premature seal failure.

It is impractical to exercise these valves during any plant condition that could result in seal damage or abnormal seal wear which could lead to a seal failure, since a seal failure is an unisolable RCS leak. It would be burdensome for the licensee to make the required system modifications that would allow testing these valves quarterly during power operations since these modifications would be costly and could result in reduced system reliability.

The seal water leak-off isolation valves will be full-stroke exercised and have their stroke times measured during each reactor refueling outage and during those cold shutdowns when the reactor coolant pumps are stopped.

Based on the impracticality of full- or partial-stroke exercising these valves quarterly or during cold shutdowns when the reactor coolant pumps are operating and the burden on the licensee if these Code requirements were imposed and considering the licensee's proposed alternate testing, relief should be granted from the Section XI requirements as requested.

4.8 Emergency Diesel Generator Air Start System

4.8.1 Category B Valves

4.8.1.1 Relief Request. The licensee has requested relief from the stroke time measurement requirements of Section XI, Paragraph IWV-3413, for 2-DG-91A, 91B, 92A, 92B, 95A, 95B, 96A, 96B, 27A, and 27B, the emergency diesel generator air start valves, and proposed to measure the diesel generator starting times to verify valve operation and to monitor valve degradation.

4.8.1.1.1 Licensee's Basis for Requesting Relief--These valves have no visible operating parts. There are no system instruments which monitor their operation. Thus there is no way to measure the stroke time of the valves. Further, the actual stroke time of these valves is very short (less than one second) and measurement of stroke time would provide no realistic information for evaluation of valve condition.

The function of these valves is to admit starting air to the diesel engine and to stop air application when the engine is operating. The Unit 2 Technical Specification requires that the diesel generator "starts from ambient condition and accelerates to >90 percent of rated speed and to >97 percent of rated voltage in ≤20 seconds." If these valves do not travel full stroke, or operate slowly, the diesel will not meet the overall operability test. Thus reliance on this overall operability test is appropriate to demonstrate prompt valve operation.

The normal operation of these valves mimics the failure mode of the valve. Valve operation is caused by interruption of actuator power.

Once per quarter each valve will be tested to assure proper operation by verifying the diesel generator meets the overall operability (starting) requirements of the Unit 2 Technical Specification when started using only one tank and one air start valve train.

4.8.1.1.2 Evaluation--These valves are totally enclosed solenoid or air operated valves which have no externally visible indication of valve position. It is not possible to measure the stroke times of these valves because there is no way to determine when a valve receives a signal to open or when it reaches the open position. These valves are rapid acting valves which normally stroke almost instantly and when they do not operate promptly, they most commonly fail to operate at all.

These valves function to admit starting air to the diesel generator starting motors, therefore, it can be indirectly verified that each valve has opened by monitoring the diesel generator start times to insure that the diesel starts within the Technical Specification limit. Measuring the diesel

start times gives an indication of possible valve degradation since any significant change in valve stroke time would result in longer diesel generator start times. Valve full-stroke times cannot be measured unless significant system modifications, such as replacing these diesel air start valves with valves that have valve disk position indication, are made to permit this testing. Replacing these valves to permit stroke time measurements would provide a limited amount of additional information above that generated by the proposed alternate testing. It would be burdensome for the licensee to make such modifications and it would not provide a compensating increase in the level of quality and safety.

Compliance with the Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality or safety. The licensee's proposed alternate testing of measuring the diesel generator starting times should verify operation of the air start valves and monitor their degradation, therefore, relief should be granted from the Code requirements 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 reviewed and the reviewer agrees with the licensee that testing these valves during power operations is not practical due to the valve type, location, or system design. These valves should not be full-stroke exercised during power operations. These valves are listed below and grouped according to the system in which they are located.

1. Fail-Safe Air Operated Valves

1.1 Category B Valves

The following air actuated valves cannot have their fail-safe operators tested quarterly during power operations because they are located inside containment and are inaccessible for isolation of the air supply and observation during reactor operations. A test which deenergizes the air solenoid valve may not adequately test valve response under loss of air pressure. The fail-safe operation of these valves will be tested during cold shutdowns and refueling outages.

2-CH-518	2-GR-11.1	2-RC-001	2-SI-628
2-CH-519	2-LRR-43.1	2-RC-002	2-SI-638
2-EB-88	2-LRR-61.1	2-RC-003	2-SI-648
2-EB-89	2-SSP-16.1	2-SI-618	

2. MAIN STEAM SYSTEM

2.1 Category B Valves

2-MS-65A and 65B, the bypass valves around the main steam isolation valves (MSIVs), cannot be full-stroke exercised during power operations

because failure of one of these valves in the open position during testing could prevent isolation of the associated main steam line. These valves are used to warm the main steam headers and equalize pressures around the MSIVs during plant startup, but are then closed and remain closed during plant operation and are not required to open to perform any safety-related function. These valves will be full-stroke exercised and have their stroke times measured during cold shutdowns and refueling outages.

2.2 Category B/C Valves

2-MS-64A and 64B, the main steam isolation valves, cannot be full-stroke exercised during power operations because fully closing one of these valves isolates the steam supply from one of the steam generators to the main turbine resulting in an unbalanced steam flow condition producing an abnormal power distribution in the reactor core which could cause a reactor trip. These valves will be partial-stroke exercised quarterly during power operations and will be full-stroke exercised, be fail-safe tested, and have their stroke times measured during cold shutdowns and refueling outages.

2.3 Category C Valves

2-MS-1A and 1B, the main steam line non-return valves, cannot be exercised during power operations because in order to close one of these valves it would be necessary to isolate one of the main steam lines which would stop the steam supply from one of the steam generators to the main turbine resulting in an unbalanced steam flow condition producing an abnormal power distribution in the reactor core which could cause a reactor trip. These valves will be verified to travel to their closed position as the plant steam load is reduced during cold shutdowns and refueling outages.

2-MS-4A and 4B, the check valves in the steam supply lines to the auxiliary feedwater turbine, cannot be full-stroke exercised during power operations because in order to ensure that maximum safety analysis steam flow passes through these valves it would be necessary for the turbine driven auxiliary feedwater pump to pump at rated flow and pressure and the only flow path where this could be accomplished is pumping into the steam generators.

Operation of the turbine driven auxiliary feedwater pump at design flow conditions would cause a significant thermal shock to the feed piping, result in steam generator level control instability, and possible reactor trip. Part stroke operation in the open direction can be conducted in conjunction with inservice testing of the turbine driven auxiliary feedwater pump at part load. These valves will be partial-stroke exercised open quarterly and full-stroke exercised open and closed during cold shutdowns and refueling outages.

3. SHUTDOWN COOLING SYSTEM

3.1 Category A Valve

2-SI-651 an isolation valve in the shutdown cooling pump suction from the RCS hot leg, cannot be exercised during power operations because this valve is interlocked with reactor coolant system pressure so that it cannot be opened when pressure is above 300 psig in order to prevent overpressurization of the low pressure shutdown cooling system piping by the higher pressure reactor coolant system. Overpressurization of the RHR piping could result in an inter-system LOCA outside of containment. This valve will be exercised and have its stroke time measured when shutdown cooling flow is established during cold shutdowns and refueling outages.

3.2 Category B Valve

2-SI-652 an isolation valve in the shutdown cooling pump suction from the RCS hot leg, cannot be exercised during power operations because this valve is interlocked with reactor coolant system pressure so that it cannot be opened when pressure is above 300 psig in order to prevent overpressurization of the low pressure shutdown cooling system piping by the higher pressure reactor coolant system. Overpressurization of the RHR piping could result in an inter-system LOCA outside of containment. This valve will be exercised and have its stroke time measured when shutdown cooling flow is established during cold shutdowns and refueling outages.

4. SAFETY INJECTION SYSTEM

4.1 Category B Valves

2-SI-659 and 660, the isolation valves in the minimum flow line for the high and low pressure safety injection pumps and the containment spray pumps, cannot be exercised during power operations since failure in the closed position during testing would isolate the minimum flow path for the safety injection and the containment spray pumps which could damage these pumps and render entire safety systems inoperable. These valves are required by plant technical specifications to remain open with valve operator power removed during power operations. These valves will be exercised, fail-safe tested, and have their stroke times measured during cold shutdowns and refueling outages.

4.2 Category C Valves

The following check valves in the low pressure safety injection lines to the reactor coolant system, cannot be exercised during power operations because the only flow path available to exercise these valves with flow is into the reactor coolant system and the low pressure safety injection/shutdown cooling pumps (discharge pressure of ~200 psig) do not produce sufficient head to overcome the normal operating reactor coolant system pressure. These valves will be full-stroke exercised during cold shutdowns and refueling outages when the shutdown cooling system is in operation.

2-SI-114	2-SI-134	2-SI-434
2-SI-124	2-SI-144	2-SI-446

2-SI-706A, 706B, 706C, and 706D, the check valves in the combined high pressure and low pressure safety injection lines to the reactor coolant system cold legs, cannot be full-stroke exercised during power operations because the only full flow path available through these valves is into the reactor coolant system and neither the high pressure safety injection pumps nor the low pressure safety injection/shutdown cooling pumps produce

sufficient head to overcome the normal operating reactor coolant system pressure. These valves will be partial-stroke exercised quarterly, using the high pressure safety injection pumps through a test path, and full-stroke exercised during cold shutdowns and refueling outages when the shutdown cooling system is in operation.

5. AUXILIARY FEEDWATER SYSTEM

5.1 Category B/C Valves

2-FW-12A and 12B, the auxiliary feedwater header check valves, cannot be exercised during power operations because to exercise these valves open would require establishing auxiliary feedwater flow into the steam generators which could cause steam generator level instability and this relatively cold water could thermal shock the feedwater piping and nozzles which could result in premature failure of those components. The air operated assist mechanism will be exercised, fail-safe tested, and the stroke time measured quarterly during power operation. These valves will be full-stroke exercised during cold shutdowns and refueling outages.

5.2 Category C Valves

2-FW-7, 8A and 8B, the auxiliary feedwater pump discharge check valves, cannot be exercised during power operations because to exercise these valves open would require establishing auxiliary feedwater flow into the steam generators which could cause steam generator level instability and the relatively cold water could thermal shock the feedwater piping and nozzles which could result in premature failure of those components. These valves will be full-stroke exercised during cold shutdowns and refueling outages.

6. CHEMICAL AND VOLUME CONTROL SYSTEM

6.1 Category A Valves

2-CH-089 and 516, the containment isolation valves in the normal letdown line, cannot be exercised during power operations because failure of either of these valves in the closed position during testing would isolate the

normal letdown flow which would cause a loss of pressurizer level control and could result in a plant trip. Also, the plant is designed with a limited number of letdown isolation thermal cycles and exercising these valves during power operations can result in a thermal cycle to the regenerative heat exchanger. These valves will be exercised, fail-safe tested, and have their stroke times measured during cold shutdowns and refueling outages.

6.2 Category B Valves

2-CH-501, the isolation valve in the line from the volume control tank to the charging pump suctions, cannot be exercised during power operations because closing this valve would isolate the normal suction source for the charging pumps which could stop charging flow and cause a thermal shock to the regenerative heat exchanger when flow is resumed. Using an alternate suction source for the charging pumps could result in injecting water with a higher concentration of boric acid into the seals and the reactor coolant system which would cause a reactor power transient and could result in a plant shutdown. These valves will be exercised and have their stroke times measured during cold shutdowns and refueling outages.

2-CH-515, an isolation valve in the normal letdown line, cannot be exercised during power operations because failure of this valve in the closed position during testing would isolate normal letdown flow which would cause a loss of pressurizer level control and could result in a plant trip. Also, the plant is designed with a limited number of letdown isolation thermal cycles and exercising this valve during power operations can result in a thermal cycle to the regenerative heat exchanger. This valve will be exercised, fail-safe tested, and have its stroke time measured during cold shutdowns and refueling outages.

2-CH-517, the isolation valve in the auxiliary spray line, cannot be exercised quarterly during power operations because opening this valve would cause low temperature spray flow into the pressurizer which could result in an RCS pressure transient and thermal shock to the pressurizer spray nozzle. A pressure transient in the RCS could result in a reactor trip and thermally shocking the spray nozzle could result in premature failure due to thermally

induced fatigue failure. This valve will be exercised, fail-safe tested, and have its stroke time measured during cold shutdowns and refueling outages.

6.3 Category C Valves

2-CH-431, the check valve in the pressurizer auxiliary spray line, cannot be exercised with flow during power operations because establishing auxiliary spray through this valve would cause a loss of reactor coolant system pressure control and could result in a plant trip. Establishing flow through this valve quarterly during power operations could also thermal shock the pressurizer spray piping which could result in its premature failure. This valve will be full-stroke exercised during cold shutdowns and refueling outages.

2-CH-177 and 190, the check valves in the emergency boration flow paths, cannot be exercised during power operations because the only flow path available to exercise these valves establishes flow from the boric acid tanks to the charging pump suction and then into the reactor coolant system which would cause a substantial boration of the reactor coolant system. This boration would cause unwanted negative reactivity addition and result in reactor power fluctuations and possibly in a plant shutdown. These valves will be full-stroke exercised during cold shutdowns and refueling outages.

7. REACTOR COOLANT SYSTEM

7.1 Category B Valves

2-RC-414, 415, 416, and 417, the reactor vessel vent valves, cannot be exercised during power operations because these valves form a two valve boundary between the reactor coolant system and the containment atmosphere and exercising them could result in venting out some RCS coolant. This testing could result in a loss of coolant accident if the series isolation valve were to fail or leak excessively. These valves will be exercised and have their stroke times measured during cold shutdowns and refueling outages.

2-RC-422, 423, 424, and 425, the pressurizer vent valves, cannot be exercised during power operations because these valves form a two valve boundary between the reactor coolant system and the containment atmosphere and exercising them could result in venting out some RCS coolant. This testing could result in a loss of coolant accident if the series isolation valve were to fail or leak excessively. These valves will be exercised and have their stroke times measured during cold shutdowns and refueling outages.

APPENDIX B

P&ID AND FIGURE LIST

APPENDIX B

P&ID AND FIGURE LIST

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

System	P&ID or Figure	Revision
Spent Fuel Pool Cooling and Cleanup System	25203-26023	16
Main Steam System	25203-26002 Sh.1	4
Safety Injection and Containment Spray Systems	25203-26015	18
Feedwater System	25203-26005 Sh.2	1
Auxiliary Feedwater System	25203-26005 Sh.3	2
Reactor Building Closed Cooling Water System	25203-26022 Sh.1 25203-26022 Sh.2	13 6
Service Water System	25203-26008 Sh.1 25203-26008 Sh.2	34 13
Chemical & Volume Control System	25203-26017	19
Chilled Water System	25203-26027 Sh.2	8
Reactor Coolant System	25203-26014	17
Containment Structure Ventilation	25203-26028 Sh.1 25203-26028 Sh.2	13 12
Instrument Air System	25203-26009 Sh.8	1
Containment Enclosure Drains	25203-26024	10
Steam Generator Blowdown System	25203-26002 Sh.2	5
Gaseous Radwaste System	25203-26021 Sh.2	6
Clean Liquid Radwaste System	25203-26020 Sh.2	13
Sampling System	25203-26025 Sh.1	6
Emergency Diesel Generator Systems	25203-26018 25203-26018 Sh.1	13 1
Emergency Generator Fuel Oil System	25203-26010	4

APPENDIX C

IST PROGRAM ANOMALIES IDENTIFIED DURING THE REVIEW

APPENDIX C

IST PROGRAM ANOMALIES IDENTIFIED 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. The licensee proposed to verify closure of the check valves in the air lines to valve operator accumulators by performing a leak test of each accumulator, however, the licensee did not provide a basis for not exercising these valves quarterly or during cold shutdowns as required by the Code. This is discussed in Section 4.1.3.1. The reviewer's evaluation concluded that it is impractical to exercise these valves quarterly or during cold shutdowns, therefore, relief should be granted from the Code requirements. The licensee, however, should document in the IST program the technical justification for not testing these valves as required by the Code.

2. The licensee has not clearly identified in their IST program (RR-IWV-3, RR-IWV-5, RR-IWV-8, RR-IWV-9, and RR-IWV-13) how they propose to implement the sample disassembly and inspection of check valves. The staff positions for sample disassembly of check valves are identified in Generic Letter 89-04, Attachment 1, Item 2. The licensee should meet these staff positions whenever they utilize a sample disassembly and inspection of check valves.

3. In relief requests RR-IWV-5, RR-IWV-8, and RR-IWV-9 (addressed in Sections 4.2.1.3, 4.4.1.1, and 4.3.1.2 respectively of this report), the licensee proposed a sample disassembly and inspection interval of 40 months. The staff position is that 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. Extension of the valve exercising interval from that allowed by

the Code (quarterly or cold shutdown frequency) to up to once every 13 $^{1}/_{3}$ year is a substantial change which may not be justified from the standpoint of valve reliability and plant safety. The NRC position relative to extending the valve testing interval above one valve every refueling outage is given in Generic Letter 89-04, Attachment 1, Item 2. The licensee has not provided sufficient information to support extending the sample disassembly test interval for these valves.

4. In relief request RR-IWV-30, which is addressed in Appendix A, Section 2.3, the licensee stated that check valves 2-MS-4A and 4B, located in the main steam supply lines to the turbine driven auxiliary feedwater pump, are full-stroked both open and closed prior to startup from cold shutdown. It is not clear how these valves are verified in the closed position during cold shutdowns. Other facilities typically have problems with verifying the reverse flow closure of similar valves due to the system design, i.e., lack of isolation valves and test connections. Verifying valve closure by leak testing using steam pressure may present a safety hazard since valve leakage could subject test personnel to high pressure steam. The licensee should verify the reverse flow closure capability of these valves by some positive means as required by IWV-3522(a). If this is found to be impractical, the licensee should revise relief request RR-IWV-30 to address this issue and submit it to the NRC for review and approval.

5. The licensee has identified check valve disassembly and inspection as the alternative to verifying the full-stroke capability of the valves addressed in relief requests RR-IWV-3, RR-IWV-5, RR-IWV-8, RR-IWV-9, and RR-IWV-13. The NRC staff considers valve disassembly and inspection to be a maintenance procedure that is not a test and not equivalent to the exercising produced by fluid flow. This procedure has some risks which may make its routine use as a substitute for testing undesirable when some method of testing is possible. Check valve disassembly is a valuable maintenance tool that can provide a great deal of information about a valve's internal condition and as such should be performed under the

maintenance program at a frequency commensurate with the valve type and service. The licensee should actively pursue the use of alternate testing methods to full-stroke exercise these valves, such as using non-intrusive diagnostic techniques to demonstrate whether they swing fully open during partial flow testing or closed when flow has ceased. In the interim when valve operational readiness cannot practically be determined by observation of system parameters, inspection may be used as an alternative, however, the licensee should perform a partial flow test of each valve prior to returning it to service following the disassembly and inspection procedure. As additional experience with the general applicability of non-intrusive techniques is gained, the staff anticipates providing the industry with updated guidance on the subject as it relates to Code requirements and, particularly, as an improvement over the use of disassembly and inspection.