July 27, 2006

Mr. Karl W. Singer
Chief Nuclear Officer and
Executive Vice President
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

SUBJECT: SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 — REQUEST FOR RELIEF FROM THE REQUIREMENTS OF THE ASME CODE (TAC NOS. MC9537, MC9538, MC9539, MC9540, MC9541, MC9542, MC9543, MC9544, MC9545, MC9546, MC9547, MC9548, MC9549, MC9550, MC9551, MC9552, MC9553, AND MC9554)

Dear Mr. Singer:

By letter dated January 10, 2006, as supplemented by letter dated April 17, 2006, Tennessee Valley Authority (TVA, the licensee) submitted a request for relief from certain inservice test requirements of the 2001 Edition through 2003 Addenda of the American Society of Mechanical Engineers *Code for Operation and Maintenance of Nuclear Power Plants (OM Code)* at Sequoyah Nuclear Plant, Units 1 and 2. TVA requested relief from specific valve and pump testing specified in OM Code, Subsection ISTB for pumps, and Subsection ISTC for valves. In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Sections 50.55a(a)(3)(i), 50.55a(a)(3)(ii), and 50.55a(f)(6)(i), your request proposes alternative pump and valve inservice testing methods as prescribed in the 2001 Edition of the ASME Boiler and Pressure Vessel Code, Section III.

Based on our review of your submittals, we have concluded that alternatives proposed in relief requests RP-04, RP-05, RV-2, and RV-3 provide an acceptable level of quality and safety and are, therefore, authorized pursuant 10 CFR 50.55a(a)(3)(i). In addition, compliance with the specified code requirements for relief requests RP-01, RP-03, and RP-06 results in hardship or unusual difficulty without a compensating increase in the level of quality and safety and, therefore, the aforementioned relief requests are authorized pursuant 10 CFR 50.55a(a)(3)(ii). Furthermore, compliance with the Code requirements for RP-02 and RV-1 is impractical and, therefore, the aforementioned relief requests are authorized pursuant 10 CFR 50.55a(f)(6)(i).

Sincerely,

/RA/

L. Raghavan, (Acting) Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-327 and 50-328

Enclosure: Safety Evaluation

cc w/encl: See next page

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Sincerely,
/RA/
L. Raghavan, (Acting) Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-327 and 50-328

Enclosure: Safety Evaluation

cc w/encl: See next page
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SUBJECT: SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 — REQUEST FOR RELIEF FROM THE REQUIREMENTS OF THE ASME CODE (TAC NOS. MC9537, MC9538, MC9539, MC9540, MC9541, MC9542, MC9543, MC9544, MC9545, MC9546, MC9547, MC9548, MC9549, MC9550, MC9551, MC9552, MC9553, AND MC9554)

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Mr. Karl W. Singer
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SEQUOYAH NUCLEAR PLANT

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST NOS. RP-01, RP-02, RP-03, RP-04, RP-005, RP-06,

RV-1, RV-2, AND RV-3

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NO. 50-327 AND 50-328

1.0 INTRODUCTION

By letter dated January 10, 2006, as supplemented by letter dated April 17, 2006, the Tennessee Valley Authority (TVA, the licensee) requested relief from certain inservice testing (IST) requirements of the 2001 Edition through 2003 Addenda of the American Society of Mechanical Engineers (ASME) *Code for Operation and Maintenance of Nuclear Power Plants (OM Code),* which are incorporated by reference in Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a, for specific valve and pump testing. These requests are in support of the third 10-year IST program interval at Sequoyah Nuclear Plant (SQN), Units 1 and 2, which commenced June 1, 2006.

2.0 BACKGROUND

Title 10 CFR 50.55a, requires that IST of certain ASME "Boiler and Pressure Vessel Code (Code) Class 1, 2, and 3 pumps and valves be performed at 120-month (10-year) IST program intervals. This is in accordance with the ASME *Code for Operation and Maintenance of Nuclear Power Plants* (OM Code), and applicable addenda, except where alternatives have been proposed or relief has been requested by the licensee and authorized or granted by the commission pursuant to paragraphs (a)(3)(I), (a)(3)(ii), or (f)(6)(I) of 10 CFR 50.55a.

In accordance with 10 CFR 50.55a(f)(4)(ii), licensees are required to comply with the requirements of the latest edition and addenda of the ASME Code incorporated by reference in the regulations 12 months prior to the start of each 120-month IST program interval. In accordance with 50.55a(f)(4)(iv), IST of pumps and valves may meet the requirements set forth in subsequent editions and addenda that are incorporated by reference in 10 CFR 50.55a(b), subject to NRC approval. Portions of editions or addenda may be used provided that all related requirements of the respective editions and addenda are met.

In proposing alternatives or requesting relief, the licensee must demonstrate that: (1) the proposed alternatives provide an acceptable level of quality and safety; (2) compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety; or (3) conformance is impractical for the facility. Section 50.55a authorizes the

Commission to approve alternatives and to grant relief from ASME Code requirements upon making necessary findings. NRC guidance contained in Generic Letter (GL) 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," provides alternatives to Code requirements which are acceptable. Further guidance is given in GL 89-04, Supplement 1, and NUREG-1482, Revision 1, "Guidance for Inservice Testing at Nuclear Power Plants."

The NRC's findings with respect to granting or denying the IST program relief requests are given below:

3.0 EVALUATION OF RELIEF REQUESTS

3.1 Pump Relief Request RP-01

3.1.1 Code Requirements

The licensee requested relief from OM Code ISTB-5121(b), which requires that system resistance be varied until the flow rate equals the reference point, then differential pressure be measured and compared to the reference value. Relief was requested for the following essential raw cooling water screen wash pumps:

A-A Essential Raw Cooling Water Screen Wash Pump
B-B Essential Raw Cooling Water Screen Wash Pump
D-A Essential Raw Cooling Water Screen Wash Pump
C-B Essential Raw Cooling Water Screen Wash Pump

3.1.2 Licensee's Basis for Requesting Relief

No in-line instrumentation exists to measure flow, and the physical configuration of the pump and piping does not allow the use of portable flow measuring equipment such as ultrasonic flow meters. These pumps take suction from the pump pit directly below the pump deck and are positioned on the deck adjacent to the traveling screens. The discharge piping for each pump is short and open ended containing several elbows, reducers, and valves prior to entering the traveling screen enclosure. The current configuration of this piping system does not provide straight lengths of piping that will support either the installation of a permanent flow measuring device nor the utilization of a portable flow measuring device capable of providing accurate flow rate measurements. Significant costly modifications, requiring the design and installation of a 3-inch diameter piping reroute, applicable piping supports, heat trace, and insulation would be required to provide a configuration that would provide reliable flow readings.

Sequoyah plans to perform the test by setting the system resistance to the same point for each test with the throttle valves full open. Flow will not be measured. The remaining variable that could affect system resistance is the spray nozzles. The condition of the spray nozzles will be inspected during each test performance with corrective actions initiated as necessary, thus providing assurance that the spray nozzle condition will not affect flow. Maintenance history was reviewed for nozzle plugging and it was determined that nozzle plugging is infrequent. The nozzles are inspected by operations personnel during spray operation with corrective maintenance initiated as required. With system resistance maintained constant for each test, pump degradation would be identified through changes in differential pressure. The pump can be trended for degradation based on differential pressure at this point. Vibration readings will also be taken at this reference point. The pumps will be tested in this manner for both the quarterly Group A test and the biennial Comprehensive test.

3.1.3 Licensee's Proposed Alternative Testing

System resistance will be set to the same point for each test with the throttle valves full open. Flow will not be measured. The condition of the spray nozzles will be inspected during each test performance with corrective actions initiated as necessary, thus providing assurance that the spray nozzle condition will not affect flow. With system resistance maintained constant for each test, pump degradation will be identified through changes in differential pressure. The pump will be trended for degradation based on differential pressure at this point. Vibration readings will also be taken at this reference point as well. The pumps will be tested in this manner for both the quarterly Group A test and the biennial Comprehensive test.

3.1.4 Evaluation

The screen wash pumps take suction from the pump pit directly below the pump deck and are positioned on the deck adjacent to the traveling screens. The discharge piping for each pump is short and open ended containing several elbows, reducers, and valves prior to entering the traveling screen enclosure. No flow instrumentation is installed in the system to measure flow as required by OM Code ISTB. The current piping configuration does not provide straight lengths of piping that will support either the installation of a permanent flow measuring device or the utilization of a portable flow measuring device capable of providing accurate flow rate measurements. Significant costly modifications, requiring the design and installation of a 3-inch diameter piping reroute, applicable piping supports, heat trace, and insulation would be required to provide a configuration that would provide reliable flow readings.

The licensee plans to perform pump testing by setting the system resistance to the same point for each test by positioning the throttle valves to the full open position thereby establishing a fixed resistance system. Flow will not be measured. To ensure that spray nozzle clogging does not mask pump degradation during pump testing the spray nozzles will be inspected during each test performance with corrective actions initiated as necessary, thus providing assurance that spray nozzle condition will not affect system flow. The licensee also stated that the spray nozzles are inspected by operations personnel during spray operation with corrective maintenance initiated as required. With system resistance maintained constant for each test, pump degradation can be identified and trended through changes in differential pressure.

The NRC staff finds that compliance with the Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety and that the proposed alternative to set system resistance to the same point for each test with the throttle valves full open while inspecting the spray nozzles to ensure nozzle clogging does not affect system flow provides reasonable assurance of the operational readiness of the Essential Raw Cooling Water (ERCW) screen wash pumps.

3.1.5 Conclusion

Based on the above evaluation, the NRC staff concludes that the licensee's alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that compliance with the Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The licensee's proposed alternative provides reasonable assurance of the operational readiness of the ERCW screen wash pumps. Accordingly, the proposed alternative is authorized for the third 10-year IST interval at SQN, Units 1 and 2.

3.2 Pump Relief Request RP-02

3.2.1 Code Requirements

The licensee requested relief from OM Code ISTB-5121, which requires that the parameters listed in Table ISTB-3000-1, including flow, be determined and recorded, that flow rate be compared to the ranges specified in Table ISTB-5100-1, and that corrective actions be taken accordingly. Relief was requested for the following residual heat removal pumps:

1A-A Residual Heat Removal Pump
1B-B Residual Heat Removal Pump
2A-A Residual Heat Removal Pump
2B-B Residual Heat Removal Pump

3.2.2 Licensee's Basis for Requesting Relief

The Residual Heat Removal (RHR) pumps are tested using the miniflow recirculation line provided for pump protection. No other flow path is available to meet the Group A quarterly test requirements of OM Code ISTB. The miniflow path is an instrumented fixed resistance flowpath and limits flow to the minimum required flow for pump protection. The nominal flowrate through the miniflow recirculation line is 500 gallons per minute (gpm).

Test results during previous 10-year inspection intervals have shown variations of recorded flow readings which exceed OM Code ISTB allowable range requirements. The RHR pump miniflow rate is measured using an installed flow measuring device in the 14-inch pump discharge header while flowing through the 3-inch miniflow line which includes a 2-inch miniflow return valve. The flow measuring device meets OM Code ISTB range and accuracy requirements, however, small changes in the differential pressure across the flow element equate to relatively large changes in the flow. A differential pressure change of 2 inches of water at the flow element would equal a 44 gpm change in flow.

While operating through the miniflow recirculation line, the pump is operating in the flat portion of the pump curve near shutoff head conditions. In this region of the pump's hydraulic curve, very small changes in the developed head correspond to large changes in produced flow. For example, a change in developed head of 0.15 pounds per square inch guage (psig) would result in a change of approximately 52 gpm. A change in flow in excess of 3000 gpm would be required for the differential pressure to exceed the OM Code ISTB acceptable range of 0.9 times the reference value.

With the configuration of the installed flow instrumentation and the resulting negligible effect that changes in the flow have on differential pressure while operating on the minimum flow path, maintaining compliance to OM Code ISTB specified flow ranges is not practical.

This relief request meets the intent of Position 9 in GL 89-04.

No other flow measurement means are available that will provide the repeatability necessary to meet OM Code ISTB ranges.

3.2.3 Licensee's Proposed Alternative Testing

The RHR pumps will be Group A tested quarterly using the miniflow recirculation line where differential pressure and vibration will be measured and trended. The RHR pumps will be subject to a comprehensive pump test in accordance with OM Code ISTB requirements each refueling outage.

3.2.4 Evaluation

The RHR pumps can only be tested quarterly using a fixed resistence recirculation flow path. GL 89-04, Position 9, "Pump Testing Using Minimum-Flow Return Lines With or Without Flow Measuring Devices," identifies that for quarterly pump testing where flow can only be established through a miniflow recirculation path during quarterly testing, and a path exists at cold shutdown or refueling outages to perform a test of the pump under full or substantial flow conditions, the staff has determined the increased interval is an acceptable alternative to the Code requirements. This is contingent upon pump differential pressure, flow rate, and bearing vibration being measured during the cold shutdown or refueling outage test and that quarterly testing measures at least pump differential pressure and vibration.

It is impractical for the licensee to test the RHR at power using the normal flow path due to the design of the RHR system. Test results during previous 10-year inspection intervals have shown variations of recorded flow readings which exceed OM Code ISTB allowable range requirements. The RHR pump miniflow rate is measured using an installed flow measuring device in the 14-inch pump discharge header while flowing through the 3-inch miniflow line which includes a 2-inch miniflow return valve. The flow measuring device meets OM Code ISTB range and accuracy requirements, however, small changes in the differential pressure across the flow element equate to relatively large changes in the flow. The licensee's alternative meets the intent of GL 89-04, Position 9, and the guidance contained in NUREG-1482, Guidlines for Inservice Testing at Nuclear Power Plants, with respect to quarterly pump testing where flow can only be established through a miniflow recirculation path during quarterly testing, and a path exists at cold shutdown or refueling outages to perform a test of the pump under full or substantial flow conditions. The licensee's alternative to test quarterly using the miniflow recirculation line measuring differential pressure and vibration, and test at a substantial flow rate during refueling shutdowns measuring flow rate, differential pressure and vibration, provides reasonable assurance of the operational readiness of the RHR pumps.

3.2.5 Conclusion

Based on the above evaluation, the NRC staff concludes that the licensee's alternative is authorized pursuant to 10 CFR 50.55a(f)(6)(I) on the basis that compliance with the Code requirements is impractical and that the alternative provides reasonable assurance of the operational readiness of the RHR pumps. The NRC staff further concludes that granting the relief will not endanger life or property or the common defense and security and is otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Accordingly, relief is authorized for the third 10-year IST interval at SQN, Units 1 and 2.

3.3 Pump Relief Request RP-03

3.3.1 Code Requirements

The licensee requested relief from OM Code ISTB-3510(b)(1), which requires that the full-scale range of each analog instrument be not greater than three times the reference value. Relief was requested for the following boric acid transfer pumps:

1A-A Boric Acid Transfer Pump
1B-B Boric Acid Transfer Pump
2A-A Boric Acid Transfer Pump
2B-B Boric Acid Transfer Pump

3.3.2 Licensee's Basis for Requesting Relief

The boric acid transfer pumps have low suction pressure requirements where the pressure is as low as 1.5 psig. To meet the instrumentation requirements of OM Code ISTB, the maximum range at this suction pressure would be 4.5 psig (three times the measured suction pressure). To meet this requirement Sequoyah would have to purchase special low pressure gauges. The maximum error for a group A test using a 2 percent accurate gauge would be 0.09 psig. Testing with a 0.5 percent accurate gauge would result in a maximum error of 0.02 psig. Using a 15 psig gauge, which complies with Code accuracy requirements during testing would result in a maximum error of 0.3 psig for Group A testing and 0.075 psig for Comprehensive pump testing. The typical discharge pressure of the boric acid transfer pumps is in the 95-105 psig range. The discharge pressure becomes the controlling value in the differential pressure measurement, which is typically 80-90 psid. The inaccuracies of the 15 psig suction pressure gauge would have negligible affect on the calculation of the pump differential pressure. The effect would not be sufficient to mask pump degradation. Compliance with the Code required instrument range requirement does not provide an increase in the level of safety.

3.3.3 Licensee's Proposed Alternative Testing

Pump testing will be performed using 15 psig suction gauges in lieu of gauges that meet the range requirements of OM Code ISTB-3510(b)(1).

3.3.4 Evaluation

OM Code ISTB requires that differential pressure be determined during pump testing activities. Differential pressure may be determined by using a differential pressure gauge or calculating the difference between the discharge and suction pressure gauges. The Code also requires that the full scale range of each analog instrument not be greater than three times the reference value. The reference value associated with boric acid transfer pump suction pressure is approximately 1.5 psig which would require a gauge with a range of 0 to 4.5 psig. The licensee proposes to use suction pressure instrumentation with a range of 0 to 15 psig. Using a 0 to 15 psig gauge which complies with the Code accuracy requirements results in a maximum error of 0.3 psig for a group A test and 0.075 psig for a comprehensive test as apposed to a maximum error of 0.09 and 0.02 psig respectively for gauges meeting all Code requirements. The typical discharge pressure of the boric acid transfer pumps is in the 95 to 105 psig range. Discharge pressure is the controlling value in the differential pressure measurement calculation and the slight increase in the suction pressure instrument inaccuracies will not be sufficient to mask pump degradation. The licensee's proposed alternative will provide reasonable assurance of the operational readiness of the boric acid transfer pumps. Requiring the licensee to purchase special low pressure gauges would not provide an increase in the level of quality and safety considering the small fraction of a psig in increased instrument inaccuracy associated with the use of a 0 to 15 psig gauge.

3.3.5 Conclusion

Based on the above evaluation, the NRC staff concludes that the licensee's alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that compliance with the Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The licensee's proposed alternative provides reasonable assurance of the operational readiness of the boric acid transfer pumps. Accordingly, the proposed alternative is authorized for the third 10-year IST interval at SQN, Units 1 and 2.

3.4 Pump Relief Request RP-04

3.4.1 Code Requirements

The licensee requested relief from OM Code ISTB-3300, which requires that vibration reference values be determined from the results of preservice testing or from the results of the first inservice test, Tables ISTB 5100-1 and ISTB 5200-1, which establishes ranges of acceptability of reference values, and OM Code ISTB 6200, which requires that action be taken based upon the ranges established in Tables ISTB 5100-1 and ISTB-5200-1. Relief was requested for the following pumps:

J-A, K-A, L-B, M-B, N-B, P-B, Q-A, and R-A Essential Raw Cooling Water Pumps
A-A, B-B, C-B, and D-A Essential Raw Cooling Water Screen Wash Pumps
C-S, 1A-A, 1B-B, 2A-A, and 2B-B Component Cooling Water Pumps
A-A and B-B Shut Down Board Room Chilled Water Pumps
1A-A, 1B-B, 2A-A, and 2B-B Boric Acid Transfer Pumps
1A-A Safety Injection Pump

3.4.2 Licensee's Basis for Requesting Relief

The listed pumps have at least one vibration reference value (Vr) that is currently less than 0.05 inches per second. Small values for Vr result in very small acceptable ranges for pump operation. The acceptable ranges are defined in Tables ISTB-5100-1 and ISTB-5200-1, as less than or equal to 2.5 Vr. Based on a small acceptable range, a smooth running pump could be subject to unnecessary corrective action.

For very small reference values, hydraulic noise and instrumentation error can be a significant portion of the reading and affect the repeatability of subsequent measurements. Also, experience gathered from the preventative maintenance program has shown that changes in vibration levels in the range of 0.05 inches per second (ips) are not typically indicative of degradation in pump performance.

To avoid unnecessary corrective action on pumps which are performing satisfactorily and with unusually low vibration, a minimum velocity measurement value of 0.05 ips will be established for velocity measurements. This minimum value will be applied to individual vibration locations where the measured reference value is less than 0.05 ips and utilized in the calculation of acceptable ranges specified in Tables ISTB-5100-1 and ISTB-5200-1.

When new reference values are established per OM Code ISTB-3310, OM Code ISTB-3320, or OM Code ISTB6200(c), the measured parameters will be evaluated for each location to determine if the provisions of this relief request still apply. If the measured Vr is greater than 0.05 ips, the requirements of OM Code ISTB-3300 will be applied even if the pump is included in the identified list of pumps. Conversely, if the measured Vr is less than 0.05 ips, a minimum value of 0.05 ips will be used for Vr, even if the pump is not currently included in the list of pumps.

In addition to the requirements of OM Code ISTB, the pumps in the IST program are included in the Predictive Maintenance Program. The Predictive Maintenance Program currently employs predictive monitoring techniques such as the following:

> Vibration monitoring and analysis beyond that required by OM Code ISTB. All data is collected currently utilizing a CSI2120 meter, downloaded into the Predictive Maintenance Program, then analyzed for vibration magnitude and frequency. Components exceeding limits may be subjected to advanced diagnostics including impact testing and spectral analysis. Additional parameters monitored and trended are:
>
> > Bearing temperature trending
> > Oil sampling and analysis

If the measured parameters are outside the normal operating range or are determined by analysis to be trending toward an unacceptable degraded state, appropriate actions are taken that may include the following:

> Increased monitoring to establish rate of change
> Review of component specific information to identify the cause, and
> Removal of the pump from service to perform maintenance

All pumps in the IST program will remain in the Predictive Maintenance Program even if certain pumps have very low vibration readings and are considered to be smooth running pumps.

Periodic reports are generated from test data collected from IST and Predictive Maintenance activities. This alternative to the requirements of OM Code ISTB-3300 provides an acceptable level of quality and safety.

3.4.3 Licensee's Proposed Alternative Testing

Pumps with a measured reference value below 0.05 ips for a specific vibration measurement location shall have subsequent test results for that location compared to an acceptable range based on 0.05 ips. In addition to the Code requirements, all pumps in the IST program are included in and will remain in the Predictive Maintenance Program regardless of their smooth running status.

3.4.4 Evaluation

OM Code ISTB requires that the vibration of all safety-related pumps be measured. For centrifugal pumps, the measurements of each pump are taken in a plane approximately perpendicular to the rotating shaft in two orthogonal directions on each accessible pump-bearing housing. For vertical line shaft pumps, the vibration measurements are taken on the upper motor-bearing housing in three orthogonal directions, including the axial direction. The measurement is also taken in the axial direction on each accessible pump thrust-bearing housing. These measurements are to be compared with the Code vibration acceptance criteria to determine if the measured values are acceptable.

If during an inservice test, a bearing vibration measurement exceeds 2.5 times Vr the pump is considered in the alert range. The frequency of testing is then doubled until the condition is corrected and the vibration level returns below the alert range. Pumps whose vibration is recorded to be 6 times Vr, are considered in the required action range and must be declared inoperable until cause of the deviation has been determined and the condition is corrected. The vibration reference values are required to be determined when the pump is in good condition.

For pumps whose absolute magnitude of vibration is an order of magnitude below the absolute vibration limits, a relatively small increase in vibration magnitude may cause the pump to enter the alert or required action range. These instances may be attributed to variation in flow, instrument accuracy, or other noise sources that would not be associated with degradation of the pump. Pumps that operate in the region are typically referred to as “smooth running”. Based on a small acceptable range, a smooth running pump could be subjected to unnecessary corrective action.

The ASME OM Code Subgroup on Pumps has tried numerous times to implement a Code change to establish test requirements for a class of pumps, defined as smooth running. These requirements focused on selecting a minimum vibration to be specified in the proposed Code change, that would assign the minimum reference values. The Code committees have not reached a consensus on the appropriate minimum reference value and on whether this approach would be sufficient to determine degradation in safety pumps during testing. In addition, the Code committees have significant discussion on what other types of pump monitoring activities should be included as compensatory requirements for testing of smooth running pumps.

At least one plant has previously been authorized to use the smooth running pump methodology as described above. The minimum reference value was 0.1 ips. However, a pump bearing at this plant experienced significant degradation even though the vibration was below the minimum reference value in the proposed alternative. Had the current Code requirements been in place, the bearing vibration level for this pump would have exceeded the alert range. The degradation was discovered during vibration monitoring for a predictive maintenance program. After this finding, it was clear to the NRC staff that a simple minimum reference value method alone would not be sufficient to determine pump degradation.

The licensee’s proposal combines the minimum reference value method with a commitment to monitor all the IST pumps with a Predictive Maintenance Program even if certain pumps have very low vibration readings and are considered to be smooth running pumps. The licensee will assign a vibration reference value of 0.05 ips to any pump bearing vibration direction where, in the course of determining its reference value, the pump has a measured value below 0.05 ips. Therefore, the acceptable range will be less than or equal to 0.125 ips and the alert range will be 0.125 to 0.30 ips.

The licensee's proposal also describes the predictive monitoring program for all IST program pumps considered important to safe and reliable plant operation. The program includes bearing temperature trending, and oil sampling and analysis. The licensee states that if the measured parameters are outside the normal operating range or are determined by analysis to be trending towards an unacceptable degraded state, appropriate actions will be taken. These actions include increased monitoring to establish the rate of degradation, review of component specific information to identify cause, and removal of the pump from service to perform maintenance. The proposed alternative is consistent with the objective of IST which is to determine degradation in safety-related components.

As described above, the NRC staff finds that the alert and required action limits specified in the relief request sufficiently address the previously undetected acute pump problems. The NRC staff assumes that the objective of the licensee's predictive maintenance program is to detect problems involving the mechanical condition, even well in advance of when the pump reaches its overall vibration alert limit.

The licensee has not provided a basis for the proposed alternative to establish a reference value of 0.05 ips in lieu of the requirement specified in OM Code ISTB. However, as described above, the use of the suggested reference value of 0.05 ips will provide an alert range of 0.125 to 0.30 ips, and the licensee's preventive maintenance program has shown that changes in vibration levels below 0.05 ips do not normally indicate significant degradation in pump performance. The reference value of 0.05 ips is consistent with the previous NRC staff safety evaluations of similar issues. Therefore, the licensee's proposed alternative will provide an acceptable level of quality and safety.

3.4.5 Conclusion

Based on the above evaluation, the staff concludes that the licensee's alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(I) on the basis that the proposed alternative provides an acceptable level of quality and safety. The licensee's proposed alternative provides reasonable assurance of the operational readiness of smooth running pumps. Accordingly, the proposed alternative is authorized for the third 10-year IST interval at SQN, Units 1 and 2.

3.5 Pump Relief Request RP-05

3.5.1 Code Requirements

The licensee requested relief from OM Code ISTB-35I0(b)(2), which requires that instruments be calibrated such that the reference value does not exceed 70 percent of the calibrated range of the instrument. Initially the licensee requested relief for all pumps. In their revised relief request submitted by letter dated April 17, 2006, the licensee limited the relief request to the following pumps:

Containment Spray Pumps

3.5.2 Licensee's Basis for Requesting Relief

Portable digital ultrasonic flow equipment is used to measure flow for the Containment Spray Pump tests with the current maximum allowable reference value for the flow at 4800 gpm. Following the calibration range requirements of OM Code ISTB-3510 (b)(2), a reference value of 4800 gpm would require digital instrumentation with a calibrated range of 7104 gpm. This flow rate would equal an approximate velocity of 45.3 feet per second in the 8-inch diameter schedule 40 piping of the Containment Spray System. Per the specification provided by the ultrasonic flow equipment manufacturer, the maximum flow velocity measurement capable is 40 feet per second or approximately 6237 gpm.

The ultrasonic flow equipment has a manufacturer's stated accuracy of +/-1 percent and is calibrated to +/-2 percent and has proven acceptable for use in determining flow measurements. Calibration of ultrasonic equipment to 7104 gpm would not provide any greater assurances that the equipment is in calibration at the reference value. SQN does not have installed instrumentation or any other means to measure flow in the Containment Spray System to the required accuracy other than through the use of ultrasonic equipment. The inability to use ultrasonic equipment would require a modification to the piping system at considerable expense with no increase in accuracy. An installed flow measuring device in the Containment Spray System would not enhance the detection of pump degradation over that presently provided by ultrasonic flow equipment.

This request is similar to Code Case OMN-6, which is scheduled for inclusion in the 2006 Addenda of the Code and is being revised to be applicable to Codes from 2004 through 2005.

3.5.3 Licensee's Proposed Alternative Testing

SQN proposes to calibrate ultrasonic flow equipment used in testing the Containment Spray Pump test such that the reference value for the parameter does not exceed 90 percent of the calibrated range. This alternative will apply to both the Group A or B quarterly test and the Comprehensive test.

3.5.4 Evaluation

The instrument range requirements of OM Code ISTB-3510(b)(2) are to ensure that test measurements are sufficiently within range to detect changes in pump condition to allow detection of degradation. OM Code ISTB-3510(b)(2) states that the digital instruments shall be selected such that the reference value does not exceed 70 percent of the calibrated range of the instrument. ASME Code Case OMN-6 provides alternate rules for digital instruments. This Code Case states that digital instruments may be selected such that the reference value does not exceed 90 percent of the calibrated range of the instrument. NRC approved Code Case OMN-6, Revision 0 is only applicable to earlier OM Code editions and is not applicable to the

2001 Edition thru 2003 Addenda in use for the SQN third 10-year interval. Revision 1 to Code Case OMN-6 is currently Board approved and is applicable to the 1998 Code and later Editions, but is not yet NRC approved in Regulatory Guide 1.192.

The digital ultrasonic flow measurement instrument does not have sufficient calibrated range such that the reference value does not exceed 70 percent of the calibrated range. The licensee has determined that piping system modifications to replace digital instruments would represent a considerable expense with no increase in accuracy or ability to detect pump degradation. The calibrated range of the instrument must be sufficient to detect 110 percent of the reference value. With the reference value set at 90 percent, the instrument should still be capable of detecting a high flow rate of 110% of the reference value. Therefore, flow measurement accuracy is not compromised by these alternate rules, unless the reading exceeds 110 percent of the reference value.

Although, Revision 1 to Code Case OMN-6 has not yet been approved by the NRC in Regulatory Guide 1.192, the NRC has approved an earlier OMN-6 Code Case applicable to older versions of the OM Code and there are no objections from the OM Code Committee members, including the NRC representative, (Ref. Ballot 06-168 closed 2/23/06) for extending this Code Case to later Code editions. Therefore, the staff finds that the proposed use of alternative rules for the use of digital instruments such that the reference value does not exceed 90 percent of the calibrated range to be acceptable.

3.5.5 Conclusion

Based on the above evaluation, the staff concludes that the licensee's alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(I) on the basis that the proposed alternative provides acceptable level of quality and safety. The licensee's proposed alternative provides reasonable assurance of the operational readiness of the identified pumps. Accordingly, the proposed alternative is authorized for the third 10-year IST interval at SQN, Units 1 and 2.

3.6 Valve Relief Request RP-06

3.6.1 Code Requirements

The licensee requested relief from the requirements of OM Code ISTB-5121(d), which requires that vibration measurements be broad band (unfiltered) and OM Code ISTB-3510(e), which requires that the frequency response range of the vibration measuring transducers and their readout system be from one-third minimum pump shaft rotational speed to at least 1000 HZ. Relief was requested for the following residual heat removal pumps:

1A-A Residual Heat Removal Pump
1B-B Residual Heat Removal Pump
2A-A Residual Heat Removal Pump
2B-B Residual Heat Removal Pump

3.6.2 Licensee's Basis for Requesting Relief

Sequoyah proposes to exclude the vibration measurement in the range from one-third up to one-half pump shaft rotational speed from the OM Code ISTB Group A test. The exclusion of vibration measurements from one-third to one-half minimum pump shaft rotational speed will exclude the readings associated with the natural frequencies described below. It has been shown that these frequencies do not affect pump performance. Excluding this range of vibration for test measurements would prevent placing these pumps in an increased frequency test status. Placing the RHR pumps in an increased frequency test status provides no added value for monitoring pump performance. The dominant peak at one-third running speed masks data trending at the frequencies that represent actual pump/motor health. This places an unnecessary burden on resources and having to place the pumps on an increased frequency results in additional wear on the equipment and potential challenges to the plant. Pump degradation due to real physical problems, will be evident with the pump test monitoring the representative pump/motor condition frequencies without being masked by the unrelated structural resonant peak. This will ensure appropriate corrective actions are taken to address those levels of vibration that could result in pump degradation.

3.6.2.1 Historical data

Pump performance historical documents indicate that a high vibration condition has existed on the RHR pumps since original installation of the pumps. This condition also existed prior to the ASME conversion to the OM Code ISTB pump criteria that incorporated an expanded frequency range for measurement of pump vibration. Tennessee Valley Authority has monitored this condition for Sequoyah's RHR pumps and concludes there is no degradation of the pump/motor/foundation assembly from the inherent high vibrations in this range.

3.6.2.2 Manufacturer data

Westinghouse Electric Company, provider of the RHR pumps, issued a Technical Bulletin (NSID-TB-86-02) that advised utilities of the potential for a high vibration condition in vertical pump/motor/foundation support assemblies. The bulletin references the condition that Sequoyah is experiencing. Consultation with Westinghouse and the results of the TVA evaluation of this issue are provided below.

3.6.2.3 Attempts to correct problem

In accordance with the vendor recommendations from NSID-TB-86-02, the RHR pumps and pump supports were inspected to verify there were no loose supporting connections contributing to the vibration condition. Plant modifications to lower vibration by installing additional supports was not a preferred option based on a concern for relocation of the vibration to other points in the pump/motor/foundation. Attempts to relocate the vibration were found to have limited success at other utilities and in some instances vibration levels were increased.

3.6.2.4 Spectral analysis

Analysis of the condition indicates that the vibration occurs in a low frequency range less than one-half rotational speed. Analysis indicates there are no problems with the bearings or rotating elements (i.e., imbalance or misalignment). TVA's request is restricted to those frequencies that exhibit the natural resonance vibration levels. The results and evaluation of the spectral analysis were provided previously in a relief request granted during the second 10-year IST interval.

3.6.2.5 Pump/System design

The RHR system pumps are the typical design for more recent Westinghouse four loop plants, which are centrifugal pumps with the motor in the vertical position. There is no typical bearing housing(s) associated with these pumps as there are with centrifugal pumps where the pump and the driver are in the horizontal position. The pump and motor utilize one continuous shaft. There is no coupling located along the shaft and all of the bearings for the pump/motor assembly are located in the motor. Although mounted vertically, these pumps are not vertical line shaft pumps. Two motor designs exist for this application with different bearing arrangements. In one design the bearing located in the upper motor housing acts as a thrust and upper radial bearing while the lower bearing is a radial bearing. In the other design, the lower motor housing bearing acts as the thrust and lower radial bearing while the upper bearing is a radial bearing.

The pump support is designed to support the pump and the motor which rests on top of the pump. The motor is unrestrained and is in effect a large moment arm. The bearings for this pump are within the motor.

3.6.2.6 Compliance with OM Code ISTB

The natural system frequency of 10 to 11 Hz exhibits sufficient force such that when measurements are taken during quarterly pump testing at the upper motor bearing, the vibration readings are outside of the OM Code acceptable range limits. When applying the OM Code criteria, the vibration limits will place the pump consistently in the "Alert Range" or the "Required Action Range."

Sequoyah originally took a literal reading of OM Code wording to determine if vibration testing was required for the RHR pumps. Since the bearings are part of the Motor (i.e., pump driver), these vibration points were not included in the IST program. Following a self-assessment of the IST program, TVA determined that was not the most conservative position. Sequoyah now evaluates these measurements in accordance with OM Code ISTB acceptance criteria for pump vibration.

3.6.2.7 Plant operation and pump vibration history

Prior to initial operation of either unit, a nonconformance report was written which identified a natural frequency associated with the RHR pumps of 10 to 11 Hz. At the time, the seismic qualification of the pump had been performed based upon no natural frequencies below 33 Hz. The safety implication was that the RHR pumps did not meet their design basis for seismic qualification. This was reported to the NRC. TVA performed design changes and reanalysis of the pump support structure and piping system to qualify the 10 to 11 Hz natural frequency condition. Westinghouse Electric Company reviewed and approved the changes.

Both units were shut down for approximately three years beginning in 1985. Both units remained on RHR at shut down cooling flow conditions (greater than 2,000 gpm) in order to maintain the reactor coolant system in accordance with Technical Specifications. During this time, there were no problems with the RHR pumps. The pumps operated continuously with no adverse conditions identified.

Both units at Sequoyah were again shut down in 1993 for approximately one year. During this time, both units remained on RHR with the pumps operating at full flow conditions. The pumps operated continuously with no adverse conditions identified.

3.6.2.8 Advanced vibration diagnostics

Sequoyah has performed advanced vibration diagnostics to assess the condition of all four RHR pumps. The same 10 to 11 Hz natural frequency identified in the late 1970's was identified again.

Impact testing was performed on all four RHR pump/motor assemblies. The testing revealed the following data:

Pump ID	Natural Frequency of Motor Alone	Natural Frequency of Motor and Frame
1A	14 to 16 Hz	120 to 350 Hz
1B	11 Hz	175 to 331 Hz
2A	10 Hz	287 to 356 Hz
2B	11 to 13 Hz	100 to 350 Hz

For the 1B and 2A RHR pump motors, this data confirms the previous evaluation that a resonant condition exists at 10 and 11 Hz, respectively. The testing revealed that the motor upper bearing exhibited natural frequencies at approximately 10 and 11 Hz, respectively, which is coincident with the maximum amplitude vibration measurement for the same point found during OM Code quarterly testing.

The testing performed on the 1A RHR pump motor revealed a 14 to 16 Hz response frequency range on the motor and the motor/support frame frequency response is between 120 and 350 Hz . The overall vibration levels on the 1A RHR pump are stable and below the alert range. However, the vibration occurring at the 14 Hz frequency is contributing to the overall levels.

The testing performed on the 2B RHR pump motor revealed a 11 to 13 Hz response frequency range on the motor and the motor support/frame frequency response is between 100 and 350 Hz . The overall vibration levels on 2B RHR pump are stable and below alert range. However, the vibration occurring at the 11 Hz frequency is contributing to the overall levels. OM Code ISTB Group A pump testing is performed with the pump operating on miniflow, approximately 500 gpm. The pump operation flow characteristics create low frequency flow pulsations which tend to excite the structural resonant frequencies of the machine assembly. Spectral analysis of vibration data collected during pump testing activities indicates a dominant peak between 10 to 14 Hz for all RHR pump motors. To improve the vibration levels would require separating the low natural frequencies away from the operating frequency of 29.8 Hz. Physical modifications to drive the natural frequency up beyond 30 Hz (greater than 15 percent of operating frequency as a rule of thumb) can be unpredictable and difficult even when performed with detailed analysis. Efforts at other plants have been unsuccessful due to shifting the vibration to adjacent components such as the pump or piping.

3.6.2.9 Full flow testing

Near full flow vibration data obtained during refueling outages shows that the vibration is greatly reduced at near full flow conditions. This indicates that the higher test measurements occur only during the quarterly tests, which are conducted with the RHR pumps on miniflow. The pumps are designed to run at full-flow conditions for normal plant operations and for accident conditions. Thus, the minimum flow test configuration causes the motor structure to be excited and a higher vibration to be present during the quarterly pump tests.

This testing supports the expected results identified by Westinghouse in Technical Bulletin NSID-TB-86-02.

3.6.2.10 Civil/Structural evaluations

TVA originally modeled the pump and its support as a rigid anchor. During the reanalysis discussed above, the pump and its support were modeled as a flexible member. The results of this analysis confirmed that the measured natural frequency of approximately 10 to 11 Hz was a system frequency, i.e., pump, pump support, and piping. The reanalysis changed the nozzle loads on the pump and on local pipe supports to meet the new support loads. The pump support was also stiffened, incidental to the vibration problem.

A Civil Engineering review has been performed on the results of the advanced vibration diagnostics with respect to the problem described above. The review determined that the new measurements reflect the problem identified during initial system operation and is not a new vibration problem. Based upon this analysis, the pump and its structure continue to meet the design requirements for acceptable operation.

3.6.2.11 Inservice inspection (ISI) examinations of the piping and supports

A review of ISI examinations of pipe welds and pipe supports in the area surrounding the pumps was performed. Of the examinations in this area which did not meet the acceptance criteria, all of them were minor indications and are characterized as typical indications found during inservice examinations following the completion of construction activities. No failures were associated with any of these indications. None of the indications could be characterized as defects due to pump vibration.

No further indications have been identified. The issues found by ISI are indicative that the vibration problems are a natural frequency of the system and not a destructive vibration force.

Based upon the above, Sequoyah concludes that the pumps operate acceptably and will perform their safety function as required during normal and accident conditions.

3.6.3 Licensee's Proposed Alternative Testing

Vibration measurements on the upper motor bearing of the RHR pumps will be taken during the OM Code ISTB Group A pump tests in a range from one-half minimum pump shaft rotational speed to at least 1000 Hz.

3.6.4 Evaluation

OM Code ISTB requires that vibration measurements be broad band (unfiltered) and that the frequency response range of the vibration measuring transducers and their readout system be from one-third minimum pump shaft rotational speed to at least 1000 HZ. The licensee proposes to take vibration measurements on the upper motor bearing of the RHR pumps during the quarterly Group A test in a range from one-half minimum pump shaft rotational speed to at least 1000 Hz.

The RHR pumps are tested quarterly using the miniflow recirculation line, and the nominal flow rate is 500 gpm. During refueling outages, the RHR pumps are tested at substantial flow rates and the vibration levels are greatly reduced indicating that the motor structure is excited during low flow conditions present during the quarterly Group A pump test. The pumps are designed to operate at full flow conditions during normal operation of the RHR system and for accident conditions.

Pump operation utilizing the miniflow recirculation line creates low frequency flow pulsations which tend to excite the structural resonant frequencies of the pump assemblies. The natural system frequency can exhibit sufficient force such that when vibration measurements are taken on the upper motor bearing, the readings exceed the OM Code acceptable range limits. However, data from the full flow tests conducted during refueling outages show that the vibration is significantly reduced in this frequency range when operating at significant flow rates and meet the OM Code acceptance criteria. Although the RHR pumps exhibit high vibration during miniflow tests, the spectral analysis indicates that there are no problems with the bearings or rotating elements. TVA has monitored the high vibration condition since original installation of these pumps and has concluded that there is no degradation of the pump/motor/ foundation assembly from the inherent high vibration during miniflow tests.

The high vibration levels in the low frequency range during miniflow operation can result in overall vibration levels higher than the OM Code acceptable limits. Exceeding the vibration limits would place the pumps in an increased frequency test status or required action status. However, the pump operation histories and spectral analysis indicates no degradation of the affected components since original installation, and pump operability has been demonstrated during refueling outages by full flow tests. Thus, increasing the test frequency or requiring maintenance on the pumps due to high vibration levels during miniflow operation would not cause an increase in the level of safety or quality in monitoring pump performance. The pumps are designed to run at full flow conditions, an increased frequency of miniflow tests could result in additional wear on the equipment and potential challenges to the plant, as well as cause unnecessary burden on the licensee. The licensee proposes to exclude the vibration measurements from one-third rotational speed up to one-half rotational speed during the quarterly group A test. Vibration levels will be monitored from one-half rotational speed to at least 1000 Hz during quarterly pump testing. The frequency response range during comprehensive pump testing will meet the Code requirement of one-third rotational speed to at least 1000 Hz. The staff finds that compliance with the Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety and that the proposed alternative to monitor vibration from one-half rotational speed to at least 1000 Hz during quarterly pump testing along with a comprehensive pump test that meets Code requirements for vibration monitoring provides reasonable assurance of the operational readiness of the RHR pumps.

3.6.5 Conclusion

Based on the above evaluation, the staff concludes that the licensee's alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that compliance with the Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The licensee's proposed alternative provides reasonable assurance of the operational readiness of the RHR pumps. Accordingly, the proposed alternative is authorized for the third 10-year IST interval at SQN, Units 1 and 2.

3.7 Valve Relief Request RV-1

3.7.1 Code Requirements

The licensee requested relief from the stroke time requirements of OM Code ISTC-3500 which requires that active and passive valves be tested in accordance with the paragraphs specified in Table ISTC-3500-1 and the applicable requirements of OM Code ISTC-5100 and OM Code ISTC-5200. Relief was requested for the following valves:

FSV-68-396
FSV-68-397

3.7.2 Licensee's Basis for Requesting Relief

These solenoid valves have no position indication and are totally enclosed which prevents visual confirmation of the valve position and therefore the inability to measure the time that it takes the valve to stroke. These valves are throttle valves with a operator which positions the valve at 0 percent, 25 percent, 50 percent, and 100 percent and is set through the use of a thumbwheel. However, these valves are fast acting valves with a stroke time of less than two seconds and a stroke of approximately a quarter of an inch.

Sequoyah will verify that the valves operate properly using acoustic instrumentation. The acoustic instrumentation takes a reading of the system noise prior to opening the valve. The valve is opened by operating the thumbwheel and another acoustic signal is obtained at the full open position. The valve is then closed and another acoustic signal is obtained at the full closed position. The initial acoustic signal at the full closed position is compared to the second acoustic signal taken at the full closed position. Comparative values provide assurance that the valves are moving to the correct position and that the valves are operating acceptably. However, the signals do not provide the means to measure the amount of time it takes the valves to go from one position to the other.

The valves are 1-inch diameter Target Rock valves with a seal welded bonnet. They are the second of two 1-inch diameter valves in parallel to each other and are normally closed. An enhanced maintenance program of disassembly and inspection was considered. This method was not considered appropriate for the following reasons. One, this process can lead to assembly and operational problems due to distortion of the valve parts caused by the repetitive welding process to reinstall the seal weld every refueling outage. This is not considered acceptable for the purposes of testing and could lead to premature replacement of the valves. Two, the repetitive removal of the seal weld between the body and the bonnet can cause another problem. When the seal weld is removed, a small amount of the base metal also has to be removed in order to find a separation point past the heat affected zone where the weld metal has not penetrated into the base metal so that the bonnet can be removed from the body. Every time this operation is performed, more and more of the base metal is removed until the required thickness no longer exists which makes the valve not functional. Third, once the valve is opened and the internals of valve are examined, the condition of the internal parts do not typically give any more indication of acceptable valve operation than the acoustic monitoring.

Considering that there is no known feasible method for measuring valve stroke time and an enhanced maintenance program does not provide additional assurance of acceptable valve operation and can possibly be detrimental to acceptable valve operation, the method described above using acoustical instrumentation provides the only known method from which acceptable valve operation can be determined. A refueling outage is the only time the valves can be monitored and the only time maintenance can be performed since the valves are located inside containment.

3.7.3 Licensee's Proposed Alternative Testing

Sequoyah will verify that the valves operate properly using acoustic instrumentation every refueling outage.

3.7.4 Evaluation

The reactor vessel head vent valves are 1-inch Target Rock solenoid valves that have no position indication and are totally enclosed (seal welded bonnet) which prevents visual confirmation of valve position. The valve design creates the inability to measure the time that it takes the valve to stroke. The valves are throttle valves with a thumbwheel control that positions the valve at 0 percent, 25 percent, 50 percent, and 100 percent. The valves are fast acting valves with a stroke time of less than two seconds and a stroke of approximately one quarter of an inch.

The Code requires that power operated valves be stroke timed either in the open direction, the closed direction, or both directions depending on the required safety function of the valve. Remote position indication is not provided for the reactor vessel head vent valves and their design prohibits the ability to visually verify the physical position of the operator, stem, or internal components. The licensee states that there is no feasible method to measure stroke time and that an enhanced maintenance program does not provide additional assurance of valve operation and can possibly be detrimental to acceptable valve operation.

Stroke timing is not possible using the conventional method of position indication. The licensee proposes to verify that the valves operate properly using acoustic instrumentation every refueling outage. Imposition of the Code requirements would result in a burden on the licensee in that modification to the valves or valve replacement would be necessary to comply with the Code requirements. The licensee's proposal to verify that the valves operate properly using acoustic instrumentation every refueling outage provides reasonable assurance of the operational readiness of these valves.

Relief is granted pursuant to 10 CFR 50.55a(f)(6)(I) based on (1) the impracticality of performing the Code required testing; (2) consideration of the burden on the licensee if the Code requirements were imposed on the facility, and; (3) the proposed alternative testing providing an acceptable level of assurance of the operational readiness of the valves.

3.7.5 Conclusion

Based on the above evaluation, the staff concludes that the licensee's alternative is authorized pursuant to 10 CFR 50.55a(f)(6)(I) on the basis that compliance with the Code requirements is impractical and that the alternative provides reasonable assurance of the operational readiness of the solenoid operated valves. The staff further concludes that granting the relief will not endanger life or property or the common defense and security and is otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Accordingly, relief is authorized for the third 10-year IST interval at SQN, Units 1 and 2.

3.8 Valve Relief Request RV-2

3.8.1 Code Requirements

The licensee requested relief from ISTC-5151 which requires a stroke time test for the following Class 3 solenoid valves that are part of the auxiliary air compressor package:

FSV-32-61
FSV-32-87

3.8.2 Licensee's Basis for Requesting Relief

These solenoid valves are part of the auxiliary air compressor package, have no position indication and are totally enclosed, preventing visual confirmation of valve position. Satisfactory operation of the auxiliary air compressors verifies that FSV-32-61 and 87 operates. Alternative testing provides an acceptable level of safety.

3.8.3 Licensee's Proposed Alternative Testing

Exercise by observing the auxiliary air compressors to ensure that the solenoid valve opens to supply ERCW cooling by ensuring auxiliary air compressor temperature is acceptable.

3.8.4 Evaluation

The subject valves are ASME Class 3 Category B active solenoid valves that open to provide ERCW to the auxiliary control air compressors. These valves are described by the licensee as solenoid valves that are part of the auxiliary air compressor package. As identified in ISTC-1200, such skid-mounted valves are excluded from ISTC provided they are tested as part of the major component and are justified by the Owner to be adequately tested. Solenoid valves of this type have no position indication and are totally enclosed. It is impractical and unnecessary to modify or replace the valves when there are alternative means to detect proper function of the valves. Observation of valve position by other means such as changes in system pressure, flow rate, level of temperature are recognized alternative indicators by the Code Committee. Sections 4.2.3 and 4.2.7 of NUREG-1482, Rev.1 address recommendations applicable to stroke time for solenoid-operated valves and verification of remote position indication for valves by methods other than direct observation. The proposed alternative testing approach gives positive indication of the valves actual position, thereby ensuring that the valves are functioning properly and is acceptable.

3.8.5 Conclusion

Based on the above evaluation, the staff concludes that the licensee's alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that the proposed alternative provides acceptable level of quality and safety. The licensee's proposed alternative provides reasonable assurance of the operational readiness of the identified valves. Accordingly, the proposed alternative is authorized for the third 10-year IST interval at SQN Units 1 and 2.

3.9 Valve Relief Request RV-3

3.9.1 Code Requirements

The licensee requested relief from Table ISTC-3500-1 which requires full stroke exercise test every three months while in cold shutdown or refueling for the following RHR System valves:

FCV-74-1
FCV-74-2

3.9.2 Licensee's Basis for Requesting Relief

Full stroking of RHR return valves during shutdown isolates decay heat removal capability, mixing capacity needed to maintain boron concentration within the RCS, and ability to produce gradual reactivity changes during boron concentration reductions in the RCS. It is generally considered not prudent to remove a valve from its safety related position to perform a periodic code test when that testing places the unit in an overall degraded condition. With respect to these specific valves, it is deemed additionally ill-advised in consideration of Unresolved Safety Issues A-31, "Residual Heat Removal Shutdown Requirements" and A-45, "Shutdown Decay Heat Removal Requirements" which addresses concerns regarding loss of residual heat removal capability leading to core damage. Reliability of performing heat removal functions is specifically identified as being dependent on the frequency of events that jeopardize decay heat removal operations. Alternative testing will provide an acceptable level of quality and safety and the increase in the level of safety by normal testing is not commensurate with the difficulties or risks involved. Extended outages of greater than three months are not normally anticipated.

3.9.3 Licensee's Proposed Alternative Testing

Full stroke exercise while shutting down when going on RHR as required. Full stroke exercise during startup when coming off RHR as required. Testing while core is off loaded is also acceptable.

3.9.4 Evaluation

The subject valves are ASME Class 1 Category A active motor actuated gate valves that open to provide suction from the RCS for the RHR when RCS is below the set point and close to prevent overpressure in the RHR system. The licensee has determined that it is impractical to exercise the subject valves during high pressure power operations and cycling the valves to an unsafe position during cold shutdowns and refueling outages when the RHR system is in service and operating is not advisable due to concerns associated with shutdown risk. ISTC-3521 describes various options for full stroke testing category A and B valves, but none of the options exactly represent the alternative approach proposed by the licensee. The licensee has proposed an alternative testing approach to provide an acceptable level of quality and safety, considering the potential risk associated the loss of the shutdown cooling function. The alternative full stroke exercise testing while shutting down when going on RHR combined with full stroke exercise testing during startup when coming off RHR or testing while the core is off loaded is an acceptable alternative approach from the Code-required frequency that will enhance the level of safety associated with decay heat removal and reactivity changes.

3.9.5 Conclusion

Based on the above evaluation, the staff concludes that the licensee’s alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that the proposed alternative provides acceptable level of quality and safety. The licensee’s proposed alternative provides reasonable assurance of the operational readiness of the identified valves. Accordingly, the proposed alternative is authorized for the third 10-year IST interval at SQN Units 1 and 2.

4.0 CONCLUSIONS

The NRC staff concludes that compliance with the Code’s requirements for the aforementioned relief requests for pump and valve inservice testing, as stated in Sections 3.1.5, 3.2.5, 3.3.5, 3.4.5, 3.5.5, 3.6.5, 3.7.5, 3.8.5, and 3.9.5 provide reasonable assurance of the operational readiness of the identified pumps and valves. Therefore, the proposed reliefs are authorized pursuant to 10 CFR 50.55a(a)(3)(i), 50.55a(a)(3)(ii), and 50.55a(f)(6)(i), for the third 10-year IST interval at Sequoyah Nuclear Plant, Units 1 and 2.

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