ATTACHMENT 1

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# TENNESSEE VALLEY AUTHORITY

# SEQUOYAH NUCLEAR PLANT

# ASME INSERVICE PUMP TESTING

# PROGRAM BASIS DOCUMENT

This document is to be used only for the second ten year inspection interval for ASME Section XI

REVISION NO. 1

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APPROVED BY W M Quinton DM&UST DATE 10-24-95
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MECHANICAL/NUCLEAR LEAD ENGINEER

REVISION LOG

| REVISION | DESCRIPTION OF REVISION | DATE |
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I. CHARTER

Note: This document has been prepared for the Second Ten Year ASME Section XI Inspection Interval. Positions or commitments regarding the first ten year inspection interval should be based on existing FSAR, SER, and other system documents.

A. MISSION STATEMENT

The ASME Section XI Section shall incorporate TVA policies and standards to support safe and reliable operation of Sequoyah Nuclear Plant through the following:

1. Establishing and maintaining a listing of all pumps subject to the ASME Section XI Inservice Test Program.

2. Establishing and maintaining the ASME Section XI Inservice Test Program to ensure the requirements of 10CFR50.55a and Technical Specifications are met.

3. For all cases where ASME pump test requirements are not met, provide a documented relief request with subsequent NRC approval.

4. Developing an Augmented Pump Test Program.

The Program Engineer & Program Test Engineer shall hold responsibility, accountability, and authority for accomplishing this mission and maintaining the program.

B. OBJECTIVES

The Objectives of the ASME Section XI Inservice Pump Test Program are as follows:

1. Perform ASME pump tests in accordance with ASME Section XI, Subsection IWP, which invokes OM-6, and Generic Letter 89-04.

2. Perform Augmented Pump Tests in accordance with 10CFR50, Generic Letter 89-04 and accepted industry standards.

3. Maintain OPERABILITY of applicable pumps to support tech spec requirements.

4. Maintain clearly defined responsibilities of organizations involved with pump testing.

5. Maintain applicable procedures, test equipment, and methods to current industry standards or better.

6. No NRC violations due to the ASME or Augmented Pump Testing Program

7. No INPO findings due to the ASME or Augmented Pump Testing Program

II. HISTORY - PURPOSE - BASES

ASME setup a committee in 1911 to establish standard rules for the fabrication of steam boilers and other pressure vessels. This committee, now called the Boiler and Pressure Vessel Committee, has also established suggested rules or good practices for inservice inspection/testing. The rules for the inservice inspection/testing for Nuclear Power Plant Components are contained in the ASME Boiler and Pressure Vessel Code, Section XI, Division 1. 10CFR50.55a of the federal law and Sequoyah's technical specifications require that ASME Section XI be met throughout the service life of the nuclear power plant and updated at each 10 year interval.

Under the provisions of 10 CFR 50.55a, inservice testing of safety-related pumps shall be performed in accordance with a specific edition of Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda. The interval dates applicable editions and addenda for the first 10 year interval were as follows"

First Interval Start Unit 1: 7/1981
First Interval Start Unit 2: 6/1982
Unit 1: 1974 Edition through the Summer 1975 Addenda
Unit 2: 1977 Edition through the Summer 1978 Addenda

ASME pump tests shall be performed in accordance with ASME/ANSI OM-6 (OMa-1988 Addenda to the OM-1987 Edition) using Generic Letter 89-04 as guidance. This program identifies the pump inservice testing that will be performed at the Sequoyah Nuclear Plant to comply with the requirements of 10 CFR 50.55a.

The safety-related pumps that are outside the scope of ASME Section XI, IWP (and therefore outside the scope of 10CFR50.55a) will be tested at a level commensurate with their intended function in the Augmented Test Program per Appendix B. Generic letter 89-04 will be used as guidance for the Augmented Pump Test Program.

As required by 10CFR50.55a(b), the effective edition of Section XI in regard to the second ten year interval is as folllows:

Second Interval Start Units 1 & 2: Estimated 12/15/95
Unit 1 & 2: 1989 Edition

III. REFERENCES

1. 10CFR50.55a Codes and Standards.

2. NRC Documents
   a. Inspection Manual, Temporary Instruction 2515/114, Inspection Requirements for Generic Letter 89-04, Acceptable Inservice Testing Programs.
   b. NRC Generic Letter 89-04, Guidance on Developing Acceptable Inservice Testing Programs. April 3, 1989.
   c. NRC letter on the "Minutes of the Public Meetings on Generic Letter 89-04 Oct 25, 1989.
   d. NRC Draft NUREG 1482, Guidelines for Inservice Testing at Nuclear Power Plants, November 1993 *(Section 8 of this document provides a comprehensive listing of regulatory and code references)*

3. Reserved

4. Reserved

5. CODES and STANDARDS
   a. ASME Boiler and Pressure Vessel Code, Division 1, Section XI, 1989 Edition.
   b. ASME/ANSI OM-6, Inservice Testing of Pumps in Light-Water Reactor Power Plants, OMa-1988 Addenda to the OM-1987 Edition (contained as Attachment 1).
   c. ANSI/ASME N45.2.6-1978, Qualification of Inspection Examination and Testing Personnel for Nuclear Power Plants.

6. TVA Calculation SQN-SQTP-001, ASME Section XI Inservice Code Class Boundaries for the Second 10 Year Interval.

7. TVA Calculation SQN-SQTP-002, ASME Section XI Pump and Augmented Pump Identification for the Second 10 Year Interval.

8. Sequoyah Site Standard Practice SSP-8.6, ASME Section XI Inservice Testing of Pumps and Valves.

9. Sequoyah Nuclear Plant Technical Specifications

10. Sequoyah Nuclear Plant FSAR 6.8

11. Sequoyah Nuclear Plant Design Criteria and Design Guides:
   a. SQ-DC-V-3.0 R6 Classification of Piping, Pumps, Valves and Vessels.
   b. SQ-DC-V-2.16 R1 Single Failure Criteria
   c. SQ-DC-V-3.2 R3 Classification of HVAC Systems

12. TVA submittals to the NRC

Later

13. NRC documents to TVA

FIRST INTERVAL
a. Safety Evaluation Report NUREG-0011 and its Supplements ,
b. Safety Evaluation Report NUREG-1232 Volume 2,
c. Safety Evaluation Report NUREG-1232 Volume 2, Supplement 1
d. Safety Evaluation Report on Sequoyah Inservice Test Program for Pumps and Valves (IST) April 5, 1985 (L44 850416 402).
e. Request for Relief from ASME Boiler and Pressure Vessel Code, Section XI, Inservice Testing Program (TAC 61835, 61836), Oct 23, 1987 (A02 871029 014).
f. Request for Relief from ASME Boiler and Pressure Vessel Code, Section XI, Inservice Testing Program (TAC 61835, 61836), Jan 19, 1988.
g. Request for Relief from ASME Boiler and Pressure Vessel Code, Section XI, Inservice Testing Program - Ultrasonic Flow Measurement (TAC 61835, 61836) - Sequoyah Nuclear Plant, Units 1 & 2. Sept 15, 1988.
h. Request for Relief from ASME Boiler and Pressure Vessel Code, Section XI, Inservice Testing Program - Boric Acid Transfer Pump Flow Rate Measurement (TAC R00479/R00480) - Sequoyah Nuclear Plant, Units 1 & 2. Mar 23, 1989 (A02 890327 014).

SECOND INTERVAL
i. later

14. Sequoyah Site Standard Practice SSP-2.9, Records Management.

IV. DEFINITIONS

OPERABLE - OPERABILITY: A system, subsystem, train, component or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified function(s), and all necessary attendant instrumentation, controls, a normal and emergency electrical power source, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component or device to perform its function(s) are also capable of performing their related support function(s).

ASME PUMP TEST PROGRAM: The pump test program required by 10CFR50.55a(f) delineates the testing requirements of ASME Code Class 1, 2, and 3 pumps by using the ASME Boiler and Pressure Vessel Code, Division 1, Section XI. This ASME PUMP TEST PROGRAM is further defined by ASME Section XI, Article IWP, and ASME/ANSI OM Part 6. Those pumps with an emergency power supply that are required in shutting down the reactor to the safe shutdown condition, maintaining the safe shutdown condition, or mitigating the consequences of an accident are to be tested per OM-6.

AUGMENTED PUMP TEST PROGRAM: The pumps that are outside the scope of ASME Section XI, IWP (and therefore outside the scope of 10CFR50.55a) but will be tested at a level commensurate with their intended function. The intent of 10CFR50 Appendix A, GDC-1, and Appendix B, Criterion XI is that all components,such as pumps, necessary for safe operation are to be tested to demonstrate that they will perform satisfactorily in service. Therefore, while 10CFR50.55a delineates the testing requirements for ASME Code Class 1, 2, and 3 pumps, the testing of pumps is not to be limited to only those covered by 10CFR50.55a. (refer to item 11 of Generic Letter 89-04)

V. PROGRAM - SCOPE & PLAN

SCOPE

ASME Section XI, Article IWA 1000 "Scope and Responsibility" paragraph IWA-1310 calls for the selection of components subject to the inservice program. Article IWP invokes OM-6. OM-6 covers those pumps with an emergency power supply that are required in shutting down the reactor to the safe shutdown condition, maintaining the safe shutdown condition, or mitigating the consequences of an accident. OM-6 Section 3.1(b) requires each pump that is to be tested to be identified and listed in the plants records. Pumps subject to testing per 10CFR50.55a and ASME Section XI (OM-6) are identified in reference 6.b (contained in Appendix B to this program document) and are included within the scope of this program.

PLAN

A. The ASME Inservice Pumps subject to testing shall be identified, documented, and the selection controlled by reference 6.b.

B. The ASME Inservice Pump Tests shall be performed in accordance with OM-6.

C. The ASME Inservice Pump Tests shall be reviewed and approved by the Program Test Engineer.

D. The ASME Inservice Pump Test records shall be maintained in accordance with Section 7 of OM-6, and Subsection IWA-1400 of the 1989 Edition of ASME Section XI.

## VI. REGULATORY REQUIREMENTS

Technical Specification 4.0.5 requires inservice testing of ASME Code Class 1, 2, and 3 components as required by 10CFR50.55a. 10CFR50.55a (f) requires the inservice testing of ASME Code Class 1, 2, and 3 pumps per the 1989 Edition of ASME Section XI. 10CFR50.55a and ASME Section XI Subsection IWP invokes ASME/ANSI OM-6 (OMa-1988 Addenda to the OM-1987 Edition). OM-6 requires the testing of pumps with an emergency power source that are needed for the safe shutdown of the reactor, maintaining safe shutdown, and mitigating the consequences of an accident. Therefore the pumps identified in reference 6.b subject to the OM-6 test program shall be tested to satisfy 10CFR50.55a requirements unless specific relief is granted by the NRC.

The pumps that are outside the scope of ASME Section XI, IWP (and therefore outside the scope of 10CFR50.55a) are to be tested at a level commensurate with their intended function. The intent of 10CFR50 Appendix A, GDC-1, and Appendix B, Criterion XI is that all components, such as pumps, necessary for safe operation are to be tested to demonstrate that they will perform satisfactorily in service. Therefore, while 10CFR50.55a delineates the testing requirements for ASME Code Class 1, 2, and 3 pumps, the testing of pumps is not to be limited to only those covered by 10CFR50.55a (refer to item 11 of Generic Letter 89-04). These pumps will be tested per the Augmented Test Program in Appendix B of this program basis document. Relief is not required from the NRC if testing is not in accordance with OM-6. These pumps are to be tested at a level commensurate with their intended function.

### RELIEF REQUESTS - IDENTIFICATION OF CODE NONCOMPLIANCE

Technical Specification 4.0.5 *(revision needed to reflect Standard Tech Specs prior to start of second 10 year interval)* and 10CFR50.55a reflect the position that relief requests from impractical code requirements do not have to be granted by the NRC before they are implemented. Relief Requests are to be identified in advance and submitted to the NRC well in advance of their implementation (minimum of 90 days suggested) where possible. 10CFR50.55a recognizes that it will not be possible in all cases to determine in advance that any particular ASME Code requirement is impractical and allows up to a full year after the beginning of an updated interval to inform the NRC and request relief. It is also recognized that, during the interval, certain ASME Code requirements may be identified as impractical due to unforeseen circumstances and relief may be requested at that time. Relief Requests identified during the interval should be submitted to the NRC within approximately two weeks of identification, after completion of the plants review/approval process. The review/approval process includes 1) preparation of the Relief Request and incorporation into this program basis document by approval of a revision hereto, 2) the appropriate 10CFR50.59 reviews for this program basis document revision in accordance with the plants Safety Assessment/Safety Evaluation process, and 3) review by PORC and approval of the Plant Manager of the change denote via the 10CFR50.59 evaluation. This methodology will avoid situations where compliance with the technical specifications cannot be achieved for the period between the time of preparation/review/approval and submittal of a relief request until the NRC has granted the relief.

When noncompliance with a code requirement is identified and testing with technical specification allowable action times is not practical (e.g. test configuration/setup, cold shutdown or refueling required to test, etc.) it may be possible to reference other tests performed in justifying continued operation. A Relief Request or a deferred test justification (cold shutdown or refueling outage) may be required. The operability of the component could be assessed using the guidance provided in Generic Letter 91-18 which discusses the need for obtaining a Temporary Waiver of Compliance or exigent relief from the ASME Code requirements. Use of the guidance provided by the NRC within ref 2.d should help avoid denial by the NRC. *Note that any alternate testing specified by the Relief Request is not to be implemented until authorized by the NRC.*

VII. DESCRIPTION

Under the provisions of 10 CFR 50.55a, inservice testing of safety-related pumps will be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda. As required by 10 CFR 50.55a (b), the effective edition of Section XI with regard to the second ten year interval is the 1989 Edition. ASME pump tests will be performed in accordance with ASME/ANSI OM-6 (OMa-1988 Addenda to the OM-1987 Edition). This program identifies the pump inservice testing that will be performed at the Sequoyah Nuclear Plant to comply with the requirements of 10 CFR 50.55a.

The pump test program shall be conducted in accordance with Subsection IWP of Section XI of the ASME Boiler and Pressure Vessel Code (applicable Edition and Addenda) except for relief requested under the provisions of 10 CFR 50.55a. Subsection IWP as modified by 10CFR50.55a(b)(2)(viii) invokes OM-6 for the performance testing of pumps. Table A details the inservice testing program for applicable ASME safety-related pumps at Sequoyah Nuclear Plant. Table A lists each pump required to be tested in accordance with OM-6. Each parameter to be measured as well as specific notes concerning nonconformance are also listed.

Pump Testing Frequency

ASME Section XI inservice pump testing (in the as found condition where practical) shall be conducted quarterly (at least once every 92 days). ASME pumps lacking required fluid inventory shall be tested at least once every two years (at least once every 24 months). Pump testing shall continue through shutdown periods on operable equipment. Pumps in systems out of service for an extended period of time are not required to be tested but will be tested within the last 92 days of the outage or prior to being returned to service or entry into an operational mode which requires the pump to be OPERABLE (unless technical specifications allows otherwise). Pumps tested during power ascension due to maintenance performed during the outage shall be considered inoperable until the post maintenance tests are completed.

The start of the second interval will include all tests that are to be performed during cold shutdown and refueling prior to startup. For extended test programs, such as the full flow pump tests, credit for similar inspections during the first interval may be taken.

Reference Values

Reference values are found in the applicable test procedure for each ASME pump. When a reference value or set of values may have been affected by repair, replacement, or routine servicing of a pump, a new reference value or set of values shall be determined or the previous value reconfirmed by an inservice test run prior to declaring the pump operable. New reference values are required in the second interval for the MD AFW pumps due to the utilization of the new larger miniflow path. Initial reference values must be established for the 6.9 kv Shutdown Board Room Chilled Water Pumps which are new to the program for the second interval.

Test Parameters

Note that pump inlet pressure and lubricant level/pressure should be specified/observed within the test procedures to determine pump operational readiness when applicable but that no acceptance criteria is applicable in accordance with OM-6.

The following test parameters shall be observed after the pump has operated for at least two minutes under stable conditions.

Speed - Pump speed is only measured for variable speed pumps.

Differential Pressure - Differential pressure is calculated from suction and discharge pressure or obtained by direct differential pressure measurement. Lake level and pump elevation are used to obtain suction pressure when necessary and the calculational method is included in the pump test procedure.

Discharge Pressure - Discharge pressure is measured for positive displacement pumps.

Flow Rate - Flow rate is measured using a rate or quantity meter installed in the pump test cicuit. If a meter does not indicate the flow rate directly, the record shall include the method used to reduce the data.

Vibration - All centrifugal pumps will have vibration measurements taken in a plane approximately perpendicular to the rotating shaft in two orthogonal directions on each accessible pump bearing housing. Measurement will also be taken in the axial direction when accessible. Vertical line shaft pumps will have vibration measurements taken on the upper motor bearing housing in three orthogonal directions, one of which is the axial direction. Reciprocating pumps will have vibration measurements taken approximately perpendicular to the crankshaft and the line of plunger travel, including the axial direction when accessible on each bearing housing.

Allowable Ranges For Test Parameters

Tables 3a and 3b and Figure 1 of OM Part 6 provide the allowable ranges for pump testing parameters. Table 3 from OMb-1989 is included along with Tables 3a and 3b in Attachment 1. The Figure on vibration displacement was omitted from OMa-1988. Expanded ranges are not allowed without relief from the NRC. New reference values may be established as allowed by OM-6, Paragraph 4.5.

For pumps in systems for which the resistance cannot be varied, the flowrate and pressure shall be determined and compared to their respective reference values and allowable ranges. For pumps in systems for which the resistance can be varied, either the flowrate or pressure shall be set to a fixed value by varying the system resistance and the other paramenter shall be determined and compared to its respective reference value and allowable ranges. When flowrate or pressure is a fixed value, it shall not vary by more than +/- 2 % (see section 5.3 of ref 2.d). The allowable ranges of OM-6 for flowrate and differential pressure do not both apply for pumps in systems for which the resistance can be varied.

Instrument Accuracy

The limits for instrument accuracies are provided in Table 1 of OM Part 6. Vibration instrument frequency response range shall be from 1/3 of the minimum pump shaft rotational speed to at least 1000 Hertz. Instruments used to determine inlet pressure (e.g. lake level) also meet the requirements of Table 1 of OM-6. Attributes such as orifice plate tolerances, tap locations, and process temperature are not considered in the determination of insturment accuracy (refer to Section 5 of reference 2.d). The accuracy for analog instruments specified in OM-6 applies only to the calibration of the instruments. TVA Sequoyah instruments meet these requirements except where specific written relief has been requested.

Relief Requests

In the event specific test requirements of 10CFR50.55a and OM-6 are impractical and cannot be met, specific relief may be granted by the NRC. The following Relief Requests are for the second interval. Each relief request is identified as to whether it follows the guidance of Generic Letter 89-04, a relief request in the first interval, and/or if it is a new relief request. Relief Requests are to be submitted prior to the start of the second interval where possible, and in any case, by the end of 12 months following the new interval start date in accordance with 10CFR50.55a(f)(5)(iv).

Data Analysis and Evaluation

If deviations fall within the alert range the frequency of testing is doubled until the cause of the deviation is determined and the condition corrected. If deviations fall within the required action range the pump is declared inoperable as soon as the data is recognized to be unacceptable until the cause of the deviation has been determined and the condition corrected or an appropriate analysis is completed. If testing indicates that instruments are erratic, the test may be discontinued and the instruments recalibrated without declaring the pump inoperable. All test data is evaluated within 96 hours after completion of a test. However, this does not preclude declaring the pump inoperable if the test data is in the required action range.

Upon finding a pump inoperable and entry into appropriate action statements of technical specifications, the test results may be reviewed and compared to previous test data to decide if a condition has or has not developed that will further degrade the pump and exceed the safety analysis limit. If the pump is found not in danger of further degradation over an acceptable period of time, an analysis may be an acceptable alternative to pump repair or replacement until such time as repairs can be effected, as allowed by the code. If the analysis determines that the pump will soon degrade further, immediate action is required. The first analysis may be a preliminary analysis (by the Program and/or System Engineers) until particular expertise is available (Vend Nuclear Engineering, etc.). The preliminary analysis must establish a basis for meeting the safety analysis limits/licensing basis and must assess the condition of the redundant train. The period the pump can be considered operable based on the preliminary analysis must be determined and limited in the event a more complete analysis determines the pump is inoperable. This period should allow adequate time to perform a thorough engineering analysis beginning without delay.

Augmented Pump Testing

The inservice operability testing of safety-related pumps associated with non-OM-6 pumping systems are not tested per this ASME inservice test program. These pumps as identified in ref 6.b are tested per the Augmented Pump test program. For example, the inservice operability testing of pumps associated with the emergency diesels, are excluded from the ASME pump test program. The fuel oil transfer pumps, and lube oil pumps are tested per the augmented test program. Other components are an integral part of the Emergency Diesel System and are functionally tested by the Diesel tests. Thus, the functional operability testing of these pumps is performed at a frequency equal to that required by Section XI for pumps or at a frequency commensurate with their safety function. Additionally, the failure of a pump to perform its intended function will be identified by the failure of the associated Emergency Diesel to meet its functional requirements. Refer to Appendix A for a complete description of the Augmented Test Program.

## Pump Relief Request - RP-01
ERCW SCREEN WASH PUMP FLOW MEASUREMENT

**Affected Components**

ERCW Screen Wash Pumps

**Test Requirement**

OM-06, Section 5.2 requires that the vibration measurement be performed coincident with the measurement of the flow rate and differential pressure.

**Basis for 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 ultrasonics. Piping from the discharge of the screen wash pumps is open-ended to the spray nozzles at the traveling screen and is relatively short with multiple elbows, reducers, and valves in different planes. The physical configuration of this piping system is such that no portion of the piping meets the requirements for adequate installation of a permanent flow measuring device. Therefore, measured flow readings from an installed device may not be repeatable nor representative of actual pump flow. Significant system modifications, such as piping rerouting and support redesign, would be required to obtain a configuration that would provide reliable flow readings.

SQN plans to perform the test at dead-headed conditions. The pump manufacturer has verified this is acceptable for a short period of time. By performing the test at dead-head conditions, the flow rate is constant (i.e, it is equal to zero) and therefore, only the differential pressure is needed to be measured. Differential pressure is calculated using inlet and discharge pressure. Although the pump does not operate at this condition, it is acceptable to perform the test in this manner. The pump can be trended for degradation based on flow and differential pressure at this point on the pump curve which should be indicative of pump performance at normal operating conditions. The pump manufacturer has suggested that the vibration measurements be performed at normal operating conditions instead of dead-head conditions.

**Alternative Test**

The pump will be tested quarterly with the differential pressure at dead-head conditions which is in compliance with OM-6. However, after these measurements are taken, the pump differential pressure will be adjusted to a reference point (near normal operating conditions) and vibration measurements will be taken and trended at this point.

## Pump Relief Request - RP-02
RESIDUAL HEAT REMOVAL PUMP FLOW MEASUREMENT

**Affected Components**

Residual Heat Removal Pumps

**Test Requirement**

OM-6, Paragraph 5.2 requires the flow rate to met the ranges specified in Table 3.

**Basis for Relief**

Residual Heat Removal Pumps are test using the minimum flow recirculation line provided for pump protection. No other flow path is available to meet the quarterly testing of OM-6. The miniflow path is of fixed resistance and limits flow to the minimum required flow for pump protection. The nominal miniflow rate is 500 gpm for pump protection.

Test results during the first ten-year inspection interval have shown variations of recorded flow readings which exceed the OM-6 allowable range requirements. Residual Heat Removal pump miniflow rate is determined 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-6 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 55 gpm change in flow.

While testing using the miniflow recirculation line, the pump is operating in the flat portion of the pump curve near shutoff head conditions. Changes in the flow rate of the magnitude which would equal or exceed the OM-6 required range for flow would result in negligible changes in pump differential pressure. Pump differential pressure would only change a maximum of 0.15 psig from the 520 gpm reference value to the OM-6 upper and lower limits for flow of 572 and 468 gpm, respectively. A change in flow in excess of 3000 gpm would be required for the differential pressure to exceed the OM-6 required acceptable range of 0.9 times the reference value.

With the configuration of the installed flow instrumentation and the negligible effect of the changes in the flow have on differential pressure while operating near the shutoff head, maintaining compliance to OM-6 specified flow ranges is not practical. Ensuring miniflow rate is in compliance with OM-6 required ranges is of little value in determining pump condition or the pumps ability to meet its design function.

No other flow measurement means are available that will provide the repeatability necessary to meet OM-6 ranges.

**Alternative Test**

The Residual Heat Removal Pumps will be tested quarterly using the minimum flow recirculation line where differential pressure and vibration will be measured and trended. During each refueling outage, the Residual Heat Removal Pumps will be tested in accordance with OM-6 at full flow to ensure compliance with their Emergency Core Cooling safety function requirements.

## Pump Relief Request - RP-03

Shutdown Board Room Chilled Water Pumps
Boric Acid Transfer Pumps

**Affected Components**

Shutdown Board Room Chilled Water Pumps
Boric Acid Transfer Pumps

**Test Requirement**

OM-6, Paragraph 4.6.1.2(a) requires that the full-scale range of each analog instrument shall be not greater than three times the reference value.

**Basis for Relief**

These pumps have low suction pressure requirements where the pressure is as low as 1.5 psig. To meet the requirements of OM-6, Paragraph 4.6.1.2(a), special low-range pressure gauges would have to be purchased. Three times this pressure is 4.5 psig and the maximum allowable error of 2% would be 0.09 psig. Using a 15 psig gage during testing would provide a maximum allowable error of 0.30 psig. The 0.21 psig difference in accuracy of the two gauges is neglible.

This relief request is based on guidance provided in the SER dated October 23, 1987 and was approved in the previous 10 year interval.

**Alternative Test**

Pump testing will be performed using 15 psig gauges in lieu of gauges required by OM-6, Paragraph 4.6.1.2(a).

## Pump Relief Request - RP-04
SAFETY INJECTION PUMP FLOW MEASUREMENT

**Affected Components**

Safety Injection Pumps

**Test Requirement**

OM-6, Paragraph 5.2 requires flow measurement to be performed. Paragraph 5.1 requires this measurement to be performed in conjunction with the quarterly pump inservice test.

**Basis for Relief**

The Safety Injection Pumps are tested quarterly using the minimum flow recirculation line provided for pump protection. No other flow path is available to meet the quarterly testing of OM-6. The miniflow path is of fixed resistance which contains a restricting orifice which limits flow to the minimum required for pump protection. The nominal miniflow rate is 30 gpm with a minimum required flow of 28 gpm for pump protection. With flow already near the minimum required, it is not practical to throttle flow lower and set to a specific value, therefore, meaurement of flow for this purpose is not needed.

While testing using the miniflow recirculation line, the pump is operating in the flat portion of the pump curve near shutoff head conditions. Changes is flow rate of the magnitude which would equal or exceed the OM-6 required range for flow would result in negligible changes in pump discharge pressure. Pump discharge pressure would only change a maximum of 3.0 psig from the 30 gpm reference value to OM-6 upper and lower limits for flow of 27 and 33 gpm, respectively. With a nominal safety injection pump discharge pressure of 1500 psig and allowable gauge range of 4500 psig, a 3.0 psig change in discharge pressure would not be detectable.

A change in flow in excess of 250 gpm would be required for the differential pressure to exceed the OM-6 required acceptable range of 0.9 times the reference value. A change in flow rate of this magnitude is not practical to expect to occur without a significant change in pump condition. Other test parameters such as vibration are measured and trended and would detect changes in the pump condition. It is, therefore, not useful to instrument and measure flow in the miniflow path or practical to set flow to a specific reference value. The fixed resistance flow path ensures differential pressure will be obtained under the same flow conditions during each quarterly test.

**Alternative Test**

The Safety Injection Pumps will be tested quarterly using the minimum flow recirculation line where differential pressure and vibration will be measured and trended. During each refueling outage, the Safety Injection Pumps will be tested in accordance with OM-6 at full flow to ensure compliance with their Emergency Core Cooling safety function requirements.

## Pump Relief Request - RP-05
CONTAINMENT SPRAY PUMP FLOW MEASUREMENT

**Affected Components**

Containment Spray Pumps

**Test Requirement**

OM-6, Paragraph 4.6.1.2 requires digital instruments to be calibrated such that the reference value does not exceed 70% of the calibrated range of the instrument.

**Basis for Relief**

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 of 4940 gpm. Following the calibrated range requirements of OM-6, a reference value of 4940 gpm would require digital instrumentation with a calibrated range of 7064 gpm. A flow rate of 7064 gpm is equal to a velacity of 45.3 feet per second in the 8 inch schedule 40 piping of the Containment Spray System. Per the specifications provided by the ultrasonic flow equipment manufacturer, the maximum flow velocity measurement capability is 40 feet per second or 6237 gpm.

The ultrasonic flow equipment has an accuracy of +/- 1% which exceeds the OM-6 accuracy requirement of +/- 2% and has proven acceptable for use in determining flow measurements. Calibration of ultrasonic equipment to 7064 gpm would not provide any greater assurance that the equipment is in calibration at the reference value than calibrating the instrumentation to the reference value. SQN does not have installed flow instrumentation or other means to measure flow in the Containment Spray System 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. An installed flow measuring device in the Containment Spray System would not enhance the detection of pump degradation over that presently provided by ultrasonics flow equipment.

**Alternative Test**

Calibrate ultrasonic flow instrumentation such that the reference value does not exceed 95% of the reference value.

## Pump Relief Request - RP-06

REQUIRED ACTION RANGES OF PUMP TEST PARAMETERS

**Affected Components**

All pumps in the Inservice Testing Program.

**Test Requirement**

OM-6, Paragraph 6.1 requires that "If deviations fall within the required action range of Table 3, the pump shall be declared inoperable until the cause of the deviation has been determined and the condition corrected."

**Basis for Relief**

The deviation of pump hydraulic and/or vibration data which falls in the required action range of Table 3 "Ranges for Test Parameters" (consisting of Figure 1 and Tables 3a and 3b of the errata to OMa-1988 contained in OMb-1989) is an indication of degradation of pump performance. However, such a deviation does not address the ability of the pump to perform its intended safety function or the rate of degradation. It may be possible through analysis of past performance data from the subject pump or other similar pumps to ensure that the pump remains capable of performing its intended safety function until the next scheduled unit outage. Such an analysis could prevent the unnecessary shutdown of the unit to perform repairs to the pump.

**Alternative Actions**

In lieu of the requirements in paragraph 6.1 "Acceptance Criteria" in OM-6 for pumps wose hydraulic and /or vibration data falls into the required action range of Table 3 "Ranges for Test Parameters", the requirements of ISTB 6.2.2 "Action Range" of the 1995 Edition of the ASME OM Code will be implemented for the inservice testing of safety related pumps. The related requirements of ISTB 4.6 "New Reference Values" will also be implemented for the inservice testing of safety related pumps.

## Pump Relief Request RP-07
VIBRATION MEASUREMENT

**Affected Components**

All pumps in the ASME Section XI Inservice Test Pump Program.

**Test Requirement**

OM-6, Table 3a requires centrifugal and vertical line shaft pumps which operate at ≥600 RPM to observe an Alert Range of the lesser of >2.5 $V_{REF}$ to 6 $V_{REF}$ or >0.325 to 0.70 in/sec and a Required Action Range of the lesser of >6$V_{REF}$ or >0.70 in/sec.

**Basis for Relief**

The OM-6 requirements do not provide for pumps which have extremely low levels of vibration. For example, the Essential Raw Cooling Water Pump Q-A lower bearing vibration is approximately 0.0081 in/sec. Based upon the OM-6 ranges, this reference value would result in entry into the Alert range at ≥0.020 in/sec and into the Required Action range at ≥0.049 in/sec. By the standards listed below, these vibration levels are considered acceptable. Based on current vibration data, the application of the OM-6 ranges would result in a significant percentage of the SQN pumps entering the Alert range with vibration levels below 0.1 in/sec. The required increased frequency testing would accelerate the normal wear process and ultimately lead to increased maintenance activity and reduced availability.

A review of three widely accepted sets of guidelines for absolute vibration limits provides the following results:

OM-6

| Vibration Level | Quality Judgement |
|---|---|
| >0.325 in/sec | Alert Range |
| >0.700 in/sec | Required Action |

ANSI S2.41 (ISO 2372)

| Vibration Level | Quality Judgement |
|---|---|
| 0 - 0.1 in/sec | Good |
| 0.1 - 0.25 in/sec | Satisfactory |
| 0.25 - 0.62 in/sec | Unsatisfactory |
| >0.62 in/sec | Unacceptable |

IRD General Machinery Vibration Severity Chart

| Vibration Level | Quality Judgement |
|---|---|
| 0 - 0.08 in/sec | Good |
| 0.08 - 0.16 in/sec | Fair |
| 0.16 - 0.31 in/sec | Slightly Rough |
| 0.31 - 0.63 in/sec | Rough |
| >0.63 in/sec | Very Rough |

Pump Relief Request - RP-07 (Continued)

**Alternative Test**

Establish a minimum reference vibration level threshold of 0.10 in/sec peak velocity for centrifugal and vertical line shaft pumps operating at ≥600 RPM. Alert and Required Action levels for baseline vibration levels at or below 0.10in/sec peak velocity will be 0.25 and 0.6 in/sec, respectively. Components with measured vibration levels less than 0.10 in/sec peak velocity during testing will be acceptable, regardless of relative change from the baseline levels. Alert and Required Action levels for baseline vibration levels above 0.10 in/sec peak velocity will be as described in Table 3a.

Alert and Required Action levels for reciprocating pumps and for centrifugal and vertical line shaft pumps operating at <600 RPM are not affected by this relief and will meet the requirements of Table 3a of OM-6.

The frequency requirements of OM-6 are not affected by this relief.

VIII. PROCEDURES

Individual Surveillance Instructions will be written to perform testing in accordance with these requirements. Completed test packages will be maintained as lifetime Quality Assurance Records in accordance with SSP-2.9.

IX. RESPONSIBILITIES

1. Program Engineer (Nuclear Engineering)
   - Overall Program Ownership
   - Initiating design changes
   - Ensure compliance with existing regulations and standards and update as required
   - Maintenance of Design Basis Calculations, Program Basis Documents, and IST Drawings

2. Program Test Engineering (Technical Support)
   - Ownership of Site Standard Practice 8.6, "Pump & Valve Test Program"
   - Initiate maintenance requests based on test results and trends
   - Site Contact for all Inservice Pump Testing
   - Maintaining state of the art technologies in the program
   - Procure services and equipment necessary to perform the pump tests
   - Coordinate test schedules with Operating and Outage schedules
   - Coordinate pump tests
   - Prepare appropriate reports (PERs, Periodic Test Reports)
   - Review and approve test results
   - Maintain pump test procedures
   - Maintain tabulations and trends of pump test results
   - Ensuring periodic tests are performed on schedule
   - Specifing post-maintenence test requirements
   - Establish and maintain a database of historical data and trend results
   - Maintain instrumentation and test equipment necessary to perform pump tests

3. Corporate
   - Preparation and Maintenance of corporate standards.
   - Interpretation and coordination of ASME Code interpretations and application of generic programs.
   - Coordinate, review and assist in preparation of requests for relief and submittals.
   - Periodic assessments of site code programs

4. Others
   - Operations shall support the pump tests with valve lineups and equipment operation as required
   - Operations shall perform their portion of the pump test procedure
   - Instrument Maintenance shall provide for calibration of necessary instrumentation
   - The Maintenance organization shall provide corrective maintenance as necessary

X. TRAINING

1. Program Engineer & Program Test Engineer
   Understanding of pump theories and laws and their application.
   Understanding of 10CFR50.55a
   Knowledge of test instrumentation used to perform pump tests
   Knowledge of industry standards ASME Section XI and OM-6
   Certification to Test Engineer in accordance with ANSI/ASME N45.2.6-1978

2. Test Performers
   Understanding of pump theories and laws and their application.
   Understanding of 10CFR50.55a
   Knowledge of test instrumentation used to perform pump tests
   Knowledge of industry standards ASME Section XI and OM-6
   Certification to Test Engineer in accordance with ANSI/ASME N45.2.6-1978 or equilivalent as appropriate

TABLE A--PUMP TEST PROGRAM
SEQUOYAH NUCLEAR POWER PLANT

Summary of Information Provided

The pump test table (Table A) provides the following information on testing requirements:

1. System
2. Drawing on which the pump is depicted
3. Speed
4. Differential Pressure
5. Flow Rate
6. Vibration Amplitude

General Notes

Quarterly testing in accordance with the requirements of Section XI, Subsection IWP is indicated by "Q", otherwise it is addressed in specific notes as indicated.

The INSERVICE PUMP TEST TABLE in reference 7 provides the selection of pumps to be tested, their unique identification numbers, TVA Class, ASME Code Class, and basis for testing.

RP refers to the asssociated relief request

Specific Notes

1. Synchronous or induction motor driven pumps do not require speed check per OM-6, Table 2.

2. *A Technical Specification Change to SR 4.7.1.2 differential pressure is required for the larger AFW miniflow path utilized in the second 10 year interval.*

3. *RHR Suction and Discharge pressure gauge range requirements are selected based on the RHR suction and discharge pressures present at the time of testing (i.e. 3 times the referenced value). This is due to the significant variation in RHR suction pressures in the various plant modes.*

4. *ERCW Suction pressure gauge range requirements are selected based upon the ERCW suction pressure present at the time of testing (i.e., 3 times the referenced value). This is due to the variation in the elevation of Chickamauga Lake from whence the suction pressure is derived.*

TABLE A--PUMP TEST PROGRAM
SEQUOYAH NUCLEAR POWER PLANT

| Pump | Drawing Number | Speed | Differential Pressure | Flow Rate | Vibration Amplitude |
|---|---|---|---|---|---|
| | | n | dp | Q | V (RP-07) |
| Auxiliary Feed Water (Motor) | 47W803-2 | Note 1 | Q Note 2 | Q | Q |
| Auxiliary Feed Water (Steam) | 47W803-2 | Q | Q | Q | Q |
| Centrifugal Charging | 47W811-1 47W809-1 | Note 1 | Q | Q | Q |
| Safety Injection | 47W811-1 | Note 1 | Q | Q RP-04 | Q |
| System Essential Raw Cooling water | 47W845-5 | Note 1 | Q | Q | Q |
| Component Cooling | 47W859-1 | Note 1 | Q | Q | Q |
| Containment Spray | 47W812-1 | Note 1 | Q RP-05 | Q | Q |
| Residual Heat Removal | 47W810-1 | Note 1 | Q | RP-02 | Q |
| Boric Acid Transfer | 47W809-5 | Note 1 | Q | Q | Q |
| ERCW Screen Wash | 47W845-5 | Note 1 | Q | Q | Q RP-01 |
| Shutdown Board Room Chilled Water | 47W865-8 | Note 1 | Q | Q | Q |

NOTES Refer to previous page

# APPENDIX A: AUGMENTED PUMP TEST PROGRAM

APPPENDIX A--AUGMENTED PUMP TEST PROGRAM
SEQUOYAH NUCLEAR POWER PLANT

| Pump | Drawing Number | Speed | Differential Pressure | Flow Rate | Vibration Amplitude |
|---|---|---|---|---|---|
| | | n | dp | Q | V |
| Diesel Fuel Oil Transfer | 47W840-1 | Note 1 | Note 2<br>Note 3 | Q | Q |
| High Pressure Fire Protection | 47W832-1 | Note 1 | 18 m<br>Note 4 | 18 m<br>Note 4 | Note 4 |
| Spent Fuel Pit Cooling | 47W855-1 | Note 1 | Q | Q | Q |
| Spent Fuel Pit Cooling Sump | 47W855-1 | Note 1 | Note 5 | Note 5 | Note 5 |
| DG Standby Oil Circ Pump Note 6 | Note 6 | Note 1 | Note 2 | Note 6 | Q |
| DG 3 gpm AC Soakback Note 6 | Note 6 | Note 1 | Note 2 | Note 6 | Q |
| DG 3 gpm DC Soakback Note 6 | Note 6 | Q | Note 2 | Note 6 | Q |
| Flood Mode Aux Charging Note 7 | 47W809-7 | Note 1 | Note 7 | 2 yr | 2 yr |
| Flood Mode Aux Charging Booster Note 7 | 47W809-7 | Note 1 | Note 7 | 2 yr | 2 yr |
| Flood Mode ERCW Station Sump Pump | 47W853-11 | Note 7 | 2 yr | 2 yr | 2 yr |

NOTES

1. Synchronous or induction motor driven pumps do not require speed check.

2. No instrumentation exists to measure inlet or outlet pressure or to determine differential pressure.

3. The only means of measuring flow rate on these pumps is by measuring an increase in the day tank while the pumps are running. Accuracy using this indirect method is poor. Even with the poor accuracy, a greater than or equal to 10 gpm limit will provide adequate margin for allowing the pumps to fulfill their intended function.

4. The High Pressure Fire Pumps will be tested per the SQN Fire Protection Program Plan and the applicable NFPA standards. The Pumps and Motors are submerged. No capability exists to measure vibration.

5. The Spent Fuel Cooling System Pumps are enclosed within a flood protected enclosure with two sump pumps. The sump is normally dry. These pumps will be bumped and checked for rotation at least once every two years using SOI-78.1.

6. These DG skid mounted pumps are shown in vendor technical manual SQN-VTM-P318-0010 (DWG A9508F03001). No means exists to determine flowrate. Adequate engine preheat will be used to ensure acceptable lube oil pump operation in lieu of differential pressure and flowrate.

7. The Flood Mode System is a normally dry system. Discharge Pressure and Vibration shall be measured every two years with the required fluid system inventory provided. Flow rate shall be determined indirectly via volume/level changes.