TVA

Tennessee Valley Authority, Post Office Box 2000, Soddy-Daisy, Tennessee 37379

September 22, 1995

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

In the Matter of	)	Docket Nos. 50-327
Tennessee Valley Authority	)	50-328

SEQUOYAH NUCLEAR PLANT (SQN) - REVISED PROGRAM AND STATUS UPDATE REGARDING NRC GENERIC LETTER (GL) 89-13 - "SERVICE WATER SYSTEM PROBLEMS AFFECTING SAFETY-RELATED EQUIPMENT"

References:
1. NRC letter to TVA dated April 21, 1995, "Notice of Violation (NRC Inspection Report Nos. 50-327/95-03 and 50-328/95-03)"
2. TVA letter to NRC dated July 29, 1992, "Sequoyah Nuclear Plant (SQN) - Revised Program and Status Update Regarding NRC Generic Letter (GL) 89-13, 'Service Water System Problems Affecting Safety-Related Equipment'"
3. TVA letter to NRC dated October 24, 1990, "Sequoyah Nuclear Plant (SQN) - Revised Program Regarding NRC Generic Letter (GL) 89-13, 'Service Water System Problems Affecting Safety-Related Equipment'"
4. TVA letter to NRC dated January 26, 1990, "Sequoyah (SQN), Browns Ferry (BFN), and Watts Bar (WBN) Nuclear Plants - Response to Generic Letter (GL) 89-13, Service Water System Problems Affecting Safety-Related Equipment"

This letter provides notification to NRC regarding several revisions to SQN's GL 89-13 program. These revisions are being submitted in response to staff recommendations from the SQN Service Water System Operational Performance Inspection (SWSOPI) that was conducted at SQN between January and March 1995 (Reference 1).

Enclosed is a description of SQN's revised GL 89-13 program that addresses GL action items. Specific actions in SQN's GL 89-13 program where changes have been made include the following:

1. Essential raw cooling water (ERCW) intake structure biofouling inspection.
2. ERCW dead leg piping.
3. ERCW chemical treatment.
4. The high pressure fire protection system.

Note that the enclosed GL 89-13 program description is being provided as information only and will supersede any previous docketed information concerning SQN's GL 89-13 program (References 2, 3, and 4).

Please direct questions concerning this issue to D. V. Goodin at (423) 843-7734.

Sincerely,

R.H. Shell

R. H. Shell
Manager
SQN Site Licensing

Sworn to and subscribed before me
this 22nd day of September 1995

Peggy M. Billingsley
Notary Public
My Commission Expires Oct. 21, 1998

Enclosure
cc: See page 3

cc (Enclosure):

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ENCLOSURE

REVISED GENERIC LETTER (GL) 89-13 PROGRAM

FOR

SEQUOYAH NUCLEAR PLANT (SQN) UNITS 1 AND 2

ACTION I

"For open-cycle service water systems, implement and maintain an ongoing program of surveillance and control techniques to significantly reduce the incidence of flow blockage problems as a result of biofouling. A program acceptable to the NRC is described in 'Recommended Program to Resolve Generic Issue 51'(Enclosure 1). It should be noted that Enclosure 1 is provided as guidance for an acceptable program. An equally effective program to preclude biofouling would be acceptable. Initial activities should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter. All activities should be documented and all relevant documentation should be retained in appropriate plant records."

A. Recommended Program A: Generic Issue 51

"The intake structure should be visually inspected, once every refueling cycle, for macroscopic biological fouling organisms (for example, blue mussels at marine plants, American oysters at estuarine plants, and Asiatic clams at freshwater plants), sediment, and corrosion. Inspections should be performed either by scuba divers or by dewatering the intake structure or by other comparable methods. Any fouling accumulations should be removed."

SQN Response

SQN performs periodic inspection, by way of SQN's preventive maintenance (PM) program, of the essential raw cooling water (ERCW) intake structure for biological fouling mechanisms (i.e., clams, varieties of mussels including Zebra mussels, and algae), sediment, and corrosion. Acceptance criteria is established and inspection results are documented and retained in appropriate plant records. SQN considers the above measures to be sufficient to satisfy the recommendations of Program A.

B. Recommended Program B: Generic Issue 51

"The service water system should be continuously (for example, during spawning) chlorinated (or equally effectively treated with another biocide) whenever the potential for a macroscopic biological fouling species exist (for example, blue mussels at marine plants, American oysters at estuarine plants, and Asiatic clams at freshwater plants). Chlorination or equally effective treatment is included for freshwater plants without clams because it can help prevent microbiologically influenced corrosion. However, the chlorination (or equally effective) treatment need not be as stringent for plants where the potential for macroscopic biological fouling species does not exist compared to those plants where it does. Precautions should be taken to obey Federal, State, and local environmental regulations regarding the use of biocides."

SQN Response

Macroscopic biofouling (i.e., clams, mussels and algae) and microbiologically influenced corrosion (MIC) at SQN are controlled by injection, as required, of a biocide into SQN's ERCW supply piping located within the ERCW pumping station. The total residual oxidant is typically maintained between 0.2 and 2 parts per million. This concentration is considered to be sufficient for controlling macrofouling in SQN's ERCW system.

Monitoring for Zebra mussels is performed by way of a monitoring station in the condenser circulating water forebay.

Precautions are taken to obey Federal, State, and local environmental regulations regarding the use of biocides. Test results of water to be discharged to the river are documented in procedures and retained by appropriate plant records. The above measures are considered to be sufficient to satisfy the recommendation of Program B.

C. Recommended Program C: Generic Issue 51

"Redundant and infrequently used cooling loops should be flushed and flow tested periodically at the maximum design flow to ensure that they are not fouled or clogged. Other components in the service water system should be tested on a regular schedule to ensure that they are not fouled or clogged. Service water cooling loops should be filled with chlorinated or equivalently treated water before layup. Systems that use raw service water as a source, such as some fire protection systems, should also be chlorinated or equally effectively treated before layup to help prevent microbiologically influenced corrosion. Precautions should be taken to obey Federal, State and Local environmental regulations regarding the use of biocides."

SQN Response

SQN's service water cooling loops are normally in service during plant operation. Flow through these loops, with the exception of stagnant/dead leg piping, is verified either by:

(1) a flow balance, which is periodically performed on SQN's ERCW system to verify that the system provides the required design flow to safety-related components and equipment, or (2) an absence of fouling or clogging verified by heat exchanger inspections.

An engineering evaluation was performed to evaluate flushing stagnant/dead leg piping with raw water that has been chlorinated but not treated with corrosion inhibitors. Stagnant/dead leg piping includes: (1) flood mode connections, (2) supply piping to the component cooling system surge tanks, (3) emergency supply piping to the auxiliary feedwater pumps, and (4) ERCW A train to B train supply crossties. The evaluation concluded that flushing with water, which is only chlorinated and does not have corrosion inhibitors, would supply the lines with fresh oxygen during the flushing process, thus promoting additional corrosion and could increase the potential for MIC. If the piping is not flushed, the rate of corrosion is controlled by the rate of diffusion of oxygen within the pipe. Consequently, flushing may induce a higher rate of corrosion in stagnant/dead leg piping. Therefore, under SQN's chemical treatment program, which does not currently include corrosion inhibitors, stagnant/dead leg piping will not be flushed. The material condition of Stagnant/Dead Leg piping is monitored by way of SQN's raw water fouling and corrosion control program (nondestructive examination), which ensures the pipe is not fouled or clogged.

SQN's ERCW motor-operated valves (MOVs), check valves, and pumps are periodically tested in accordance with American Society of Mechanical Engineers (ASME) Section XI Code requirements.

SQN's containment spray heat exchangers (shell side cooled by ERCW) are maintained in chemically controlled wet layup with demineralized water and a corrosion inhibitor. The containment spray heat exchangers are periodically sampled to verify the concentration of the layup solution remains within required limits.

SQN's high pressure fire protection (HPFP) system is a nonsafety-related system. The HPFP system is not included as a service water system under SQN's GL 89-13 program (refer to SQN response to Action IV); however, the system is periodically flushed and chemically treated with sodium hypochlorite in accordance with plant procedures, except those portions of the HPFP system ordinarily not exposed to raw water (e.g., maintained dry).

The above measures are considered to be sufficient to satisfy the recommendations of Program C.

ACTION II

"Conduct a test program to verify the heat transfer capability of all safety-related heat exchangers cooled by service water. The total test program should consist of an initial test program and a periodic retest program. Both the initial test program and the periodic retest program should include heat exchangers connected to or cooled by one or more open-cycle systems as defined above. Operating experience and studies indicate that closed-cycle service water systems, such as component cooling systems, have the potential for significant fouling as a consequence of aging-related in-leakage and erosion or corrosion. The need for testing on closed-cycle system heat exchangers has not been considered necessary because of the assumed high quality of existing chemistry control programs. If the adequacy of these chemistry control programs cannot be confirmed over the total operating history of the plant or if during the conduct of the total testing program any unexplained downward trend in heat exchanger performance is identified that cannot be remedied by maintenance of an open-cycle system, it may be necessary to selectively extend the test program and the routine inspection and maintenance program addressed in Action III, below, to the attached closed-cycle systems.

A program acceptable to the NRC for heat exchanger testing is described in 'Program for Testing Heat Transfer Capability' (Enclosure 2). It should be noted that Enclosure 2 is provided as a guidance for an acceptable program. An equally effective program to ensure satisfaction of the heat removal requirements of the service water system would also be acceptable.

Testing should be done with necessary and sufficient instrumentation, though the instrumentation need not be permanently installed. The relevant temperatures should be verified to be within design limits. If similar or equivalent test have not been performed during the past year, the initial test should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter.

As a part of the initial test program, a licensee or applicant may decide to take corrective action before testing. Tests should be performed for the heat exchangers after the corrective actions are taken to establish baseline data for future monitoring of heat exchanger performance. In the periodic retest program, a licensee or applicant should determine after three test the best frequency for testing to provide assurance that the equipment will perform the intended safety functions during the intervals between tests. Therefore, in the periodic retest program, to assist that determination, tests should be performed for the heat exchangers before any corrective actions are taken. As in the initial test program, tests should be repeated after any corrective actions are taken to establish baseline data for future monitoring of heat exchanger performance.

An example of an alternative action that would be acceptable to the NRC is frequent regular maintenance of a heat exchanger in lieu of testing for upgraded performance of the heat exchanger. This alternative might apply to small heat exchangers, such as lube oil coolers and pump bearing coolers or readily serviceable heat exchangers located in low radiation areas of the facility.

In implementing the continuing program for periodic retesting of safety-related heat exchangers cooled by service water in open-cycle systems, the initial frequency of testing should be at least once each fuel cycle, but after three tests, licensees and applicants should determine the best frequency for testing to provide assurance that the equipment will perform the intended safety functions during the intervals between tests and meet the requirements of GDC 44, 45, and 46. The minimum final testing frequency should be once every 5 years. A summary of the program should be documented, including the schedule for test, and all relevant documentation should be retained in appropriate plant records."

<u>SQN Response</u>

SQN will maintain a program to verify the heat transfer capability of safety-related heat exchangers cooled by service water. The program consists of test, inspection, and/or maintenance. The program has a performance frequency of at least once every fuel cycle. Performance frequencies may be revised based on results of the periodic inspections after three fuel cycles starting from the Unit 2 Cycle 4 refueling outage for Unit 2 and the Unit 1 Cycle 5 refueling outage for Unit 1. The trending of thermal performance tests and/or inspections is performed to identify degrading conditions and provide timely corrective actions. The results of SQN's test/maintenance/inspection program is documented and retained in appropriate plant records. The following is a list of each safety-related heat exchanger by major grouping and the type of program to be used.

A. Component Cooling Heat Exchangers

   Thermal performance testing is periodically performed to verify heat transfer capability.

B. Engineered Safety Features (ESF) Room/Area Coolers

SQN has taken temperature measurements on the inlet and outlet piping of the ESF coolers. The temperature differentials across the ESF coolers, coupled with the currently available instrumentation for measuring bulk average air temperature, are insufficient to provide meaningful test data. Consequently, SQN considers testing to be impractical for the ESF coolers. Therefore, periodic maintenance and inspection is performed on the tube side (ERCW) for MIC, clams and mussels, silt, biofouling, and corrosion products, and on the air side for blockage and fouling. Periodic air flow testing is performed on the air side of the coolers to confirm minimum air flow requirements.

C. Lower Containment Vent Coolers

SQN has performed a total of 10 thermal performance tests on the lower compartment vent coolers. These tests were performed at shutdown for refueling, during unit start-up from refueling, and after normal cleaning. The inlet air temperature measurements varied as much as 50 degrees Fahrenheit. The margin of pass or fail was such that a 1- to 2-degree variance in average inlet air temperature significantly changed the final results. Consequently, SQN considers testing to be impractical for the lower compartment vent coolers. Periodic maintenance and inspection is performed on the tube side (ERCW) for MIC, clams and mussels, silt, biofouling, and corrosion products, and on the air side for blockage and fouling. Periodic air flow testing is performed on the air side of the coolers to confirm minimum air flow requirements.

D. Containment Spray Heat Exchangers

The shell side (ERCW) of the containment spray heat exchangers is maintained in a chemically controlled layup condition with demineralized water and a corrosion inhibitor. Periodic monitoring of the water in the shell side of the heat exchangers is performed. Periodic maintenance and inspection is performed on the shell side (ERCW) for MIC, clams and mussels, silt, biofouling, and corrosion products.

E. Diesel Engine Coolers

These heat exchangers are in service typically once every month during regularly scheduled surveillance runs of the diesel generators. During the monthly surveillance run, diesel engine coolant and lube oil temperatures are evaluated, recorded, and trended. Periodic maintenance and inspection is performed on the tube side (ERCW) for MIC, clams and mussels, silt, biofouling, and corrosion products.

F. Auxiliary Control Air Compressor After-cooler

Periodic maintenance and inspection is performed for MIC, clams and mussels, silt, biofouling, and corrosion products.

G. Condensers for Air-Conditioning Packages (i.e., Main Control Room, Shutdown Board Room, Electric Board Room)

Periodic maintenance and inspection is performed for MIC, clams and mussels, silt, biofouling, protective coating, and corrosion products.

H. Lube Oil Coolers

1. Centrifugal charging, safety injection, and ERCW pump oil coolers:

   Oil/bearing temperatures are evaluated, recorded, and trended in accordance with ASME Section XI pump tests. Periodic maintenance and inspection is performed for MIC, clams and mussels, silt, biofouling, and corrosion products on centrifugal charging and safety-injection pump oil coolers.

2. Air conditioner packages (i.e., main control room, shutdown board room, and electric board room):

   Periodic maintenance and inspection is performed for MIC, clams and mussels, silt, biofouling, protective coatings, and corrosion products.

Safety-related heat exchangers cooled by SQN's component cooling system are not included in a test/inspection program. Inspections were performed on the (component cooling side) of the component cooling heat exchangers, spent fuel pit heat exchangers, and post accident sampling facility sample coolers. The results of these inspections verified no fouling. Present chemistry programs are sufficient to ensure high-water quality for SQN's component cooling system.

A summary of the program is documented in plant instructions and all testing/inspection documentation is retained in appropriate plant records.

<u>ACTION III</u>

"Ensure by establishing a routine inspection and maintenance program for open-cycle service water piping and components that corrosion, erosion, protective coating failure, silting, and biofouling cannot degrade the performance of the safety-related systems supplied by service water. The maintenance program should have at least the following purposes:

A. To remove excessive accumulations of biofouling agents, corrosion products, and silt;

B. To repair defective protective coatings and corroded service water system piping and components that could adversely affect performance of their intended safety functions.

This program should be established before plant startup following the first refueling outage beginning 9 months after the date of this letter. A description of the program and the results of these maintenance inspections should be documented. All relevant documentation should be retained in appropriate plant records."

SQN Response

SQN's PM program provides for routine inspections and maintenance of piping and components to ensure that corrosion, erosion, protective coating failure, silting, and biofouling does not degrade the performance of the safety-related components supplied by ERCW. The program inspection and maintenance results are documented and retained in appropriate plant records. The components of SQN's inspection/maintenance program are as follows:

A. Periodic inspection and maintenance is performed on all safety-related heat exchangers cooled by ERCW for MIC, erosion, corrosion, clams and mussels, silting, protective coating failures, and biofouling as noted previously under Action II.

B. Ultrasonic inspections of selected portions of ERCW piping are performed by way of SQN's raw water fouling and corrosion control program to monitor for piping degradation and verify minimum wall thickness.

ACTION IV

"Confirm that the service water system will perform its intended function in accordance with the licensing basis for the plant. Reconstitution of the design basis of the system is not intended. This confirmation should include a review of the ability to perform required safety functions in the event of failure of a single active component. To ensure that the as-built system is in accordance with the appropriate licensing basis documentation, this confirmation should include recent (within the past 2 years) system walk down inspections. This confirmation should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter. Results should be documented and retained in appropriate plant records."

SQN Response

The ERCW system is designed as a two-train system, each train having the capability to provide the required cooling water for safe shutdown of both units. These equipment trains are sufficiently independent to guarantee the availability of at least one train at any time. They are designed with sufficient redundancy, separation, and reliability so that a single active failure will not remove more than one supply header loop per plant (i.e., either Headers 1A and 2A or 1B and 2B will remain in service). The system is designed to support safe shutdown of both units during any of the design basis events.

The SQN design baseline and verification program (DBVP) confirmed the adequacy of modifications made (since the issuance of Units 1 and 2 operating licenses) to systems or portions of systems that must be operable to mitigate Final Safety Analysis Report (FSAR) Chapter 15 events and to provide for safe shutdown of the units. Additionally, the DBVP effort included system walkdowns of safety-related equipment and documentation of problems identified. This walkdown served to identify ERCW system configuration problems and ensured the as-built system is in accordance with the applicable licensing basis documentation. The ERCW system evaluation report summarizes the evaluation performed on ERCW.

In 1987, NRC conducted an integrated design inspection (IDI) of the ERCW system to evaluate the adequacy of the SQN original design. This was accomplished by performing an in-depth, multi-discipline review of the representative vertical slice of the overall plant design in order that conclusions could be made regarding the adequacy of the TVA design process. The IDI team reviewed calculations, drawings, procurement documents, design change documentation, maintenance request, and licensee event reports. The determination of the design adequacy was made by verifying that the design documents correctly and consistently implemented NRC regulations, FSAR licensing commitments, and national industry standards.

A periodic flow balance is performed on the ERCW system. This flow balance verifies that the ERCW system provides the required flow to required safety-related components and equipment.

The periodic performance of the flow balance and the resolution of discrepancies previously identified and completed following the DBVP and NRC's IDI confirm that the ERCW system is performing its intended function in accordance with licensing basis for the plant.

The component cooling system (CCS) is an intermediate closed loop system that transfers heat from the safety-related components to the ERCW system. The ERCW rejects the heat to the ultimate heat sink (Tennessee River). The CCS is not subject to significant sources of fouling and is one in which water chemistry in controlled.

The high pressure fire protection (HPFP) system is a nonsafety-related system. It does not transfer heat from safety-related structures, systems, or components to the ultimate heat sink and does not serve as an intermediate system between safety-related items and the ultimate heat sink. For SQN, the ultimate heat sink has been defined as the Tennessee River's Chickamauga Reservoir; therefore, any service water system required to meet the requirements of GL 89-13 would reject heat to the reservoir. A review of the functions associated with SQN's HPFP system concluded that the system rejects heat to the atmosphere when operating as the flood mode source of steam generator cooling and not to the ultimate heat sink (Tennessee River). Therefore, the SQN HPFP system is not included as a service water system under SQN's GL 89-13 program. The system is periodically flushed and chemically treated with sodium hypochlorite in accordance with plant procedures (refer to SQN response to Action I, Item C).

ACTION V

"Confirm that maintenance practices, operating and emergency procedures, and training that involves the service water system are adequate to ensure that safety-related equipment cooled by the service water system will function as intended and that operators of this equipment will perform effectively. This confirmation should include recent (within the past 2 years) reviews of practices, procedures, and training modules. The intent of this action is to reduce human errors in the operation, repair and maintenance of the service water system. This confirmation should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter. Results should be documented and retained in appropriate plant records."

SQN Response

A. Maintenance Practices

SQN's maintenance practices for the ERCW system fall under SQN's PM program. PM instructions provide inspection requirements for components within the service water system. Instructional steps within these PM's include inspection for blockage because of corrosion products, silt, and Asiatic clams. Inspection requirements for MIC or other defects that would affect equipment performance are also included in the instructions. These PM's require sign-offs by System engineers, Component engineers, Chemistry, metallurgical, or other appropriate personnel. Based on the instructional requirements contained in SQN's PM program for ERCW, SQN considers these maintenance practices to be adequate for ensuring that these systems will perform their required safety functions.

B. Operating and Emergency Procedures

SQN's operating and emergency instructions were reviewed and found to be adequate for ensuring SQN's ERCW system will function as intended and that operators of this equipment will perform effectively.

C. Training

SQN maintains a training program for Operations, Maintenance and Nuclear Engineering personal which is accredited by INPO.

The SQN training program addresses the operation, maintenance and testing of service water systems and components, to address the problems outlined in NRC GL 89-13.