

TENNESSEE VALLEY AUTHORITY

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MAR 16 1990

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

Gentlemen:

In the Matter of)
Tennessee Valley Authority)

Docket Nos. 50-259
50-260
50-296

BROWNS FERRY NUCLEAR PLANT (BFN) - RESPONSE TO GENERIC LETTER (GL) 89-13
SERVICE WATER SYSTEM PROBLEMS AFFECTING SAFETY-RELATED EQUIPMENT

Enclosure 1 to this letter provides BFN's response to Generic Letter 89-13.
Enclosure 2 contains a summary list of the commitments made by Enclosure 1.
An extension to March 16, 1990, for BFN to submit its response to Generic
Letter 89-13 was granted by T. M. Ross, NRC BFN Project Manager.

If you have any questions, please telephone Patrick P. Carrier at
(205) 729-3570.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

Mark O. Medford

Mark O. Medford, Vice President
Nuclear Technology and Licensing

Enclosures
cc: See page 2

Subscribed and sworn to before me
on this 16th day of Mar., 1990.

Paulette H. White
Notary Public

My Commission Expires 11-4-92

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U.S. Nuclear Regulatory Commission

MAR 16 1990

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ENCLOSURE 1

BFN RESPONSE TO GENERIC LETTER 89-13

I. INTRODUCTION

By letter dated July 18, 1989, NRC issued Generic Letter 89-13 "Service Water System Problems Affecting Safety-Related Equipment." Generic Letter 89-13 requested licensees to advise NRC that it has established programs to implement the five specified recommended actions or that it has pursued equally effective actions. These actions are to ensure that the systems used to transfer heat from safety-related structures, systems and components to the ultimate heat sink satisfy the requirements of the applicable General Design Criteria of 10 CFR 50, Appendix A.

A number of procedures and practices are being used at BFN to address concerns for flow blockage and biofouling of safety-related Raw Service Water systems. Included is an aggressive inspection and cleaning program for heat exchangers in lieu of testing. Chlorination is used for asiatic clam control. An NRC approved program to address Microbiological Induced Corrosion (MIC) is in place (Reference: TVA letter dated September 29, 1988 titled Browns Ferry Nuclear Plant Units 1, 2, and 3 - MIC Program).

The following includes a discussion of the systems used at BFN to transfer heat from safety-related structures, systems and components to the ultimate heat sink, and a response to each of the five recommended actions specified by the generic letter.

II. GENERAL SYSTEM INFORMATION

BFN complies with the Atomic Energy Commission proposed General Design Criteria current at the time of the BFN design as discussed in the BFN Final Safety Analysis Report. These criteria do not specifically address cooling water systems; however, heat removal systems for the containment and decay heat removal are discussed.

The BFN systems within the scope of the generic letter are the Residual Heat Removal Service Water System (RHRSW) and the Emergency Equipment Cooling Water System (EECW). The RHRSW and EECW are the only systems that transfer heat from safety-related structures, systems and components directly to the ultimate heat sink. The RHRSW and EECW are safety-related systems. The safety-related heat exchangers serviced by the RHRSW and EECW are identified in the BFN response to NRC Recommended Action II.

The BFN Reactor Building Closed Cooling Water System (RBCCW) is a nonsafety-related, closed cooling water system which rejects heat to the raw water system. The RBCCW is operated with controlled water chemistry, is not subject to significant sources of contamination, and does not reject heat directly to the ultimate heat sink. The RBCCW, therefore, is not considered to be within the scope of the generic letter.

III. BFN RESPONSE TO NRC RECOMMENDED ACTION:

NRC RECOMMENDED 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 also be acceptable. Initial activities should be completed before plant startup following the first refueling outage beginning nine 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."

NRC RECOMMENDED ACTION, GENERIC ISSUE 51, PROGRAM A:

"The intake structure should be visually inspected, once per 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."

BFN RESPONSE:

The current BFN visual inspection program of the intake pump pits satisfies the intent of the generic letter.

The current BFN Preventive Maintenance (PM) program, however, requires intake pump pit inspections using divers to be performed every five years. The next inspection is scheduled to be performed in 1990. The five-year inspection frequency is considered adequate to prevent significant accumulation of biofouling, sediment and corrosion, based on the results of inspection conducted in 1985 and 1988. The PM provides for reassessing this inspection frequency based on the results of future inspections and pump flow testing, as discussed in the BFN response to NRC Recommended Action, Generic Issue 51, Program C.

NRC RECOMMENDED ACTION, GENERIC ISSUE 51, PROGRAM B:

"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 exists (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 MIC. 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."



BFN RESPONSE:

The current BFN chemical treatment program for EECW satisfies the generic letter. The RHRSW will be modified and incorporated into the existing chemical treatment program, if feasible, or an equally effective alternative will be proposed.

Testing for clam larva is conducted when conditions are conducive to spawning. Plant procedures require chlorination of the EECW when clam larva spawning is detected or when a pre-established date is reached. Chlorination of the EECW is continued until conditions are not longer conducive to clam spawning.

The current program of RHRSW cleaning and flushing appears to be adequate as discussed in BFN response to NRC Recommended Action, Generic Issue 51, Program C. No macroscopic fouling has been identified to date.

To address RHRSW corrosion, a chemical treatment program is being pursued. However, the RHRSW is an infrequently used system, and makeup flow is low. As such, it may be difficult to maintain an effective chemical concentration. BFN will establish a test program to determine if chemical treatment is feasible. The RHRSW will be modified to provide chemical injection points by BFN cycle 7 operation (BFN is currently in an extended outage and is scheduled to begin cycle 6 operation by the end of September 1990). Within two months of cycle 7 operation, TVA will incorporate the RHRSW into the existing chemical treatment program, if chemical treatment of the RHRSW is determined to be feasible. Otherwise, BFN will propose an equally effective alternative for the NRC Recommended Action in the followup submittal required to confirm implementation of the actions taken in response to the generic letter.

NRC RECOMMENDED ACTION, GENERIC ISSUE 51, PROGRAM C:

"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 equivalently 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."

BFN RESPONSE:

The current BFN program for flushing and flow testing and for layups satisfies the intent of the generic letter.

The RHRSW and EECW pumps are annually tested to verify the design flow (4,500 gpm) through normally assigned flow paths in accordance with the BFN Technical Specifications.

Flow monitoring of the RHR heat exchangers is performed every six months. Possible flow blockage is identified by measuring and trending the pressure drop across each heat exchanger. The pressure drop between the RHRSW pump discharge and the RHR heat exchanger inlet is also monitored to determine if any possible flow blockage exists.

Flow testing to verify the design flow requirements to safety-related components through EECW piping is verified quarterly as part of the American Society of Mechanical Engineers Section XI requirements.

BFN's policy is to drain and isolate components or maintain flow through components put into an extended layup condition, rather than use chlorinated water. Consequently, RHRSW, EECW and High Pressure Fire Protection (HPFP) System components placed in extended layup condition are drained and isolated. (The HPFP is a nonsafety-related system. It does not transfer heat from safety-related structures, systems and components to the ultimate heat sink, and does not serve as an immediate system between safety-related items and the ultimate heat sink. The HPFP is not connected to RHRSW or EECW. However, the HPFP is chlorinated twice a year in accordance with plant procedures relative to the clam spawning season, except those portions of the HPFP system ordinarily not exposed to raw water, e.g., stored dry.)

NRC RECOMMENDED ACTION, GENERIC ISSUE 51, PROGRAM D:

"Samples of water and substrate should be collected annually to determine if Asiatic clams have populated the water source. Water and substrate sampling is only necessary at freshwater plants that have not previously detected the presence of Asiatic clams in their source water bodies. If Asiatic clams are detected, utilities may discontinue this sampling activity if desired, and the chlorination (or equally effective) treatment program should be modified to be in agreement with paragraph B, above."

BFN RESPONSE:

Asiatic clams have been detected at BFN. The current BFN program for chlorination is discussed in response to NRC Recommended Action, Generic Issue 51, Program B.

NRC RECOMMENDED 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 water systems, have the potential for significant fouling as a consequence of aging-related in-leakage and erosion or corrosion. The need for testing of 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."

BFN RESPONSE:

BFN's current program of regular testing and cleaning of heat exchangers will be revised to become an equally effective alternative to the NRC recommended test program and satisfies the intent of the generic letter.

The purpose of the recommended test program is to verify the heat transfer capability of safety-related heat exchangers. Upon poor test results, the affected heat exchanger would be inspected and cleaned. BFN considers regular inspection and cleaning of heat exchangers to ensure their optimum performance to be preferable to inspection and cleaning after degraded performance is exhibited.

The current BFN inspection program has been effective in ensuring optimum heat exchanger performance. This inspection program will be documented in the preventive maintenance program and will be revised to address the shutdown board room coolers and the H₂O₂ analyzer coolers by December 31, 1990. This inspection is as follows:

HEAT EXCHANGER

ACTION

RHR

Inspect and clean the cooling water side of the RHR heat exchangers at least once per cycle.

Diesel Generator Coolers

Inspect and clean the cooling water side of each diesel generator cooler annually.

RHR Pump Seal Coolers

Inspect and clean each pump seal cooler at least once per cycle.

Control Bay Chillers

Inspect and clean the cooling water side of the control bay chillers annually.

Shutdown Board Room Chillers

Inspect and clean the cooling water side of the shutdown board room chillers on an annual basis.

RHR Pump Room Coolers

Chemically flush the cooling water side of the RHR pump room coolers at least once per cycle.

HEAT EXCHANGERACTION

Core Spray Room Coolers	Chemically flush the cooling water side of the core spray room coolers at least once per cycle.
Unit 1 and 2 Emergency Chiller	Inspect and clean the cooling water side of the unit 1 and 2 emergency chiller annually. (Note: There is not a unit 3 emergency chiller.)
H ₂ O ₂ Analyzer Coolers	Chemically flush the cooling water side of the H ₂ O ₂ analyzer coolers at least once per cycle.

Based on the results of the inspections and cleanings, BFN may elect at a later date to conduct performance testing on certain heat exchangers in accordance with NRC Recommended Action, II in lieu of the above described heat exchanger inspection plan.

NRC RECOMMENDED ACTION III:

"Ensure by establishing a routine inspection and maintenance program for open-cycle service water system 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."

BFN RESPONSE:

The current BFN inspection and maintenance program will be revised to satisfy the intent of the generic letter.

Flow monitoring is done on a periodic basis as described in BFN's response to item I.C to verify that corrosion, erosion, silting, and biofouling have not degraded the performance of safety-related systems supplied by service water.



To reduce the susceptibility of the EECW system piping to flow blockage, selected sections of carbon steel piping (four-inch diameter and less) have been replaced with stainless steel. To prevent flow blockage from occurring in the heat exchangers, the RHRSW and EECW systems receive inspection and cleaning as described in BFN's response to NRC Recommended Action II. When the RHRSW or EECW system is opened for preventative maintenance, it is inspected before system closure per a site procedure. This inspection ensures that excessive amounts of debris do not exist and that foreign objects have not been left in the system. The preventive maintenance instructions for the EECW and RHRSW systems will be revised to require notification of the system engineer if any clams, excessive silt, or other blockage is present when the system is opened. This allows the system engineer to evaluate the need to perform inspections and cleaning in other areas of the system and/or change the frequency of the inspection.

Since the RHRSW and EECW piping systems are not internally coated, no inspections for paint integrity are made. Numerous "information only" inspections have been conducted within the last seven years utilizing Ultrasonic Test and Radiographic Test (RT) techniques to verify that corrosion has not degraded piping. A number of stainless steel piping welds in the EECW system have been inspected with RT as described in a previous TVA submittal on the BFN MIC program dated September 29, 1988. This program has been reviewed by NRC and a safety evaluation was issued October 24, 1989. The inspections conducted to date have not indicated problems which would impede the safety function of the piping. To improve detection of corrosion and deposits in the EECW and RHRSW systems, on-line corrosion monitoring devices will be installed before the completion of the unit 2, cycle 6 operating cycle. (In a letter dated June 1, 1989, TVA stated that the scheduled installation of these monitors was February 25, 1990 based on manpower resources.) The due date has been extended to the end of unit 2 cycle 6 operation based on the scheduling of manpower for the unit 2 restart.

NRC RECOMMENDED 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 walkdown 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."

BFN RESPONSE:

Those portions of the RHRSW and EECW systems will be verified that they satisfy their design criteria before the restart of their respective units.

The RHRSW and EECW Systems are included in the scope of the Design Baseline and Verification Program (DBVP), and in the scope of the related Calculation and Restart Test Programs described in Volume III of the BFN Nuclear Performance Plan (NPP). Under the DBVP, the design basis of the RHRSW and EECW Systems is documented through Design Criteria, flow and control diagrams, and essential calculations. The "as-built" system configuration is reflected in these documents and reconciled with the plant licensing basis. As part of the baseline program, the systems have been walked down to ensure the system is consistent with its design basis. The design basis for the EECW and RHRSW systems requires the ability to perform required safety-related functions in the event of failure of a single active component. Testing requirements have been specified for system safety functions. The system capability to perform these functions is demonstrated through the restart test program.

Implementation of restart testing before unit 2 restart is a commitment made in Volume III of the BFN NPP. The portions of the RHRSW and EECW systems required to support unit 2 operation will be verified to meet their design basis before unit 2 restart. The associated portions of the EECW and RHRSW systems required to support unit 1 and unit 3 operation will also be verified before their respective restarts.

NRC RECOMMENDED 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 (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."

BFN RESPONSE:

The current operating and emergency procedures satisfy the generic letter. The maintenance procedures and training will be revised to satisfy the generic letter.

Maintenance Practices

The BFN maintenance practices, when revised, will ensure that the EECW and RHRSW systems function as intended. The maintenance procedures, as described below, reduces the chance of human error affecting operation of a system.

1. Numerous Mechanical Maintenance Instructions have been written to provide consistent maintenance practices for those activities beyond the skills of craft. These instructions have been walked down and verified. The instructions are required to be reviewed every 2 years per site procedures.

2. Maintenance Requests reference the appropriate Maintenance Instructions for post-maintenance testing and provide the correct instruction to craft.

Operating and Emergency Procedures

The present BFN Operating Instructions are adequate to ensure that the EECW and RHRSW systems are operated as intended. To reduce the chance of human error affecting operation, the following is being or has been carried out:

1. The Operating Instructions for the RHRSW system and the EECW system have been walked down and verified per the requirements established in site procedures. These instructions are required to be reviewed every two years per site procedures.
2. The Emergency Operating Instructions used at BFN are in the process of being verified and validated before unit 2 restart per the requirements of a plant procedure.

Training

A review of operations, engineering, and maintenance training has been performed. The following is a summary of the review findings and planned actions:

1. Lessons for operations personnel include general information on chlorination, biofouling, and heat exchanger performance monitoring. Specific instruction concerning biofouling and flow reduction of safety-related heat exchangers has not been provided. Lesson plans for the EECW and RHRSW systems will be revised to include the significance of biofouling in creating degraded flow conditions. Methods used to control biofouling will also be discussed.
2. Lesson plans used for Maintenance and Technical training have covered limited aspects of the generic letter. To provide additional information, the Maintenance and Technical Training on RHRSW and EECW will be revised to include information on chemical control, flow blockage, corrosion, and heat exchanger performance relative to the generic letter. Chemistry Training will also revise lesson plans to include concerns expressed in the generic letter.

IV. CONCLUSION

TVA considers the programs described above to be adequate to ensure that systems are capable of transferring heat from safety-related structures, systems and components to the ultimate heat sink and to satisfy the intent of the generic letter.

A summary of the programs described herein, including schedules for inspections and other activities, has been documented. Relevant documentation of inspections and other activities are retained in appropriate plant records.

BFN will confirm to NRC that the activities discussed herein have been completed within 30 days of the implementation of the last activity.

ENCLOSURE 2

GL 89-13 COMMITMENTS FOR BFN

1. The RHRSW will be modified to provide chemical injection points by BFN cycle 7 operation.
2. Within two months of cycle 7 operation, TVA will incorporate the RHRSW into the existing chemical treatment program, if chemical treatment of the RHRSW is determined to be feasible. Otherwise, BFN will propose an equally effective alternative in the followup submittal required to confirm implementation of the actions taken in response to the generic letter.
3. The BFN heat exchanger inspection program will be documented in the preventive maintenance program by December 31, 1990 and will include the Shutdown Board Room Coolers and the H₂O₂ Analyzer Coolers.
4. The maintenance instructions for the RHRSW and EECW systems will be revised by December 31, 1990 to require notification of the system engineer if any clams, excessive silt, or other blockage is present when the system is opened.
5. To improve detection of corrosion and deposits in the EECW and RHRSW systems, on-line corrosion monitoring devices will be installed before completion of the Unit 2 cycle 6 operation.
6. Those portions of the RHRSW and EECW systems will be verified that they satisfy their design basis before restart of their respective unit.
7. Training lesson plans for licensed and non-licensed operators, Maintenance and Technical training, and Chemistry training will be revised to cover the aspects of Generic Letter 89-13 by January 31, 1991.
8. BFN will confirm to NRC that the activities discussed herein have been completed within 30 days of the implementation of the last activity.



11-11-11