

May 27, 2005

10 CFR 54

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Mail Stop: OWFN P1-35  
Washington, D.C. 20555-0001

Gentlemen:

In the Matter of	)	Docket Nos. 50-259
Tennessee Valley Authority	)	50-260
		50-296

**BROWNS FERRY NUCLEAR PLANT (BFN) - UNITS 1, 2, AND 3 -  
LICENSE RENEWAL APPLICATION (LRA) - RESPONSE TO NRC REQUEST  
FOR ADDITIONAL INFORMATION CONCERNING THE UNIT 1 LAYUP  
PROGRAM (TAC NOS. MC1704, MC1705, AND MC1706)**

By letter dated December 31, 2003, TVA submitted, for NRC review, an application pursuant to 10 CFR 54, to renew the operating licenses for the Browns Ferry Nuclear Plant, Units 1, 2, and 3. As part of its review of TVA's LRA, the NRC staff, through an informal request on March 29, 2005, requested additional information concerning the Unit 1 Layup Program.

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This letter addresses concerns in the following areas:

- proposed unresolved item 3.0-2 LP,
- proposed unresolved item 3.0-3 LP,
- proposed unresolved item 3.0-4 LP,
- proposed unresolved item 3.0-5 LP,
- proposed unresolved item 3.7.2.2-1, and
- proposed unresolved item 3.7.2.2-2.

The remainder of the concerns were previously addressed in separate correspondence submitted to the NRC on May 18, 2005.

The enclosure to this letter contains the specific NRC requests for additional information and the corresponding TVA responses.

If you have any questions regarding this information, please contact Ken Brune, Browns Ferry License Renewal Project Manager, at (423) 751-8421.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 27th day of May, 2005.

Sincerely,

Original signed by

T. E. Abney  
Manager of Licensing  
and Industry Affairs

Enclosure:

cc: See page 3

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Enclosure

cc (Enclosure):

State Health Officer  
Alabama Department of Public Health  
RSA Tower - Administration  
Suite 1552  
P.O. Box 303017  
Montgomery, Alabama 36130-3017

Chairman  
Limestone County Commission  
310 West Washington Street  
Athens, Alabama 35611

(Via NRC Electronic Distribution)

Enclosure

cc (Enclosure):

U.S. Nuclear Regulatory Commission  
Region II  
Sam Nunn Atlanta Federal Center  
61 Forsyth Street, SW, Suite 23T85  
Atlanta, Georgia 30303-8931

Mr. Stephen J. Cahill, Branch Chief  
U.S. Nuclear Regulatory Commission  
Region II  
Sam Nunn Atlanta Federal Center  
61 Forsyth Street, SW, Suite 23T85  
Atlanta, Georgia 30303-8931

NRC Senior Resident Inspector  
Browns Ferry Nuclear Plant  
10833 Shaw Road  
Athens, Alabama 35611-6970

NRC Unit 1 Restart Senior Resident Inspector  
Browns Ferry Nuclear Plant  
10833 Shaw Road  
Athens, Alabama 35611-6970

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cc: (Enclosure)

Margaret Chernoff, Project Manager  
U.S. Nuclear Regulatory Commission  
(MS 08G9)  
One White Flint, North  
11555 Rockville Pike  
Rockville, Maryland 20852-2739

Eva A. Brown, Project Manager  
U.S. Nuclear Regulatory Commission  
(MS 08G9)  
One White Flint, North  
11555 Rockville Pike  
Rockville, Maryland 20852-2739

Yaira K. Diaz-Sanabria, Project Manager  
U.S. Nuclear Regulatory Commission  
(MS 011F1)  
One White Flint, North  
11555 Rockville Pike  
Rockville, Maryland 20852-2739

Ramachandran Subbaratnam, Project Manager  
U.S. Nuclear Regulatory Commission  
(MS 011F1)  
One White Flint, North  
11555 Rockville Pike  
Rockville, Maryland 20852-2739

ENCLOSURE

TENNESSEE VALLEY AUTHORITY  
BROWNS FERRY NUCLEAR PLANT (BFN)  
UNITS 1, 2, AND 3  
LICENSE RENEWAL APPLICATION (LRA)

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION (RAI)  
CONCERNING THE UNIT 1 LAYUP PROGRAM

(SEE ATTACHED)

**TENNESSEE VALLEY AUTHORITY  
BROWNS FERRY NUCLEAR PLANT (BFN)  
UNITS 1, 2, AND 3  
LICENSE RENEWAL APPLICATION (LRA)**

**RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION (RAI)  
CONCERNING THE UNIT 1 LAYUP PROGRAM**

By letter dated December 31, 2003, TVA submitted, for NRC review, an application pursuant to 10 CFR 54, to renew the operating licenses for the Browns Ferry Nuclear Plant, Units 1, 2, and 3. This letter addresses concerns in the following areas: proposed unresolved item 3.0-2 LP, proposed unresolved item 3.0-3 LP, proposed unresolved item 3.0-4 LP, proposed unresolved item 3.0-5 LP, proposed unresolved item 3.7.2.2-1, and proposed unresolved item 3.7.2.2-2. The remainder of the concerns were previously addressed in separate correspondence submitted to the NRC on May 18, 2005.

This enclosure contains the specific NRC requests for additional information and the corresponding TVA responses.

**NRC Proposed Unresolved Item 3.0-2 LP - Refurbished Basis For Replacing Certain Components And Not Others**

For portions of Unit 1 systems that have not been replaced, the applicant has not provided information to establish that there is sufficient operating history or sufficient data to conclude that one-time inspections are appropriate in lieu of periodic inspections. For example, carbon and low alloy steel materials that rely on one-time inspections may show no signs of degradation as the result of effective layup programs, but will experience aging effects that will go undetected when returned to service. The applicant should provide additional information to establish if there is sufficient data to conclude that one-time inspections are appropriate to manage future aging effects for Unit 1 systems exposed to layup conditions. In response to RAI 3.0-9 LP the applicant identifies the Unit 2 and 3 lessons learned to determine system integrity for certain systems. If the applicant is crediting operating experience from Units 2 and 3, the applicant is requested to justify how that experience, including inspection results, is applicable to Unit 1. Alternatively the applicant may commit to appropriate targeted periodic inspections. This item still unresolved.

**NRC Proposed Unresolved Item 3.0-2 LP - One-Time-Inspection (B.2.1.29) - Commit To Appropriate Targeted Periodic Inspections**

The applicant is requested to explain how Unit 1 one-time inspection and restart inspections performed prior to startup are adequate to detect future degradation, especially in crevices, when the system is returned to service. For example, in Table 3, the one-time inspection program is credited with managing the condenser circulating water system for loss of material in a raw water environment. One-time inspection may not be appropriate to manage loss of material in a raw water environment where degradation is expected. If the applicant is crediting operating experience from Units 2 and 3, the applicant is requested to justify how that experience, including inspection results, is applicable to Unit 1. Alternatively, the applicant could commit to appropriate targeted periodic inspections. This item still unresolved.

**NRC Proposed Unresolved Item 3.0-3 LP - One-Time Inspection May Not Be Appropriate To Manage Loss Of Material In A Raw Water Environment**

The applicant is requested to explain how Unit 1 one-time inspection and restart inspections performed prior to startup are adequate to detect future degradation, especially in crevices, when the system is returned to service. For example, in Table 3, the one-time inspection program is credited with managing the condenser circulating water system for loss of material in a raw water environment. One-time inspection may not be appropriate to manage loss of material in a raw water environment where degradation is expected. If the applicant is crediting operating experience from Units 2 and 3, the applicant is requested to justify how that experience, including inspection results, is applicable to Unit 1. Alternatively, the applicant could commit to appropriate targeted periodic inspections. This item still unresolved.

**TVA Response to NRC Proposed Unresolved Items 3.0-2 LP (1 & 2) and 3.0-3 LP**

The above three items are being addressed together since BFN will implement the alternative resolution of targeted periodic inspections for Unit 1 systems that have been shutdown during the extended plant shutdown. However, prior to discussing the implementation of periodic inspections, the following clarification to statements included in the

potential open items is being provided to remove any misunderstanding:

- The restart program and associated restart inspections are being implemented to return BFN Unit 1 to operation for the remainder of the current licensed operating period. The restart program does not take credit for lay-up in returning a system to operation and instead depends on inspections and/or replacement to ensure the components are satisfactory for the remainder of the current licensed operating period. Following the return of Unit 1 systems to operation, the same aging management programs currently identified for Units 2 and 3 will also be applied to Unit 1. In this response, targeted periodic inspections to assess the effectiveness of the aging management program and to identify whether latent aging effects were present will be included for Unit 1.
- The Condenser Circulating Water System (System 27) raw water environment identified in two of these unresolved items was deleted by the response to RAI 3.4.-4 (Reference 1). The environment for the in-scope portions of the Condenser Circulating Water System is air during lay-up and air following restart. The One-Time Inspection Program is not used as the aging management program for any of the Unit 1 shutdown raw water systems

The targeted Unit 1 periodic inspections will be performed after Unit 1 is returned to operation to verify aging management program effectiveness and to verify no additional latent aging effects are occurring. These periodic inspections are in addition to the restart inspections performed prior to Unit 1 restart. The targeted periodic inspection sample locations will be a subset of non-replaced piping locations inspected as described in the response to NRC Follow-Up to RAI 3.0-9 (Reference 2). The susceptible locations identified in RAI 3.0-9 were those areas determined to have the highest potential for service induced wear or latent aging effects, which includes all types of corrosion. The inspection techniques utilized evaluate internal conditions and are sensitive to the presence of unacceptable conditions including wear, erosion, corrosion (including crevice corrosion) if present. For these locations, the restart inspections can be utilized as a baseline for comparison.

The following table describes the environments where additional periodic inspections will be performed for systems that were shutdown during the extended Unit 1 shutdown:

<b>Extended Lay-up Environment</b>	<b>Operating Environment Following Restart</b>	<b>Aging Management Program Following Restart</b>	<b>Systems (or portions thereof) Where Periodic Inspections Will Be Performed</b>
Air/gas	Treated water	Chemistry Control Program	CS(75), FW(03), HPCI(73), MS(01), RCIC(71), RHR(74)
Treated water	Treated water	Chemistry Control Program	CRD(85), CS(75), FW(03), HPCI(73), RCIC(71), RHR(74),
Treated water	Treated water	Closed-Cycle Cooling Water System Program	RBCCW <sup>1</sup> (70)
Raw water	Raw water	Open-Cycle Cooling Water Program	RHRSW(23) (A&C loops in tunnels), FP(26), EECW <sup>1</sup> (67), RCW <sup>1</sup> (24)

Note 1: The majority of this system was in service with water flow in the system during the lay-up period

The first periodic inspection will be performed prior to the end of the current operating period and the subsequent frequency of the periodic inspections will be determined based on the outcome of the first periodic inspections performed. The surveillance frequency is re-evaluated each time the surveillance is performed and can be changed based on the trend of the data results. The inspections will continue until such time as the trend of the data results provides a basis to discontinue the inspections. The scope and extent of periodic inspections performed will be similar to the One-Time Inspection Program and will be developed and implemented prior to the period of extended operation.

**NRC Proposed Unresolved Item 3.0-4 LP - Need implementing Procedure For B.2.1.29**

In regard to one-time inspections, the applicant's response does not adequately address important aspects such as the sample size, the rate of degradation, the timing for one-time inspections or the justification for one-time inspections in lieu of periodic inspection to account for latent aging effects. In audit RAI 7.1.20-1, the project team identified that the applicant submit its one-time inspection written implementation procedure for staff review after it is developed. As identified in GALL AMP XI.M32, one-time inspection is to be reviewed by the staff on a plant specific basis. Although identified as consistent with GALL, the detailed plant-specific elements of the one-time inspection are to be developed by the applicant and reviewed by staff as a condition to the extended operating license. This item still unresolved.

**TVA Response to NRC Proposed Unresolved Item 3.0-4 LP**

The one-time inspection and the new periodic inspection implementation procedures will be submitted for staff review at least two years prior to the expiration of the current operating license. This will provide adequate time to implement the procedures prior to the period of extended operation.

**NRC Proposed Unresolved Item 3.0-5 LP MIC Is Not A Concern For Systems Subject To Conditions That Promote MIC**

Proper attention to lay-up is crucial to avoid MIC and during lay-up, microbial growth may proceed unimpeded as fluid forces that remove attached organisms from pipe or vessel surfaces are absent. Staff is also concerned that corrosion mechanisms that were not active during dry lay up, may become active when the systems are wetted and returned to operation. To complete its review, the staff requires additional information requested in RAI 3.0-10 LP on inspections performed or planned to determine that MIC is not a concern for systems subject to conditions that promote MIC. This item still unresolved.

**TVA Response to NRC Proposed Unresolved Item 3.0-5 LP**

Unresolved item 3.0-5 LP was addressed by the TVA response to the NRC Follow-Up to RAI 3.0-10 LP (Reference 2).

**NRC Proposed Unresolved Item 3.7.2.2-1- RCS Dissolved O<sub>2</sub> Not To Exceed 100 Ppb**

The staff believes that if the dissolved oxygen content exceeds 100 ppb during the wet layup period, crevice corrosion of the RVIs could occur. In order to ensure that crevice corrosion is not occurring in the RV and RVIs, the staff requests that the applicant confirm that the dissolved oxygen content in the RCS water did not exceed 100 ppb during the wet layup period. This item still unresolved.

**TVA Response to NRC Proposed Unresolved Item 3.7.2.2-1**

When in Cold Shutdown conditions (i.e., wet lay-up conditions for Unit 1), the RCS is open to the atmosphere and the water becomes air-saturated. Although the Unit 1 RCS dissolved oxygen was not specifically measured, the expected dissolved oxygen concentration under air-saturated conditions is approximately 8 ppm and, therefore, did exceed 100 ppb. In the absence of boiling and condenser vacuum with no acceptable additives, non-condensables, such as oxygen, can not be removed. This condition is normal for all BWRs when in Cold Shutdown conditions (i.e., wet lay-up conditions for Unit 1).

Crevice corrosion is a potential aging mechanism for carbon and low-alloy steels and stainless steels provided that the oxygen levels in the bulk fluid are greater than 100 ppb. However, as noted in industry guidance documents, "Although not required for crevice corrosion, any impurities and high temperatures significantly increase the rate at which crevice corrosion occurs. Crevice corrosion is not expected to cause excessive degradation in crevice joints such as socket welds or flange joints in a properly controlled low impurity environment." (Reference 3)

Although crevice corrosion is not predicted, the crevice corrosion aging mechanism cannot be discounted. Therefore, inspection of identified crevice locations within the reactor vessel internals is appropriate to address this concern. These reactor vessel internals inspections are described in response to NRC Proposed Unresolved Item 3.7.2.2-2.

**NRC Proposed Unresolved Item 3.7.2.2-2 - Inspection Guidelines To Detect Any Crevice Corrosion Of The RVIs Prior To BFN, Unit 1 Restart**

To confirm that the crevice locations in RVIs are not susceptible to corrosion, the staff requests that the applicant identify these locations and provide information as to how it uses the applicable BWRVIP inspection guidelines to detect any crevice corrosion of the RVIs prior to BFN, Unit 1 restart. This item still unresolved.

**TVA Response to NRC Proposed Unresolved Item 3.7.2.2-2**

The following locations in the RVI are categorized by BFN Unit 1 as areas having creviced type configuration. The areas are listed by systems within the RVI, their respective BWRVIP document, specific component within the system, and the type of examination. All components listed are based on the recommendations from the BWRVIP documents and will be performed prior to startup.

**Core Spray**

BWRVIP-18, "BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines"

- Junction Box, Vessel Nozzle Region Welds: Locations P1, P2, and P3 will be inspected by EVT-1 and/or UT.
- Sleeve Coupling Region Welds: Locations P5, P6, and P7 will be inspected by UT.
- Shroud Connection Region Welds: Locations P8a and P8b will be inspected by EVT-1 and/or UT. Location P9 is not inspectable with current technology. Inspection of Location P9 will be evaluated as the technology is developed and demonstrated.
- Tee Box Region Welds: Locations S1 and S2, will be inspected by EVT-1.
- Nozzle Assembly Welds: Location S3 will be inspected by VT-1.
- Sparger Pipe End Cap Welds: Location S4 will be inspected by EVT-1
- Note that 2 P2 welds, 1 P3 weld, 4 P5 welds, 4 P6 welds, 4 P7 welds, 4 P8a welds, and 4 P8b welds were ultrasonically examined in 2001 with no recordable indications.

### **Jet Pump Assembly**

BWRVIP-41, "BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines"

- Nozzle Thermal Sleeve Welds: Location TS-2 is not inspectable with current technology. Inspection of Location TS-2 will be performed as the technology is developed and demonstrated.

### **Top Guide**

BWRVIP-26, "BWR Top Guide Inspection and Flaw Evaluation Guidelines"

- Grid Beam and Beam to Beam Crevice Slot: Location 1, will be inspected by EVT-1.
- Aligner Pin and Sockets: Locations 2 and 3, will be inspected by VT-1.
- Grid Beam to Cover Plate and Bottom Plate Pins: Location 4, will be inspected by EVT-1
- Rim Pins and Rim Welds: Locations 10 and 11 will be inspected by EVT-1.
- Rim and Cover Plate Fabrication Welds: Location 12 will be inspected by EVT-1.
- Eye Bolt Boss: Location 13 will be inspected by EVT-1.

### **Control Rod Guide**

BWRVIP-47, "BWR Lower Plenum Inspection and Evaluation Guidelines"

- Tube Sleeve to Alignment Lug Welds: Location CRGT-1, a 10% sample will be inspected by VT-3.
- Tube Body to Sleeve Welds: Location CRGT-2, a 10% sample will be inspected by EVT-1.
- Tube Base to Body Welds: Location CRGT-3, a 10% sample will be inspected by EVT-1.
- Tube and Fuel Support Alignment Pin: Location FS/GT-ARPIN-1, a 10% sample will be inspected by VT-3.

### **Core Plate**

BWRVIP-25, "BWR Core Plate Inspection and Flaw Evaluation Guidelines"

- Aligner Pin and Socket to Rim Welds: Location 8 will be inspected by VT-3.
- Rim Hold Down Bolts: Location 10 will be inspected by EVT-1.

### **Additional Clarification for TVA Response to Follow-Up to RAI 3.0-9 LP [Reference 2]**

The following is additional information which is to be added to the first paragraph of the TVA response to Follow-Up to RAI 3.0-9 LP:

The susceptible locations identified in RAI 3.0-9 were those areas determined to have the highest potential for service induced wear or latent aging effects, which includes all types of corrosion. The inspection techniques utilized evaluate internal conditions and are sensitive to the presence of unacceptable conditions including wear, erosion, corrosion (including crevice corrosion) if present.

### **Additional Clarification for TVA Response to Follow-Up to RAI 3.0-10 LP [Reference 2]**

The Response to Follow-Up to RAI 3.0-10 included the following statement:

"For Browns Ferry Unit 1, the raw water piping systems were inspected and evaluated. Piping that has unacceptable wall thickness is being replaced."

This is clarified to read:

For Browns Ferry Unit 1, the raw water piping systems were inspected and evaluated. Piping that has unacceptable wall thickness will be replaced prior to Unit 1 restart.

## **References**

1. TVA Letter to U.S. Nuclear Regulatory Commission, Document Control Desk, "Browns Ferry Nuclear Plant (BFN) - Units 1, 2, and 3 License Renewal Application - Mechanical Systems Sections 3.2 and 3.4 - Response to NRC Request for Additional Information (RAI) (TAC Nos. MC1704, MC1705, and MC1706)" dated December 16, 2004
2. TVA Letter to the U.S. Nuclear Regulatory Commission, Document Control Desk, "Browns Ferry Nuclear Plant (BFN) - Units 1, 2, and 3 - License Renewal Application (LRA) - Response to NRC Request for Additional Information Concerning the Unit 1 Lay-up Program (TAC Nos. MC1704, MC1705, and MC1706)" dated May 18, 2005
3. EPRI Technical Report 1003056: "Non-Class 1 Mechanical Implementation Guidelines And Mechanical Tools, Revision 3"