December 8, 2003

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

Dear Sirs:

**TENNESSEE VALLEY AUTHORITY - BROWNS FERRY NUCLEAR PLANT (BFN) - UNITS 1, 2, and 3 - DOCKETS 50-259, -260, AND -296 - FACILITY OPERATING LICENSES DPR – 33, - 52, AND - 68 – RESPONSE TO GENERIC LETTER (GL) 2003-01 – CONTROL ROOM HABITABILITY**

GL 2003-01 directed that all licensees provide to the NRC specific information related to control room habitability. The enclosure to this letter provides the requested information for BFN.

The BFN Units 1, 2, and 3 design basis and licensing basis are in compliance with the applicable regulatory requirements. The plant is constructed and maintained in accordance with its design, and the testing performed in accordance with the BFN Technical Specifications (TS) and their bases is adequate to demonstrate this compliance and material condition.

During the week of November 10, 2003, additional testing using an American Society for Testing and Materials (ASTM) tracer gas methodology was completed on the common BFN control room habitability zone (CRHZ) for the quantification of unfiltered in-leakage. This testing determined that the unfiltered in-leakage into the CRHZ was less than 600 cubic feet per minute (CFM). This quantity is approximately 16% of the 3717 CFM assumed in the BFN design and licensing bases. The tracer gas testing confirmed that the in-leakage quantification testing which has been periodically performed on the BFN CRHZ since 1991 has been and remains adequate to detect degradation in the CRHZ envelope.

The BFN design basis regarding the potential harmful effects of a toxic gas release near the site and the potential for migration of smoke into the CRHZ from an on-site fire were also evaluated as requested in GL 2003-01. Neither of these situations were found to be of safety concern. Additional details are provided in the Enclosure.

I declare under penalty of perjury that the foregoing is true and correct. Executed on December 8, 2003.

Sincerely,

Original signed by:

T. E. Abney
Manager of Licensing
and Industry Affairs

Enclosure:
GL 2003-01 Control Room Habitability BFN Response

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**ENCLOSURE**
**GENERIC LETTER (GL) 2003-01 - CONTROL ROOM HABITABILITY**
**BROWNS FERRY (BFN) RESPONSE**

## EXECUTIVE SUMMARY

On June 12, 2003, NRC issued GL 2003-01 on the subject of control room habitability. The fourfold purpose of the GL (as quoted below from the GL text) was to:

1) *alert addressees to findings at U.S. power reactor facilities suggesting that the control room licensing and design bases, and applicable regulatory requirements (see section below) may not be met, and that existing technical specification surveillance requirements (SRs) may not be adequate,*
2) *emphasize the importance of reliable, comprehensive surveillance testing to verify control room habitability,*
3) *request addressees to submit information that demonstrates that the control room at each of their respective facilities complies with the current licensing and design bases, and applicable regulatory requirements, and that suitable design, maintenance and testing control measures are in place for maintaining this compliance, and*
4) *collect the requested information to determine if additional regulatory action is required.*

This document provides the information as requested for BFN Units 1, 2, and 3. The BFN design basis and licensing basis are in compliance with the applicable regulatory requirements. The plant is constructed and maintained in accordance with its design, and the testing performed in accordance with the BFN Technical Specifications (TS) is adequate to demonstrate this compliance and material condition.

## BACKGROUND

The construction permits for BFN Units 1, 2, and 3 pre-date the formal issuance of the current General Design Criteria (GDC) of 10 CFR 50 Appendix A. During the construction permit licensing process, each of the three BFN units was evaluated against the then-current draft of the Atomic Energy Commission (AEC) Proposed General Design Criteria. Units 1 and 2 were evaluated against the Comment Draft of 27 Criteria which was issued on November 22, 1965, while Unit 3 was evaluated against the

Comment Draft of 70 Criteria which was issued on July 10, 1967. Although neither version of these proposed criteria had been adopted as regulatory requirements, the design, material procurement, and fabrication of each reactor unit was responsive to the respective applicable criteria for a construction permit. Although the later criteria (AEC-70) did not wholly complement the earlier (AEC-27), and also contained many aspects which could have been modified or clarified before their formal adoption, the design bases of each BFN unit were reevaluated at the time of initial Final Safety Analysis Report (FSAR) preparation against the draft of the 70 criteria current at the time of operating license application. Based on the understanding of the intent of the proposed criteria current at the time of operating license application, it was concluded that each Browns Ferry unit conforms with the intent of the AEC General Design Criteria for Nuclear Power Plant Construction Permits.

As the GDC were finalized, the requirements for control room habitability were placed into GDC-19. The AEC Safety Evaluation Report (SER) dated December 21, 1972 (Reference 1), concluded that the BFN plant design met GDC-19 guidelines. Appendix A to the BFN FSAR provides additional details on the conformance of the BFN design to the applicable licensing requirements.

Following the accident at Three Mile Island in March 1979, the NRC staff issued NUREG-0660 to provide a comprehensive and integrated plan to improve safety at power reactors. Specific action items from NUREG-0660 were approved by the NRC Commissioners for implementation at power reactors. These specific action items were compiled in NUREG-0737 to clarify the actions expected of power reactor owners. NUREG-0737 included actions addressing control room habitability, and TVA’s response to the actions mandated by NUREG-0737 addressed the control room habitability issue. The NRC SER dated August 30, 1982 (Reference 2), concluded that the BFN design satisfactorily met the criteria in NUREG-0737 for control room habitability.

In Licensee Event Report 259/88-25, dated October 11, 1988 (Reference 3), TVA documented the discovery of a mechanism for the entry of unfiltered air from the outside environs into the control room habitability zone under certain meteorological conditions. This unfiltered air in-leakage was not in accordance with BFN’s original design basis of essentially zero

in-leakage, and the estimated quantity of this unfiltered in-leakage was such that GDC-19 requirements might be violated under some accident scenarios concurrent with certain meteorological conditions. Subsequently, modifications were made to the control room emergency ventilation (CREV) system, which, together with new calculations for allowable quantities of unfiltered in-leakage, resolved this technical issue. The design basis unfiltered in-leakage value used in relevant calculations was revised upward from "essentially zero" to 3717 cubic feet per minute (CFM) based on testing performed by TVA.

**INFORMATION REQUESTED BY GL 2003-01**

On pages 5 and 6 of GL 2003-01, information falling into three broad categories was requested to be provided by the licensees to NRC. To ease the correlation between the information requested and the information provided in this response, the request wording from the GL is repeated verbatim below in bold italicized text. The BFN response then follows in regular text.

1. ***Provide confirmation that your facility's control room meets the applicable habitability regulatory requirements (e.g., GDC 1, 3, 4, 5, and 19) and that the CRHSs*** [control room habitability systems] ***are designed, constructed, configured, operated, and maintained in accordance with the facility's design and licensing bases.***

   As described above, the BFN construction permits for the three units predated the GDC, and, as such, BFN was not required to meet the GDC. However, based on the understanding of the intent of the proposed criteria current at the time of operating license application, it was concluded that each Browns Ferry unit conforms with the intent of the AEC General Design Criteria for Nuclear Power Plant Construction Permits.

   The BFN control room habitability zone (CRHZ) is the floor elevation 617 of the control building. The zone contains the following areas:

   - common Unit 1 and Unit 2 control rooms
   - the separate Unit 3 control room
   - the plant common switchyard relay equipment room

- the technical support center room
- the Control Room Emergency Ventilation (CREV) system equipment room
- miscellaneous equipment rooms and office spaces on either end of the floor

BFN FSAR section 10.12 provides a full description of these spaces and their normal and emergency ventilation. Numerous TVA licensing documents have been submitted to NRC relating to BFN compliance with GDC-19. Through the issuance of SERs, the most recent of which is dated March 14, 2000 (Reference 4), NRC has recognized TVA's position that the CRHZ and its supporting ventilation systems meet the requirements of GDC-19. BFN FSAR Appendix F describes how the shared system requirements defined in GDC-5 are met for the shared CRHZ equipment.

***Emphasis should be placed on confirming:***

***(a) That the most limiting unfiltered inleakage into your CRE*** [control room envelope – at BFN this is synonymous to the CRHZ] ***(and the filtered inleakage if applicable) is no more than the value assumed in your design basis radiological analyses for control room habitability. Describe how and when you performed the analyses, tests, and measurements for this confirmation.***

The BFN design and licensing bases assumes an unfiltered CRHZ in-leakage rate of 3717 CFM. In accordance with TS requirements and their bases, BFN has been periodically performing testing since 1991 to demonstrate that unfiltered in-leakage is maintained within these limits. The typical in-leakage values determined from this testing were found to be approximately one-half of the assumed value. A review of the current testing methods was undertaken following the issuance of GL 2003-01, and this review identified that the in-leakage measurement accuracy was less than desirable, and in the worst case the margin between the measured in-leakage value and the assumed value was smaller than had been thought. Testing using American Society for Testing and

Materials (ASTM) E741 methods (i.e., tracer gas testing) was therefore undertaken to provide better quantification of the in-leakage value and to independently confirm the validity of the in-leakage values determined via historical testing methods.

During the week of November 10, 2003, tracer gas testing was completed on the BFN CRHZ. This testing determined that the unfiltered in-leakage into the CRHZ was less than 600 cubic feet per minute (CFM). This quantity is approximately 16% of the 3717 CFM assumed in the BFN design and licensing bases.

Unfiltered in-leakage was also quantified for the infrequent, abnormal CRHZ configuration where a single electrical board room, physically adjacent to the CRHZ, requires alternate cooling and is then considered as part of the CRHZ. In this configuration the unfiltered in-leakage to the CRHZ was less than 900 CFM.

The unfiltered in-leakage values determined by the tracer gas testing confirmed that the in-leakage quantification testing which has been periodically performed on the BFN CRHZ since 1991 has been and remains adequate to detect degradation in the CRHZ envelope.

***(b) That the most limiting unfiltered inleakage into your CRE is incorporated into your hazardous chemical assessments. This inleakage may differ from the value assumed in your design basis radiological analyses. Also, confirm that the reactor control capability is maintained from either the control room or the alternate shutdown panel in the event of smoke.***

BFN has reviewed both the on site and off-site threats to the CRHZ habitability posed by hazardous chemicals in accordance with the guidance of Regulatory Guide 1.78. The evaluation has been updated to combine several separate analyses and to update these analyses to contain the latest available information. FSAR Section 10.12.5.3 regarding toxic gas protection

for the control room states: " It was concluded that, of chemicals stored onsite, offsite within a 5-mile radius, or transported by the site by barge, rail or road within a 5-mile radius, only chlorine traveling by barge could present a hazard to control room personnel. However, due to the low probability of this event it can be excluded from the control room habitability analysis." This conclusion remains valid. The number of chlorine shipments has increased slightly from 30 shipments to 32 shipments per year. Analysis shows that up to 37 shipments per year of chlorine would be required to exceed the probability of 1E-6 events per year which would impact the habitability of the main control room. This evaluation conservatively included Pasquill stability classes A, B, C and D in the evaluation.

Based on the above, hazardous chemical releases from on-site, off-site, or transportation sources do not adversely affect the BFN CRHZ.

Also following the issuance of GL 2003-01, an evaluation in accordance with RG 1.196, using NEI 99-03 Revision 1, methodology was performed to confirm that reactor control capability is maintained from either the control room or the alternate shutdown panel in the event of smoke. This evaluation determined that, in all fire scenarios which could generate significant smoke quantities, the capability to control the reactor and to place it in a safe shutdown condition would be retained.

The Electrical Board Rooms housing the alternate shutdown panels and the Control Rooms are separated by 3 hour fire barriers. These areas are also served by independent HVAC systems (both ventilation and cooling). Therefore, a single smoke event (either external or internal to the control room habitability zone) does not simultaneously result in contamination of the control room and alternate shutdown locations.

The Electrical Board Rooms housing the alternate shutdown panels can be accessed via two separate entry points. In case of a smoke event where the control

room has to be evacuated, the direct path to the Electrical Board Rooms will be used if available. If the direct path is not available, the Electrical Board Rooms can also be accessed from EL 621 of the reactor building.

El 617 of the control building is fully protected with photo-electric smoke detection system. A smoke event will be immediately detected and alarmed in the main control room and at the fire brigade station. Plant procedures have adequate guidance to re-align ventilation systems to exhaust smoke from the building or use portable ventilation to exhaust smoke away from the control room and alternate shutdown panel as necessary.

Additionally, although self-contained breathing apparatus (SCBA) is not credited in the successful mitigation of a smoke event, all control room assigned operators are required to be trained in the use of SCBA. The operators are provided training in the use of SCBA on an annual basis as part of the General Employee Training curriculum.

SCBAs are located within the main control room area and are readily accessible to the operators. The Operators are aware of the SCBA location. The SCBAs are inspected on a monthly basis.

***(c) That your technical specifications verify the integrity of the CRE, and the assumed inleakage rates of potentially contaminated air. If you currently have a DP surveillance requirement to demonstrate CRE integrity, provide the basis for your conclusion that it remains adequate to demonstrate CRE integrity in light of the ASTM E741 testing results. If you conclude that your DP surveillance requirement is no longer adequate, provide a schedule for: 1) revising the surveillance requirement in your technical specification to reference an acceptable surveillance methodology (e.g., ASTM E741), and 2) making any necessary modifications to your CRE so that compliance with your new surveillance requirement can be demonstrated.***

***If your facility does not currently have a technical specification surveillance requirement for your CRE integrity, explain how and at what frequency you confirm your CRE integrity and why this is adequate to demonstrate CRE integrity.***

The BFN Technical Specifications (TS) surveillance requirement (SR) 3.7.3.4 (on each of the BFN units) calls for periodic testing of each CREV subsystem to verify that a CRHZ pressure $\geq$ 0.125 inches water gauge can be maintained. This SR as performed at BFN also quantifies the CRHZ unfiltered in-leakage. The TS bases associated with this SR state that the testing verifies the in-leakage assumptions are valid. This has been demonstrated by the fact that BFN has performed complex testing to specifically quantify CRHZ unfiltered in-leakage on a periodic basis since 1991.

The BFN testing currently being performed is adequate to demonstrate CRHZ integrity and no TS changes are required.

2. ***If you currently use compensatory measures to demonstrate control room habitability, describe the compensatory measures at your facility and the corrective actions needed to retire these compensatory measures.***

   BFN does not use compensatory measures in demonstrating CRHZ compliance with regulatory requirements.

3. ***If you believe that your facility is not required to meet either the GDC, the draft GDC, or the "Principal Design Criteria" regarding control room habitability, in addition to responding to 1 and 2 above, provide documentation (e.g., Preliminary Safety Analysis Report, Final Safety Analysis Report sections, or correspondence) of the basis for this conclusion and identify your actual requirements.***

   As discussed above, the three BFN units' construction permits predate the GDC and, as such, BFN is not required to meet the GDC. However, the BFN design was evaluated against the draft GDC that were current at the time of

licensing. This evaluation concluded that the BFN design met the intent of the GDC. This is documented in Appendix A of the FSAR.

## CONCLUSION

Historical testing data and the results of the recently completed testing using ASTM E741 methods demonstrate that unfiltered CRHZ in-leakage does not approach assumed values. An assessment of hazardous chemical releases from on-site, off-site, or transportation sources concluded that such releases do not adversely affect the CRHZ. There are no credible scenarios in which smoke can simultaneously prevent the shutdown of the reactors from both the control room and the alternate shutdown panels. In all scenarios involving smoke either the control room or the alternate shutdown panels (or both) will not be significantly affected.

No actions beyond compliance with the current TS and maintenance of the plant in accordance with its design basis are required at BFN to ensure control room habitability under all analyzed conditions.

**ENCLOSURE**
**GENERIC LETTER (GL) 2003-01 - CONTROL ROOM HABITABILITY**
**BROWNS FERRY (BFN) RESPONSE**

## REFERENCES


1. SUPPLEMENT NO. 1 TO THE SAFETY EVALUATION BY THE DIRECTORATE OF LICENSING; U. S. ATOMIC ENERGY COMMISSION IN THE MATTER OF TENNESSEE VALLEY AUTHORITY, BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3 DOCKET NOS. 50-259, 260, AND 296 (Issuance Date: December 21, 1972)
2. SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION SUPPORTING RESOLUTION OF NUREG-0737, ITEM III.D.3.4, “CONTROL ROOM HABITABILITY,” TENNESSEE VALLEY AUTHORITY, BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3, DOCKET NOS. 50-259, 50-260, AND 50-296 (August 30, 1982)
3. LETTER from TVA to NRC dated October 11, 1988 - TENNESSEE VALLEY AUTHORITY – BROWNS FERRY NUCLEAR PLANT UNIT 1 – DOCKET NO. 50-259 – FACILITY OPERATING LICENSE DPR-33 – REPORTABLE OCCURRENCE REPORT BFRO-50-259/88025
4. LETTER from NRC to TVA dated March 14, 2000: BROWNS FERRY NUCLEAR PLANT UNITS 2 AND 3 – ISSUANCE OF AMENDMENTS REGARDING LIMITS ON MAIN STEAM ISOLATION VALVE LEAKAGE (TAC NOS. MA6405 AND MA6406)