



Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

January 27, 2009

10 CFR 50.12
10 CFR 50, Appendix R

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

In the Matter of)
Tennessee Valley Authority)

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

**BROWNS FERRY NUCLEAR PLANT (BFN) - UNITS 1, 2, AND 3 - PROPOSED
REQUEST FOR EXEMPTION FROM 10 CFR 50, APPENDIX R, PARAGRAPH III.G.2,
FIRE PROTECTION OF SAFE SHUTDOWN CAPACITY**

In accordance with 10 CFR 50.12, Specific Exemptions, as specified in Regulatory Issue Summary (RIS) 2006-10, Regulatory Expectations With Appendix R, Paragraph III.G.2 Operator Manual Actions, BFN is requesting an exemption from the provisions of 10 CFR 50, Appendix R, Paragraph III.G.2, Fire Protection of Safe Shutdown Capability, for the use on operator manual actions (OMAs) on Units 1, 2, and 3 as a means to ensure one redundant safe shutdown train is free of fire damage.

This exemption request is limited to those types of manual actions previously accepted by NRC in a safety evaluation. The OMAs addressed in this proposed exemption request are similar to those that were previously approved by an NRC safety evaluation for BFN Units 2 and 3 Operation.

Information in this record was deleted
in accordance with the Freedom of Information
Act, exemptions 4
FOIA- 2009-0155

Ex 4, portions

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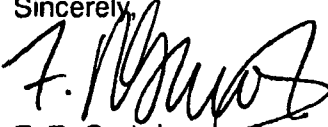
U. S. Nuclear Regulatory Commission
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Enclosure 1 provides BFN's request for Exemption from 10 CFR 50, Appendix R, Paragraph III.G.2. Enclosure 2 is TVA Calculation, Appendix R III.G.2 Manual Action Feasibility Evaluation. This calculation, performed using guidance from NUREG 1852, Demonstrating the Feasibility and reliability of Operator manual Actions in Response to Fire, is BFN's basis for the Browns Ferry Plant Exemption Request. The calculation contains bases for the Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA). Attachment number 1 to the calculation is the List of Time Critical Operator Manual Actions, and Attachment number 2 is the Verification and Validation of Appendix R Manual Actions.

TVA has found that the OMAs listed in the exemption are feasible. NRC has previously reviewed the actions and found them acceptable for use in achieving post-fire safe shutdown. Hence, the special circumstances for the issuance of an exemption are satisfied in accordance with the requirements of 10 CFR 50.12(a)(2)(ii) and RIS 2006-10. The application of the rule is not necessary to achieve the underlying purpose of the rule, that is; achieve safe shutdown in the event of a fire. The exemption request is authorized by law and is consistent with the common defense and security. Therefore, the requirements of 10 CFR 50.12 (a)(1) are satisfied.

There are no new regulatory commitments contained within this request. If you have any questions about this request, please telephone me at (256) 729-2636.

I Declare under penalty of perjury that the foregoing is true and correct. Executed on this 27th day of January 2009.

Sincerely,

F. R. Godwin
Manager of Licensing
and Industry Affairs

U. S. Nuclear Regulatory Commission
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January 27, 2009

Enclosures:

1. Request for Exemption from 10 CFR 50 Appendix R, Paragraph III.G.2
2. TVA Calculation, Appendix R III.G.2 Manual Action Feasibility Evaluation Revision 1

cc (Enclosures):

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ENCLOSURE 1

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

REQUEST FOR EXEMPTION FROM 10 CFR 50 APPENDIX R, PARAGRAPH III.G.2

Pursuant to 10 CFR 50.12, BFN is requesting an exemption from 10 CFR 50, Appendix R, Paragraph III.G.2, Fire Protection of Safe Shutdown Capability for BFN Units 1, 2, and 3. Paragraph III.G.2 of Appendix R does not list operator manual actions (OMAs) as a means of ensuring that one redundant train is free of fire damage.

Contrary to the above, Appendix R, Paragraph III.G.2 areas at BFN rely on OMAs to ensure a train is free from fire damage when the redundant train is in the same fire area.

1.0 Applicable Rule

The applicable rules for this exemption request are 10 CFR 50.48 and 10 CFR 50, Appendix R. Pursuant to 10 CFR 50.48(a), each operating nuclear plant must have a plan to satisfy Criterion 3, Fire Protection, of 10 CFR 50, Appendix A. The fire protection features that BFN must meet to satisfy Criterion 3 of Appendix A are established by 10 CFR 50, Appendix R. Specifically, 10 CFR 50, Appendix R, Paragraph III.G.2 requires, in part, where cable or equipment, including associated non-safety circuits that could prevent operation or cause maloperation as a result of hot shorts, open circuits, or shorts to ground of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within the same fire area outside of primary containment, shall be free of fire damage.

2.0 Requested Exemption

TVA is requesting an exemption from 10 CFR 50, Appendix R, Paragraph III.G.2, Fire Protection of Safe Shutdown Capability, for BFN Units 1, 2, and 3 to the extent that OMAs are necessary to achieve and maintain hot shutdown for areas in which both trains of safe shutdown equipment are located.

3.0 Justification and Assessment of Safety Impact

Background

Regulatory Issue Summary, (RIS) 2006-10, Regulatory Expectations With Appendix R, Paragraph III.G.2 Operator Manual Actions, provides NRC's position on OMAs as part of the strategy for compliance with 10 CFR 50, Appendix R, Paragraph III.G.2. NRC requires that plants which credit OMAs for Paragraph III.G.2 compliance to obtain approval for the OMAs via the exemption request in accordance with the requirements of 10 CFR 50.12. As stated below, RIS 2006-10 addresses operator manual actions previously approved outside the exemption process.

"For pre-1979 licensees, the staff decision in a safety evaluation report that approves the use of operator manual actions, in lieu of one of the means specified in paragraph III.G.2, does not eliminate the need for an exemption. Pre-1979 licensees who have SERs but not a corresponding exemption, which approve manual actions should request an

exemption under 10 CFR part 50.12, citing the special circumstances section of 50.12(a)(2)(ii), using the SER as the safety basis, and confirming that the safety bases established in the SER remains valid. The staff expects to grant the exemption on these without further review."

Basis That The Manual Actions Are Previously Approved

Browns Ferry is unique in their approach to the application of Appendix R. Browns Ferry Units 1, 2, and 3 were shutdown in 1985. As TVA restarted each unit, NRC approved the application of 10 CFR 50, Appendix R to support the operation of that unit. TVA restarted Unit 2 in 1991, Unit 3 in 1995, and Unit 1 in 2007. NRC approved the application of an Appendix R Fire Protection Program for BFN in several safety evaluations (SEs). The following provides a general timeline of the approval process:

By letter dated January 31, 1986 (Reference 1), TVA submitted the 10 CFR 50 Appendix R Fire Protection and Safe Shutdown Systems Analysis Report for Browns Ferry Nuclear Plant. On December 8, 1988 (Reference 2), supplemented by an October 3, 1989 (Reference 3), letter NRC issued the Safety Evaluation (SE) for post safe-shutdown in support of Unit 2 Operation. Section 2.4.3 and Section 2.7 of the respective SEs discuss OMAs.

On January 15, 1992 (Reference 4), TVA issued the BFN Fire Protection Report for NRC review. The report established the BFN Fire Protection Plan in accordance with NRC Generic Letter (GL) 86-10, Implementation of Fire Protection Requirements, and GL 88-12, Removal of the Fire Protection Requirements from Technical Specifications. As part of the evaluation, the NRC reviewed the Fire Protection Plan and Fire Hazard Analysis. On March 31, 1993 (Reference 5), NRC issued a SE that approved the new BFN Fire Protection Report. The Safe Shutdown Analysis, which included use of OMAs and Unit 2 Appendix R Safe Shutdown Program, were previously approved in the above referenced NRC SEs.

In a December 20, 1994 letter (Reference 6), BFN provided the revised FPR for combined Unit 2 and 3 operations. By letter dated November 2, 1995 (Reference 7), NRC approval of a Fire Protection Report for Units 2 and 3 operations with Unit 1 shutdown and defueled. Sections 3.5 and 3.5.1 of the SE summarizes the manual actions for the combined operation of Units 2 and 3. In the SE, the NRC noted that the OMAs involve the same types of actions currently performed on Unit 2. These OMAs include positioning valves, operating switches, and opening breakers. NRC also noted that the time for performing these actions for Unit 3 was consistent with those established for Unit 2.

On April 5, 2006, prior to the restart of Unit 1, TVA met with NRC to discuss the progress of the BFN Fire Protection Program and the reliance on OMAs. During this meeting, TVA discussed maintaining operational fidelity of Unit 1 with Units 2 and 3 by using the same type of OMAs that are currently approved for the Units 2 and 3 Safe Shutdown Program. The Licensing Basis for the proposed Unit 1 Fire protection plan was consistent with the current Unit 2 and 3 Fire Protection Plan. TVA Indicated the Unit 1 Appendix R Safe Shutdown Analysis did not require the addition of any new type OMAs to meet safe shutdown requirements. The OMAs needed for Unit 1 safe shutdown are similar to those approved for Units 2 and 3.

As a result of the April 5, 2006 meeting, as stated in a letter dated April 24, 2006 (Reference 8), BFN committed to perform a Fire Protection Significance Determination Process (SDP) analysis to determine the risk associated with the OMAs approved for Units 2 and 3 operation and the proposed Unit 1 OMAs., and for Units 2 and 3, correct or take

compensatory actions for those OMAs that are risk significant (greater than green). For Unit 1, correct any OMAs that are risk significant prior to Unit 1 entering mode 2 or 3.

BFN performed a risk evaluation of the fire Appendix R, Paragraph III.G.2 area OMAs using NRC Inspection Manual Chapter 609, Significance Determination Process, Appendix F, Fire Protection. The BFN risk analysis found the OMAs used for safe shutdown of Units 1, 2, and 3 to be green (not risk significant). NRC reviewed the analysis and concluded in an April 25, 2007, SE (Reference 9) that BFN has identified the post-fire safe shutdown OMAs performed outside the main control room in Paragraph III.G.2 areas for Units 1, 2, and 3 and placed them in the corrective action program. Furthermore, BFN is treating the OMAs as compensatory measures, which is consistent with RIS 2006-10. NRC found this approach acceptable until full compliance with Paragraph III.G.2 is established.

Feasibility and Dependability Review

Following the guidance provided in NUREG-1852, Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire, BFN performed a feasibility review of the 10 CFR Appendix R, Paragraph III.G.2, OMAs needed to shutdown Units 1, 2, or 3 in the event of a postulated fire. Enclosure 2 provides BFN's Appendix R III.G.2 Manual Action Feasibility Evaluation. Attachment Number 1 to the calculation is the List of Time Critical Operator Manual Actions. Attachment Number 2 is the Verification and Validation of Appendix R Manual Actions.

BFN's evaluation concludes that OMAs required for achieving and maintaining hot shutdown conditions are feasible, reliable, and not affected by environmental conditions associated with fires in Appendix R, Paragraph III.G.2 areas. In addition, the equipment needed to implement OMAs remains available and the areas remain accessible during the event. Plant demonstrations have shown that plant procedures and staffing is adequate and time margin is available to account for uncertainties that may arise during an event. The evaluation found that OMAs are feasible and reliable and using OMAs; therefore, BFN meets the underlying purpose and intent of the Appendix R, Paragraph III.G.2 rule.

4.0 Authorized By Law

NRC has issued TVA's Operating License for BFN under the provisions of Section 104.b of the Atomic Energy Act. Operating licenses issued by the Commission pursuant to Section 104.b are not limited, by stature, to specify the methods for complying with the requirements of 10 CFR 50, Appendix R. As previously stated, 10 CFR 50.12 allows the NRC to grant exemptions from the requirements of 10 CFR 50.48 and Appendix R to 10 CFR 50. Thus, the Commission is authorized by law to exempt BFN from these requirements.

5.0 Presents No Undue Risk to Public Health and Safety

The purpose of this rule is satisfied by the requested exemption since the manual actions previously described provide an equivalent level of protection as required by 10 CFR 50, Appendix R, Paragraph III.G.2. Therefore, the proposed exemption presents no undue risk to the public health and safety.

6.0 Does Not Endanger Common Defense and Security

The Commission's Statement of Considerations in support of the exemption rule noted with approval the explanation of standard as set forth in Long Island Lighting Company (Shoreham Nuclear Power Station, Unit 1) LBP-84-45, 20 NRC 1343, 1400

(October 29, 1984). There, the term "common defense and security" refers principally to safeguarding of special nuclear material, the absence of foreign control over the applicant, the protection of Restricted Data, and the availability of special nuclear material for defense needs. The granting of the requested exemption will not affect any of these matters and, thus, the requested exemption is consistent with the common defense and security.

7.0 Special Circumstances are Present

According to NRC regulations, special circumstances are present if any one of the six cases cited in 10 CFR 50.12 (a)(2) are present. TVA has found that special circumstances found in application of paragraphs (ii) and (iii) exist for this exemption:

- (ii) *"Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule."*

10 CFR 50, Appendix R, Paragraph III.G.2, specifies methods to ensure that one train of systems necessary to achieve and maintain safe shutdown capability remains free from fire damage. Paragraph III.G.2 does not list manual operator actions as a means of ensuring that one of the redundant trains is free of fire damage. Specifically, Paragraph III.G.2 of Appendix R requires that, where cables and equipment including associated non-safety circuits that could prevent operation or cause maloperation as a result of hot shorts, open circuits, or shorts to ground of redundant trains of systems necessary to achieve and maintain hot shutdown must be protected in accordance with Paragraph III.G.2 of Appendix R.

NRC Regulatory Issue Summary (RIS) 2006-10, Regulatory Expectations With Appendix R Paragraph III.G.2, Operator Manual Actions, allows pre-1979 licensees, who have a staff decision in a Safety Evaluation Report that approves the use of manual operator actions, in lieu of one of the means specified in Paragraph III.G.2 should request an exemption citing special circumstances. NRC approved the use of manual actions for Browns Ferry, Units 2 and 3 in a Safety Evaluation at the time the each Unit was restarted (References 2, 3, and 5). Although not explicitly approved in a NRC Safety Evaluation, the manual operator actions put in place for Unit 1 similar to those approved on Units 2 and 3. That is, positioning valves, operating switches, and opening breakers. In addition, two analyses performed by BFN indicate that the Paragraph III.G.2 manual operator actions for Units 1, 2, and 3 are not risk significant, are feasible, reliable and can be performed under post fire circumstances.

Therefore, the underlying purpose of the rule, to achieve safe shutdown in the event of a postulated Appendix R Fire, is met using operator manual actions. The rule continues to be satisfied by the requested exemption since the existing analyses described provide an equivalent level of safe shutdown capability as required by 10 CFR 50, Appendix R, Paragraph III.G.2.

- (iii) *"Compliance would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted, or that are significantly in excess of those incurred by others similarly situated."*

As previously discussed, the underlying purpose of Paragraph III.G.2 is to ensure that one train of systems necessary to achieve and maintain safe shutdown capability remains free from fire damage. The underlying purpose of the rule continues to be satisfied by the use of operator manual actions. The engineering activities accompanied

by plant physical modifications, procedure revisions and possible extension of planned outages, needed to implement Paragraph III.G.2 of Appendix R will result in a considerable expense to BFN. The cost associated with these activities places an unwarranted burden on BFN with a negligible increase in safety as compared to the alternate means of satisfying the requirements of Paragraph III.G.2 of Appendix R.

Therefore, the special circumstances exist that warrant granting an exemption to 10 CFR 50, Appendix R, Paragraph III.G.2 as described in RIS 2006-10.

8.0 Environmental Impact

TVA has reviewed the proposed exemption and determined implementation of the exemption will not effect the environment. That is there is no construction of operational activities, which could significantly affect the environment. Implementation of the exemption does not result in a significant increase in any adverse environmental impact previously evaluated, result in a significant change in effluents or power levels, or affect any matter not previously reviewed by NRC that may have a significant environmental impact.

The proposed exemption does not alter the land use for the plant, any water uses or impacts on water quality, or ambient air quality. The proposed exemption does not affect the previous analysis of environmental impacts.

References:

1. TVA letter to NRC dated January 31, 1986: In the Matter of the Tennessee Valley Authority – 10 CFR 50 Appendix R Submittal Fire Protection and Safe Shutdown Systems Analysis Report for Browns Ferry Nuclear Plant TVA.
2. NRC letter to TVA dated December 8, 1988: Browns Ferry Nuclear Plant, Units 1, 2, and 3 – Appendix R Safe Shutdown System Analysis. (Tac Nos. 60627, 60628, 60629)
3. NRC letter to TVA dated November 3, 1989: Supplemental Safety Evaluation of Post-Fire Safe Shutdown Systems and Final Review of the Nation Fire Protection Association Code Deviations – Browns Ferry Nuclear Plant, Unit 2 (Tac Nos. 72098 and 00459)
4. TVA letter to NRC dated January 15, 1992: Browns Ferry Nuclear Plant – Fire Protection Report
5. NRC letter to TVA dated March 31, 1993: Fire Protection Program – Browns Ferry Nuclear Plant Units 1, 2, and 3. (Tac Nos. M82687, M82688, and M82689)
6. TVA letter to NRC dated December 20, 1994: Browns Ferry (BFN) – Unit 2 and 3 Browns Ferry Nuclear Plant Fire Protection Report
7. NRC letter to TVA dated November 2, 1995: Safety Evaluation of Post-Fire Safe Shutdown Capability and Issuance of Technical Specification Amendments for the Browns Ferry Nuclear Plant Units 1, 2, and 3. (Tac Nos. M85254, M87900, M87901 and M87902) (TS 337)
8. TVA letter to NRC dated April 24, 2006: Browns Ferry Nuclear Plant (BFN) Units 1, 2, and 3 – Fire Protection Program – Post-Fire Operator Manual Actions
9. NRC letter to TVA dated April 25, 2007: Browns Ferry Nuclear Plant, Units 1, 2, and 3 – Issuance of Amendments Regarding Revision to Appendix R License Conditions to Reflect Three Unit Operation (Tac Nos. MD3596, MD3597, and MD3598)(TS-459)

ENCLOSURE 2

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

TVA Calculation, Appendix R III.G.2 Manual Action Feasibility Evaluation Revision 1



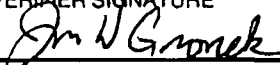
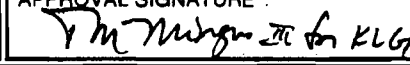
See Attached:

QA Record

ORIGINAL

NPG CALCULATION COVERSHEET/CCRIS UPDATE

Page 1

REV 0 EDMS/RIMS NO. R14080819105				EDMS TYPE: calculations(nuclear)		EDMS ACCESSION NO (N/A for REV. 0) R14 090114 101			
Calc Title: Appendix R III.G.2 Manual Action Feasibility Evaluation									
CALC ID	TYPE	ORG	PLANT	BRANCH	NUMBER	CUR REV	NEW REV	REVISION APPLICABILITY	
CURRENT	CN	NUC	BFN	NTB	NDQ099920080007	000		Entire calc <input checked="" type="checkbox"/> Selected pages <input type="checkbox"/>	
NEW	CN	NUC					001		
ACTION	NEW REVISION <input checked="" type="checkbox"/>	DELETE RENAME <input type="checkbox"/>	SUPERSEDE DUPLICATE <input type="checkbox"/>		CCRIS UPDATE ONLY <input type="checkbox"/> (Verifier Approval Signatures Not Required)			No CCRIS Changes <input type="checkbox"/> (For calc revision, CCRIS been reviewed and no CCRIS changes required)	
UNITS 0, 1, 2, 3		SYSTEMS 999			UNIDS N/A				
DCN,EDC,N/A N/A		APPLICABLE DESIGN DOCUMENT(S) BFN-50-747					CLASSIFICATION D		
QUALITY RELATED? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	SAFETY RELATED? (If yes, QR = yes) Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		UNVERIFIED ASSUMPTION Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		SPECIAL REQUIREMENTS AND/OR LIMITING CONDITIONS? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		DESIGN OUTPUT ATTACHMENT? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		SAR/TS and/or ISFSI SAR/CoC AFFECTED Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
PREPARER ID ltstafford	PREPARER PHONE NO 729-2563		PREPARING ORG (BRANCH) MEB		VERIFICATION METHOD Design Review		NEW METHOD OF ANALYSIS <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
PREPARER SIGNATURE 			DATE 1-13-2009		CHECKER SIGNATURE 			DATE 1/13/09	
VERIFIER SIGNATURE 			DATE 1/13/09		APPROVAL SIGNATURE 			DATE 1-13-2009	
STATEMENT OF PROBLEM/ABSTRACT 10CFR50 Appendix R Section III.G.2 requires that, where cables or equipment of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located in the same fire area outside of primary containment, one of the following means of ensuring that one of the redundant trains is free of fire damage shall be provided: <ol style="list-style-type: none"> 1. Separation of cables and equipment by a fire barrier having a 3-hour rating 2. Separation of cables and equipment by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards and with fire detection and an automatic fire suppression system in the fire area 3. Enclosure of cables and equipment in a fire barrier having a 1-hour rating and with fire detection and an automatic fire suppression system in the fire area. <p>According to the NRC's most recent interpretation of Paragraph III.G.2 requirements in Federal Register Volume 71, Number 43 dated March 6, 2006, reliance on operator manual actions is no longer permitted in lieu of the means above to ensure that one of the redundant safe shutdown trains in the same fire area is free of fire damage. Consistent with prior practice within the industry, BFN's Appendix R Program utilize operator manual actions for safe shutdown in Fire Areas 1, 2, 3 and 25. However, based on the interpretation by the NRC, BFN does not have an approved license exemption to allow operator manual actions for III.G.2 fire areas.</p> <p>This evaluation supports the exemption request to allow the use of operator manual actions in III.G.2 fire areas to ensure safe shutdown can be achieved during an Appendix R event.</p> <p>Revision 1 makes clarifications to the references and discussion on combustibles in a Fire Area/Zone in Appendix A.</p>									
MICROFICHE/EFICHE Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> FICHE NUMBER(S) <input type="checkbox"/> LOAD INTO EDMS AND DESTROY <input checked="" type="checkbox"/> LOAD INTO EDMS AND RETURN CALCULATION TO CALCULATION ADDRESS:SAB 1C-BFN LIBRARY. <input type="checkbox"/> LOAD INTO EDMS AND RETURN CALCULATION TO:									

Page 44

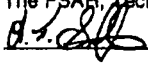
ALTERNATE CALCULATION IDENTIFICATION

KEY NOUNS (A-add, D-delete)

CROSS-REFERENCES (A-add, C-change, D-delete)

CCRIS ONLY UPDATES:

Following are required only when making keyword/cross reference CCRIS updates and page 1 of form NEDP-2-1 is not included:

NPG CALCULATION RECORD OF REVISION	
CALCULATION IDENTIFIER: NDQ099920080007	
Title Appendix R III.G.2 Manual Action Feasibility Evaluation	
Revision No.	DESCRIPTION OF REVISION
0	<p>Initial Issue - This evaluation supports the exemption request to allow the use of operator manual actions in 10CFR50 Appendix R III.G.2 Fire Areas to in lieu of the separation requirements in the rule.</p> <p>The FSAR, Technical Specifications, ISFSI SAR and COC and Fire Protection Report have been reviewed by <u>L.T. Stafford</u> and are not impacted by this calculation.</p> <p>Total Pages: 204</p>
1	<p>This revision makes clarifications to the discussion on combustibles in the Fire Area/Zones and adds the Combustible Load Tables as a reference in Appendix A.</p> <p>The FSAR, Technical Specifications, ISFSI SAR and COC and Fire Protection Report have been reviewed by <u></u> and are not impacted by this calculation.</p> <p>Pages Revised: iv, Appendix A (sheets A-37, A-60) Pages Added: none Pages Deleted: none Pages Replaced: i, ii, iii, v Total Pages: 204</p>

NPG CALCULATION TABLE OF CONTENTS		
Calculation Identifier: NDQ099920080007		Revision: 1
TABLE OF CONTENTS		
SECTION	TITLE	PAGE
	Coversheet/CCRIS Update	i
	Record of Revision	iii
	Table of Contents	iv
	Design Verification	v
1.0	Purpose	1
2.0	References	1
3.0	Design Input Data	1
4.0	Assumptions	1
5.0	Special Requirements/Limiting Conditions	1
6.0	Computations and Analyses	1
7.0	Supporting Graphics	1
8.0	Summary of Results	1
9.0	Conclusions	1
	Appendix A	60 pages
	Attachment 1	44 pages
	Attachment 2	94 pages

NPG CALCULATION VERIFICATION FORM

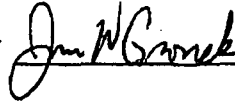
Calculation Identifier NDQ099920080007

Revision 1

Method of verification used:

1. Design Review ☒
2. Alternate Calculation ☐
3. Qualification Test ☐

Verifier



Date

1/12/09

Comments:

Design verification has been performed by design review in accordance with NEDP-2 and NEDP-5. The methodology used is consistent with good engineering practice and the results were found to be acceptable.

Calculation: ND-Q0999-2008-0007	Rev.: 1	Plant: BFN	Page 1 of 1
Title: Appendix R III.G.2 Manual Action Feasibility Evaluation			

1.0 Purpose

This calculation is being issued to support the 10CFR50 Appendix R III.G.2 exemption request to allow the use of operator manual actions in lieu of separation as described in the rule.

2.0 References

2.1	0-FPR-Volume 1	Fire Protection Report
2.2	ED-Q0999-2003-0048	Units 1, 2, & 3 Appendix R Manual Action Requirements
2.3	0-SSI-001	Safe Shutdown Instructions
2.4	BFN PER 101631	Appendix R Section III.G.2 Operator Manual Actions
2.5	NEI 00-01	Guidance for Post-Fire Safe Shutdown Circuit Analysis
2.6	NUREG-1852	Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire

3.0 Design Input Data

- 3.1 See Attachment 1 for listing of Time Critical Operator Manual Actions (ref. 2.2).
- 3.2 See Table 1 of Appendix A for listing of Appendix R III.G.2 Fire Areas/Zones (ref. 2.1).

4.0 Assumptions

- 4.1 Time Critical Operator Manual Actions are defined as operator manual actions that must be completed within the first 60 minutes of the event and must be completed from outside the Main Control Room.
Verification: Based on industry guidance and past approval by the NRC, after 60 minutes the fire is assumed to be extinguished and the impact to the operators will be substantially reduced.
- 4.2 Actions performed in the Main Control Room are not included in the evaluation.
Verification: Actions taken in the Main Control Room are not considered operator manual actions since they are being performed from the normal safe shutdown location.

5.0 Special Requirements/Limiting Conditions

None.

6.0 Computations and Analyses

See Appendix A for analysis methodology and basis.

7.0 Supporting Graphics

None.

8.0 Summary of Results

See Appendix A for Summary of the Evaluation Results

9.0 Conclusions

Based on the evaluation performed in Appendix A, the operator manual actions that are performed for post-fire safe shutdown in 10CFR50 Appendix R III.G.2 fire areas/zones are feasible and reliable. The evaluation in Appendix A will be used to support an Appendix R III.G.2 exemption request.

Browns Ferry Nuclear Plant (BFN)
Exemption Request for Appendix R
III.G.2 Areas Operator Manual Actions
(OMA)

Prepared: Rashid Abbas P.E., FPE *Rashid Abbas* 8/1/08
Sr. Fire Protection Engineer (SAIC)

Approved: L.T. STAFFORD *L.T. Stafford* 8-13-08
Appendix R / Fire Protection Engineer (TVA-BFN)

**Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas
Operator Manual Actions (OMA)**

Exemption from Manual Actions Credit for Appendix R III.G.2 Areas

Paragraph III.G.2 of Appendix R does not list operator manual actions as a means of ensuring that one of the redundant trains is free of fire damage. Specifically, paragraph III.G.2 of Appendix R requires that, where cables or equipment, including associated non-safety circuits that could prevent operation or cause maloperation as a result of hot shorts, open circuits, or shorts to ground of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within the same fire area outside of primary containment, one of the following means of ensuring that one of the redundant trains is free of fire damage shall be provided:

- (a) separation of cables and equipment by a fire barrier having a 3-hour rating,*
- (b) separation of cables and equipment by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards and with fire detectors and an automatic fire suppression system in the fire area, and*
- (c) enclosure of cables and equipment in a fire barrier having a 1-hour rating and with fire detectors and an automatic fire suppression system in the fire area.*

Contrary to these requirements, Appendix R III.G.2 areas at BFN rely on operator manual actions in lieu of one of the means specified in paragraph III.G.2 to ensure a train is free of fire damage when redundant trains were in the same fire area.

**Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas
Operator Manual Actions (OMA)**

Justification

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**Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas
Operator Manual Actions (OMA)**

Introduction:

The purpose of the analysis presented herein is to show that the operator manual actions (OMA) required to achieve and maintain hot shutdown conditions are not affected by the environmental conditions associated with fires in Appendix R III.G.2 areas, and that the functionality of equipment needed to implement operator actions remains available and the area remains accessible. Realistic plant demonstrations will be provided to show that adequate time margin remains available to account for uncertainties. The analysis follows the guideline of NUREG 1852 and uses a deterministic approach for assessing the feasibility and reliability of operator manual actions. This evaluation will demonstrate that BFN meets the underlying purpose and intent of Appendix R III.G.2 rules.

The information provided within is BFN's basis for the exemption being requested in accordance with the requirements set forth by 10 CFR 50.12(a)(2)(ii) since compliance with the regulation in this instance is not necessary to achieve the underlying purpose of the rule. It should also be noted that the types of actions being evaluated have been previously approved by NRC (Reference 8) and no new type of actions are being introduced.

1. Identification of Appendix R III.G.2 Areas

Following Appendix R III.G.2 areas have been identified in the Fire Protection Report, Volume 1 (FPR) (Reference 1):

(b)(4)



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**Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas
Operator Manual Actions (OMA)**

(b)(4)

MD
3.1Exempt
4**2. List of Operator Manual Actions (OMA) by Functions and Their Requirement to Establish Safe Shutdown Path or to Mitigate Adverse Consequences to the Analyzed Safe Shutdown Path**

The Unit 1, 2 and 3 Appendix R Manual Action Requirement calculation ED-Q0999-2003-0048 R6 (Reference 2) lists all the actions that are necessary for safe shutdown of the plant in the event of an Appendix R fire. This evaluation considers actions performed outside the main control room (MCR) within a period of one hour. Attachment 1 provides a list of all actions required to be performed in the first 60 minutes. It is expected that the fire affects after one hour will be substantially reduced so that manual actions are not impacted. The Operator Manual Actions (OMA) for the above areas will first be categorized according to their functions as follows:

- Reactivity Control
- Reactor Coolant Makeup Control
- Reactor Coolant System Pressure Control
- Decay Heat Removal
- Support Systems (Equipment Cooling)
- Support Systems (Electric Power)

These categories are consistent with the Boiling Water Reactor (BWR) generic Multiple Spurious Operation (MSO) listing as prepared by the BWR Owners Group (Reference 3). The groupings provide the relative order of manual actions for safe shutdown to be performed in a BWR plant. The equipment cooling and electric power supply systems provide the necessary support for safe shutdown functions.

These actions were then further separated in two categories:

**Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas
Operator Manual Actions (OMA)**

Category 1. Manual Operator Actions required to Establish Analyzed Safe Shutdown Path.

This includes actions that are associated with part of the train required to achieve and maintain post fire hot shutdown* such as:

- High pressure injection (HPCI and RCIC)
- Low pressure injection (LPCI)
- Depressurization (ADS & MSRVs)
- Diesel generator loading (loading analysis)
- Diesel generator cooling (EECW)
- Power alignments (4 kV power supplies etc.)

*For BFN, the post-fire hot shutdown systems will include all systems required for high and low pressure injection, depressurization, and associated power supplies and cooling water for these systems. Note that the high pressure injection (HPCI and RCIC) is typically not credited for most III.G.2 areas. Long term decay heat removal is considered a cold shutdown process.

Category 2. Manual Operator Actions Required to Mitigate Adverse Consequences to the Analyzed Safe Shutdown Path.

This includes actions that are not associated with part of the train required to achieve and maintain post-fire hot shutdown, but can impact the ability of credited train to perform its safe shutdown function. Examples of these actions are:

- RPV overfill (spurious HPCI start w/loss of high level trip)
- All flow diversions from credited makeup path (includes single and multiple spurious)
- System trips (recirculation pump trip)
- System isolation (RWCU isolation)
- Preventive actions (open breakers to avoid damage, high impedance faults, preclude spurious operation, preclude dead-head, etc.)

The breakdown of the operator actions is primarily based on the NRC-NEI meeting report (Reference 4) on the deterministic post-fire safe shutdown methodology to address multiple spurious operations. The exemption request will concentrate on OMAs performed in the first category, i.e. OMAs associated with the credited train. OMAs performed in the second category are primarily due to associated circuits (spurious operations) which have an adverse impact on the credited train. These actions are allowed per the guidelines provided in Generic Letter 81-12 (Reference 5). Actions to mitigate the effects of associated circuits have to be pre-planned and feasible.

The following Table 2 provides a review of all OMAs and lists them in their functional grouping along with placing them in one of the two categories as discussed above. HVAC actions are not included in Table 2, and will be addressed separately. The table also highlights actions that are performed in the III.G.2 areas (outside the EBRs).

Pages 23 through 52 redacted for the following reasons:

(b)(4)

**Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas
Operator Manual Actions (OMA)**

MD
3.1
Etc
4

3.1.2 Feasibility of OMAs Based on Other Environmental Factors (Radiation, Lighting)

Other environmental factors that can negatively impact the ability to perform manual actions are lighting and radiation. At BFN emergency lighting is provided as required by Appendix R, Section III.J for paths to and from locations requiring

R

**Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas
Operator Manual Actions (OMA)**

any actions and in areas where actions are performed. Therefore, lighting availability is considered adequate.

Access and egress paths and locations in the reactor building where manual actions are performed are typically categorized as "radiation areas" ($>5\text{mrem/hr}$ and $<100\text{mrem/hr}$). These are considered accessible areas with normal precautions. No actions are required in "high radiation" ($>100\text{mrem/hr}$) areas. Other areas where manual actions are performed are non-radiation areas. Radiation and lighting levels are also discussed in detail in Attachment 2.

3.2 Equipment Functionality and Accessibility

The analysis in Section 3.1 (a) shows that majority of the actions are performed on electrical boards located in the electrical board rooms. The functionality of equipment and cables, needed to implement operator actions in these areas, will remain unaffected by the fire environment in the III.G.2 areas. All areas in the electrical board rooms are readily accessible.

The analysis in Section 3.1 (b) Table 3 shows that based on floor to floor fire zone separations and large distances within fire zones, the functionality of equipment and cables, needed to implement operator actions in these areas, will remain unaffected by the fire environment in the III.G.2 areas.

Adequacy of diagnostic instrumentation, communications, portable equipment and personnel protective equipment (PPE) is detailed in Attachment 2.

3.3 Feasibility and Reliability of Manual Actions and Time Margins

The feasibility and reliability of the OMAs are evaluated based on demonstrations, i.e. the actions can be performed in the analyzed time available and are feasible. The demonstration is performed by a randomly selected established crew. Table 4 lists all the OMAs in the Electrical Board Rooms and Table 5 lists all the OMAs in the Reactor Building, their required time and demonstrated time and the technical basis of the required time.

A detailed validation and verification (V&V) of manual actions listed in the Safe Shutdown Instructions (SSIs) was performed. See Attachment 2 for details. The V&V demonstrated the feasibility and reliability of manual actions based on the adequacy of diagnostic instrumentation, communications, special tools, accessibility, procedures, staffing and training. The timing validation demonstrated that the actions are feasible and operators can perform the actions reliably. Sufficient time margin is available to account for uncertainties.

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 4—Adequacy of Time Available to Perform the Manual Actions (Electrical Bld. Room Actions)

Component Requiring Manual Action	Location of Action	Actions required for Fire Zones	Demonstrated Time (min)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
HPCI	2-BDDD-281-0002A	2-3	3:10	10	Spurious operation of the HPCI system could cause overfill of the reactor vessel if the automatic high-level trip is disabled and no manual operator action is performed. The time at which the spuriously operated HPCI pump would fill the reactor vessel up to the MSL using the SAFER code is approximately 6 minutes without a high water level (level 8) trip. For Fire Zone 02-03, an additional (confirmatory) manual operator action to trip both HPCI logic buses (from either Battery Board 2 or the 250V RMOV Boards 2A and 2B) will be taken to assure HPCI isolation. Adequate time is available for the operator to perform the required action.
HPCI	2-BDDD-281-0002B	2-3	3:34	10	Same as HPCI (2-BDDD-281-0002A)
1-FCV-074-0053	1-BDBB-268-0001A	1-2, 1-4	12:16	25	The 25 minute required time for opening of the LPCI injection valve is an approximation based on the analysis presented in Calculation MD-N0999-980113, Rev. 1, "Appendix R Fire Protection Evaluation". Adequate time is available for the operator to perform the required action.
1-FCV-074-0060	1-BDBB-268-0001A (BKR 06B)	1-4	9:15	20	Mitigate flow diversion prior to establishing LPCI injection (25 minutes). Adequate time is available for the operator to perform the required action. Additional margin of 5 minutes is available prior to LPCI start.
1-FCV-074-0061	1-BDBB-268-0001A (BKR 07B)	1-4	14	20	Same as 1-FCV-074-0060
1-FCV-074-0066	1-BDBB-268-0001B (BKR 03A)	1-5	14	20	Prevent spurious isolation of the LPCI injection path. Additional margin of 5 minutes is available prior to LPCI start.
1-FCV-074-0067	1-BDBB-268-0001B	1-1, 1-3, 1-5	15:38	25	The 25 minute required time for opening of the LPCI injection valve is an approximation based on the analysis presented in Calculation MD-N0999-980113, Rev. 1, "Appendix R Fire Protection Evaluation". Adequate time is available for the operator to perform the required action.

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 4 – Adequacy of Time Available to Perform the Manual Actions (Electrical Bld. Room Actions)

Component Requiring Manual Action	Location of Action	Actions required for Fire Zones	Demonstrated Time (m:s)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
1-FCV-074-0071	1-BDBB-268-0001B (BKR 11C)	1-3, 1-5	16	20	Same as 1-FCV-074-0060
1-FCV-074-0074	1-BDBB-268-0001B (BKR 10C)	1-3, 1-5	16	20	Same as 1-FCV-074-0060
2-FCV-074-0060	2-BDBB-268-0002A (BKR 13C)	2-1, 2-3, 2-4	14	20	Same as 1-FCV-074-0060
2-FCV-074-0061	2-BDBB-268-0002A (BKR 11E)	2-1, 2-3, 2-4	14	20	Same as 1-FCV-074-0060
2-FCV-074-0074	2-BDBB-268-0002B (BKR 14E)	2-4	14	20	Same as 1-FCV-074-0060
2-FCV-074-0075	2-BDBB-268-0002B (BKR 10E)	2-4	14	20	Same as 1-FCV-074-0060
1-PMP-074-0005 [1A]	0-BDAA-211-0000A (BKR 0018)	1-4	10:22	20	Due to concerns relating to the potential dead-head operation of the RHR pumps, which could be induced by a spurious RHR min-flow valve closure signal during an Appendix R event, the RHR pumps shall be started at the same time blow-down is initiated (or immediately prior to). This will minimize the potential for dead-head pump operation of greater than 7 and ½ minutes, which had been established as a maximum time limit per General Electric Calculation GE-NE E12-00171-00, Rev. 0, "RHR Pump Dead-head Evaluation". Adequate time is available for the operator to perform the required action.
1-PMP-074-0039 [1D]	0-BDAA-211-0000D (BKR 0016)	1-3	5:25	20	Same as 1-PMP-074-0005 [1A]
2-PMP-074-0039 [2D]	0-BDAA-211-0000D (BKR 0017)	2-1, 2-3, 2-4	5:25	20	Same as 1-PMP-074-0005 [1A]
3-PMP-074-0016 [3C]	3-BDAA-211-0003EB (BKR 0004)	3-2	9:30	20	Same as 1-PMP-074-0005 [1A]
3-PMP-074-0028 [3B]	3-BDAA-211-0003EC (BKR 0002)	3-3	13:27	20	Same as 1-PMP-074-0005 [1A]
2-BDDD-281-	2-BDDD-281-0002A	2-1, 2-2, 2-3, 2-	14	20	The Reactor Recirculation Pumps are tripped for two reasons: (1) to

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 4 – Adequacy of Time Available to Perform the Manual Actions (Electrical Bld. Room Actions)

Component Requiring Manual Action	Location of Action	Actions required for Fire Zones	Demonstrated Time (hrs)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
0002A	(BKR 01B1)	4, 2-6			assure the RHR pump being used can inject into the reactor vessels and (2) to assure core flow imbalances do not result. Pumps are tripped prior to LPCI start. Adequate time is available for the operator to perform the required action.
3-BDDD-281-0003A	3-BDDD-281-0003A	3-1, 3-2, 3-3	8:30	20	Same as 2-BDDD-281-0002A
1-PCV-001-0004	1-LPNL-925-0032	1-3, 1-5	6:51	10	One MSRV is assumed to open immediately due to a spurious opening signal generated as a result of the fire. The MSRV is reclosed at 10 minutes into the event due to the operator action. The operator initiates ADS (3 MSRVs at 20 minutes into the event). A minimum of three (3) main steam relief valves (MSRVs) are required for depressurization, while only one (1) MSRV is required to maintain the alternate shutdown cooling path. Once the reactor vessel has been depressurized, reactor pressure should be maintained greater than 100 psig to assure the alternate shutdown cooling path remains open and equal to or less than 215 psig to ensure continued LPCI system injection. Adequate time is available for the operator to perform the required action.
1-PCV-001-0005	1-LPNL-925-0032	1-3, 1-5	6:51	10	Same as 1-PCV-001-0004
1-PCV-001-0018	1-LPNL-925-0658	1-3, 1-5	6:51	10	Same as 1-PCV-001-0004
1-PCV-001-0019	1-LPNL-925-0658	1-3, 1-5	6:51	10	Same as 1-PCV-001-0004
1-PCV-001-0022	1-LPNL-925-0032	1-3, 1-5, 1-4	6:51	10	Same as 1-PCV-001-0004
1-PCV-001-0023	1-LPNL-925-0032	1-5	6:51	10	Same as 1-PCV-001-0004
1-PCV-001-0030	1-LPNL-925-0032	1-3, 1-5	6:51	10	Same as 1-PCV-001-0004
1-PCV-001-0031	1-LPNL-925-0658	1-3, 1-5	6:51	10	Same as 1-PCV-001-0004
1-PCV-001-0034	1-LPNL-925-0032	1-3, 1-5, 1-4	6:51	10	Same as 1-PCV-001-0004
1-PCV-001-0041	1-LPNL-925-0032	1-3, 1-5	6:51	10	Same as 1-PCV-001-0004
1-PCV-001-0042	1-LPNL-925-0032	1-5	6:51	10	Same as 1-PCV-001-0004
1-PCV-001-0179	1-LPNL-925-0658	1-3, 1-5	6:51	10	Same as 1-PCV-001-0004

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 4 – Adequacy of Time Available to Perform the Manual Actions (Electrical Bd. Room Actions)

Component Requiring Manual Action	Location of Action	Actions required for Fire/Zones	Demonstrated Time (m:s)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
1-PCV-001-0180	1-LPNL-925-0032	1-5	6:51	10	Same as 1-PCV-001-0004
0-PMP-023-0001 [A1]	0-BDAA-211-0000A (BKR 0010)	1-4	8	30	On the 4kV shutdown board supplying power to the required RHRSW pump (e.g. 4kV Shutdown Board D supplying RHRSW Pump D2), when the initial board alignment occurs for the RHR pump, the required RHRSW pump will be tripped off. Then, within 2 hours, the required RHRSW pump will be started. This will help to assure that minimum flow problems on the RHRSW pumps are avoided (reference Calculation MD-Q0023-880125, Rev. 4, "RHRSW Pump Minimum Flowrate Analysis"). Adequate time is available for the operator to perform the required action.
0-PMP-023-0008 [C1]	0-BDAA-211-0000B (BKR 0010)	1-3, 25-1	8	30	Same as 0-PMP-023-0001 [A1]
0-PMP-023-0012 [C2]	0-BDAA-211-0000B (BKR 0015)	25-1	3	30	Same as 0-PMP-023-0001 [A1]
0-PMP-023-0015 [B1]	3-BDAA-211-0003EC (BKR 0008)	25-11	3	30	Same as 0-PMP-023-0001 [A1]
0-PMP-023-0019 [B2]	0-BDAA-211-0000C (BKR 0016)	25-11	3	30	Same as 0-PMP-023-0001 [A1]
0-PMP-023-0027 [D2]	0-BDAA-211-0000D (BKR 0015)	2-3, 25-11	8	30	Same as 0-PMP-023-0001 [A1]
0-PMP-023-0085 [A3]	3-BDAA-211-0003EA (BKR 0005)	25-1	3	10	<p>All four EECW pumps will be started from the MCR for Fire Area 25 except for fires on EL 550 of the intake pumping station. If pumps B3 / D3 start, Division II is available and no fire will cause pumps B3 / D3 to trip off. If B3 / D3 do not start, Division I pumps A3 / C3 are available and must be started using their backup control circuitry. Using the backup control circuitry, spurious trip of the pumps is isolated.</p> <p>For a fire on EL 550 of the intake pumping station, pumps B3 / D3 may initially start, but their long-term operation cannot be assured. Thus, for fires on EL 550 of the intake pumping station, pumps A3 / C3 are</p>

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 4 -- Adequacy of Time Available to Perform the Manual Actions (Electrical Bld. Room Actions)

Component Requiring Manual Action	Location of Action	Actions required for Fire Zones	Demonstrated Time (min)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
					available and will be started using their backup control circuitry as described above. Adequate time is available for the operator to perform the required action.
0-PMP-023-0088 [B3]	0-BDAA-211-0000C (BKR 0009)	25-11	3	10	Same as 0-PMP-023-0085 [A3]
0-PMP-023-0091 [C3]	3-BDAA-211-0003EB (BKR 0010)	25-1	3	10	Same as 0-PMP-023-0085 [A3]
0-PMP-023-0094 [D3]	0-BDAA-211-0000D (BKR 0010)	25-11	3	10	Same as 0-PMP-023-0085 [A3]
0-FCV-067-0049	0-BDBB-219-0000A (BKR 12C)	1-1, 1-2, 1-3	16	20	Cooling to the diesel generators is established via EECW pumps start within 10 minutes (see above). Any flow diversion possibilities are corrected within 20 minutes prior to diesel loading with RHR pumps. Adequate time is available for the operator to perform the required action.
0-BATA-248-0000C	2-BDBB-268-0002A	1-3	21:45	60	Align to alternate battery charger feed. See detailed discussion below.
0-BATA-248-0001	0-CHGA-248-0002B	1-1	11	60	<p>The 250V DC battery chargers are required to support long-term battery requirements. These battery chargers are normally aligned to their respective battery board with Battery Charger 2B (0-CHGA-248-0002B) being an alternate. These chargers receive an automatic trip which must be reset at the charger with the emergency on / off switch.</p> <p>In addition, when Battery Charger 2B is to be used it must be properly aligned to the respective battery board. This alignment is accomplished by placing the output transfer switch (located at Battery Charger 2B) to the selected battery board and then positioning the associated breakers at the selected battery board. Adequate time is available for the operator to perform the required action.</p>
0-BATA-248-0002	0-CHGA-248-0002B	1-2, 1-3, 1-4, 1-5	11	60	Same as 0-BATA-248-0001

Table 4 – Adequacy of Time Available to Perform the Manual Actions (Electrical Bd. Room Actions)

Component Requiring Manual Action	Location of Action	Actions required for Fire Zones	Demonstrated Time (m:s)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
0-BATA-248-0003	0-CHGA-248-0002B	3-3	11	60	Same as 0-BATA-248-0001
0-BDAA-211-0000A	0-BDAA-211-0000A	1-1	3	10	Align alternate DC control power. Adequate time is available for the operator to perform the required action.
0-BDAA-211-0000A (Breakers 1614, 1716, 1818, 1824)	0-BDAA-211-0000A	1-1, 1-4, 2-3, 3-1, 3-2, 3-3	15	20	Precludes spurious actuations. Adequate time is available for the operator to perform the required action.
0-BDAA-211-0000B	0-BDAA-211-0000B	1-5, 2-5	3:45	20	Align alternate DC control power. Adequate time is available for the operator to perform the required action.
0-BDAA-211-0000B	0-BDAA-211-0000B	1-5	6:37	20	Board alignment and load shedding operation. Only credited Appendix R loads are connected to the 4kV Shutdown Boards and only at the timeframe specified. Non-Appendix R loads and non-credited Appendix R loads must be verified tripped or manually tripped during the initial alignment to the credited power supply (i.e., diesel generator) to maintain the basis for the APS calculation. Alignment of the electrical system to the credited diesel generators will be performed within t=20 minutes of a reactor trip.
0-BDAA-211-0000B (Breakers 1616, 1714, 1822, 1828,)	0-BDAA-211-0000B	1-3, 2-3, 2-4, 3-3	12	20	Precludes spurious actuations. Adequate time is available for the operator to perform the required action.
0-BDAA-211-0000C	0-BDAA-211-0000C	1-5, 2-5, 2-6	6:39	20	Align alternate DC control power. Adequate time is available for the operator to perform the required action.
0-BDAA-211-0000C	0-BDAA-211-0000C	2-4	13:45	20	Board alignment and load shedding operation. Same as 0-BDAA-211-0000B.
0-BDAA-211-0000C (Breakers 1624, 1718, 1812, 1814)	0-BDAA-211-0000C	1-1, 1-3, 2-4, 3-2, 3-3	7	20	Precludes spurious actuations. Adequate time is available for the operator to perform the required action.
0-BDAA-211-	0-BDAA-211-0000D	2-3, 2-4	11:40	20	Align alternate DC control power. Adequate time is available for the

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 4 – Adequacy of Time Available to Perform the Manual Actions (Electrical Bld. Room Actions)

Component Requiring Manual Action	Location of Action	Actions required for Fire Zones	Demonstrated Time (mins)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
0000D					operator to perform the required action.
0-BDAA-211-0000D (Breakers 1618, 1724, 1816, 1826)	0-BDAA-211-0000D	1-1, 1-2, 1-3, 1-4, 2-1, 2-2, 2-3, 2-4, 3-2, 3-3	5:25	20	Precludes spurious actuations. Adequate time is available for the operator to perform the required action.
0-BDDD-280-0001 (BKR 609)	0-BDDD-280-0001 (BKR 609)	1-1	9:26	20	Align alternate DC control power. Adequate time is available for the operator to perform the required action.
0-BDDD-280-0002	3-BDDD-281-0003A	3-2	8:30	20	Trip those loads associated with the Unit 3 HPCI system prior to transferring the 250V RMOV Board 3A to its alternate power supply. The basis for this action comes from Calculation ED-Q0248-2002-0042, Revision 5, "250V DC Unit Battery Load Study, VD, SC, and Battery Capacity for LOCA / LOOP, Station Blackout and Appendix R Analysis for Unit / Shutdown Board Batteries".
0-BDDD-280-0002 (BKR 607)	0-BDDD-280-0002 (BKR 607)	1-2, 1-3, 1-4, 1-5	16	20	Align alternate DC control power. Adequate time is available for the operator to perform the required action.
0-BDDD-280-0003	2-BDDD-281-0002A	2-4	13:45	20	Same as 0-BDDD-280-0002.
0-BDDD-280-0003 (BKR 609)	0-BDDD-280-0003 (BKR 609)	3-3	13:27	20	Align alternate DC control power. Adequate time is available for the operator to perform the required action.
0-BDDD-280-0003 (BKR 710)	0-BDDD-280-0003 (BKR 710)	1-1, 1-2, 1-3, 1-4, 1-5, 1-6, 2-1, 2-2, 2-3, 2-4, 2-5, 2-6, 3-1, 3-3, 3-4, 25-1, 25-11	16	20	The basis for this action comes from Calculation ED-Q0248-2002-0042, Revision 5, "250V DC Unit Battery Load Study, VD, SC, and Battery Capacity for LOCA / LOOP, Station Blackout and Appendix R Analysis for Unit / Shutdown Board Batteries". Adequate time is available for the operator to perform the required action.
0-CHGA-248-0001	0-CHGA-248-0001	1-2, 1-5, 1-6, 2-1, 2-2, 2-3, 2-4, 2-5, 2-6, 3-1, 3-3, 3-4, 25-1,	16	20	The Station Battery Chargers 1, 2A, 2B, and 3 receive an automatic trip on initiation of the load shed logic and must be reset with the Emergency On / Off Switch. Component may require resetting due to being load-shed on a loss of offsite power, not as a direct result of the

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 4—Adequacy of Time Available to Perform the Manual Actions (Electrical Bd. Room Actions)

Component Requiring Manual Action	Location of Action	Actions required for Fire Zones	Demonstrated Time (m:s)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
		25-11			fire. The requirements of Appendix R dictate that safe shutdown capability be demonstrated with and without offsite power available. Adequate time is available for the operator to perform the required action.
0-CHGA-248-0002A	0-CHGA-248-0002A	1-1, 1-6, 2-1, 2-2, 2-5, 2-6, 3-1, 3-2, 3-3, 3-4, 25-1, 25-11	16	60	Same as 0-CHGA-248-0001
0-CHGA-248-0002B	0-CHGA-248-0002B	1-1, 1-2, 1-3, 1-4, 1-5, 3-3	16	60	Same as 0-CHGA-248-0001
0-CHGA-248-0003	0-CHGA-248-0003	1-1, 1-2, 1-3, 1-4, 1-5, 1-6, 2-1, 2-2, 2-3, 2-4, 2-5, 2-6, 3-1, 3-4, 25-1, 25-11	16	60	Same as 0-CHGA-248-0001
0-GEN-082-000A	0-BDAA-211-0000A	2-1	4:04	10	Isolate and trip breakers. The basis for this manual action is in Calculation ED-Q0999-2003-0055, Rev. 2, "Unit 1,2,3 Appendix R - Auxiliary Power System Alignments and Diesel Generator Loading". Adequate time is available for the operator to perform the required action.
0-GEN-082-000A	0-BDAA-211-0000A	1-2, 2-4, 3-3, 25-1, 25-11	12	20	Same as 0-GEN-082-000A.
0-GEN-082-000B	0-BDAA-211-0000B	1-5, 2-1, 2-3,	6:51	10	Same as 0-GEN-082-000A.
0-GEN-082-000B	0-BDAA-211-0000B	2-4, 3-3, 25-1, 25-11	12:06	20	Same as 0-GEN-082-000A.
0-GEN-082-000C	0-BDAA-211-0000C	2-4	6	10	Same as 0-GEN-082-000A.
0-GEN-082-000C	0-BDAA-211-0000C	25-11	5:20	20	Same as 0-GEN-082-000A.
0-GEN-082-000D	0-BDAA-211-0000D	2-3, 2-4	4:58	10	Same as 0-GEN-082-000A.
0-GEN-082-000D	0-BDAA-211-0000D	25-11	5:20	20	Same as 0-GEN-082-000A.
3-GEN-082-	3-BDAA-211-	3-1, 3-2	5:42	10	Same as 0-GEN-082-000A.

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 4 – Adequacy of Time Available to Perform the Manual Actions (Electrical Bd. Room Actions)

Component Requiring Manual Action	Location of Action	Actions required for Fire Zones	Demonstrated Time (m:s)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
0003A	0003EA				
3-GEN-082-0003A	3-BDAA-211-0003EA	3-1, 3-2	17:22	20	Same as 0-GEN-082-000A.
3-GEN-082-0003A	0-BDAA-211-0000A	1-1	4:27	20	Same as 0-GEN-082-000A.
3-GEN-082-0003A	0-BDAA-211-0000A	1-4	4:16	20	Same as 0-GEN-082-000A.
3-GEN-082-0003A	0-BDAA-211-0000A	2-3	7:15	20	Same as 0-GEN-082-000A.
3-GEN-082-0003A	0-BDAA-211-00003EA	25-11	7:36	20	Same as 0-GEN-082-000A.
3-GEN-082-0003B	3-BDAA-211-0003EB	3-3	2:56	10	Same as 0-GEN-082-000A.
3-GEN-082-0003B	3-BDAA-211-0003EB	3-2, 3-3	8:45	20	Same as 0-GEN-082-000A.
3-GEN-082-0003B	0-BDAA-211-0000B	1-3	16	20	Same as 0-GEN-082-000A.
3-GEN-082-0003B	3-BDAA-211-0003EB	3-2	8:45	20	Same as 0-GEN-082-000A.
3-GEN-082-0003C	3-BDAA-211-0003EC	3-3	8:45	20	Same as 0-GEN-082-000A.
3-GEN-082-0003C	0-BDAA-211-0000C	1-3	16	20	Same as 0-GEN-082-000A.
3-GEN-082-0003C	3-BDAA-211-0003EC	3-3	8:45	20	Same as 0-GEN-082-000A.
3-GEN-082-0003C	3-BDAA-211-0003EC	25-1, 25-11	7:36	20	Same as 0-GEN-082-000A.
3-GEN-082-0003D	0-BDAA-211-0000D	1-1, 1-2, 1-3, 1-4, 2-1,	16	20	Same as 0-GEN-082-000A.
3-GEN-082-	3-BDAA-211-	1-1, 1-2, 1-3, 1-	16	20	Same as 0-GEN-082-000A.

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 4 – Adequacy of Time Available to Perform the Manual Actions (Electrical Bld. Room Actions)

Component Requiring Manual Action	Location of Action	Actions required for Fire Zones	Demonstrated Time (m:s)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
0003D	0003ED	4, 2-1,			
3-GEN-082-0003D	3-BDAA-211-0003ED	25-1, 25-11	7:36	20	Same as 0-GEN-082-000A.
1-BDBB-231-0001A	1-BDBB-231-0001A	1-5	9:11	20	Power alignments for 480V SDBDs. The basis for this manual action is in Calculation ED-Q0999-2003-0055, Rev. 2, "Unit 1,2,3 Appendix R - Auxiliary Power System Alignments and Diesel Generator Loading". Adequate time is available for the operator to perform the required action
1-BDBB-231-0001A	1-BDBB-231-0001A	1-5	13:48	20	Same as 1-BDBB-231-0001A
1-BDBB-231-0001B	1-BDBB-231-0001B	1-3, 2-5, 2-6	16	20	Same as 1-BDBB-231-0001A
1-BDBB-231-0001B	1-BDBB-231-0001B	2-5	16:15	20	Same as 1-BDBB-231-0001A
1-BDBB-231-0001B	1-BDBB-231-0001B	1-3	16	20	Same as 1-BDBB-231-0001A
1-BDBB-268-0001B	1-BDBB-268-0001B	1-5	13:48	20	Same as 1-BDBB-231-0001A
1-BDBB-268-0001B	1-BDBB-231-0001A (BKR 03B)	1-5	13:48	20	Same as 1-BDBB-231-0001A
1-BDDD-281-0001A	1-BDDD-281-0001A	1-4	9:15	20	Power alignments for 250V RMOV Boards. The basis for this manual action is in Calculation ED-Q0999-2003-0055, Rev. 2, "Unit 1,2,3 Appendix R - Auxiliary Power System Alignments and Diesel Generator Loading". Adequate time is available for the operator to perform the required action
1-BDDD-281-0001B	1-BDDD-281-0001B	1-1, 1-2, 2-1, 2-2, 25-1, 25-11	16	20	Same as 1-BDDD-281-0001A
2-BDDD-281-0002A	2-BDDD-281-0002A	2-4	13:45	20	Same as 1-BDDD-281-0001A
2-BDDD-281-	2-BDDD-281-0002B	3-2, 3-3	8:45	20	Same as 1-BDDD-281-0001A

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 4 – Adequacy of Time Available to Perform the Manual Actions (Electrical Bld. Room Actions)

Component Requiring Manual Action	Location of Action	Actions required for Fire Zones	Demonstrated Time (m:s)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
0002B					
1-LPNL-925-0032	1-LPNL-925-0032	1-3	16	20	Align to alternate power supply. The basis for this manual action is in Calculation ED-Q0999-2003-0055, Rev. 2, "Unit 1,2,3 Appendix R - Auxiliary Power System Alignments and Diesel Generator Loading". Check calc.
2-BDBB-231-0002A	2-BDBB-231-0002A	2-5	16:15	20	Power alignments for 480V SDBDs. The basis for this manual action is in Calculation ED-Q0999-2003-0055, Rev. 2, "Unit 1,2,3 Appendix R - Auxiliary Power System Alignments and Diesel Generator Loading". Check calc. Adequate time is available for the operator to perform the required action
2-BDBB-231-0002A	2-BDBB-231-0002A	2-4, 2-5	16	20	Same as 2-BDBB-231-0002A
2-BDBB-231-0002A	2-BDBB-231-0002A	2-4	13:45	20	Same as 2-BDBB-231-0002A
2-BDBB-231-0002A	2-BDBB-231-0002A	2-5	16:15	20	Same as 2-BDBB-231-0002A
2-BDBB-231-0002A	2-BDBB-231-0002A	2-3	21:58	60	Same as 2-BDBB-231-0002A
2-BDBB-231-0002A	0-BDAA-211-0000B (BKR 0005)	2-4	31:15	60	Close normal feeder breaker from 0-BDAA-211-0000B. These actions have been identified as an additional level of assurance to preclude the occurrence of multiple high impedance faults on the subject boards (reference Calculation ED-Q2999-880574, Rev. 8, "Class 1E Electrical Boards Margin Study for 4kV, 480V, 120VAC, & 250V, 125V, 24VDC Systems" and Calculation ED-Q3999-920253 Rev. 4, "Appendix R – Margin Study for Required AC & DC Power Distribution Boards/Panels"). Adequate time is available for the operator to perform the required action
2-BDBB-231-0002A	2-BDBB-231-0002A	2-4	31:15	60	Same as 2-BDBB-231-0002A
2-BDBB-231-0002A	2-BDBB-231-0002A	2-4	31:15	60	Remove non required loads. Same as 2-BDBB-231-0002A

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 4—Adequacy of Time Available to Perform the Manual Actions (Electrical Bd. Room Actions)

Component Requiring Manual Action	Location of Action	Actions required for Fire Zones	Demonstrated Time (m:s)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
2-BDDB-231-0002B	2-BDDB-231-0002B	2-4	13:45	20	Power alignments for 480V SDBDs. The basis for this manual action is in Calculation ED-Q0999-2003-0055, Rev. 2, "Unit 1,2,3 Appendix R - Auxiliary Power System Alignments and Diesel Generator Loading". Adequate time is available for the operator to perform the required action
2-BDDB-231-0002B	0-BDDD-280-0003 (BKR 708)	2-3, 2-4	13:45	20	This action is required due to the possibility of a spurious operation of the DC control power transfer switch followed by the subsequent loss of the alternate DC power feed. By opening the alternate DC power feeder breaker, the potential spurious operation of the transfer switch is defeated since the transfer will occur only when the alternate power source is available. Adequate time is available for the operator to perform the required action
2-BDDB-231-0002B	2-BDDB-231-0002B	2-4	13:45	20	Power alignments for 480V SDBDs. The basis for this manual action is in Calculation ED-Q0999-2003-0055, Rev. 2, Adequate time is available for the operator to perform the required action
2-BDDB-231-0002B	2-BDDB-231-0002B	2-5	16:15	20	Same as 2-BDDB-231-0002B for Power alignments for 480V SDBDs.
2-BDDB-231-0002B	2-BDDB-231-0002B	2-3	13:10	20	Same as 2-BDDB-231-0002B for Power alignments for 480V SDBDs.
2-BDDB-231-0002B	2-BDDB-231-0002B	2-4	13:45	20	Same as 2-BDDB-231-0002B for Power alignments for 480V SDBDs.
2-BDDB-268-0002A	2-BDDB-268-0002A	2-5	11:30	20	480V RMOV Bd. Power alignments. Remove non-required loads, high impedance faults, etc. Adequate time is available for the operator to perform the required action
2-BDDB-268-0002A	2-BDDB-231-0002A	2-1, 2-2, 2-3, 2-4, 2-5, 2-6	16	20	Loads removed from the 480V RMOV Boards. These actions have been identified as an additional level of assurance to preclude the occurrence of multiple high impedance faults on the subject boards (reference Calculation ED-Q2999-880574, Rev. 8, "Class 1E Electrical Boards Margin Study for 4kV, 480V, 120VAC, & 250V, 125V, 24VDC Systems" and Calculation ED-Q3999-920253 Rev. 4,

Table 4 – Adequacy of Time Available to Perform the Manual Actions (Electrical Bd. Room Actions)

Component Requiring Manual Action	Location of Action	Actions required for Fire Zones	Demonstrated Time (m:s)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
					"Appendix R – Margin Study for Required AC & DC Power Distribution Boards/Panels".)
2-BDBB-268-0002A	2-BDBB-231-0002A	2-1, 2-2, 2-4, 2-6,	16	20	480V RMOV Bd. Power alignments. Remove non-required loads, high impedance faults, etc. Adequate time is available for the operator to perform the required action.
2-BDBB-268-0002A	2-BDBB-231-0002B	1-3	21:45	60	480V RMOV Bd. Power alignments. Remove non-required loads, high impedance faults, etc. Adequate time is available for the operator to perform the required action.
2-BDBB-268-0002A	2-BDBB-268-0002A	1-3	21:45	60	480V RMOV Bd. Power alignments. Remove non-required loads, high impedance faults, etc. Adequate time is available for the operator to perform the required action.
2-BDBB-268-0002A	2-BDBB-268-0002A	1-3	21:45	60	480V RMOV Bd. Power alignments. Remove non-required loads, high impedance faults, etc. Adequate time is available for the operator to perform the required action.
2-BDBB-268-0002B	2-BDBB-268-0002B	2-1	15:43	60	480V RMOV Bd. Power alignments. Remove non-required loads, high impedance faults, etc. Adequate time is available for the operator to perform the required action.
2-BDBB-268-0002B	2-BDBB-268-0002B	2-1, 2-3, 2-5, 2-6	16	20	480V RMOV Bd. Power alignments. Remove non-required loads, high impedance faults, etc. Adequate time is available for the operator to perform the required action.
2-BDBB-268-0002B	2-BDBB-268-0002B	2-1, 2-3, 2-4, 2-6	16	20	480V RMOV Bd. Power alignments. Remove non-required loads, high impedance faults, etc. Adequate time is available for the operator to perform the required action.
2-BDBB-268-0002B	2-BDBB-268-0002B	2-3	13:10	60	480V RMOV Bd. Power alignments. Remove non-required loads, high impedance faults, etc. Adequate time is available for the operator to perform the required action.
3-BDBB-268-0003A	3-BDBB-268-0003A	3-2, 3-3, 3-4	16:15	20	Manually shed non-Appendix R loads.
3-BDBB-268-0003A	3-BDBB-268-0003A	3-2, 3-3, 3-4	16:30	60	480V RMOV Bd. Power alignments. Remove non-required loads, high impedance faults, etc. Adequate time is available for the operator to

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 4 – Adequacy of Time Available to Perform the Manual Actions (Electrical Bd. Room Actions)

Component Requiring Manual Action	Location of Action	Actions required for Fire Zones	Demonstrated Time (m:s)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
					perform the required action.
3-BDBB-268-0003A	3-BDBB-268-0003A	3-3, 3-4	16:15	20	Manually shed non-Appendix R loads.
3-BDBB-268-0003B	3-BDBB-268-0003B	3-1, 3-3, 3-4	16:30	60	480V RMOV Bd. Power alignments. Remove non-required loads, high impedance faults, etc. Adequate time is available for the operator to perform the required action.
3-BDBB-268-0003B	3-BDBB-268-0003B	3-1, 3-3	16:15	20	Manually shed non-Appendix R loads.
3-BDBB-268-0003B	3-BDBB-268-0003B	3-3, 3-4	16:15	20	Manually shed non-Appendix R loads.
3-BDAA-211-0003EA	3-BDAA-211-0003EA	1-3, 1-4	4:30	10	Align to alternate control power DC. Adequate time is available for the operator to perform the required action.
3-BDAA-211-0003EA	3-BDAA-211-0003EA	3-1, 3-2, 25-1, 25-11	7:36	20	Isolate breaker to mitigate closure. 4kV Bd. 3EA power alignments. Adequate time is available for the operator to perform the required action.
3-BDAA-211-0003EB	3-BDAA-211-0003EB (BKR 0009)	3-3	8:45	20	Isolate breaker to mitigate closure. 4kV Bd. 3EB power alignments. Adequate time is available for the operator to perform the required action.
3-BDAA-211-0003EB	3-BDAA-211-0003EB	3-2, 3-3, 25-1, 25-11	8:45	20	Isolate breaker to mitigate closure. 4kV Bd. 3EB power alignments. Adequate time is available for the operator to perform the required action.
3-BDAA-211-0003EC	3-BDAA-211-0003EC	3-1, 3-3, 25-1, 25-11	7:36	20	Isolate breaker to mitigate closure. 4kV Bd. 3EC power alignments. Adequate time is available for the operator to perform the required action.
3-BDAA-211-0003ED	3-BDAA-211-0003ED	2-3, 2-4, 3-1	7:36	20	Isolate breaker to mitigate closure. 4kV Bd. 3ED power alignments. Adequate time is available for the operator to perform the required action.
3-BDAA-211-0003ED	3-BDAA-211-0003ED	3-1, 25-1, 25-11	7:36	20	Isolate breaker to mitigate closure. 4kV Bd. 3ED power alignments. Adequate time is available for the operator to perform the required action.

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 4 – Adequacy of Time Available to Perform the Manual Actions (Electrical Bd. Room Actions)

Component Requiring Manual Action	Location of Action	Actions required for Fire Zones	Demonstrated Time (m:s)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
3-BDBB-219-0003EA	3-BDBB-219-0003EA	3-3	13:27	20	480V Diesel Aux. Board. Align to the alternate power supply. Adequate time is available for the operator to perform the required action.
3-BDBB-231-0003A	3-BDBB-231-0003A	3-3, 3-4	4:47	20	480V SDBD 3A alternate power alignments and removing non-required loads. Adequate time is available for the operator to perform the required action.
3-BDBB-231-0003A	3-BDBB-231-0003A	3-3, 3-4	4:47	20	480V SDBD 3A alternate power alignments and removing non-required loads. Adequate time is available for the operator to perform the required action.
3-BDBB-231-0003A	3-BDBB-231-0003A	1-3, 1-4	4:47	20	480V SDBD 3A alternate power alignments and removing non-required loads. Adequate time is available for the operator to perform the required action.
3-BDBB-231-0003A	3-BDBB-231-0003A	3-3, 3-4	5:32	60	480V SDBD 3A. Remove non-required Appendix R loads. Adequate time is available for the operator to perform the required action.
3-BDBB-231-0003A	3-BDBB-231-0003A	3-3	5:32	60	480V SDBD 3A. Isolate, transfer control and locally operate breaker 1C and 8C. Adequate time is available for the operator to perform the required action.
3-BDBB-231-0003B	3-BDBB-231-0003B	3-3, 3-4	16:15	20	480V SDBD 3B, power alignments. Adequate time is available for the operator to perform the required action.
3-BDBB-231-0003B	3-BDBB-231-0003B	3-4	16:30	60	480V SDBD 3B, loads. Remove non-required loads. Adequate time is available for the operator to perform the required action.
3-BDBB-231-0003B	3-BDBB-231-0003B	3-3	16:15	20	480V SDBD 3B, remove non-required. Adequate time is available for the operator to perform the required action.
3-BDBB-231-0003B	3-BDBB-231-0003B	3-3	16:15	20	480V SDBD 3B, isolate, transfer control and locally operate breaker 1C, 8C. Adequate time is available for the operator to perform the required action.
3-BDBB-231-0003B	3-BDBB-231-0003B	2-2	12:11	60	480V SDBD 3B, manually shed non-Appendix R loads. Adequate time is available for the operator to perform the required action.
3-BDDD-281-0003A	3-BDDD-281-0003A	3-2	8:30	20	250V RMOV Bd. 3A, power alignment. Adequate time is available for the operator to perform the required action.

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 4 – Adequacy of Time Available to Perform the Manual Actions (Electrical Bld. Room Actions)

Component Requiring Manual Action	Location of Action	Actions required for Fire Zones	Demonstrated Time (m:s)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
3-BDDD-281-0003B	3-BDDD-281-0003B	1-3, 1-4, 1-5, 2-5, 3-3, 3-4	16:15	20	250V RMOV Bd. 3B, power alignment. Adequate time is available for the operator to perform the required action.

1. Demonstrated time is based on area specific SSIs. However, maximum demonstrated time from Attachment 2 may have been used instead. The listed action was always completed by the listed demonstrated time.

Table 5 – Adequacy of Time Available to Perform the Manual Actions (Reactor Building Actions)

Location of Action (Fire Zone)	Description of Action	Actions required for Fire Zones	Demonstrated Time (m:s)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
1-VTV-032-5103 (1-5, El 621)	Open vent valve to manually close FCV-069-0094 (RWCU Isolation)	1-3, El 593	21:45	30	In each Fire Area / Fire Zone, except 01-03, 01-05, 04, and 16, valve 1-FCV-069-0002 will be closed from the main control room in 30 minutes. For Fire Zone / Fire Area 01-03, 01-05, and 16, neither valve 1-FCV-069-0002 or -0001 can be assured available to isolate the RWCU system. Manual operator action to close 1-FCV-069-0094 by opening the valve actuator vent valve, 1-VTV-032-5103 in 30 minutes will ensure RWCU isolation. Adequate time is available for the operator to perform the required action.
2-VTV-032-5103 (2-5, El 621)	Open vent valve to manually close FCV-069-0094 (RWCU Isolation)	2-4, El 593	22:15	30	For Fire Zones 02-04 and 16, neither valve 2-FCV-069-0001 or -0002 can be assured to be available to isolate the RWCU system. Manual operator action to close 2-FCV-069-0094 by opening the valve actuator vent valve, 2-VTV-032-5103, will ensure RWCU isolation within 30 minutes. Adequate time is available for the operator to perform the required action.

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 5 – Adequacy of Time Available to Perform the Manual Actions (Reactor Building Actions)

Location of Action (Fire Zone)	Description of Action	Actions required for Fire Zones	Demonstrated Time (m:s)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
3-VTV-032-5103 (3-4, El 621)	Open vent valve to manually close FCV-069-0094 (RWCU Isolation)	3-3, El 593	16:06	30	For Fire Zone / Fire Area 03-03 and 16, neither valve 3-FCV-069-0002 or -0001 can be assured available to isolate the RWCU system. Manual operator action to close 3-FCV-069-0094 by opening the valve actuator vent valve, 3-VTV-032-5103, will ensure RWCU isolation within 30 minutes. Adequate time is available for the operator to perform the required action.
2-BDBB-268-0002D (BKR 02C) (2-4, El 593)	Isolate valve to preclude closure by the Appendix R emergency switch. (RHR LPCI injection 2-FCV-074-0053)	2-2, El 565, El 519 2-5, El 621	15:58 18:45	25	Where manual operator action is required for LPCI injection valve FCV-074-0053 or FCV-074-0067, the emergency switches (located at 480V RMOV Boards D and E respectively for Units 2 and 3, and located at 480V RMOV Boards A and B respectively for Unit 1) are to be used to open the valve locally. The 25 minute required time for opening of the LPCI injection valve is an approximation based on the analysis presented in Calculation MD-N0999-980113, Rev. 1, "Appendix R Fire Protection Evaluation". The actual time requirement is the time at which the pressure permissive is reached for opening of the LPCI injection valve based on initiating reactor depressurization with three (3) MSRVs by 20 minutes. Adequate time is available for the operator to perform the required action.
2-BDBB-268-0002E (BKR 02C) (2-5, El 621)	Isolate valve to preclude closure by the Appendix R emergency switch. (RHR LPCI injection 2-FCV-074-0067)	2-1, El 565, 519 2-3, El 593 2-4, El 593	15:39 15:40 15:50	25	Same as 2-FCV-074-0053
3-BDBB-268-0003D (3-3, El 593)	Isolate valve to preclude closure by the Appendix R emergency switch. (RHR LPCI injection 3-FCV-074-0053)	3-2, El 565, 519	15	25	Same as 2-FCV-074-0053
3-BDBB-268-0003E	Isolate valve to	3-1, El 565, 519,	11:15	25	Same as 2-FCV-074-0053

Table 5: Adequacy of Time Available to Perform the Manual Actions (Reactor Building Actions)

Location of Action (Fire Zone)	Description of Action	Actions required for Fire Zones	Demonstrated Time (mins)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
(3-4, EI 621)	preclude closure by the Appendix R emergency switch. (RHR LPCI injection 3-FCV-074-0067)	639 3-3, EI 593	14:32		
2-VFD-068-2002 (2-6, EI 639)	Stop pump using E-Stop. Action to trip recirculation pump, 2-PMP-068-0060A	2-5, EI 621	8	20	The Reactor Recirculation Pumps are tripped for two reasons: (1) to assure the RHR pump being used can inject into the reactor vessels and (2) to assure core flow imbalances do not result. These pumps are required to be tripped by manual operation action at the VFD E-Stop or the supply breaker(s) (e.g., the RPT Boards), or from the Main Control Room (for Unit 1 only, for remote trip and lockout of the Unit 1 RR Boards). The RPT Board DC control power must be removed from the manually tripped supply breaker(s) in order to preclude spurious closure. If the RPT Board breakers are tripped prior to the removal of DC control power, the RPT Board breakers must be re-verified open to ensure they did not spuriously recluse. When stopping the Recirc Pump using the VFD E-Stop, the RPT DC control power need not be removed. Adequate time is available for the operator to perform the required action.
RPT-2-II (BKR 1452), 2-5, EI 621	Manually trip breaker. Action to trip recirculation pump, 2-PMP-068-0060A	2-1, EI 565, 519 2-2, EI 565, EI 519 2-3, EI 593 North Side 2-4, EI 593, South Side 2-6, EI 639	7:15 7:15 13:10 13:45 9:09	20	Same as 2-PMP-068-0060A
2-VFD-068-2112, (2-6, EI 639)	Stop pump using E-Stop. Action to trip recirculation pump, 2-PMP-068-0060B	2-5, EI 621	8	20	Same as 2-PMP-068-0060A

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 5 - Adequacy of Time Available to Perform the Manual Actions (Reactor Building Actions)

Location of Action (Fire Zone)	Description of Action	Actions required for Fire Zones	Demonstrated Time (m:s)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
RPT-2-II (BKR 1552), 2-5, El 621	Manually trip breaker. Action to trip recirculation pump, 2-PMP-068-0060B	2-1, El 565, 519 2-2, El 565, El 519 2-3, El 593 North Side 2-4, El 593, South Side 2-6, El 639	7:15 7:15 13:10 13:45 9:09	20	Same as 2-PMP-068-0060A
RPT BD 3-II (3-4, El 621)	Manually trip breaker. Action to trip recirculation pump, 3-PMP-068-0060A	3-1, El 565, 519, 639 3-2, El 565, 519 3-3, El 593	9:15 11:00 12:42	20	Same as 2-PMP-068-0060A
RPT BD 3-II (3-4, El 621)	Manually trip breaker. Action to trip recirculation pump, 3-PMP-068-0060B	3-1, El 565, 519, 639 3-2, El 565, 519 3-3, El 593	9:15 11:00 12:42	20	Same as 2-PMP-068-0060A
0-BDBB-219-0000A (BKR 12C) Diesel Aux. Bd A (unit 1 & 2 DGB, Fire area 20, EL 583)	Prevent EECW / RHRSW south header intertie valve 0-FCV-067-0049 spurious opening. Open breaker.	1-1, El 565 1-2, El 565 1-3, El 593	16	20	This action is to prevent flow diversion of cooling water from one to the other header. Adequate time is available for the operator to perform the required action.
0-FCV-067-0049 (Intake Pump station Pump comp. C, Fire area 25, EL 565)	Prevent EECW / RHRSW south header intertie valve spurious opening. Close valve manually.	1-1, El 565 1-2, El 565 1-3, El 593	17	20	This action is to prevent flow diversion of EECW cooling water from one to the other header. Adequate time is available for the operator to perform the required action.
1-BDDD-281-0001C, 250V DC	Align to the alternate power supply 0-	1-2, El 565, 519 2-1, El 565, 519	7:55	20	Alternate power supply alignment. Adequate time is available for the operator to perform the required action.

Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas Operator Manual Actions (OMA)

Table 5 – Adequacy of Time Available to Perform the Manual Actions (Reactor Building Actions)

Location of Action (Fire Zone)	Description of Action	Actions required for Fire Zones	Demonstrated Time (m:s)	Required Time (Min)	Technical Basis, Feasibility and Reliability Assessment
RMOV Board 1C (Fire zone 1-1)	BDDD-280-0001, DC Battery board 1.	2-3, EI 593			
3-BDDD-281-0003C, 250V DC RMOV Board 3C (Fire zone 3-1)	Align to the alternate power supply 0-BDDD-280-0003, DC Battery board 3.	2-2, EI 565, EI 519 2-3, EI 593 North Side 2-4, EI 593, South Side	14	20	Alternate power supply alignment. Adequate time is available for the operator to perform the required action.
2-BDBB-268-0002C, 480V RMOV Bd. 2C (Fire zone 2-2, EL 565)	Remove non-Appendix R loads to prevent diesel and or 4kV/480V transformer overload.	1-3, EI 593	19:30	60	The basis for this manual action is in Calculation ED-Q0999-2003-0055, Rev. 2, "Unit 1,2,3 Appendix R - Auxiliary Power System Alignments and Diesel Generator Loading". This is the APS Electrical Loading Calculation in support of the combined Unit 1, 2, and 3 2003 baseline Appendix R computer separation analysis, Calculation ED-Q0999-2003-0037, Rev. 3, "Appendix R Computerized Separation Analysis" (Units 1, 2, and 3). Adequate time is available for the operator to perform the required action.
2-BDBB-268-0002D (Fire zone 2-4, EL 593)	Align to alternate power 2-BDBB-268-0002C (BKR R7B)	2-5 EI 621	16	20	Alternate power supply alignment. Adequate time is available for the operator to perform the required action.

2. Demonstrated time is based on area specific SSIs. However, maximum demonstrated time from Attachment 2 may have been used instead. The listed action was always completed by the listed demonstrated time.

**Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas
Operator Manual Actions (OMA)**

3.4 Plant Procedures

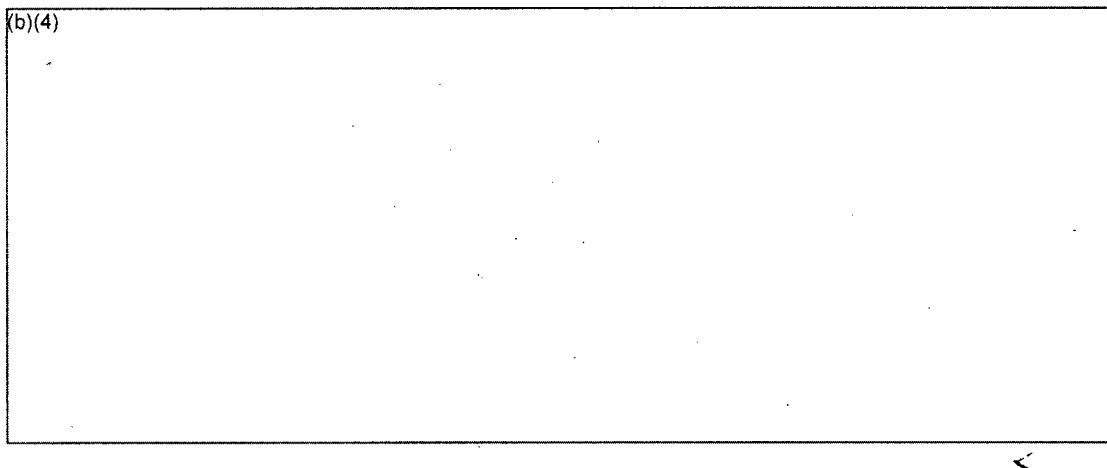
Detailed post-fire safe shutdown procedures have been developed. These procedures, referred to as Safe Shutdown Instructions (SSI), provide instructions to the operator with the equipment and actions necessary to shutdown the plant in the event of a fire in any area of the plant. All operators are periodically trained to perform the SSIs with special emphasis on procedures involving complex actions and time critical steps (e.g. the main control room fire). The process involves a walkthrough from the control room (or other locations) to where the action is being performed. The operator remains in constant communication with the main control room during this period. Performance of the action has to be clearly demonstrated in a timely manner. Any required tools or replacement parts (e.g. breaker racking tool) are made available locally. Breathing apparatus, if necessary are donned during this exercise. Each shift is fully staffed to perform the required post-fire safe shutdown actions per the SSI. The procedures are reviewed by Independent Qualified Reviewers (IQR) to ensure each required action was incorporated into the procedures and reviewed by procedure sponsors, with comments incorporated at each process phase, if required.

3.5 Staffing

The staffing levels are adequate to implement the three units Safe Shutdown Instructions (SSI). Staff needed to implement Appendix R manual actions is within that specified by BFN Tech Specs. The staffing level consists of 1 Shift Manager, 3 Unit SROs, 6UOs, 8AUOs, with the incident commander position filled by another qualified individual. The staffing level designates an SRO for each unit, two UOs per unit to accommodate the additional MCR board actions for load shed/diesel generator operation, and eight AUOs allows implementation of the field manual actions as well as any ventilation system alignments that may be required by O-AOI-26-1, as requested by Fire Captain or Incident Commander to facilitate smoke/gas removal, prior to entering the SSIs.

4.0 HVAC Actions

(b)(4)



**Browns Ferry Nuclear Plant (BFN) Exemption Request for Appendix R III.G.2 Areas
Operator Manual Actions (OMA)**

(b)(4)

D
3.1

Exempt

4

5.0 Conclusion

The above analysis shows that operator manual actions required to achieve and maintain hot shutdown conditions are not affected by environmental factors associated with fires in Appendix R III.G.2 areas. The functionality of equipment and cables needed to implement operator actions are not affected by fire environment and the equipment remains accessible. Adequate plant procedures and staffing is provided to implement operator actions. Realistic plant demonstrations and adequate time margin shows that operator manual actions are feasible and reliable. The evaluation demonstrates that BFN meets the underlying purpose and intent of Appendix R III.G.2 rules.

6.0 References

1. Browns Ferry Nuclear Plant, Fire Protection Report, Volume 1
2. Calculation ED-Q0999-2003-0048 R6, Unit 1, 2 and 3 Appendix R manual Action Requirement
3. BWR Generic Multiple Spurious Operation (MSO) list (Prepared by BWROG)
4. NRC-NEI Meeting on Deterministic Post-Fire Safe Shutdown Methodology, May 7, 2008, (SECY-08-0093)
5. NRC Generic Letter 81-12
6. Calculation ND-Q0999-2008-0001 "Appendix R TMG Analysis for Loss of HVAC", Loss of HVAC to EBR and MCB
7. Calculation MD-N0026-9100163 "Combustible Load Table"
8. SER dated November 2, 1995, Subject: Safety Evaluation of Post-fire Safe Shutdown capability and issuance of Technical Specification Amendments for Browns Ferry Nuclear Plant Units 1, 2, and 3 (ML020040025).

R1

R1

Calculation: ND-Q0999-2008-0007	Rev.: 1	Plant: BFN	Attachment 1
Title: Appendix R III.G.2 Manual Action Feasibility Evaluation			Sheet 1

Attachment 1

List of Time Critical Operator Manual Actions

Ex. 4
all

Pages 78 through 120 redacted for the following reasons:

(b)(4)

Calculation: ND-Q0999-2008-0007	Rev.: 1	Plant: BFN	Attachment 2
Title: Appendix R III.G.2 Manual Action Feasibility Evaluation			Sheet 1

Attachment 2

Verification and Validation of Appendix R Manual Actions

Ex 4
all

Pages 122 through 214 redacted for the following reasons:

(b)(4)