

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

400 Chestnut Street Tower II

March 7, 1983

Director of Licensing  
Attention: Mr. Domenic B. Vassallo, Chief  
Operating Reactors Branch No. 2  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Dear Mr. Vassallo:

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

Please reference your letter to H. G. Parris dated January 11, 1983, subject, "Safety Evaluation for Environmental Qualification of Safety-Related Electrical Equipment" and L. M. Mills' letter to you dated February 28, 1983. Enclosed is our response regarding item 87 (presented in Franklin Research Center's Technical Evaluation Report (TER)) for which justification for continued operation was not previously submitted.

If you have any questions, please call Jim Domer at FTS 858-2725.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

*D S Kammer*

D. S. Kammer  
Nuclear Engineer

Subscribed and sworn to before  
me this 7<sup>th</sup> day of March 1983.

*Paulette H. White*  
Notary Public  
My Commission Expires 9-5-84

Enclosure  
cc: See page 2

*A046*

Mr. D. B. Vassallo

March 7, 1983

cc (Enclosure):

U.S. Nuclear Regulatory Commission  
Region II  
ATTN: James P. O'Reilly, Regional Administrator  
101 Marietta Street, N.W., Suite 2900  
Atlanta, Georgia 30303

Mr. R. J. Clark  
Browns Ferry Project Manager  
U.S. Nuclear Regulatory Commission  
7920 Norfolk Avenue  
Bethesda, Maryland 20814

## BROWNS FERRY UNITS 1 AND 2

### Justification for Continued Operation

#### TER Equipment Item No. 87

#### Resolution of Deficiency

TER item 87 concerns General Electric series 100 modular electrical penetrations in the drywell room 0. There are three of this type penetration in both the unit 1 and unit 2 drywells. The TVA penetration designations are EA, EF, and EG, for each unit and the penetrations are used for low voltage power and control circuitry. The deficiencies noted in the TER are:

1. Criteria regarding spray not satisfied (not addressed).
2. Criteria regarding irradiation not satisfied (test irradiation is less than identified by TVA SCEW sheet for gamma and beta plateout not considered.)

The GE series 100 penetrations have substantial steel junction boxes mounted on the drywell end which encloses and protects all important penetration parts (seals, pigtails, splices) from any spray impingement. Furthermore, the penetration pressure seals are low moisture absorption epoxy and the crosslinked polyethylene insulated GE vulkene SIS pigtails and Raychem heat shrink tubing are well documented for operation in wet or submerged conditions, so any minor incursion of spray into the box that might occur would have no more effect than condensed steam would. Prototype series 100 assemblies have been LOCA tested as documented in GE 100 Series Electrical Penetrations Low Voltage Qualification Test Report dated January 1974, and the presence of a spray system in the Browns Ferry containment does not effect the penetration qualification.

Although the junction boxes enclose and protect the penetration parts, the boxes and the conduits exiting them are not sealed at LOCA pressures. Beta plateout within the box can occur with the integrated 1 year accident beta dose conservatively calculated to be  $2.4 \times 10^9$  rads.

Both the primary and secondary penetration conductor seals are shielded from all beta radiation, including that due to plateout, by the steel module shell and the conductor transition connection epoxy potting. Recalculation of the gamma dose to the penetration seals taking into account the location of the seals at the outboard end of a relatively long nozzle shows the 10-year plus LOCA dose is less than  $2.6 \times 10^7$  rads. The seals have been qualified to  $5 \times 10^7$  rads gamma as documented in the previously referenced GE test report. Therefore, these penetrations are qualified to maintain containment integrity before, during, and after a LOCA after 10 years (minimum) of normal operation, not 40 years as indicated in the original TVA 79-01B Report environmental worksheets.

BROWNS FERRY UNITS 1 and 2  
Justification for Continued Operation

The penetration pigtails are GE Vulkene SIS switchboard wire which has been qualified to  $6.9 \times 10^7$  rads gamma by Wyle Laboratories Report 43854-3, Qualification Test Report on Eight Cable Splice Assemblies. Calculations show the total beta and gamma dose, including beta plateout, will not exceed  $6.9 \times 10^7$  rads until 30 minutes into a LOCA after 10 years (minimum) of normal operation. Although unlikely, it will be assumed that all pigtails can fail 30 minutes into a LOCA and Attachment A is the safety evaluation report of this condition.

Since, as indicated in Attachment A, all necessary electrical safety functions can be completed prior to electrical failure and the subsequent failure will not degrade any safety function or mislead the operator, continued operation is justified.

BROWN'S FERRY NUCLEAR PLANTSAFETY EVALUATION REPORT

TITLE: Safety Evaluation -  
Penetrations EA, EF, and EG

SYSTEM: Primary Containment

APPLICABLE UNITS: 1 & 2 BFNP

SYSTEM NUMBER: \_\_\_\_\_

REV NO.	TOT PP	PREPARED	REVIEWED	APPROVED	DATE APPD
0*	6	D. A. Waller	T. M. [unclear]	L. E. [unclear]	2/23/83
1					
2					
3					
4					
5					

\*R0=INITIAL ISSUE

MEDS ACCESSION NO.	
R 0	NEB '83 0222 22
R 1	
R 2	
R 3	
R 4	
R 5	

Attachments  
cc (Attachments)

Project BFNP

Special Requirement(s) or Precaution(s) .. ☐

(☒) , Marks Subject to Which  
This Page Applies)

Safety Evaluation ..... ☒

Preparer DAW

Additional Information ..... ☐

Reviewer TWB  
(initial)

## Safety Evaluation - Penetrations EA, EF, EG

This safety evaluation will determine the impact on safety due to the loss of all electrical circuitry through primary containment penetrations EA, EF, and EG at the 30 minute point of the design basis LOCA (FSAR ~~14.6.3~~ 14.6.3) for BFNP Units 1 & 2. The 30 minute survival period is based on a total radiation dose below the qualified dose of  $6.7 \times 10^7$  rads. The total radiation dose is an integrated 10 year life plus accident dose (including plate-out). The terminal boxes associated with the subject penetrations have their internals replaced on 10-year intervals. Spurious operation of 3-phase power circuits will not be considered based upon the attached failure analysis (attachment 1).

This evaluation will also provide a portion of the TVA response to the Franklin Research Center's (FRC) technical evaluation report (TER) on BFNP (see review of equipment item number 87 contained in FRC's TER).

All equipment that could be affected by failure of the subject penetrations will be addressed on an item by item basis. These cables are documented on drawings 45A841-8 thru 11, sheets 72 thru 102; and 45A842-8 thru 11 sheets 72 thru 102.



## UNREVIEWED SAFETY QUESTION DETERMINATION

R-O

IDENTIFIER

Project BFNPSpecial Requirement(s) or Precaution(s) .. ☐Safety Evaluation ..... ☒Additional Information ..... ☐( ☒, Marks Subject to Which  
This Page Applies)

Preparer

Reviewer

(initial)

Equipment Affected and Justification

Drywell Blowers (A-1, 2, 3, 4, and 5; B1, 2, 3, 4, and 5)  
Loss of the drywell blowers is acceptable  
30 minutes after a design basis LOCA. The  
blowers do not perform any safety function  
post-LOCA.

FCV-68-1 and 77 (Recirculation pump suction valves)  
Loss of <sup>operability</sup> function of these valves is  
acceptable 30 minutes after a design basis  
LOCA. The valves do not perform any  
safety function post-LOCA.

FCV-68-3 and 79 (Recirculation pump discharge valves)  
Loss of operability of these valves is  
acceptable 30 minutes after a design basis  
LOCA. The valves are required to close  
within the first 2 minutes following a  
LOCA. After closure, the loss operability  
due to the 480-V 3-phase supply is acceptable.  
Spurious operation of the valve is not  
creditable due to the 3-phase supply.  
(see attachment 1).

FCV-68-33 and 35 (Recirculation equalizing valves)  
Loss of operability of these valves is  
acceptable 30 minutes after a design basis  
LOCA. The valves are presently not  
operable due to disconnection of their  
power supplies (3-phase).

Project BFNPSpecial Requirement(s) or Precaution(s) .. ☐Safety Evaluation ..... ☒Additional Information ..... ☐( ☒, Marks Subject to Which  
This Page Applies)

Preparer

Reviewer

(initial)

Equipment Affected and Justification (cont'd)

FCV-69-1 (RWCU Suction Valve)

Loss of operability of this valve is acceptable 30 minutes after a design basis LOCA. This valve <sup>is required to</sup> must close within the first 2 minutes following a LOCA. After closure, the loss of operability due to the 480-V 3phase supply is acceptable (see attachment 1).

FCV-71-2 (RCIC Steam Supply Line)

Loss of operability of this valve is acceptable 30 minutes after a design basis LOCA. This valve is required to close on low steamline pressure post-LOCA. This will be accomplished within the first 30 minutes and operability is not required once it is closed.

FCV-73-2 (HPCI Steam Supply Line)

See FCV-71-2. Requirements and description are identical.

FSV-76-59 and 61 (CH<sub>2</sub>-O<sub>2</sub> Analyzer Valves)

These valves <sup>and their operation</sup> are unaffected by the LOCA. Their position and cabling have been moved to outside containment.

TE-64-52C (Drywell Temperature Monitor)

This component was required to monitor



Project BFNP

Special Requirement(s) or Precaution(s) .. ☐

Safety Evaluation ..... ☒

Additional Information ..... ☐

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This Page Applies)

Preparer

Reviewer

(initial)

## Equipment Affected and Justification (cont'd)

drywell temperature during a post-LOCA environment to allow the operator sufficient information to initiate containment spray. However, during a design basis LOCA, the governing variable to initiate containment spray is drywell pressure. These pressure indications will remain available. Another concern would be the effect high drywell temperature could have on measured RPV water level. By losing one temperature indicating loop, only one indicator would be available to monitor drywell temperature. If the additional indicator is considered to be the single failure, the operator would be required to assume the maximum possible error ( $\approx 40^\circ$  water below indication; see NEDE 24801) to ensure adequate core cooling is maintained. Therefore, loss of the temperature element would be acceptable for the design basis LOCA provided the operator responds as described for if the redundant indicator is lost.

FCV-74-48 (RRR shutdown cooling suction valve)  
Loss of operability of this valve is acceptable 30 minutes after a design basis LOCA. Valve is normally closed

BENP

Special Requirement(s) or Precaution(s) .. ☐Safety Evaluation ..... ☒Additional Information ..... ☐( ☒, Marks Subject to Which  
This Page Applies)

Preparer

DAW

Reviewer

RMB

(initial)

and is required to remain closed throughout the accident. Therefore, operability is not required.

FCV-74-78 (RHR RPV Head Spray Valve)

See FCV-74-48. Requirements and description are identical.

FCV-1-55 (Main Steam Line Drain Valve)

See FCV-74-48. Requirements and description are identical.

All other cables (see list on attachment 2) involved in the subject penetrations either provide power or control circuits to non-essential components that would not affect plant safety if the cables failed in any manner.

In addition to the operation of circuits served by the subject penetrations, it is also required to ensure the penetrations will not lose their integrity for maintaining primary containment. Attachment 3 states that the seal will not be jeopardized due to the design basis LOCA.

Based upon the information given and the above mentioned justifications, primary containment electrical penetrations EA, EF, and EG can fail the enclosed circuits due to a LOCA in any manner without having any adverse impact on operation of the required equipment or the integrity of primary containment.

BROWNS FERRY NUCLEAR PLANT  
Units 1 and 2  
Failure Analysis

1. Failure Mechanism: Following a LOCA, the environmental conditions surrounding cable penetrations EA, EF, and EG will be such that the insulation on all cables routed through these penetrations could assume to be lost after 30 minutes.
2. Failure Mode: With a loss of insulation, the cables passing through these penetrations could short together or short to ground in any of many possible configurations. It is impossible to predict the final configuration.
3. Consequences of Failure: The 480V ac, 3 phase power cables for the valves listed below pass through these penetrations. The possibility exists, although highly remote and unlikely, that a direct short could occur between an energized 3 phase circuit and an unenergized 3 phase circuit in the right sequence (i.e., A phase to A phase or C phase, B phase to B phase, C phase to C phase or A phase), causing one or more of these valves to move from its required closed/opened position to the open/closed position. It is so unlikely that such a fault could occur that further analysis is not required.

The valves involved are (penetrations are in parentheses):

FCV-68-3 (EF)	FCV-68-79 (EA)	FCV-74-48 (EA)
FCV-74-78 (EA)	FCV-69-1 (EA)	FCV-73-2 (EA)
FCV-71-2 (EF)		

Also, the following devices have cables routed through these penetrations and are required to be operational following a LOCA:

FSV-76-61 (EF)	FSV-76-59 (EF)	TE-64-52C (EF)
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Virtually any short circuit condition would defeat the proper operation of these devices.

The following is a summary of the potential 480V power sources which could be shorted:

- a. Penetration EG - None of the devices listed has cabling in penetration EG. None of the cabling in penetration EG has any possibility of impacting any device of concern.
- b. Penetration EA - The following devices have 480V power cables routed through penetration EA:

FCV-68-77	FCV-1-55	Drywell Blowers
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These devices should not be operated following a LOCA, but could be. FCV-68-33 has cables routed through this penetration, but they have been disconnected from their power source.

- c. Penetration EF - 480V power cables for the CRD hoist electrical outlets and the recirculation pump heaters are routed through penetration EF, and they are energized at all times following a LOCA. 480V power cables for FCV-69-1, FCV-69-3, and drywell blower also route through penetration EF, and could be energized although they shouldn't be. FCV-60-35 480V power cables routed through penetration EF have been disconnected from their power source.

The drywell sump pumps have 480V power cables routed through this penetration and are likely to be energized during the 100-day period following a LOCA.

- d. General - There are no other cables routed through any of these penetrations which could under any circumstance impact the devices of concern, i.e., no control cables which could, because of a short, cause a 480V power source to be energized.
4. Conclusions: Spurious operation of the 3 phase electrically operated motor operated valves due to hot shorts of power circuit cables is considered to be incredible; therefore, these valves can be considered to stay in the post LOCA condition. There is a high probability; however, that the solenoid valves and temperature element will not be operable.

Prepared by: Dan Masters Date 2-14-83  
Reviewed by: T.B. Robinson <sup>MRB</sup> Date 2-17-83  
Approved by: G.T. Payano Date 2-18-83

SUBJECT Safety Evaluation - Penetrations EA, EF, EG PROJECT SENPD.A. Walker  
COMPUTED BY2/22/83  
DATE

CHECKED BY

DATE

Cable Numbers  
Collectively EvaluatedUnit 1

1PP470, 1PP471  
 1V2412, 1V2413  
 1V2425, 1V2426  
 1V2437, 1V2438  
 1PP596, 1PP595  
 1PL2060, 1PL2061  
 1V2400, 1V2401  
 1PL5175, 1PL5177  
 1PL2275, 1PL2276  
 1PL2325, 1PL2326  
 1PL2350, 1PL2351  
 1PL2300, 1PL2301  
 1M85, 1M86, 1M87, 1M88 }  
 1M91, 1M92  
 1PL5180, 1PL5182

## Device(s) Serviced

Recirculation Pump  
 Spare  
 Spare  
 Spare  
 Recirculation Pump  
 Power Outlets  
 Spare  
 Recirculation Pump  
 Equip. Drain Sump Pump  
 Floor Drain Sump Pump  
 Floor Drain Sump Pump  
 Equip. Drain Sump Pump  
 Integrated Leak  
 Rate Testing  
 Recirculation Pump

Unit 2

2PP470, 2PP471  
 2V2412, 2V2413  
 2V2425, 2V2426  
 2V2437, 2V2438  
 2PP596, 2PP595  
 2PL2060, 2PL2061  
 2V2400, 2V2401  
 2PL5175, 2PL5177  
 2PL2275, 2PL2276  
 2PL2325, 2PL2326  
 2PL2350, 2PL2351  
 2PL2300, 2PL2301  
 2M85, 2M86, 2M87  
 2M88, 2M91, 2M92  
 2PL5180, 2PL5182



1

Attachment 3

F O R	NAME	DATE
	Don Wilson	2-23-83
F R O M	ADDRESS	EXTENSION
	W10A18 C-K	<input type="checkbox"/> Chatta <input type="checkbox"/> M.S. <input type="checkbox"/> Knox <input type="checkbox"/> Nor
Fold here for return		
F R O M	NAME	EXTENSION
	KW Brown 1000 gnu	<input type="checkbox"/> Chatta <input type="checkbox"/> M.S. <input type="checkbox"/> Knox <input type="checkbox"/> Nor
F R O M	ADDRESS	
	W8D182C-K	

Reference Browns Ferry Units 1 & 2  
TER item 87, GE electrical  
penetrations, mark EA, EF, and EG.

Calculations made by NEB (L.E. Stanford)  
indicate that these penetrations have  
been qualified by test to be capable  
of maintaining containment integrity for  
a 1 year LOCA after at least 10  
years of normal operation.