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MAR 06 1992

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U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
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Gentlemen:

In the Matter of  
Tennessee Valley Authority )

Docket Nos. 50-259  
50-296

BROWNS FERRY NUCLEAR PLANT (BFN) - ADDITIONAL INFORMATION ON TVA'S ACTION  
PLAN FOR UNITS 1 AND 3 CABLE INSTALLATION ISSUES INCLUDING CABLE  
SEPARATIONS

Reference: TVA letter dated May 10, 1991, Action Plan to Disposition  
Concerns Related to Units 1 and 3 Cable Installation Issues  
Including Cable Separations

This letter provides additional information concerning TVA's corrective action plan that was described in the referenced letter. TVA stated in the referenced letter that confirmatory walkdowns would be performed at BFN Units 1 and 3 to confirm adequate installation practices as found during Unit 2 recovery efforts. These confirmatory walkdowns are similar to the walkdowns performed to assess BFN Unit 2 installation practices. Also, to confirm the validity of data in TVA's cable database, walkdowns would be performed to verify cable attributes for a random sample of the cable database. The following information is included in Enclosure 1 to this letter:

1. Selection criteria for inclusion of cables in walkdowns,
2. A discussion of the walkdown attributes and methodologies
3. Methodology for the BFN consolidated cable routing system (CCRS) database validation, and
4. System and voltage level distribution of the sample to demonstrate the adequacy of the random sample.

This information was discussed with Joseph Williams and Frank Ashe on December 17, 1991 by teleconference.

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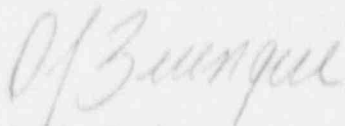
## U.S. Nuclear Regulatory Commission

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Walkdowns and other actions to resolve installation issues are in progress at BFN Unit 3. The results of the walkdowns will be discussed in a final report on the resolution of cable installation issues. The report will be similar to the Cable Issues Walkdown and Summary Reports issued for BFN Unit 2 and transmitted to NRC by TVA letter dated June 19, 1989 and the Electrical Cable Separations Report transmitted by letter dated January 6, 1989. The report for Unit 3 will be submitted prior to restart of Unit 3. The Unit 1 report will be submitted prior to Unit 1 restart.

Procedures cited in Enclosure 1 are available for review at TVA's Rockville, Maryland offices. A summary of the commitment contained in this letter is provided as Enclosure 2. Please refer any questions concerning this submittal to J. E. McCarthy, Restart Licensing Manager, at (205) 729-2703.

Sincerely,



O. J. Zeringue

Enclosures

cc (Enclosures):

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## ENCLOSURE 1

### ADDITIONAL INFORMATION CONCERNING BFN UNITS 1 AND 3 CABLE INSTALLATION ISSUES CORRECTIVE ACTION PLAN

#### 1.0 Issues requiring confirmatory walkdown

#### 1.1 Selection criteria for issues requiring confirmatory walkdown

As stated in TVA's May 10, 1991 letter, TVA is performing confirmatory walkdowns as part of the resolution of sidewall pressure, jamming, pulling through 90° conduits, mid-run flexible conduits, and pullby issues for BFN Units 1 and 3. The condition of installed cables observed during Unit 2 recovery efforts was attributed to good installation practices at BFN. This was part of the basis for establishing the acceptability of installed cables for Unit 2 for these issues. The purpose of the confirmatory walkdowns is to verify that good installation practices, as found on Unit 2, were used for BFN Units 1 and 3. The criteria for selecting cables for inclusion in the confirmatory walkdown and the confirmatory walkdown methodology is the same as was used for Unit 2.

The selection criteria for inclusion in the confirmatory walkdowns is discussed below for these issues. Where Unit 3 activities are specifically discussed, the planned approach for Unit 1 is the same.

##### 1.1.1 Selection criteria for sidewall pressure

A list of BFN Unit 3 conduits, which include size #1/0 AWG and larger safety related cables, was prepared. These larger cable sizes were chosen since the mechanical pulling devices generally used to install these cables would have resulted in increased sidewall pressure on the cables during installations. Conduits less than 20 feet in length were not considered since the pulling forces applied to these short lengths would be small and do not warrant study. Safety-related conduits longer than 20 feet were evaluated during a preliminary walkdown in an effort to identify the degree of conduit bends, and the types of fittings installed. After these preliminary walkdowns, the conduits with the longest runs and those containing the most degree of bends were selected for inspection by industry experts during the confirmatory walkdown.

##### 1.1.2 Selection criteria for walkdown for jamming

The review for this issue for Unit 3 was limited to safety-related V4 and V5 cables, size #10 AWG and larger installed in conduits. The list of these cables and associated conduits was prepared from consolidated cable routing system (CCRS). The ratio of the inside diameter of a conduit (D) to the cable diameter (d) was determined from the database. Conduits equal to or greater than twenty feet long containing three single conductor cables with a D/d ratio between 2.8 and 3.1 have the potential of cable jamming. These conduits were reviewed during the preliminary walkdown.

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Configurations with D/d ratio in the critical range, which are long runs (to preclude hand pulls) and have many conduit bends and cable access points (i.e., junction boxes, pull boxes, and conduit fittings), were listed for confirmatory walkdown by industry experts. The experts inspected those junction/pull boxes or conduit fittings for cable damage that could be caused by jamming during installation.

#### 1.1.3 Selection Criteria for walkdown for pulling through 90 degree condulets and mid-run flexible conduits

For Unit 3, a preliminary walkdown of the Reactor, Control, and Diesel Generator buildings was performed to locate safety-related mid-run flexible conduits and 90 degree condulets for further inspection by the industry experts. Mid-run flexible conduits or 90 degree condulets found were selected for confirmatory walkdown.

#### 1.1.4 Selection criteria for walkdown for pullby

Conduits containing 8 or more V1, V2, or V3 cables and V4 conduits containing 4 or more cables were examined. These conduits are further reviewed by using the pull cards to determine the date of pull for each cable. The conduits which contain cables pulled on different dates are selected. Additionally, the conduits must be 50 feet in length or longer and contain 180° or more in bends, as determined from the preliminary walkdown. These conduits are selected for confirmatory walkdown inspection.

### 1.2 Confirmatory walkdown methodology

Some Unit 3 activities have been completed. Where Unit 3 activities are specifically discussed, the planned approach for Unit 1 is the same.

The Unit 3 selected conduits were walked down for the following attributes in accordance with walkdown procedure BC-015. The methodology is summarized below.

1.2.1 A free hand sketch of the conduit run was drawn during preliminary walkdowns to describe the bending directions, conduit size, condulet size, type, manufacturer and sizes of pull boxes. The sketch facilitated the experts review.

1.2.2 The cable number, mark letter, manufacturer and jacket type were recorded. Outside diameters of cables were also measured and recorded during this walkdown.

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1.2.3 After the confirmatory walkdowns are completed, the industry experts answer the following questions for the selected conduits.

- (a) Were any condulets or boxes physically installed such that they could not be used as pullpoints?
- (b) Was there any evidence of the use of cable pulling lubricant? (Open condulets and boxes and inspect for evidence of lubricants.)
- (c) Was conduit used for a dedicated run. i.e., no pullbys?
- (d) Was flexible conduit installed in mid-run of rigid conduit?
- (e) Do cables in conduit have different jacket materials? If so, what are materials?
- (f) Is there evidence of damage to insulation or jacket as observed in condulets or junction boxes? If so, describe.
- (g) Does it appear that mechanical assistance was required for cable pulling due to conduit configuration and conduit fill? If so, explain.
- (h) Does the estimated length between pullpoints exceed 100 feet?
- (i) Does estimated number of degree bends between pullpoints exceed 360°?
- (j) Is the conduit oriented in a horizontal or incline plane at the pull point such that pulling lubricant could not have been poured in to conduit?
- (k) Do cables in this conduit fall within jam ratio of 2.8 to 3.1? Complete this question if there are single conductor wires size #10 AWG or larger in a single conduit.
- (l) Were any spare or abandoned cables observed in the conduit?
- (m) Was a pull rope or pull wire left in the conduit? If yes, describe the type of pull rope in the comments section.

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- (n) If the conduit or any portion of it is vertical, does its effective vertical drop exceed 25% of the allowable length in the General Construction Specification G-38 for the applicable cable size? If so, describe the cable condition at the top of the run (90 degree conduit, 90 degree field bend, horizontal or vertical cable tray, etc.).

Based on their findings, the confirmatory walkdown team reports their assessment of Units 1 and 3 installation practices, and concludes whether or not installation practices were similar to Unit 2.

#### 2.0 Other Issues

Walkdowns associated with resolution of the following issues involve a specific approach for each issue as discussed in TVA's May 10, 1991 letter. A summary of TVA's approach to these walkdowns is discussed below.

#### 2.1 Bend radius

Some Unit 3 activities have been completed. Where Unit 3 activities are specifically discussed, the planned approach for Unit 1 is the same. The selection criteria and walkdown methodology for Units 1 and 3 involve the same approach that was taken for Unit 2.

##### 2.1.1 Selection criteria for walkdown

BFN Unit 3 specific safety-related medium voltage (V5) power cables were walked down and evaluated against the criteria of G-38.

##### 2.1.2 Walkdown methodology

The selected cables were walked down in accordance with Walkdown Procedure BC-004 to determine if the bend radius has been violated. The attributes walked down and recorded were cable ID, mark no., diameter and bend radius. An engineering analysis is performed using this information.



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### ADDITIONAL INFORMATION CONCERNING BFN UNITS 1 AND 3 CABLE INSTALLATION ISSUES CORRECTIVE ACTION PLAN

#### 2.2 Vertical supports

The selection criteria and walkdown methodology for Units 1 and 3 involves the same approach as for Unit 2.

##### 2.2.1 Selection criteria for walkdown

G-38 specifies vertical cable support criteria. For Unit 3, the single-line drawings and physical layout drawings were used to prepare a list of the raceways/cables requiring walkdown inspection for vertical drops using the following criteria:

- (a) Safety-related vertical tray sections equal to or greater than 8'-6" require walkdown.
- (b) Safety related conduits with vertical lengths equal to or greater than 25% of the cable support spacing specified in G-38 require walkdown.
- (c) Safety related medium voltage raceways/cables require walkdown.

##### 2.2.2 Walkdown methodology

Selected raceways and cables are walked down in accordance with walkdown procedure BC-004. Data is collected for each vertical drop to document the following:

- (a) Conduit fittings or junction boxes at the top of the vertical drop,
- (b) Cable jacket deformation and cable stress at conduit fittings, junction boxes or trays,
- (c) Effective vertical drop length, in accordance with G-38,
- (d) Existing cable support, and
- (e) Raceway layout.

## ENCLOSURE 1

### ADDITIONAL INFORMATION CONCERNING BFN UNITS 1 AND 3 CABLE INSTALLATION ISSUES CORRECTIVE ACTION PLAN

#### 2.3 Missing conduit bushings

The selection criteria and walkdown methodology for Units 1 and 3 involve the same approach that was taken for Unit 2.

##### 2.3.1 Selection criteria for walkdown

The missing conduit bushings program was a result of missing bushings that resulted in damage to type PN cables. Conduit installations with missing bushings are located during the integrated walkdown of 10CFR50.49 cables, within the harsh environments and to the first box into the mild environments. The walkdown teams open and inspect junction, pull or conduit boxes containing these cables.

##### 2.3.2 Walkdown methodology

At the time of the 10CFR50.49 cable walkdown, enclosures that are opened are checked for missing bushings in accordance with walkdown procedure BC-004. The cable ID and the location of the enclosure is recorded and the cables are checked for damage due to missing bushings.

#### 2.4 Use of condulets as pull points for large 600 V cables

The selection criteria and walkdown methodology for Units 1 and 3 involve the same approach that was taken for Unit 2.

##### 2.4.1 Selection criteria for walkdown

BFN Unit 3 specific safety-related low voltage (V4) cables size 300 MCM and larger that are routed in conduit were walked down.

##### 2.4.2 Walkdown methodology

Cables walked down for this issues are checked for damage and the findings recorded. The condulet size, type, manufacturer and location were recorded, along with cable ID, mark number, conductor size, and number of conductors. This is in accordance with walkdown procedure BC-004.



## ENCLOSURE 1

### ADDITIONAL INFORMATION CONCERNING BFN UNITS 1 AND 3 CABLE INSTALLATION ISSUES CORRECTIVE ACTION PLAN

#### 2.5 CCRS validation

Unit 3 activities are discussed below. The planned approach for Unit 1 is similar.

##### 2.5.1 Selection criteria for walkdown

Utilizing CCRS and data from the BFN Unit 3 10CFR50 Appendix R, 10CFR50.49 Environmental Qualification and Q-List programs, approximately 7,000 cables were selected to make up a safety related population. The remaining population of approximately 18,000 cables are considered the non-safety population. In accordance with engineering procedure 4.90-08, a random selector program was used to provide a sample of 58 safety and 58 non-safety cables. The following represents a breakdown of the sampled cables:

SAFETY RELATED CCRS SAMPLE			NON-SAFETY CCRS SAMPLE		
VOLTAGE LEVEL	NO. OF CABLES IN SAMPLE	APPROXIMATE NO. OF CABLES IN TOTAL POPULATION	VOLTAGE LEVEL	NO. OF CABLES IN SAMPLE	APPROXIMATE NO. OF CABLES IN TOTAL POPULATION
V1	1	150	V1	5	2300
V2	3	15	V2	13	3400
V3	50	6000	V3	37	10400
V4	3	700	V4	3	1900
V5	1	50	V5	0	50
SYSTEM NO. (SEE NOTE 1)	NO. OF CABLES IN SAMPLE	APPROXIMATE NO. OF CABLES IN TOTAL POPULATION	SYSTEM NO. (SEE NOTE 1)	NO. OF CABLES IN SAMPLE	APPROXIMATE NO. OF CABLES IN TOTAL POPULATION
000	1	400	000	2	1600
001	5	380	001	2	500
002	1	5	002	5	1600
023	1	115	003	2	625
027	1	350	005	1	250
047	1	5	006	4	720
064	4	380	024	2	360
068	1	100	027	3	360
069	2	90	035	1	120
070	1	160	039	1	720
071	6	400	040	1	60
073	2	410	043	1	215
074	4	960	047	2	640
076	1	200	056	1	140

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SAFETY RELATED CCRS SAMPLE			NON-SAFETY CCRS SAMPLE		
SYSTEM NO.	NO. OF CABLES IN SAMPLE	APPROXIMATE NO. OF CABLES IN TOTAL POPULATION	SYSTEM NO.	NO. OF CABLES IN SAMPLE	APPROXIMATE NO. OF CABLES IN TOTAL POPULATION
077	1	35	063	1	40
078	1	55	064	2	480
082	1	270	066	3	575
085	4	800	068	1	670
090	7	270	069	5	655
244	1	175	074	1	360
254	1	10	082	2	70
257	8	260	085	4	1390
258	2	550	092	1	400
281	1	5	202	1	60
			244	2	670
			258	4	300
			260	2	90
			263	1	140
BUILDING	NO. OF CABLES IN SAMPLE	SEE NOTES 2 AND 3	BUILDING	NO. OF CABLES IN SAMPLE	SEE NOTES 2 AND 3
Reactor Bldg.	42		Reactor Bldg.	15	
Control Bay	24		Control Bay	28	
Drywell	8		Drywell	1	
Turbine Bldg.	3		Turbine Bldg.	23	
Diesel Gen. Bldg.	4		Diesel Gen. Bldg.	2	
Off-Gas Treatment Bldg.	0		Off-Gas Treatment Bldg.	2	

Note 1: System numbers correspond to the following plant systems at BFN.

000 Spare Local Panels and Miscellaneous  
 001 Main Steam System  
 002 Condensate and Demineralized Water System  
 003 Reactor Feedwater System  
 005 Extraction Steam System  
 006 Heater Drains and Vents System  
 023 Residual Heat Removal (RHR) Service Water System  
 024 Raw Cooling Water System  
 027 Condenser Circulating Water System  
 035 Generator Hydrogen System  
 039 CO<sub>2</sub> Storage, Fire Protection, and Purging System  
 040 Station Drainage Sytem  
 043 Sample and Water Quality System  
 047 Turbine Generator Electro-Hydraulic Control System

## ENCLOSURE 1

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Note 1 (cont'd):

056	Temperature Monitoring System
063	Standby Liquid Control System
064	Primary Containment Isolation System
066	Off-Gas System
068	Reactor Water Recirculation System
069	Reactor Water Cleanup System
070	Reactor Building Closed Cooling Water System
071	Reactor Core Isolation Cooling System
073	High-Pressure Coolant Injection System
074	RHR System
076	Containment Inerting System
077	Radwaste System
078	Fuel Pool Cooling and Demineralizing System
082	Standby Diesel Generator System
085	Control Rod Drive System
090	Radiation Monitoring System
092	Neutron Monitoring System
202	4 KV Unit Boards
244	Communication System
254	Diesel 125-Volt DC System
257	Reactor Protection System
258	Operation Recorder
260	Security Including Door Interlock and Alarm System
263	Condenser Tube Cleaning System
281	250-V Reactor Motor Operated Valve Boards

Note 2: No Index devoted to building identification exists for CCRS.

Note 3: Cables located in two or more buildings are counted for each building.

#### 2.5.2 Walkdown methodology

Walkdown procedure BC-008 was developed to collect the attributes of the cables by the walkdown team. These attributes are to-from, size, route, mark number and cable ID for the safety and non-safety samples.

## ENCLOSURE 2

### SUMMARY OF COMMITMENT

The results of the walkdowns will be discussed in a final report on the resolution of cable installation issues. The report will be similar to the Cable Issues Walkdown and Summary Reports issued for BFN Unit 2 and transmitted to MRC by TVA letter dated June 19, 1989 and the Electrical Cable Separations Report transmitted by letter dated January 6, 1989. The Unit 3 report will be submitted prior to restart of Unit 3. The Unit 1 report will be submitted prior to Unit 1 restart.