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NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION (4-95)						APPROVED BY OMB NO. 3150-0104 EXPIRES 04/30/98													
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On March 8 and 13, 1996, during this same reevaluation, TVA discovered two additional. Appendix R noncompliance conditions in Unit 2. The first condition involves previously unidentified associated circuits of the torus suppression pool level and/or drywell pressure indication instruments. The circuits were found to be common to the instruments, power supply. An Appendix R fire could potentially cause a failure that results in a loss of the supporting power supply to the instruments in specific fire areas. While it was immediately determined from the reevaluation that other instrumentation for torus level/drywell pressure monitoring were available to the operators, those instruments were not specifically called out in the Safe Shutdown Instructions (SSIs). The second and third condition involves mis-routing of power cables. Power cables for the torus suppression pool temperature and reactor level/pressure indication instruments were routed through Fire Area 2-3, where these indication instruments are required to be available during an Appendix R fire. Also, the power cable for the Unit 2 High Pressure Coolant Injection (HPCI) Steam Supply valve was routed through Fire Area 11, where the HPCI system is required to be available. There are no operator responses to the affected indication instruments identified in the Appendix R analysis. These events resulted from past failures to correctly implement the design criteria during the original development of the Unit 2 and Unit 3 Appendix R Programs and to properly evaluate design changes for the Appendix R requirements. TVA revised the SSP along with the appropriate SSIs to use other available instrumentation for torus level/drywell pressure monitoring. TVA will reroute the power cables for the torus suppression pool temperature and reactor level/pressure indication instruments out of Fire Area 2-3 and revise the Appendix R Program to use other available equipment for Fire Area 2-3 and revise the Appendix R Program to use other available equipment for Fire Area 2-1.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

I. PLANT CONDITIONS

At the time of this event, Unit 2 was operating at approximately 94 percent power with Unit 3 at 100 percent power. Unit 1 was shutdown and defueled.

II. DESCRIPTION OF EVENT

A. Event:

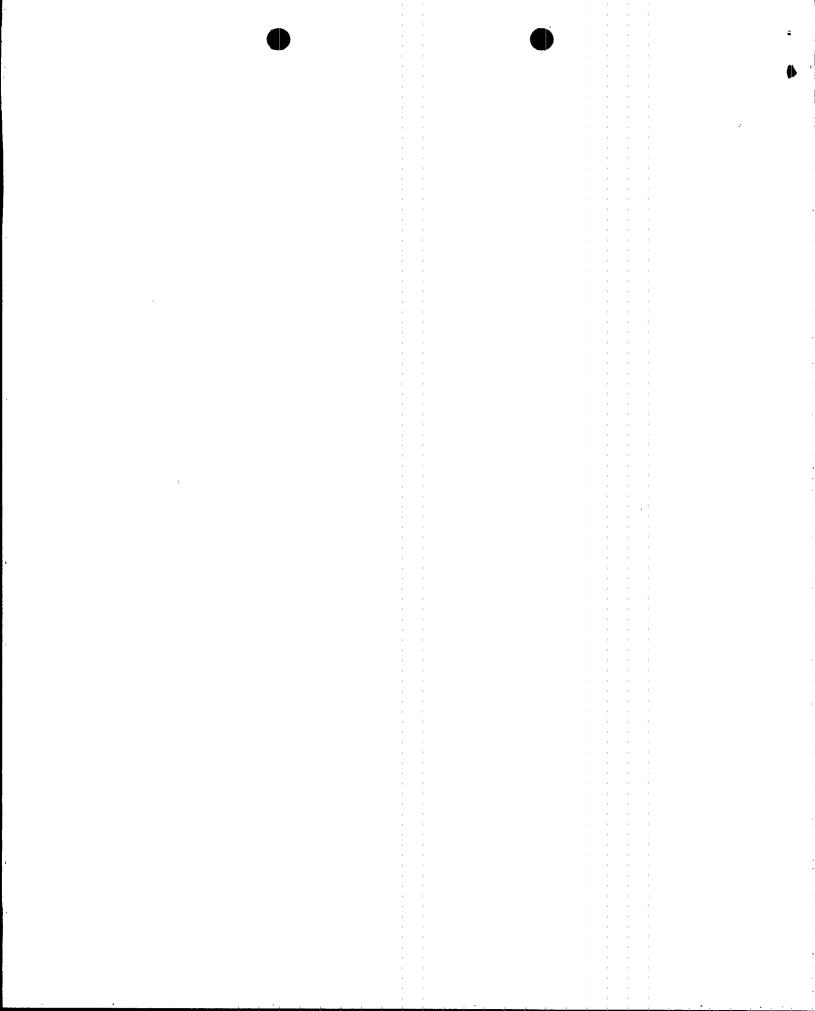
On February 16, 1996, at approximately 1130 hours, TVA discovered that a condition involving noncompliance with 10 CFR Part 50 Appendix R, Criterion III.G.2.a and III.G.2.b existed in Unit 2 and Unit 3. The noncompliance was discovered during TVA's programmatic reevaluation of the Unit 2 Appendix R Safe Shutdown Program (SSP) to improve the overall Appendix R Program for both Units 2 and 3. This reevaluation is currently on-going and was initiated in May 1995 to simplify operator actions and provide for Unit fidelity. TVA expects this reanalysis to be completed by March 31, 1996.

TVA discovered that certain torus level indication (LI) and drywell pressure indication (PI) instruments could potentially be unavailable following an Appendix R fire in certain fire areas. The affected instruments were credited in the Appendix R analysis and its implementing procedures (Safe Shutdown Instructions (SSIs)). However, there were no operator responses to the affected indication instruments identified in the Appendix R analysis.

Specifically, associated circuits of the Unit 2 and Unit 3 torus suppression pool level indication and/or drywell pressure indication instruments, which could result in previously unidentified failures, were not identified in Fire Areas 1, 2-1, 2-2, 2-3, 2-4, 2-5, 3-2, 3-4, and 20 during the original development of the Unit 2 and Unit 3 Appendix R Programs. Since the associated circuits are common (fed from the same feeder breaker) to the power supply for the affected instruments, an Appendix R fire could potentially cause a failure that results in a loss of the supporting power supply to the instruments. (TVA determined that the instruments affected would fail downscale from a loss of power supply, thus alerting the operators to the problem.)

For Unit 2, the suppression pool water level indication, which is provided by indicator 2-LI-64-159A and recorder 2-XR-64-159 (2-LI-64-159B), could potentially be unavailable for a fire in Fire Areas 1, 2-1, 2-2, 2-3, 2-4, 2-5, and 20. For Unit 3, a fire in Fire Areas 1, 3-2, and 20 could make suppression pool level indicator 3-LI-64-159A unavailable. Additionally, the Unit 3 drywell pressure indication, which is provided by indicator 3-PI-64-160A and recorder 3-XR-64-159 (3-PI-64-160B), could be unavailable for a fire in Fire Areas 1, 2-1, 2-2, 2-3, 2-4, 3-4, and 20.

On March 8 and 13, 1996, additional deficiencies were discovered as part of this reevaluation or reanalysis. Specifically, on March 8, 1996, power cables for instrument loops 2-LI-3-58A (reactor level), 2-PI-3-74 (reactor pressure), and 2-TI-64-161 (torus temperature) were determined to be routed through Fire Area 2-3. However, these instruments are required by the Safe Shutdown Analysis to be available for a fire in this fire area. If a fire was to occur in Fire Area 2-3, reactor level/pressure and torus temperature indications could potentially be unavailable or lost. There is no alternate instrumentation for these indications available in the control room.



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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

Also, on March 13, 1996, the power cable for the Unit 2 High Pressure Coolant Injection (HPCI) [BJ] Steam Supply valve (2-FCV-73-16) was found routed through Fire Area 11, where the HPCI system is required to be available for Appendix R safe shutdown. If a fire occurs in this fire area, this normally closed valve is required to automatically open to admit steam to the HPCI turbine. However, with its power cable routed through Fire Area 11, the auto open function of this valve can not be assured during an Appendix R fire and the HPCI system could potentially be lost.

These events are reportable pursuant to 10 CFR 50.73(a)(2)(ii)(B) and (C) as conditions that were outside the design basis of the plant and as conditions not covered by the plant's operating procedures. The plant's Appendix R analysis does not address the loss of the HPCI system and the monitoring capability of the drywell pressure, torus level/temperature, and reactor level/pressure. The operating procedures (SSIs) for each fire area were written to take credit for these instruments, and consequently, did not address the loss of the specific instruments.

Inoperable Structures, Components, or Systems that Contributed to the B. Event:

None.

Dates and Approximate Times of Major Occurrences: C.

> TVA identified 10 CFR Part 50 February 16, 1996 at 1130 hours Appendix R noncompliance in several fire areas and established compensatory fire watches in accordance with the Appendix R SSP.

February 16, 1996 at 1206 hours TVA made a one-hour nonemergency notification to NRC in accordance

with 10 CFR 50.72(b)(1)(ii). March 8, 1996 at 1016 hours TVA identified Appendix R

noncompliance in Fire Area 2-3 and made a supplement to the February 16, 1996 one-hour notification. fire watch was posted for this fire area.

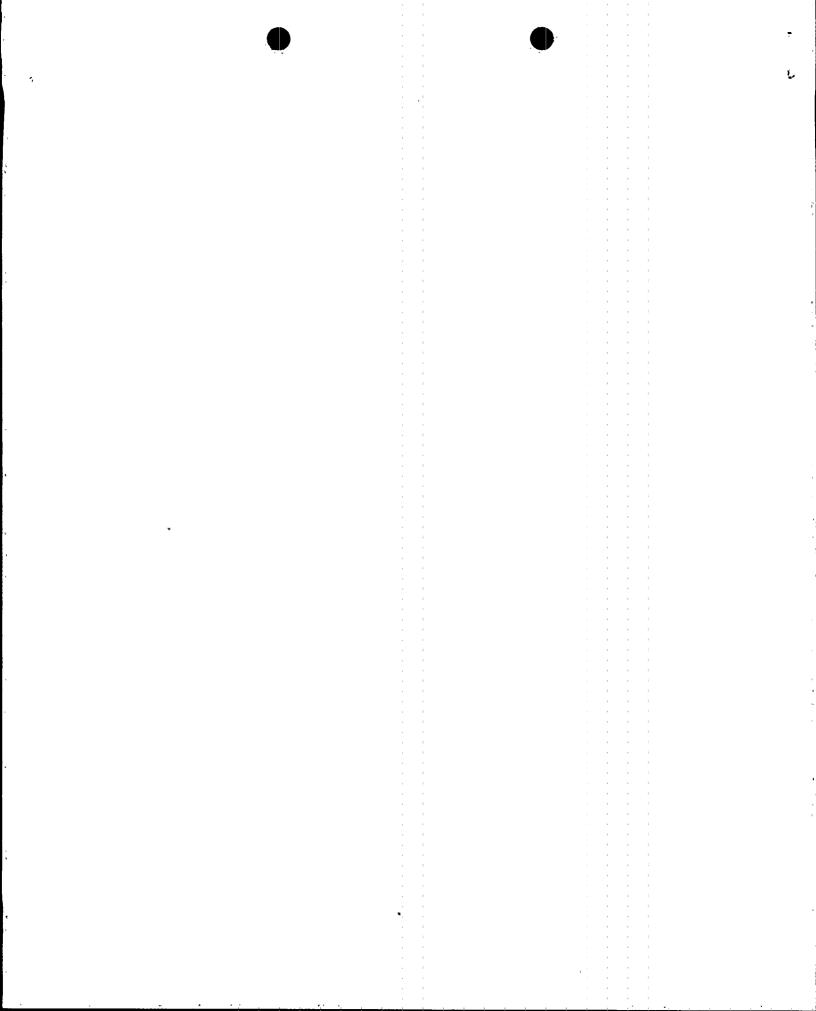
TVA identified Appendix R noncompliance in March 13, 1996 at 1109 hours Fire Area 11 and made an additional supplement to the February 16, 1996 one-

hour notification. A fire watch was

posted for Fire Area 11,

Other Systems or Secondary Functions Affected: D.

None.



LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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E. Method of Discovery:

The Appendix R noncompliance conditions were identified as part of TVA's on-going reanalysis of the Unit 2 SSP. The reanalysis is being performed to make Unit 2 consistent with the Unit 3 program.

TVA started the Unit 2 reanalysis in May 1995 to incorporate into Unit 2 the improved technology (i.e., computerization and more versatile safe shutdown strategies), which were used for the original development of the Unit 3 program. TVA considers that by utilizing these enhancements, the improved technology would essentially simplify the overall Appendix R responses which would make the program more effective. That is, to reduce the number of required operator actions and to increase the number of plant components that can be credited during an Appendix R fire.

F. Operator Actions:

Upon discovery of these events, operators [utility. licensed] entered an Appendix R Limiting Condition of Operation which established compensatory fire watches in the affected areas. Although not specified in the SSIs, other indication instrumentation for torus suppression pool level/drywell pressure monitoring were determined to be available and the operators were made aware of these instruments.

G. Safety System Responses:

None.

III. CAUSE OF THE EVENT

A. Immediate Cause:

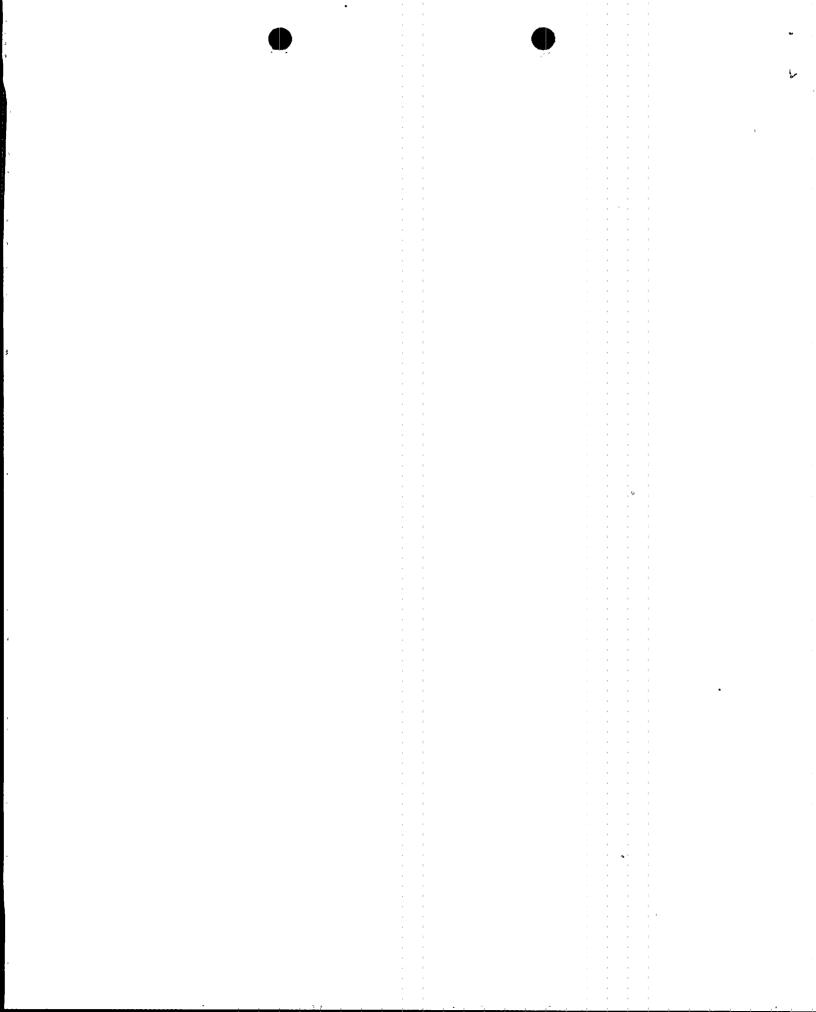
Noncompliance with 10 CFR Part 50 Appendix R

B. Root Cause:

These events resulted from past failures to correctly implement the design criteria during the original development of the Unit 2 and Unit 3 Appendix R Programs and to properly evaluate design changes for the Appendix R requirements. The Unit 2 Appendix R Program was developed from 1985 through Unit 2 restart in May 1991 and the Unit 3 program from 1991 through Unit 3 restart in November 1995.

Unidentified Torus Suppression Pool Level/Drywell Pressure Associated Circuits

The individuals involved in preparing the initial Appendix R circuit analysis did not evaluate (personnel cognitive error) the drawings that depicted the associated circuits of the torus suppression pool level indication and drywell pressure indication instruments. The drawings were referenced in the Unit 2 and Unit 3 torus level/drywell pressure schematic diagrams, but were inadvertently overlooked during the original development of the Unit 2 and Unit 3 Appendix R Programs.



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FACILITY NAME (1)	DOCKET		LER NUMBER	PAGE (3)			
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FACILITY NAME (1) Frowns Ferry Unit 2	05000260	96	- 001 -	00	5	OF	8

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

Mis-routed Torus Suppression Pool Temperature and Reactor Level/Pressure Power Cables

The individuals involved in preparing a design change did not properly evaluate (personnel cognitive error) the change for the Appendix R requirements. Specifically, when the Unit 2 Emergency Core Cooling System Analog Trip Unit power inverter was replaced in 1987, the individuals did not recognize that by rerouting the power cables for the torus temperature and reactor level/pressure indication instruments through Fire Area 2-3 could potentially cause these instruments to be unavailable for a fire in this fire area.

Mis-routed HPCI Steam Supply Valve Power Cable

The individuals involved in preparing a field design change did not properly evaluate (personnel cognitive error) the field change for the Appendix R requirements. In 1991, a modification was made to resize the operator motor of the Unit 2 HPCI Steam Supply valve. This resulted in a larger power cable for the valve. The addition of this new larger size cable, and a field change for ease of conduit construction for this cable, resulted in a reroute of the power cable through Fire Area 11. Since this valve is required to admit steam to the HPCI turbine, the HPCI system could potentially be lost during an Appendix R fire in this fire area.

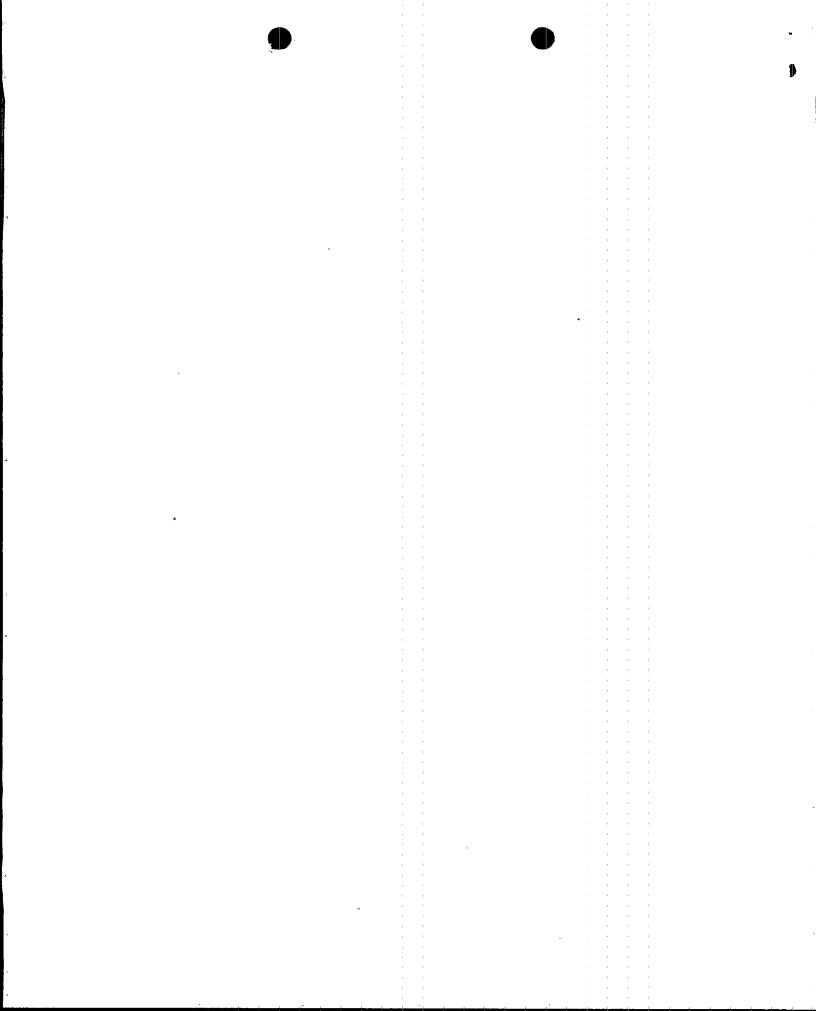
IV. ANALYSIS OF THE EVENT

Unidentified Torus Suppression Pool Level/Drywell Pressure Associated Circuits

The Appendix R SSP requires torus water level and drywell pressure monitoring from the main control room and the remote shutdown stations. This ensures adequate monitoring of the torus during operation of the HPCI, Reactor Core Isolation Cooling (RCIC) [BN], and Residual Heat Removal (RHR) [BO] systems and provides the operators with drywell parameters if Reactor Pressure Vessel (RPV) [RCT] full depressurization is required prior to 2 hours into an Appendix R event.

As noted in the Safe Shutdown Analysis, torus suppression pool water level instrumentation aids the operator in confirmation of the suppression pool as a heat sink. Additionally, the suppression pool level indicator could be used to ensure that adequate suppression pool level would be available for RPV Main Steam Relief Valve (MSRV) [SB] steam suppression and RHR pump net positive head. These functions have been reviewed, and there is no credible event, due to an Appendix R fire, that could cause adverse effects to the suppression pool. The suppression pool water level indication is for long term water level verification, and the suppression pool water level would remain acceptable during the Appendix R event. Additionally, the existing analysis and staff position (NRC Generic Letter 86-10, "Implementation of Fire Protection Requirements," Appendix R Questions and Answers paragraph 5.3.7 on Torus Level Indication) indicates that suppression pool level would not be significantly changed during emergency shutdown conditions.

The only sources of water that have the potential to overfill the suppression pool are the Condensate Storage Tank (CST) [KA], Wheeler Reservoir [BS], and the other unit suppression pool. The connections to the river and the torus from the other units have been evaluated to ensure that a single spurious operation will not result in the overfilling of the suppression pool. Additionally, the only connections from the CST to the torus which depend on



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Draining of the torus water is not an issue, because the connections are either manually isolated or pump operation is required to affect the level. HPCI, RCIC, RHR, and Core Spray [BM] all take suction from the suppression pool. A single spurious operation of the HPCI or RCIC will not cause the system to remove water to the CST. Also, if water is pumped into the RPV by one of these systems, it will eventually be returned to the suppression pool through the operation of the MSRVs.

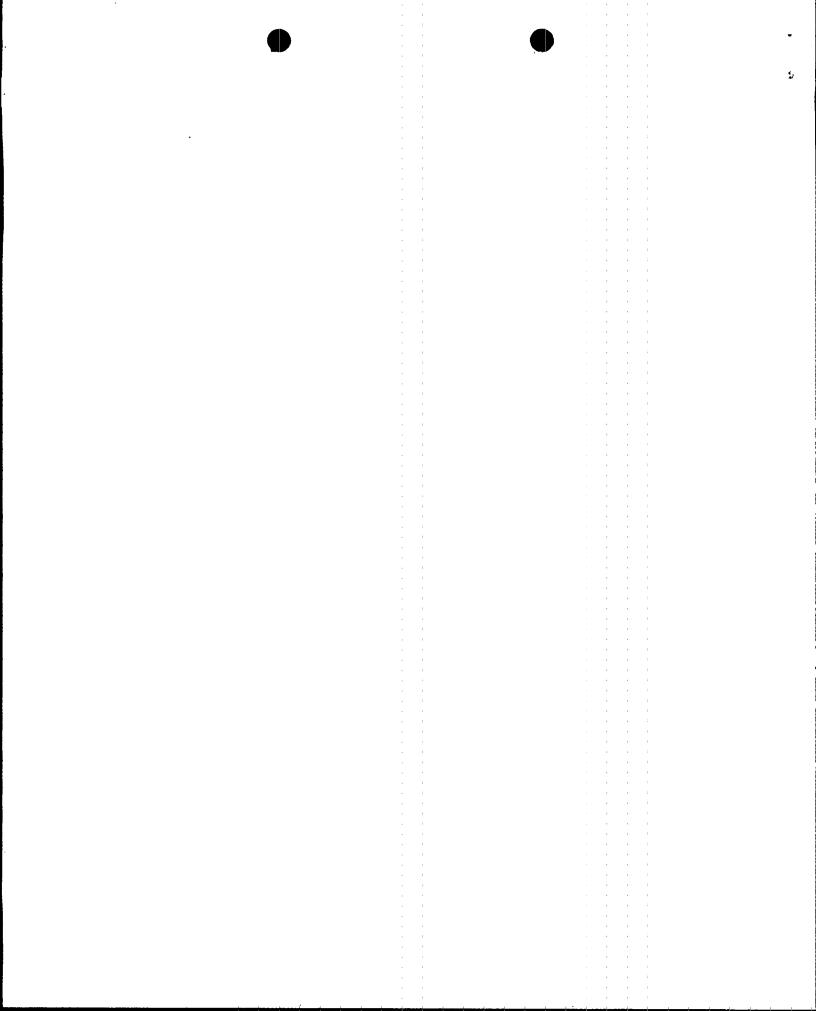
Drywell pressure indication is provided to the operators for monitoring the drywell conditions, should conditions indicate RPV depressurization is required. It has been previously evaluated that drywell pressure would not increase beyond an unacceptable level during the Appendix R event (NUREG/CR-2182, "Station Blackout at Browns Ferry Unit One - Accident Sequence Analysis"). As documented in NUREG/CR-2182, drywell pressure will reach a maximum of 25 psig at 5 hours into the event. (The station blackout scenario for the response of the drywell would be comparable to that for an Appendix R event.) Since the RPV is to be depressurized within 2 hours of the event initiation and the drywell is designed for 56 psig, an Appendix R event would not challenge the pressure rating of the drywell. There are no operator actions identified in Appendix R analysis which are based on a response to increasing drywell pressure. From the Appendix R analysis standpoint, drywell pressure indication is provided to give operators additional information only.

Additionally, should these associated circuits have resulted in the failure of the required instrumentation, the level and pressure indication instruments would have failed downscale from the loss of their power supply. The instruments would not have provided the operators with erroneous information. Therefore, the fire's impact on these instruments would not have resulted in the operators performing actions based on erroneous information that could have adversely impacted either Unit's safe shutdown capability.

Mis-routed Torus Suppression Pool Temperature and Reactor Level/Pressure Power Cables

The torus suppression pool temperature indication aids in the confirmation of the suppression pool as a heat sink and thus is used as an aid for the operators to start torus cooling with Residual Heat Removal Service Water (RHRSW) [BI] prior to 2 hours into the Appendix R event. However, analysis contained in NEDC-31119, "10 CFR 50 Appendix R Submittal Fire Protection and Safe Shutdown System Analysis Report for Browns Plant Nuclear Plant," has demonstrated that the suppression pool integrity can be adequately ensured by starting cold shutdown within 3 hours after the event initiation. Therefore, since the SSIs require initiation of RHRSW at 2 hours into the Appendix R event and suppression pool temperature does not determine any operator actions, the loss of this parameter would not inhibit the safe shutdown of the plant for an Appendix R event.

The reactor water level indication is utilized to determine the need for additional coolant inventory. The loss of this level indication, while undesirable, would not inhibit the ability of the plant to accomplish a safe shutdown. Initiated by 25 minutes into the Appendix R event, the high rate of coolant injection from an RHR pump (10,000 gpm) will rapidly replenish inventory loss. The RHR pump coolant injection will reflood the core until the water level rise to the main steam lines and spill out from the MSRVs back into the suppression pool. With a spurious MSRV opening, the minimum flow rate out of an MSRV has been calculated to be 6000 gpm. Therefore, with the required number of MSRVs open, this alternate shutdown cooling path would maintain adequate core cooling.



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The reactor pressure indication is used to determine when the RHR system can function. That is, open permissive for Low Pressure Coolant Injection (LPCI) [BP] injection valve. The required Appendix R shutdown path for Fire Area 2-3 is RHR injection via the LPCI flow path following manual depressurization of the reactor. The loss of the reactor pressure indication would not be significant for an Appendix R event since SSIs require the operator to initiate a rapid depressurization for this fire area by 20 minutes into the event by opening three MSRVs. (The SSIs provide direction for operational monitoring of pressure for reaching the permissive for opening of the LPCI injection valves.) Rapid depressurization will enable the operator to manually inject by the required 25 minutes into the event.

Based on the above, the loss of affected indication instruments would not have adversely impacted the safe shutdown capability of the plant. Therefore, TVA concludes that the above condition did not compromise plant safety and would not have jeopardized the public health and safety.

Mis-routed HPCI Steam Supply Valve Power Cable

The HPCI Steam Supply valve opens to allow steam flow to the HPCI turbine. If this valve, which is normally closed, had been opened prior to its power cable being damaged by a fire in Fire Area 11, the HPCI system would be available since a spurious closure for this valve is not postulated. However, even if the damage occurred prior to the valve opening, TVA's on-going Unit 2 Appendix R reanalysis indicates that the RCIC would be available for this fire area. Additionally, should the HPCI system not respond, the operator could initiate a RPV depressurization blowdown and use the LPCI mode of RHR for shutdown cooling. Therefore, the potential loss of the HPCI system would not have prevented the safe shutdown of the plant for an Appendix R event.

V. CORRECTION ACTIONS

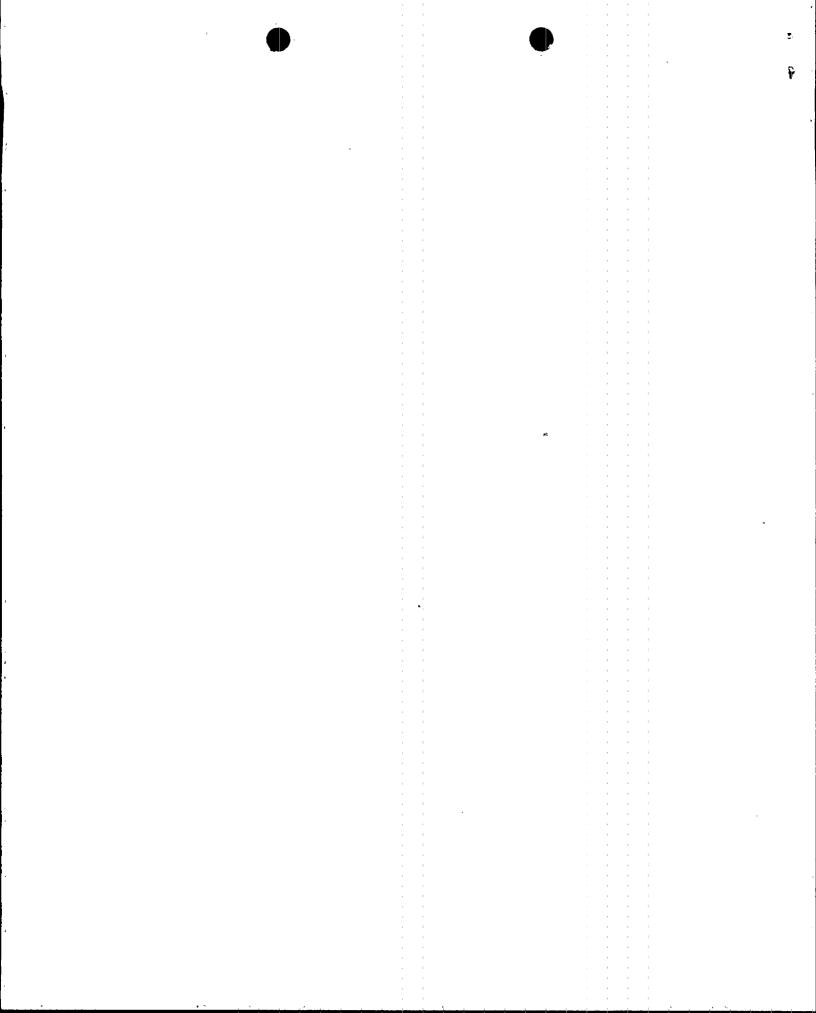
A. Immediate Corrective Actions:

A Problem Evaluation Report (PER) was initiated in accordance with the TVA Corrective Action Program.

When each noncompliance condition was discovered, TVA immediate established fire watches in the affected areas in accordance with the BFN Unit 2 and Unit 3 Appendix R SSP. Additionally, information indicating other instruments available for the same suppression pool level/drywell pressure data in the affected fire areas were provided to the operators. (While it was immediately determined that other instrumentation for torus suppression pool level/drywell pressure monitoring were available to the operators from the reanalysis, those instruments were not specifically called out in the SSIs.)

B. Corrective Actions to Prevent Recurrence:

The overlooked associated circuits and the mis-routed cables were the results of individuals making cognitive errors while performing initial Appendix R analysis and previous design changes, respectively. The errors were self-identified during TVA's on-going programmatic reevaluation of the Unit 2 Appendix R Safe Shutdown Program. The specific instances did not indicate any consistent trend or methodology, or that present procedural controls for SSP were inadequate. TVA considers these errors do not represent a programmatic Appendix R concern.



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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

Missed Torus Suppression Pool Level/Drywell Pressure Associated Circuits

TVA identified torus water level indication and drywell pressure indication instruments that would be available to monitor the required torus and/or drywell parameters. The SSP along with the appropriate SSIs were revised to use those available indication instruments.

For Unit 2 torus suppression pool level indication, TVA added to the Safe Shutdown Analysis level indicator 2-LI-64-54A for Fire Area 2-3 and 2-LI-64-66 for Fire Areas 1, 2-1, 2-2, 2-4, 2-5, and 20. For Unit 3, level indicator 3-LI-64-54A was added for Fire Area 3-2 and pressure indicator 3-PI-64-50 for Fire Areas 1 and 3-4 to provide for the operators the suppression pool level and drywell pressure monitoring, respectively, in the affected fire areas.

Mis-routed Torus Suppression Pool Temperature and Reactor Level/Pressure Power Cables

TVA will reroute the power cables for instrument loops 2-LI-3-58A, 2-PI-3-74A, and 2-TI-64-161 out of Fire Area 2-3 so that these instruments will be available in this fire area.

Mis-routed HPCI Steam Supply Valve Power Cable

TVA will revise the Appendix R Program to show the RCIC system as available for Appendix R safe shutdown in Fire Area 11.

VI. ADDITIONAL INFORMATION

A. Failed Components:

None.

B. Previous LERs on Similar Events:

There were two previous LERs (260/94002 and 260/94007) involving noncompliance with Appendix R that resulted from individuals failing to correctly implement/interpret the design criteria used during the original development of the Appendix R program. The corrective actions identified in the LERs would not have prevented this event.

VII. COMMITMENTS

- 1. TVA will reroute the power cables for instrument loops 2-LI-3-58A, 2-PI-3-74A, and 2-TI-64-161 before the end of the Unit 2 Cycle 9 outage.
- 2. TVA will revise the Appendix R Program to show the RCIC system as available for Fire Area 11 by April 30, 1996.

Energy Industry Identification System (EIIS) system and component codes are identified in the text with brackets (e.g., [XX]).

