

**LICENSEE EVENT REPORT (LER)**

(See reverse for required number of digits/characters for each block)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-8 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001.

FACILITY NAME (1)

Browns Ferry Nuclear Plant (BFN) Unit 3

DOCKET NUMBER (2)

05000296

PAGE (3)

1 OF 6

TITLE (4)

Loss of the Emergency Core Cooling Systems (ECCS) Division I Instrumentation Renders ECCS Equipment Inoperable.

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
07	17	96	96	004	01	09	30	96	N/A	
									FACILITY NAME	DOCKET NUMBER
									N/A	
									FACILITY NAME	DOCKET NUMBER
									N/A	

OPERATING MODE (9) N

POWER LEVEL (10) 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)(B)	50.73(a)(2)(viii)
20.2203(a)(1)	20.2203(a)(3)(i)	50.73(a)(2)(ii)	50.73(a)(2)(x)
20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71
20.2203(a)(2)(ii)	20.2203(a)(4)	50.73(a)(2)(iv)	OTHER
20.2203(a)(2)(iii)	50.36(c)(1)	50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A
20.2203(a)(2)(iv)	50.36(c)(2)	X 50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME

James E. Wallace, Compliance Licensing Engineer

TELEPHONE NUMBER (Include Area Code)

(205) 729-7874

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
X	AD	SCR	H177	N		X	AD	FU	B569	
X	AD	INVT	H177	Y						

SUPPLEMENTAL REPORT EXPECTED (14)

X	YES (If yes, complete EXPECTED SUBMISSION DATE).	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
				10	30	96

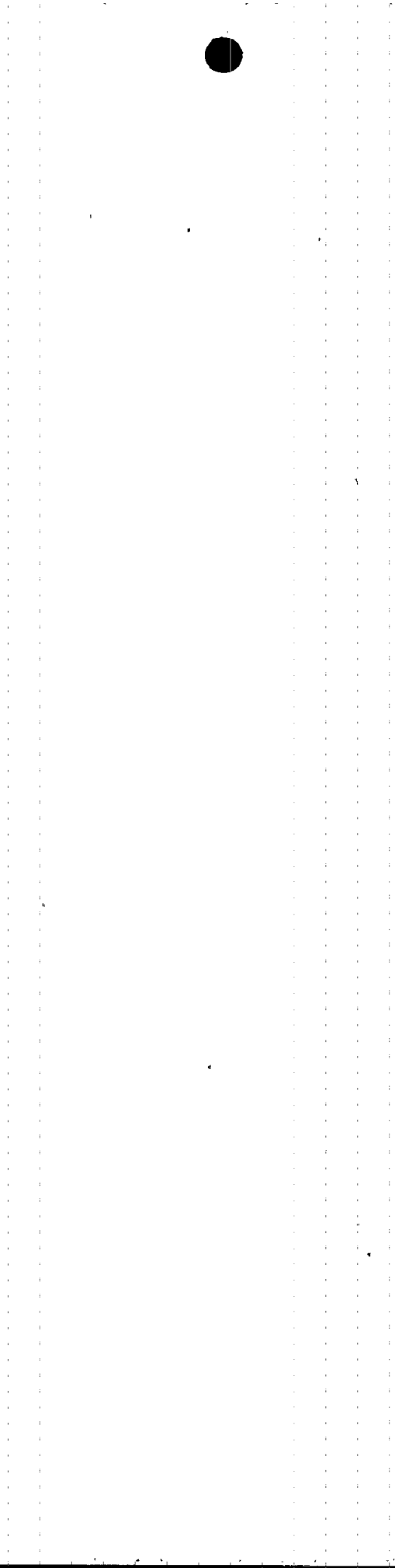
ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On July 17, 1996, with Units 2 and 3 at approximately 100 percent power and Unit 1 shutdown and defueled, Unit 3 operators declared ECCS Division I instrumentation inoperable, in accordance with TS 3.2.B. However, ECCS Division II instrumentation remained operable during this event. This event was presumed to be caused by a failed control board in the ECCS Division I Analog Trip Unit Inverter, which resulted in the loss of the inverter output. Unit 3 entered several limiting condition for operations (LCO) and prepared to shut the unit down. Operators initiated troubleshooting that found a cleared fuse, a shorted silicon control rectifier, and the failed ATU Inverter control board. The failed components were replaced, the ECCS instrumentation was declared operable, and the LCOs were exited. On August 6, 1996, a second similar event occurred. When TVA has determined the root causes and corrective actions for these events, TVA will provide a supplemental report.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(vii) as any event where a single cause or condition caused at least one independent train or channel to become inoperable in multiple systems.

Previous LERs on similar events were: 260/94001, 260/94006, and 260/94010.

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LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Browns Ferry Unit 3	05000296	96	-- 004	-- 01	2 of 6

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

I. PLANT CONDITIONS

At the time of discovery, Units 2 and 3 were operating at approximately 100 percent power. Unit 1 was shutdown and defueled.

II. DESCRIPTION OF EVENT

A. Event

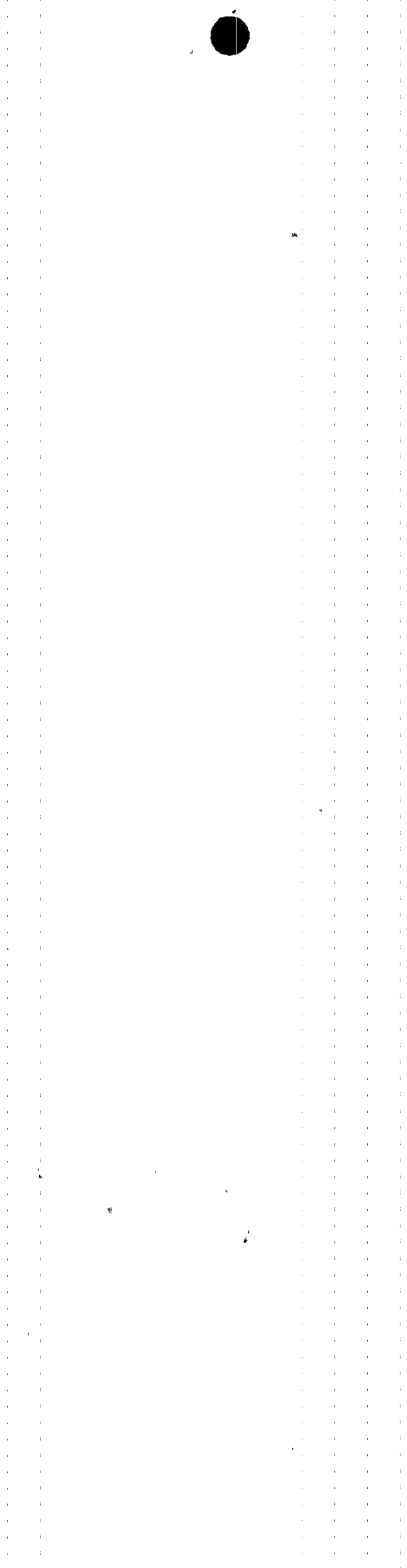
On July 17, 1996, at 1300 hours Central Daylight Time (CDT), the Unit 3, Division I Emergency Core Cooling Systems (ECCS) Analog Trip Unit (ATU) inverter power was lost as a result of a failed control board in the ECCS Division I Analog Trip Unit Inverter. This failure affected two of the four channels of the drywell pressure and reactor water level sensors. These sensors feed both divisions of initiation logic for the ECCS (Residual heat removal (RHR) [BO] system, core spray (CS) [BG] system, high pressure core injection (HPCI) [BJ] system, automatic depressurization systems (ADS) [JC], Anticipated Transient Without Scram (ATWS) [JC], and the Unit 3 diesel generators (EDG) [EK]). Additionally the failure affected the Reactor Core Injection Cooling (RCIC) [JN] system.

The above ECCS and RCIC were declared inoperable due to the loss of logic inputs as delineated in Technical Specifications (TS) Table 3.2.B. Since the ADS was declared inoperable, the plant was placed in limiting condition for operations (LCO) requiring the unit to be in hot shutdown within 12 hours. Additionally TS 3.5.A.3 and 3.5.B.8 for RHR and CS require the unit to be in cold shutdown within 24 hours. These were the most restrictive LCOs. As a result of these LCOs, power reduction was initiated on Unit 3 at 1700 hours. At 1757 hours, the ECCS ATU Inverter was repaired by the replacement of a cleared fuse, a shorted silicon control rectifier (SCR), and the failed ATU Inverter control board. At this time, the LCOs were exited.

It should be noted that HPCI was out of service for the first two and a half hours because of scheduled maintenance.

On August 6, 1996, a second similar event occurred. When TVA has determined the root causes and corrective actions for these events, TVA will submit a supplemental report.

This report is being submitted in accordance with 10 CFR 50.73 (a) (2) (vii) as any event where a single cause or condition caused at least one independent train or channel to become inoperable in multiple systems. BFN notified the NRC Operations Center of a one-hour non-emergency report due to the



LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Browns Ferry Unit 3	05000296	96	-- 004	-- 01	3 of 6

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

required initiation of the plant shutdown per TSs in accordance with 10 CFR 50.72(b)(1)(i)(A).

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

None.

**C. Dates and Approximate Times of Major Occurrences:**

July 17, 1996, at 1300 hours, CDT	Unit 3 ECCS ATU Inverter power was lost due to a failed inverter control board.
1700 hours, CDT	Unit 3 power reduction was initiated.
1747 hours, CDT	One-hour non-emergency report to the NRC was made due to the required initiation of the plant shutdown per TSs in accordance with 10 CFR 50.72(b)(1)(i)(A).
1757 hours, CDT	The ECCS ATU Inverter was repaired, and LCOs were exited.
August 6, 1996, at 2041 hours, CDT	Unit 3 ECCS ATU Inverter power was lost.

**D. Other Systems or Secondary Functions Affected:**

None.

**E. Method of Discovery:**

These events were promptly discovered when control room alarms indicated ECCS Division I instrumentation problems. One of the received alarms was ECCS ATU Trouble alarm.

**F. Operator Actions:**

There were no TS safety initiations required of the control room operators. The steps taken to identify the problem and initiated maintenance actions were appropriate.

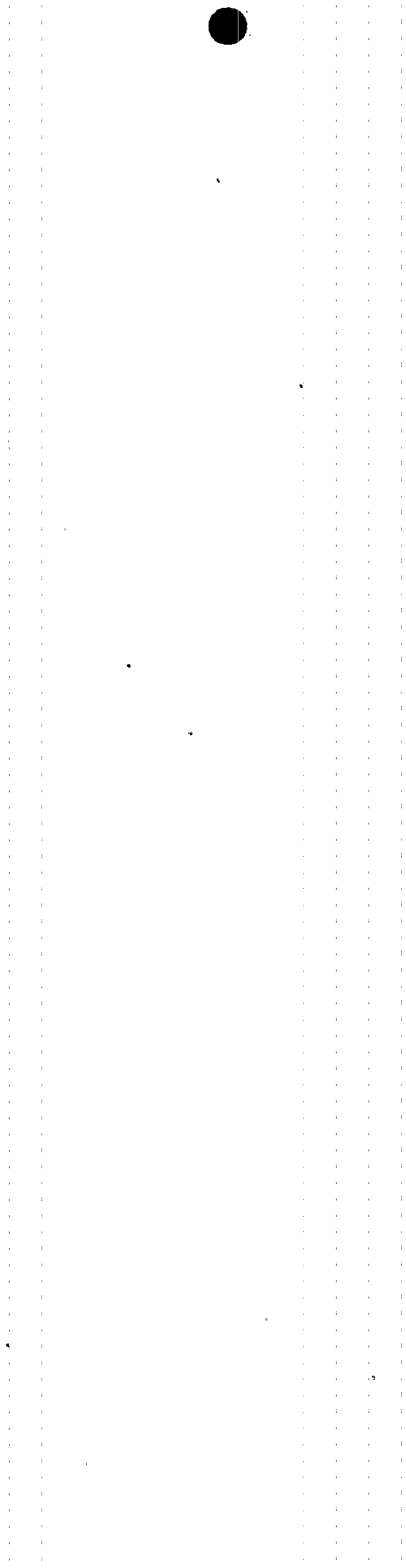
**G. Safety System Responses:**

None.

**III. CAUSE OF THE EVENT**

**A. Immediate Cause:**

The immediate cause of the event was a loss of inverter output.



LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Browns Ferry Unit 3	05000296	96 --	004 --	01	4 of 6

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

B. Root Cause:

The root cause of the event was presumed to be a failed inverter control board. However, a second similar event on the Unit 3 ECCS occurred on August 6, 1996. TVA is continuing to determine the root cause for both events.

C. Contributing Factors:

None.

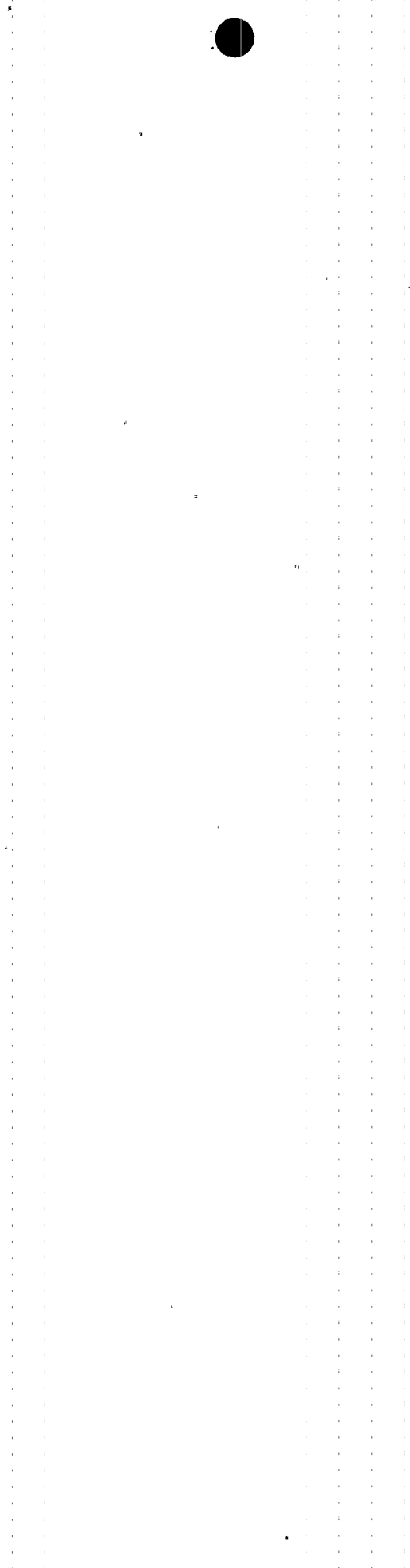
IV. ANALYSIS OF THE EVENT

July 17, 1996, Event

The failed ECCS Division I ATU Inverter caused a loss of level and/or pressure input signals to the HPCI, CS, RHR, ATWS, and ADS from their respective instrumentation logic systems.

This event did not result in a condition outside the plant's design basis for the following reasons:

- This event resulted from a power supply failure to the instrumentation logic of Division I of the ECCS. However, Division II instrumentation remained available for automatic initiation of ECCS Division I and Division II equipment during this event. Division I and Division II ECCS equipment remained available with the following exceptions: (1) RCIC would not automatically inject water into the reactor vessel as a result of a loss of flow controller power. However, HPCI was available to initiate and to inject water into the reactor vessel, and (2) Core Spray (CS) loop I would also not inject water into the reactor vessel due to the loss of the inboard injection valve control circuit to sense a reactor pressure less than 450 psig. However, CS loop I inboard injection valve could be manually opened to allow water to inject into the reactor vessel.
- The BFN Final Safety Analysis Report (FSAR), Section 6.5.2, states in part "...the reliability and the redundancy of the controls and instrumentation of the Emergency Core Cooling Systems show that no failure of a single initiating sensor either prevents or falsely starts the initiations of these cooling systems. No single control failure prevents the combined cooling systems from providing the core with adequate cooling."
- The event did not result in any plant transient described in the BFN FSAR, Chapter 14, Accident Analyses.





LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Browns Ferry Unit 3	05000296	96	-- 004	-- 01	.5 of 6

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

Therefore, based on the above, this event did not result in a condition outside the design basis of the plant, nor did it adversely affect the health and safety of plant personnel or the public.

V. CORRECTIVE ACTIONS

A. Immediate Corrective Actions:

July 17, 1996, and August 6, 1996

A cleared fuse, a shorted SCR, and the failed inverter control board were replaced in the ECCS Division I ATU Inverter. As a result of these replacements, the instrumentation logic was restored. The LCOs were exited.

B. Corrective Actions To Prevent Recurrence:

TVA is in the process of returning the inverter control board to the vendor for further investigation. Based on the recommendations of the vendor analysis of the failed inverter control board, appropriate actions will be implemented in accordance with BFN's Corrective Action Program.

As an enhancement, TVA is designing an alternate power supply which should minimize the impact of the loss of a single ATU Inverter.<sup>1</sup> This design is currently scheduled for fiscal year 1997. The installation of the alternate power supply will be scheduled for installation at the next outage where installation is practical.

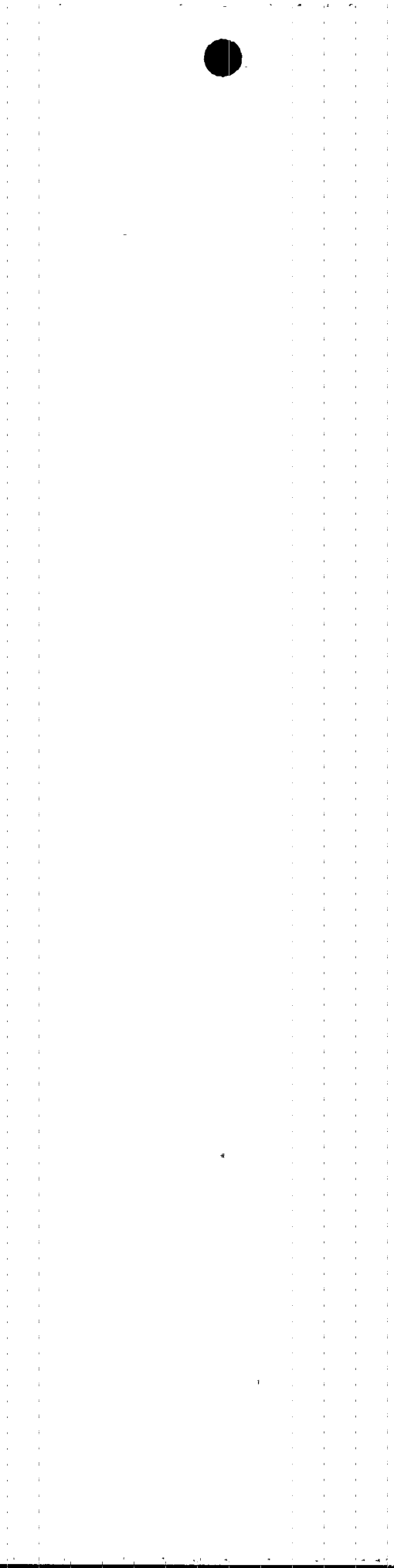
VI. ADDITIONAL INFORMATION

A. Failed Components:

July 17, 1996

- Silicon Controlled Rectifier, Part No. TD 42 F-HDR 6841310 13C, manufactured by HDR Power Systems, Inc.
- ATU Inverter control board, Part No. 2033189G, manufactured by HDR Power Systems, Inc.
- BUSS Semiconductor fuse, Part No. FWH-125A, 550v AC/DC manufactured by Bussmann, Inc.

<sup>1</sup>This action is considered an enhancement. TVA does not consider it a regulatory requirement.



LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Browns Ferry Unit 3	05000296	96	-- 004	-- 01	6 of 6

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

**B. Previous LERs on Similar Events:**

TVA has reviewed previous BFN LERs to determine if similar events have occurred. Three previous events have occurred:

LER (260/94001) was written as a result of an ATU DC input fuse failure. However, the root cause of the event was determined to be a failure of the ECCS ATU Inverter control board. Since this event occurred on a different unit, the corrective actions taken in LER 260/94001 would not have precluded this event (296/96004).

LER 260/94006 described the failure of an ECCS Division I ATU Inverter, 250v DC reactor motor operator valve (RMOV) breaker trip. This ECCS RMOV breaker tripped as a result of a shorted SCR. Therefore, corrective actions taken for LER 260/94006 would not have precluded this event (296/96004).

LER 260/94010 addressed the failure of C1 capacitor in the Division II ATU Inverter capacitor bank. This failed capacitor was a result of a manufacturing defect. Therefore, corrective actions for LER 260/94010 would not have precluded this event (296/96004).

TVA has had previous similar events. At this time, TVA believes that corrective actions taken to resolve those events would not have precluded this event. However, due to the aggregate of these events, TVA is conducting a broader evaluation of inverter problems. Consequently, TVA's current presumption that past ~~inverter~~ inverter problems were separate and isolated may change. This evaluation result will be addressed in the supplemental report.

**VII. COMMITMENTS**

TVA expects to submit a supplemental report by October 30, 1996.

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

