



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

R. D. (Rick) Machon
Vice President, Browns Ferry Nuclear Plant

September 20, 1994

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555


Dear Sir:

BROWNS FERRY NUCLEAR PLANT (BFN) - UNITS 1, 2, AND 3 - DOCKET
NOS. 50-259, 260, and 296 - FACILITY OPERATING LICENSE
DPR-33, 52, AND 68 - LICENSING EVENT REPORT 50-259/94002

The enclosed report provides details concerning the results
of the trip timing test at low level current settings on the
General Electric 250 VDC, 1600 amp, AKR circuit breakers.

This report is submitted as a voluntary LER because of its
potential generic safety significance.

Sincerely,



for R.D. Machon

R. D. Machon
Site Vice President
PAB 1E-BFN

Enclosure
cc: See page 2

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cc (Enclosure):

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LICENSEE EVENT REPORT (LER)

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

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)

Browns Ferry Nuclear Plant (BFN) Unit 1

DOCKET NUMBER (2)

05000259

PAGE (3)

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TITLE (4) Circuit Breakers Failed Trip Time Tests Because of Different Testing Equipment Used to Perform the Tests

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
4	28	94	94	002	00	09	20	94	BFN Unit 2	05000260
									BFN Unit 3	05000296
OPERATING MODE (9)		N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
POWER LEVEL (10)		100	20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)	
			20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)		73.71(c)	
			20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)		<input checked="" type="checkbox"/> OTHER	
			20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		Voluntary	
			0.405(a)(1)(iv)		50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		Report	
			20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)			

S LER (12)

NAME

Clare S. Hsieh, Compliance Engineer

TELEPHONE NUMBER (Include Area Code)

(205) 729-2635

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRPDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRPDS

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE).	<input checked="" type="checkbox"/> NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
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ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On April 28, 1994, TVA conducted an acceptance test for General Electric (GE) 250 VDC, 1600 Amp, AKR circuit breakers equipped with EC1 trip devices. Using the TVA test set, the breakers tripped at time intervals in excess of GE's published tripping times (or curves) at low-level current settings [i.e., 1.5X rated current (2400 Amp) and 2X rated current (3200 Amp)]. The breakers had been factory tested and passed the tests at GE with a much shorter trip time using the GE test set. TVA cannot make a conclusive determination as to why the curves and the breaker settings differ. However, TVA believes that the differences in breaker tripping time could be due to the different test equipment used by TVA and GE for their breaker testing. Specifically, GE's test equipment may have contained sufficient harmonic distortions to cause the breakers to trip faster at low-level settings and that these distortions could lead to the breakers actual operating characteristic being different from the curves published by GE. The above condition is not reportable per 10 CFR 50.73; however, TVA is reporting it voluntarily since this may be a potential safety concern at other nuclear plants in the industry. At TVA's request, GE lowered EC1 device oil viscosity so that the breakers will pass TVA test criteria.

LICENSEE EVENT REPORT
TEXT CONTINUATION

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

I. PLANT CONDITIONS

Unit 2 was at approximately 100 percent power. Units 1 and 3 were shutdown and defueled.

II. DESCRIPTION OF EVENT

A. Event

On April 28, 1994, during a DC circuit breaker acceptance test, the General Electric (GE) 250 VDC, 1600 Amp, AKR breakers [BKR] were found tripping at approximately 100 to 200 seconds in excess of GE's published criteria.

In April-May 1994, TVA procured two GE AKR breakers as part of the modifications on the plant 250V DC distribution system [EI]. Each breaker was equipped with two GE EC1 trip devices rated at 1600 Amp. DC circuit breaker acceptance tests were performed at BFN on the AKR breakers prior to their installation. Using the TVA DC test set, the AKR breakers trip times exceeded the limits of the published characteristic curve at low-level current settings. [For example, at 1.5X rated current (2400 Amp) and 2X rated current (3200 Amp), the acceptance criteria require the breaker to trip within 90 to 290 seconds. As tested at TVA, the breaker took approximately 450 seconds to trip.]¹ TVA contacted GE concerning this situation, since the breakers had previously passed the GE DC breaker acceptance tests with a much shorter trip time.²

As a result of the above DC testing discrepancy, TVA conducted a calibration verification test on the TVA DC test set. The calibration verification test, which included placing a calibrated shunt in series with the breakers being tested, found that the TVA DC test set within acceptable tolerances. The same calibrated shunt was taken to the GE facility. A single point check found the meter on the GE test set agreed with the direct

¹ At high-level current testing values [above 4.5X rated current (7200 Amp)], the trip time results at both TVA and GE were within the published characteristic curves.

² The EC1 devices were calibrated and tested with the GE DC test set to trip within the limits of their published characteristic curves at GE testing facility in Norcross, Georgia before the AKR breakers were shipped to TVA.

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current determined from TVA's shunt. However, TVA discovered a high value sixth harmonic pulsating current in the output of the GE DC test set. TVA believes that this high harmonic content could be the cause of the shorter trip time obtained by GE tests at low-level breaker settings.

On May 10, 1994, the AKR breakers were returned to GE for retest and rework. At the request of TVA, GE lowered the EC1 device oil viscosity to a level at which the EC1 devices, when tested with TVA DC test set, would pass the DC acceptance test. One AKR breaker was subsequently installed in the 250V DC distribution system.

The above condition is not reportable in accordance with 10 CFR 50.73 and is not a potential safety concern at BFN. The excessive tripping times were found during acceptance tests of the breakers. The breakers were procured as non-class 1E items to be used in non-safety portion of the 250 VDC distribution system. Additionally, TVA routinely tests breakers before their installations and periodically inspects currently installed breakers to ensure their functionality. These circumstances may not apply to other licensees and the condition could represent a potential safety concern at other nuclear plants in the industry.

Therefore, TVA is voluntarily reporting the above condition because of its potential generic safety significance.

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

None.

C. Dates and Approximate Times of Major Occurrences:

April 23, 1994	The above condition was identified during the TVA DC acceptance testing on the AKR breakers.
May 10, 1994	TVA returned the AKR breakers to the GE testing facility.
During late May and early June 1994	GE made additional adjustments and tests on the EC1 devices; the AKR breakers were then shipped back to TVA.
June 22, 1994	One AKR breaker passed the TVA DC acceptance testing.

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D. Other Systems or Secondary Functions Affected:

TVA tests 250 VDC breakers on a routine basis, which demonstrates that existing breakers operate within their published characteristic curves.

E. Method of Discovery:

The above condition was discovered during the AKR DC circuit breaker acceptance tests at TVA BFN facility.

F. Operator Actions:

None.

G. Safety System Responses:

None.

III. CAUSE OF THE EVENT

A. Immediate Cause:

The AKR DC circuit breakers failed the TVA acceptance tests at low overcurrent breaker settings by exceeding published vendor operating times.

B. Root Cause:

TVA cannot make a conclusive determination why the curves and the breaker settings differ. However, TVA believes that the differences in the breaker tripping time could be due to the differences in test equipment used by TVA and GE for their breaker testings. GE's test equipment may have contained sufficient harmonic content to cause faster tripping than will occur with TVA's test equipment at low-level settings.

TVA uses Multi-Amp high current DC testing equipment that gives a clean, DC output waveform simulating as close as possible the DC required by the American National Standard for calibration marks on trip element. However, the DC test set used by GE for both calibrating and testing the ECI devices is a 3-phase, silicon control rectifier controlled, unfiltered DC output unit, which produces an output waveform with significant harmonic distortion. The high harmonic output content of the GE test set could lead to the breakers actual operating characteristic being different from the curves published by GE.

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C. Contributing Factors:

None.

IV. ANALYSIS OF THE EVENT

Circuit breakers with EC1 trip devices may not trip as specified by the breaker curves for low overcurrent conditions, this could result in a possible loss of selective coordination or allow equipment to be damaged. However, it is not a potential concern at TVA BFN as the AKR breakers involved in this event were procured from GE as non-class 1E components. Even if TVA had obtained the AKR breakers as class 1E, the breakers would not have caused any safety concern because TVA tests and verifies breakers for functionality prior to their installation and usage in safety-related systems. TVA performed these tests and verifications using a Multi-Amp DC test set as compared to GE DC test set. Additionally, TVA periodically inspects breakers and has not found any problems with the AKR breakers currently installed in the plant.

Therefore, TVA does not believe that the above condition involves or implicates any potential degradation for the currently installed circuit breakers. This condition did not adversely affect the safety and health of plant personnel or the public.

V. CORRECTIVE ACTIONS

A. Immediate Corrective Actions:

TVA conducted a calibration verification test on the TVA DC test set. After TVA's Multi-Amp DC test set was verified to be operating within acceptable tolerances, TVA returned the AKR breakers to GE for additional rework and retest.

B. Corrective Actions to Prevent Recurrence:

TVA performs acceptance tests on circuit breakers prior to their installation and usage. These tests ensure the proper functioning of circuit breakers regardless of whether or not they have been tested by the vendors.

TVA has informed GE of the above condition and is continuing to coordinate with GE to obtain a permanent resolution of this concern.

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VI. ADDITIONAL INFORMATION

A. Failed Components:

EC1 trip devices with a current rating of 1600 Amp, supplied by GE, failed to meet the manufacturers supplied current characteristic curve when tested using a DC test set with a clean DC output waveform.

B. Previous LERs on Similar Events:

There were no previous LERs on conditions similar to this. GE has indicated that TVA may be the first utility to test the 1600 Amp circuit breakers at low-level current settings of 1.5X and 2X rated current. TVA tests at these low breaker settings in order to perform more complete validations on breakers with high current ratings. Other utilities have breaker acceptance test inspections but usually test at higher values (such as 3X rated current).

GE 1600 Amp, AKR DC circuit breakers equipped with GE EC1 trip devices are the only ones identified by TVA so far to have unacceptable trip time at low-level testing current.

VII. Commitments

None.

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