Energy Systems Group
8900 De Soto Avenue
Canoga Park, California 91304

Telephone: (213) 341-1000
TWX: 910-494-1237
Telex: 181017

Rockwell International

March 11, 1983

In reply refer to 83ESG-1483

U.S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive
Arlington, Texas 76012

Attention: Mr. John Collins, Administrator
Region IV

References:
(1) ESG Letter 82ESG-7725 dated October 21, 1982, D. C. Empey to John Collins

(2) ESG Letter 82ESG-8085 dated November 3, 1982, D. C. Empey to John Collins

(3) ESG Letter 82ESG-7948 dated November 3, 1982, D. C. Empey to John Collins

(4) ESG Letter 82ESG-8933 dated December 14, 1982, D. C. Empey to John Collins

(5) ESG Letter 82ESG-8998 dated December 17, 1982, D. C. Empey to John Collins

Gentlemen:

Subject: Report of Deviation (10 CFR 21)

During ESG's IEEE-323 qualification program as described in the references, the post-LOCA hydrogen recombiner component noted below failed to function properly at elevated temperature. It is concluded from the test results and recent discussions with the manufacturer that the circuit breaker, which was initially selected by an ESG subcontractor who performed the design and fabrication of the BWR power cabinet in 1975-1976, was not properly selected for the specific application.

Rockwell
International

Component Description

ITE Gould circuit breaker, 3 pole, 600 V ac, fully enclosed, thermal magnetic, P/N EF3-B015, IEEE No. 79. This component was originally selected in 1975-1976 by Timetrol, the vendor to ESG. The specification from ESG called for 50°F to 148°F environment. The ITE catalog at that time gave derating data from 40°C (104°F) to 60°C (140°F) and extrapolation would indicate that operation at 150°F could be expected with proper derating. Subsequent reviews upon transferring fabrication to ESG in the post-1976 time period assumed that the component was satisfactory.

Test Results

Under the IEEE-323 Environmental Qualification Testing, the circuit breaker failed to reset (close) the circuit at 165°F (150°F design temperature plus 15°F margin) and post-test at ambient temperature, during the post-LOCA Environmental Testing. The circuit breakers provide 480 V ac power to various recombiner components and control devices. The failure of the circuit breaker would prevent the operation of these circuits and cause the recombiner to shut down.

An attempt was made on January 28, 1983, to repeat the test conditions during which the circuit breaker had failed. This test was conducted on a new EF3-B015 circuit breaker. The test which was completed on January 31, 1983, demonstrated that in post-LOCA environmental conditions, i.e., a high relative humidity and 169°F, the circuit breaker will automatically trip without any current load. The 169°F temperature was the circuit breaker case temperature during a transient to 212°F. An additional no load test conducted on March 9, 1983, on the same breaker showed that the breaker would trip at 147°F. The discrepancy in the trip temperature measured is due to the heating ramp rate and indicates that although the exterior of the case was at 169°F the internals were still at a lower temperature.

Further testing was performed to establish the temperature where the EF3-B015 circuit breaker would carry the required load without tripping. The tests were conducted at 3.5 amperes simulating the worst case load of the two operating BWR plants (Hatch and LaSalle). The other BWR plant requirements are enveloped by this test. The circuit breaker failed by tripping after 13 minutes at 140°F while carrying 3.5 amperes. At 130°F the breaker had not tripped after several days while carrying the 3.5 ampere load. Based on engineering judgment

Rockwell
International

this time period is believed to be sufficient to have achieved temperature stabilization and indicates that this load can be carried continuously for the specified 60-day recombiner post-LOCA operating duration.

Corrective Action/Comments

The results of the tests conducted from January-March 1983 on the EF3-B015, and discussion with ITE Gould personnel, indicates that this problem may be common to several lines of ITE thermal magnetic circuit breakers when applied at temperatures >120°F. This includes EF2-B, EF3-B, HE3-B, and JL3-B, all of which have been used in recombiner applications.

ESG is currently conducting a review and some further testing to investigate the behavior of the EF-2B, EF3-B, HE3-B, and JL3-B circuit breakers. A further report and recommended corrective actions will be made if the testing verifies that these other circuit breakers are not operable in the required environment.

BWR Recombiners (Hatch 2, LaSalle 1 and 2, Fermi 2, Shoreham 1, Nine Mile Point 2)

As an interim fix, the circuit breaker should be bypassed. Another alternative is to relocate the power cabinet or to provide supplemental cooling of the power cabinet to reduce the temperature to less than 140°F nonoperating (this number includes a 7°F margin). The maximum power cabinet ambient during operation must be determined by measuring the temperature rise in the individual power cabinets under startup conditions and subtracting this value from the 130°F maximum breaker operating temperature. It is expected that the temperature rise in the cabinet is approximately 20°F. Installation of properly sized magnetic breakers is currently considered the permanent corrective action.

PWR Recombiners (Hartsville & Phipps Bend, Clinton 1 and 2, Byron, Palo Verde 1, 2, and 3)

The maximum specified ambient temperature for PWR power and control cabinets is 122°F. The worst case load on the EF3-B015 breaker in PWR applications is the cooling fan motor. A test was conducted to determine the maximum operating temperature for this breaker in the PWR application. The test condition was 33 amperes applied for 5 seconds to simulate the motor in rush (locked rotor current) immediately followed by 5.6 amperes continuous (full-load running current). Under these conditions the breaker will trip at 130°F. At 120°F local breaker ambient, the load was carried for several days.

Rockwell International

The temperature rise in PWR power and control cabinets has been measured at a cabinet ambient of 72°F and was found to be 20°F.

As an interim fix, the circuit breaker should be bypassed. Another alternative is to relocate the power and control cabinet or to provide supplemental cooling of the power and control cabinet to reduce the ambient to <100°F. Replacement of the thermal magnetic breakers with magnetic only breakers is being considered as the permanent fix.

Affected Plants

Customer Name	NRC Licensed Facility/Activity	Qty	Date Shipped
Detroit Edison	Fermi 2 NPS	6	08-76[2]
Long Island Lighting Company	Shoreham 1 NPS	6	02-22-77[2]
Georgia Power Company	Hatch 2 NPS	6	06-14-77[1]
Niagara Mohawk Power Corporation	Nine Mile Point 2 NPS	6	02-23-79[2]
Commonwealth Edison	LaSalle County 1 and 2 NPS	4	08-29-78[1,2]
Tennessee Valley Authority	Hartsville & Phipps Bend NPS	8	02-23-79[3]
Illinois Power	Clinton 1 and 2 NPS	10	02-08-80[3]
Commonwealth Edison Company	Bryon NPS	22	09-09-80[3]
Arizona Public Service Company	Palo Verde 1, 2, and 3 NPS	12	02-22-79[3]

(1) Operating plant
(2) BWR Mark 1 or 2 plants. The recombiner power cabinet for BWR Mark 1 and 2 plants has a maximum post-LOCA ambient operating temperature requirement of 150°F.
(3) The recombiner power and control cabinets for PWR and BWR Mark 3 plants have a maximum post-LOCA ambient temperature requirements of 122°F. The cabinet temperature rise must be considered to determine the impact of PWR systems. At an ambient temperature of 72°F, the measured value of cabinet temperature rise is 20°F.

Rockwell
International

Notifications

Concurrent with this report, each listed plant operator is being notified of our test results and will receive our continuing test results as well. We will further request each plant operator to review the actual ambient temperature requirements for his particular facility in order to more positively define the magnitude of the problem.

Additional components which failed to function properly as a result of our qualification program are given in the references.

If you require further information or clarification, please call me at (213) 700-3926.

Very truly yours,

D. C. Empey, Director
Quality Assurance
Energy Systems Group

6891A/cp

cc: Director, Office of Inspection and Enforcement (3)
U.S. Nuclear Regulatory Commission
Washington, DC 20555