



MISSISSIPPI POWER & LIGHT COMPANY

Helping Build Mississippi

P. O. BOX 1640, JACKSON, MISSISSIPPI 39205

JAMES P. McGAUGHY, JR.  
ASSISTANT VICE PRESIDENT

September 15, 1981

Office of Inspection Enforcement  
U. S. Nuclear Regulatory Commission  
Region II  
101 Marietta Street, N.W.  
Suite 3100  
Atlanta, Georgia 30303



Attention: Mr. J. P. O'Reilly, Director

Dear Mr. O'Reilly:

SUBJECT: Grand Gulf Nuclear Station  
Units 1 and 2  
Docket Nos. 50-416/417  
File 0260/15525/15526  
PRD-80/39, Final Report  
Defective Terminations in  
ITE/Brown Boveri Electric  
Breakers and Switchgear  
AECM-81/338

- References: 1) AECM-80/177, 8/1/80  
2) AECM-80/276, 11/6/80  
3) AECM-81/70, 2/17/81

On July 3, 1980, Mississippi Power & Light Company notified Mr. R. Wright, of your office, of a Potentially Reportable Deficiency (PRD) at the Grand Gulf Nuclear Station (GGNS) construction site. The deficiency concerns defective terminations in ITE/Brown Boveri Electric breakers and switchgear.

We have determined that this deficiency, had it remained uncorrected, could adversely affect the safety of operations of the nuclear power plant and is reportable under the provisions of 10CFR50.55(e). The systems containing the deficient equipment have been turned over to MP&L, but the affected equipment had been identified prior to turnover so the deficiency is not reportable under 10CFR21.

Attached is our final report giving all necessary information.

Yours truly,

*J. P. McGaughy, Jr.*  
J. P. McGaughy, Jr.

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ATTACHMENT

cc: See page 2

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Mr. J. P. O'Reilly  
NRC

AECM-81/338  
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cc: Mr. N. L. Stampley  
Mr. R. B. McGehee  
Mr. T. B. Conner

Mr. Victor Stello, Director  
Office of Inspection & Enforcement  
U. S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Mr. G. B. Taylor  
South Miss. Electric Power Association  
P. O. Box 1589  
Hattiesburg, MS 39401

FINAL REPORT FOR PRD-80/39

I. Description of Deficiency

Vendor terminations (ring tongue terminal lugs) in the 4.16 KV metal clad switchgear and 480 volt load centers manufactured by Brown Boveri Electric, Inc. were found to have faulty crimps.

After this deficiency was noted, our Constructor undertook, with the equipment vendor, Brown Boveri Electric, Inc., an inspection of all lugs in the switchgear to verify that the conductors are visible inside the lug barrel, and that a crimp has been placed properly on each barrel.

During this inspection program several other deficiencies were noted such as:

1. Lugs for #10 and #12 wire were used on #14 wire.
2. Some lugs were bent and/or deformed.
3. Some terminal lugs had been trimmed or cut to fit into the terminal strips.
4. Wires were inserted too far and protruded past the end of the lug barrel.
5. Individual strands were bent back and protruded from the rear of the lug barrel.

Several other problems were also identified during the inspection of the circuit breakers on nine (9) of the breakers. These included deficient vendor wires, cables, contacts, and lugs. The scope of this PRD was expanded to include these breakers.

The deficient equipment is in the 4.16 KV Switchgear and Load Shedding and Sequencing Panels, (R21). Most of the other plant systems are affected also. The deficiency affects both Unit 1 and Unit 2.

The cause of the deficiency was improper workmanship at the manufacturer's shop. This deficiency does not apply to the NSSS supplier.

II. Analysis of Safety Implications

Approximately fifteen (15) lugs were noted which had wire not visible in the end of the barrel, and/or which had loose wires. One of these deficient terminations could have affected the overcurrent protection of the equipment and cause a failure. Therefore, these deficiencies are reportable under the provisions of 10CFR50.55(e).

The deficient equipment had been identified prior to turnover to MP&L by our Constructor, so this deficiency is not reportable under 10CFR21.

Brown Boveri Electric Inc. has reported this condition to the NRC under the provisions of 10CFR21. This was by letter from D. D. Duvall, Vice President and General Manager, to Mr. Victor Stello, Jr., Director, Office of Inspection and Enforcement, U. S. Nuclear Regulatory Commission, Washington, D. C., April 3, 1981.

### III. Corrective Actions Taken

The cause of the deficiency was improper workmanship at the manufacturer's shop. All safety-related medium voltage switchgears and 480 volt load centers supplied by Brown Boveri Electric for Unit 1 (4.16 KV Buses 15AA and 16AB and 480 Volt Load Centers 15BA1 through 15BA6 and 16BB1 through 16BB6) have been inspected and reworked as necessary. In all cases where a defective lug was found, the affected lug was cut off and reworked to our Constructor's standards. The drawout circuit breakers in the 480 volt load centers were given an inspection of all lugs which could be readily seen without disassembly of the breaker. It was decided that full breaker disassembly was not required since most deficient terminations were in the cabinets, not in the breakers. Further, the breakers were manufactured in a different factory under a more rigid QA/QC program. This inspection also covered the breakers for the deficiencies noted in IE Information Notice No. 81-06, March 1, 1981.

All corrective actions for Unit 1 with the exception of nine (9) circuit breakers have been completed. These will be repaired during future plant switchgear outages prior to Unit 1 fuel load. Our Constructor has issued Nonconformance Report (NCR) 5173 to track this.

Brown Boveri Electric Switchgears and Load Centers for Unit 2 will be inspected at a future date. Management Corrective Action Report (MCAR) 117 will track this inspection. All corrective actions for Unit 2 will be completed prior to Unit 2 fuel load.

Actions to preclude future recurrence have been undertaken by Brown Boveri, Inc. as outlined in their letter of April 3, 1981, to the Nuclear Regulatory Commission, which is attached.

bbc: Mr. D. C. Lutken  
Dr. D. C. Gibbs  
Mr. J. N. Ward  
Mr. J. P. McGaughy, Jr.  
Mr. J. D. Heaton  
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Brown Boveri Electric, Inc.

Manufacturer of I-T-E Electrical Power Equipment

RECEIVED 4/12/81  
~~412-20/1~~  
YT 291  
YT 517  
MCAR-117

April 3, 1981

RECEIVED  
APR - 6 1981  
WASH. D.O.

Mr. Victor Stello, Jr.  
Director, Region II  
Office of Inspection & Enforcement  
U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555

Dear Mr. Stello:

This report is a follow-up to a 10CFR50.55(e) report issued by the Mississippi Power & Light Company on the Grand Gulf Nuclear Station with respect to problems noted with ring tongued wire terminals in medium voltage metal-clad switchgear and 480V load centers supplied by Brown Boveri Electric, Inc., (formerly known as I-T-E).

This condition was documented in NCR 4851 by Bechtel who is both Engineer and Constructor for the Grand Gulf Nuclear Station. Initially, it was reported that two (2) crimped wire terminals came loose from their control wires in safety related switchgear. BBEL and Bechtel mutually agreed that an inspection should be made to determine that there were no other loose wire terminals in the safety related switchgear wiring. Prior to this inspection an inspection criteria was established. This inspection criteria was to make a visual inspection of the crimped wire terminals to determine that the stranded wire was visible in the barrel of the terminal. If the wire were not visible, this crimped termination was not acceptable. This criteria was verified by tests performed by BBEL.

The results of this inspection which was performed by Bechtel show that there were approximately 15 wire terminals in which the wire was not visible in the end of the barrel, or which had loose wires. Bechtel reported that one of these wires could have affected the overcurrent protection of the equipment.

During the course of this equipment inspection program at the jobsite, there were other wire terminal anomalies which were detected. These included the items listed below.

1. No. 10-12 wire terminals had been crimped to a No. 14 wire.
2. Some wire terminals were bent or deformed.
3. Some wire terminals had been trimmed or cut to fit into a terminal board connection.

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4. Wire was protruding too far from the end of the barrel.
5. In some cases, individual wire strands were bent back and protruding from the rear end of the wire terminal.

Although the wire terminal anomalies listed above do not represent perfect workmanship, the nature of these anomalies is such that they would not result in a safety related problem. It should be noted that the equipment inspection reference so far, and the deficiencies and anomalies noted were found in Unit #1 switchgear which was manufactured during the period of late 1975 through early 1977 at the EBEL Chalfont, Pa. Switchgear Systems Division Operation.

On the average, during the manufacturing of a single cubicle of low-voltage switchgear there are some 282 wire terminal connections which are crimped. In the metal-clad switchgear there are some 240 connections per cubicle in the 5HK equipment and some 297 connections per cubicle in 15HK equipment.

In the Unit 1 switchgear at Grand Gulf there are approximately 36,000 wire terminal connections and approximately one-half of these are in safety related circuits. These figures are based on the "as built" drawings for the switchgear but there have been many additional circuits added to the equipment during field modifications.

Although the deficient wire terminal connections at Grand Gulf are less than 0.1 of one percent, other users should determine the need for inspecting the safety related circuits to assure that wire terminals are not loose and that wire strands are visible when looking into the end of the crimped wire terminal.

The cause of the deficiency at Grand Gulf is improper workmanship. During the time span of manufacturing of the switchgear for Grand Gulf, inspection was performed on a sampling basis. Early in 1977 BBEL procured new and improved crimping tools. These tools were identified by individual serial numbers and were issued to wiring personnel in accordance with a controlled plan. Wiring personnel were retrained in accordance with the tool manufacturers instructions.

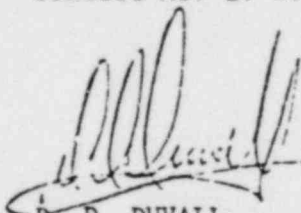
Wire terminal inspection procedures were revised and updated. Crimping tool calibration and procedures were revised and updated and during the second quarter of 1977, the wire terminal inspection criteria was changed from a sampling inspection to a 100% inspection for safety related switchgear.

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Unit #2 switchgear at Grand Gulf has also been furnished by BBEL. This equipment was manufactured during 1978 and early 1979. A cursory inspection of the equipment was performed at the jobsite during a recent visit and a few minor anomalies such as a single strand of wire protruding from the rear of the wire terminal were noted. BBEL will propose to Bechtel to perform a sample inspection of Unit #2 switchgear wire terminals to determine if any further action is required.

Although the majority of the safety related switchgear has been manufactured at the BBEL Chalfont, Pa. Operation, equipment of the same design has been manufactured at the BBEL Tulsa, Oklahoma Operation and a small amount of equipment has been manufactured at the BBEL Sanford, Florida Operation.

If you require any additional details in this matter, please feel free to contact Mr. E. W. Rhoads at 215-628-7660.



D. D. DUVALL  
Vice President & General Manager  
Switchgear Systems Division

EWR/jm

cc: J. P. O'Reilly  
Director, Region II  
Office of Inspection and Enforcement