

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

May 31, 1984

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BLRD-50-438/83-59
BLRD-50-439/83-52

U.S. Nuclear Regulatory Commission
Region II

Attn: Mr. James P. O'Reilly, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30303

Dear Mr. O'Reilly:

BELLEFONTE NUCLEAR PLANT UNITS 1 AND 2 -DEFICIENT SQUARE ROOT EXTRACTOR
MODULES FOR REACTOR PROTECTION SYSTEM BY BAILEY METER COMPANY
- BLRD-50-438/83-59, BLRD-50-439/83-52 - FINAL REPORT

The subject deficiency was initially reported to NRC-OIE Inspector
Linda Watson on November 14, 1983 in accordance with 10 CFR 50.55(e) as NCR
2517. This was followed by our interim reports dated December 8, 1983 and
February 17, 1984. Enclosed is our final report. We consider 10 CFR Part
21 applicable to this deficiency.

If you have any questions, please get in touch with R. H. Shell at
FTS 858-2688.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills

L. M. Mills, Manager
Nuclear Licensing

Enclosure

cc: Mr. Richard C. DeYoung, Director (Enclosure)
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Records Center (Enclosure)
Institute of Nuclear Power Operations
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ENCLOSURE

BELLEFONTE NUCLEAR PLANT UNITS 1 AND 2
DEFICIENT SQUARE ROOT EXTRACTOR MODULES FOR REACTOR
PROTECTION SYSTEM BY BAILEY METER COMPANY
BLRD-50-438/83-59, BLRD-50-439/83-52
NCR 2517
10 CFR 50.55(e)
FINAL REPORT

Description of Deficiency

Square root extractor modules were returned to the manufacturer, Bailey Meter Company (BCCo), Wickliffe, Ohio, for rework to incorporate Babcock & Wilcox (B&W) field change package (FCP) No. 54. The rework was to add an enhanced input filter which would help to suppress turbulence-induced noise in the reactor protection system (RPS) measurement of reactor coolant system (RCS) flow, and thus, increase overall accuracy of the flow measurement.

When the reworked modules were returned from Bailey to the site, it was discovered that the module subcircuit board retaining hardware was loose, missing, or improperly installed.

B&W and BCCo have reviewed the nonconformance report (NCR) and determined that the following represents the root cause of the subject deficiencies.

1. Loose subcircuit boards - At some point after the final inspection at BCCo, some of the subcircuit boards became disengaged from their retaining clips. It is not possible to determine the exact cause/mechanism of this problem; however, testing conducted on the module frames has revealed that distortion of the module frame can cause some or all of the subcircuit boards to become disengaged from their retaining clips. It is believed that forces imposed upon the modules during packing/shipment/unpacking/handling could produce enough distortion to cause the subcircuit boards to disengage. While this is the most likely cause of the loose subcircuit boards, it cannot be stated to be the exact cause of the problem.
2. Nonfunctional subcircuit boards - Four of the modules contain an extra, nonfunctional subcircuit board. The root cause of this deficiency is failure by BCCo to visually detect the extra subcircuit board during final inspection of the modules. Additionally, BCCo did not allow representatives from TVA's Division of Engineering Design's (EN DES) Quality Engineering Branch (QEB) to inspect the modules at their facilities before returning them to Bellefonte.

3. Defective/missing subcircuit board retaining hardware - Some of the subcircuit board retaining devices (overhead retaining clips and terminal blocks) are cracked. This defect is similar to that reported in NCR 1795 (BLRD-50-438/82-30, BLRD-50-439/82-27) for retaining devices in other BCCo plug-in modules. The exact cause of the cracking is indeterminate. B&W and BCCo believe that the most likely cause of the cracking is the same distortion of the module which caused disengagement of the subcircuit boards. However, this cannot be stated to be the exact cause of the problem.

Also, some modules are missing nonfunctioning overhead retaining clips for some of the spare subcircuit board locations. This is not in accordance with design drawings which indicate overhead retaining clips at all spare locations. The root cause of this discrepancy is the same as that indicated above for the nonfunctional subcircuit boards.

Safety Implications

The square root extractor modules are part of the electrical equipment that enable the plant operator to monitor power, RCS hot and cold leg temperatures, RCS flow and pumps status, pressurizer level, and main feedwater flow and pump status. The retaining hardware deficiencies could have led to equipment malfunctions due to loosened or shortened electrical connections caused by loose subcircuit board movement, especially during a seismic event. If this equipment had been installed and left uncorrected, the operator might not have been able to monitor vital, essential, and operational control functions of the primary and secondary systems. Thus, the safe operation of the plant could be adversely affected.

Corrective Action

The defective modules are to be returned to the manufacturer (BCCo) for correction of the reported deficiencies. Upon delivery, TVA's Division of Construction (CONST) will install the repaired modules by February 1, 1985.

The following action has been taken to prevent recurrence of the reported deficiencies.

1. Loose circuit boards - To prevent distortion of the modules during shipping and handling, BCCo will place a retainer strip around the center of the module frame to restrain the frame. The strap must be removed before installation of the module.
2. Nonfunctional subcircuit boards - BCCo has taken steps to prevent recurrence of this problem by increasing the education of employees assembling the units and placing additional emphasis on the visual inspection of these modules. BCCo Quality Assurance is increasing its surveillance of this process to verify that these measures correct the problem.

Additionally, B&W has agreed to advise TVA (QEB) when equipment will be ready for shipment. This will permit TVA to inspect reworked equipment at BCCo facilities before shipment to Bellefonte.

3. Defective/missing subcircuit board retaining hardware - The action required to prevent recurrence of the cracked connector defect is the same as that for NCR 1795 (restated below).

"QEB will inspect all new plug-in modules which contain the subject components at BCCo facilities before shipment to the site. Any components which contain the subject defects will be rejected. BCCo will be required to replace all defective components before TVA's approval for shipment.

Additionally, EN DES has recommended that construction personnel inspect the polycarbonate components in the subject modules on a periodic basis for six months subsequent to their return to the site. Any recurrence of the defect in NCR 1795 in the replacement components must be reported to EN DES as soon as detected."

The action required to prevent recurrence of the missing subcircuit board retaining hardware is the same as that outlined above for the nonfunctional subcircuit boards.