



Westinghouse
Electric Corporation

Energy Systems

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October 29, 1990
NS-NRC-90-3547

Document Control Desk
US Nuclear Regulatory Commission
Washington, DC 20555

Attention: Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation

Dear Mr. Murley:

The following information is provided pursuant to the requirements of 10CFR Part 21 to report the potential for the existence of a substantial safety hazard as communicated by Ms. P. A. Loftus to Mr. C. E. Rossi of the Nuclear Regulatory Commission by telephone on October 26, 1990. This issue concerns the potential for the failure of a component in safety related instrumentation within the range of abnormal conditions for which the equipment was qualified.

BACKGROUND

Within the last several months, Westinghouse became aware of an unusually high failure rate of some printed circuit boards during prototype testing of a Westinghouse designed instrumentation system at elevated temperatures. An extensive investigation revealed that the board failures were related to commercial grade DC/DC converter modules supplied by Burr-Brown and qualified by Westinghouse for safety related applications. Failures were being detected at temperatures lower than those for which the DC/DC converter module had previously been qualified as documented in Westinghouse environmental qualification reports.

These devices are utilized in the following Westinghouse designed instrumentation systems: EAGLE-21 Process Protection System (PPS), Qualified Display Processing System (QDPS), Plant Safety Monitoring System (PSMS), Reactor Vessel Level Instrumentation System (RVLIS), Inadequate Core Cooling Monitor (ICCM), and Auxiliary Shutdown Indication System (ASIS).

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EVALUATION

Upon receiving notice of a potential for temperature related failures of printed circuit boards which contain the Burr-Brown 724 (BB724) module, Westinghouse began a test program to determine the exact cause of the observed failures. Through this test program, it was determined that when certain date codes of BB724 devices were subjected to elevated temperatures, two transistors within the circuitry conducted simultaneously, causing an overcurrent condition which resulted in a failure of the device.

The results of the engineering tests are summarized as follows:

- 1) There were no failures in any of the 1986/1987 date code BB724 devices tested at elevated temperatures. The environmental qualification programs for the systems which use the BB724 device were performed with devices manufactured in 1987 or earlier. All BB724 modules manufactured before 1988 are concluded to be reliable devices and totally consistent with those qualified by the Westinghouse safety related instrumentation equipment qualification test program which demonstrated that the safety related instrumentation is capable of performing its designated functions under all specified environmental conditions.
- 2) There were no failures at temperatures less than 55°C (131°F) in any of the 1988/1989 date code BB724 devices tested at elevated temperatures.
- 3) There were no failures at temperatures less than 45°C (113°F) in any of the 1990 date code BB724 devices tested at elevated temperatures.

SAFETY IMPACT

The normal operating environment for safety related instrumentation systems is approximately 24°C (75°F). If, during an elevated temperature condition, failures of the BB724 device were to occur in a safety system, it is possible that the affected safety system would be unable to perform a reactor trip, engineered safety features actuation system, control, or display function consistent with plant specific requirements. The plants for which our records indicate BB724 devices with date codes 1988/1989/1990, may have been supplied, are identified in the attachment to this letter.

Westinghouse does not have the necessary information to evaluate plant specific environmental conditions for which the instrumentation systems will be subjected for all credible events which could lead to an elevated temperature situation. Therefore, Westinghouse has characterized this condition as a potential substantial safety hazard on the basis that failures of BB724 1988/1989/1990 date code devices may occur at internal rack temperatures lower than the 60 °C (140°F) specified by the environmental qualification program for the affected systems, thus leading to a potential loss of safety functions.

CORRECTIVE ACTION

Westinghouse and Burr-Brown have worked closely together to develop circuit modifications which support reliable operation of the BB724 devices at temperatures consistent with the application of these devices in Westinghouse designed safety related instrumentation systems. These circuit modifications have been completed and successfully tested.

RECOMMENDED ACTION

It is recommended that the potentially affected utilities confirm the applicability of this issue to their plants. If affected, it is recommended that a review of their plant specific HVAC design basis be conducted to determine if a credible event can be postulated which would lead to a condition where rack temperatures would exceed those temperatures below which failures did not occur for 1988/1989/1990 date code BB724 devices as observed by the Westinghouse test program.

If credible events of this type are determined, the following alternatives are available:

- A. Replace the BB724 devices with devices having a pre-1988 date code or with devices which include the noted design modification to support reliable performance under the specified environmental conditions.
- B. Adopt administrative procedures which would serve to maintain temperatures in the range for which failures of the BB724 device have not been observed. The relevant BB724 date codes and associated temperatures are summarized here below:

<u>Date Code</u>	<u>Rack Temperature</u>	<u>Ambient Temperature</u>
1985/1987	Note 1	Note 1
1988/1989	55°C, 131°F	44°C, 111°F
1990	45°C, 113°F	34°C, 93°F

Note 1. Tests have demonstrated that 1986/1987 BB724 devices perform reliably at temperatures consistent with the Westinghouse equipment qualification specifications for safety related instrumentation.

COMMUNICATIONS

Westinghouse has informed the potentially affected utilities identified in the attachment and is forwarding a copy of this letter to all nuclear utilities with a Westinghouse NSSS. If you have any questions regarding this matter, please contact Mr. P. J. Morris of my staff at (412) 374-5761, or myself.

Sincerely,



W. J. Johnson, Manager
Nuclear Safety Department

Attachment

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Sincerely,



W. J. Johnson, Manager
Nuclear Safety Department

Attachment

Attachment to
NS-NRC-90-3547

POTENTIAL APPLICATIONS OF 1988/1989/1990 DATE CODE
BB724 DEVICES IN WESTINGHOUSE SAFETY RELATED SYSTEMS

Sequoyah Units 1, and 2⁽¹⁾
Watts Bar Unit 1⁽²⁾
Beaver Valley Units 1 and 2
Shearon Harris Unit 1
Catawba Unit 1
McGuire Unit 1
Seabrook Unit 1
South Texas Unit 1
Surry Unit 1
Vogtle Unit 1
Oconee Units 1, 2, and 3
Prairie Island Unit 1

NOTES:

- (1) 1988/1989/1990 BB724 date code devices have been replaced for Unit 2.
- (2) This plant has not yet operated, this issue could result in the potential for the existence of a substantial safety hazard if corrective action is not taken prior to operation.