



Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

APR 05 1991

WBRD-50-390/91-04
WBRD-50-391/91-04

10 CFR 50.55(e)

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

Gentlemen:

In the Matter of the Application of)
Tennessee Valley Authority) Docket Nos. 50-390
50-391

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2 - INADEQUATE DESIGN OF VARIOUS
AIR HANDLING UNIT (AHU) CONTROL CIRCUITS - WBRD-50-390/91-04,
WBRD-50-391/91-04 - FINAL REPORT

The subject deficiency was initially reported to NRC Region II on
February 22, 1991, in accordance with 10 CFR 50.55(e) as Condition
Adverse to Quality Report WBP 900581 R1. Enclosure 1 is TVA's final
report. The commitment in this report is provided in Enclosure 2. The
delay in submitting this report was discussed with Region II on March 25,
1991.

If there are any questions, please telephone P. L. Pace at (615) 365-1824.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

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Enclosures
cc: See page 2

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ENCLOSURE 1

WATTS BAR NUCLEAR PLANT (WBN)
INADEQUATE DESIGN OF VARIOUS AIR
HANDLING CONTROL CIRCUITS
CONDITION ADVERSE TO QUALITY REPORT WBP 900581 R1
WBRD 50-390/91-04 AND WBRD 50-391/91-04

FINAL REPORTDESCRIPTION OF DEFICIENCY

During post modification testing, prior to performance of system preoperational testing, two design deficiencies were discovered in the Main Control Room air handling unit control circuits. First, the standby air handling unit would not automatically start following (1) low differential water pressure across the operating chilled water pump, (2) low discharge airflow velocity from the operating air handling unit, or (3) when the inlet air temperature to the operating air handling unit was above 85 degrees Fahrenheit. Second, the existing air handling unit control circuit design would not allow the operating Main Control Room air handling unit and chilled water pump to start immediately after loading onto the emergency diesel generator buses following a loss of offsite power event.

Schematic drawings for Systems 30 (Ventilating), 31 (Air Conditioning), and 65 (Emergency Gas Treatment) were reviewed for similar control circuit design problems. The Electrical Board Room and Shutdown Board Room air handling unit control circuits were determined to have the same basic design deficiencies as those discovered in the Main Control Room air handling unit control circuits. The WBN Final Safety Analysis Report requires the standby Main Control Room, Electrical Board Room, and Shutdown Board Room air handling units to automatically start upon failure of the operating air handling unit. Additionally, the operating air handling units are required to start immediately after loading onto the emergency diesel generator buses following a loss of offsite power event.

SAFETY IMPLICATIONS

The primary safety function of the Main Control Room air handling units is to provide safe, uninterrupted occupancy of the Main Control Room habitability zone during normal, accident, and post-accident recovery conditions. The operators and equipment located in the Main Control Room could be subjected to temperatures and humidities outside the habitability zone requirements upon loss of the air handling units.

The primary safety function of the Electrical Board Room and Shutdown Board Room air handling units is to maintain acceptable environmental conditions for protection of safety-related mechanical and electrical equipment and controls following a design basis event. This equipment is designed to alarm only on the switchover to the standby system. Therefore, the following conditions would not be alarmed in the control room: (1) loss of power to the operating air handling unit and (2) loss of offsite power.

SAFETY IMPLICATIONS (continued):

Under conditions which would not produce an alarm in the control room, and with no personnel in the areas served by the Electrical Board Room or Shutdown Board Room air handling units, the only indication of the failed condition for the air handling units would be the state of the lights on the handswitches in the Main Control Room. Credit is not taken for the operator checking the operating condition of the Electrical Board Room and Shutdown Board Room air handling units by observing the handswitch lights during his shift or during a loss of offsite power. These areas could experience environmental conditions outside the plant design basis upon loss of the area air handling units. This, in turn, could cause failure of safety-related equipment to perform its intended safety function.

CORRECTIVE ACTIONS

1. The cause for the failure of the Main Control Room, Electrical Board Room, and Shutdown Board Room standby air handling units to start on loss of the operating unit was determined to be a timing problem in the circuit design. The time delay relay which initiated switchover to the standby unit (as well as deactivating the operating unit) is reset by the seal-in operate relay as soon as the operate relay is deactivated by the standby start relay. Only one relay state change is required to reset the standby start relay. The start of the standby unit requires three relay state changes through the buffer relay scheme. The standby unit does not have time to start before the initiating standby start relay is deenergized. The cause of this condition is design error. The designer failed to consider the finite amount of time required for a relay to respond to an input state change.

The original design basis documents, WB-DC-40-20 Revision 0, "Control Building Heating, Ventilating, and Air-Conditioning System," and WB-DC-40-21 Revision 0, "Auxiliary Building Heating, Ventilating, and Air-Conditioning Systems," did not contain the requirement for automatic switchover to the standby unit on a loss of power to the operating unit. The cause of this condition is design error.

Procedure Method (PM) 86-19 (Electrical Engineering Branch [EEB]), "Relay Logic," states the following design principle, "design the circuits such that the controlled load will assume its 'failsafe' position upon loss of control power." This PM was placed into effect after the above design error occurred. Adherence to PM 86-19 (EEB) will serve to prevent such occurrences in the future.

CORRECTIVE ACTIONS (continued):

2. The cause for the failure of the Main Control Room, Electrical Board Room, and Shutdown Board Room operating air handling units to automatically restart upon loading onto the emergency diesel generator buses following a loss of offsite power event was determined to be a circuit design which failed to consider this requirement. The relay that initiates operation of the unit must be sealed in through the Main Control Room switch start position. The presently installed switch spring returns to the center position. Once power is lost, the unit cannot be restarted from the Main Control Room until the switch is placed in the start position. The original design basis documents, WB-DC-40-20, Revision 0, and WB-DC-40-21, Revision 0, did not contain the requirement for the operating unit to automatically restart upon loading onto the diesel following loss of offsite power. Upon inclusion of this requirement in the design basis document, the document reviewer failed to recognize the inadequate air handling unit control circuit design. The affected design drawings may not have been reviewed as part of the design basis document change review. The cause of this condition was inadequate review.

Watts Bar Engineering Procedure (WBEP)-5.10, "Maintenance of Design Basis Document," includes the following review guideline, "ensure technical information contained in these drawings is consistent with the system description or system design criteria." This procedure was placed into effect after the above inadequate review occurred. Adherence to WBEP-5.10 will serve to prevent this condition from occurring in the future.

3. The Main Control Room, Electrical Board Room, and Shutdown Board Room air handling unit control circuits will be modified to meet the operational performance requirements specified in the Final Safety Analysis Report prior to System Group 2A completion.

ENCLOSURE 2
LIST OF COMMITMENTS

The Main Control Room, Electrical Board Room, and Shutdown Board Room air handling unit control circuits will be modified to meet the operational performance requirements specified in the Final Safety Analysis Report prior to System Group 2A Completion.