TENNESSEE VALLEY AUTHORITY
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WBRD-50-390/89-01
WBRD-50-391/89-02

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 - DEFICIENCY IN THE DESIGN OF THE EMERGENCY GAS TREATMENT SYSTEM (EGTS) - WBRD-50-390/89-01 AND WBRD-50-391/89-02 FINAL REPORT

The subject deficiency was initially reported to NRC Region II Inspector Ken Barr on February 8, 1989, in accordance with 10 CFR 50.55(e) as Condition Adverse to Quality Reports (CAQRs) WBP 880772 and WBP 880773. Enclosure 1 contains our final report for this deficiency. Enclosure 2 contains a list of commitments identified in this report.

If there are any questions, please telephone G. R. Ashley at (615) 365-8527.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

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Enclosures
cc: See page 2

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ENCLOSURE 1

WATTS BAR NUCLEAR PLANTS UNITS 1 AND 2
DEFICIENCY IN THE DESIGN OF THE EMERGENCY
GAS TREATMENT SYSTEM (EGTS)
WBRD-50-390/89-01 AND WBRD-50-391/89-02
CAQRs WBP 880772 AND WBP 880773
10 CFR 50.55(e)

FINAL REPORT

Description of Deficiency

Contrary to the design requirements specified in the EGTS system description, N3-65-4001, revision 1, a single failure of the auto path controls for the discharge modulating damper of the air cleanup subsystem or a mechanical failure of the auto path discharge modulating dampers can prevent the automatic switchover to the standby exhaust path resulting in the loss of annulus pressure control capabilities.

These dampers are in the EGTS (air cleanup subsystem) discharge ductwork to the Shield Building exhaust stack. Redundant ductwork and dampers are provided for each unit. These dampers are modulated by a differential pressure (DP) controller (PDIC-65-80, -82, respectively) to maintain the Containment Building annulus pressure below atmospheric (-0.5 inches water) during a loss of coolant accident (LOCA). This function is accomplished by the EGTS fans taking suction from the annulus and regulating the discharge flow out the Shield Building exhaust stack (PCO-65-80, -82) or recirculating airflow back to the lower extremities of the annulus (PCO-65-88, -89). During normal plant operations, the annulus is maintained at approximately -5.0 inches water by way of the annulus vacuum control fans. Upon initiation of the EGTS operation on a phase A containment isolation signal, the normal lineup is for one train of the EGTS discharge ductwork to be in automatic operation and the other train to be in a standby state in which it can be put into operation in the event of a failure in the automatic train.

Automatic operation of the discharge ductwork components involves the modulating dampers being controlled by the DP controller and the downstream isolation valves being open, allowing discharge airflow to be directed out the Shield Building stack or recirculated back to the lower annulus. The redundant train in the standby state involves the modulating dampers being controlled by redundant DP instrumentation similar to the automatic train, but the downstream isolation valves are closed in order to isolate airflow via these paths. Bistable modules associated with the DP instrumentation are utilized to detect a failure in the operating train when annulus pressures exceed a deadband around the setpoint (-0.5 inches water). If a failure occurs, the intent of the design is for the bistable logic to cause the isolation valves in the operating train to close and the isolation valves in the standby train to open, hence transferring automatic control to the standby train. The bistable logic is comprised of four setpoints, two of which are used as arming signals (-4.0 and -0.7 inches water), and the other two setpoints (-0.2 and -1.2 inches water) comprise the deadband around the setpoint of -0.5 inches water which if exceeded is indicative of a failure.

The arming bistables are such that when actuated, they are sealed into the logic unless manually reset by a local handswitch. The -4.0 inches water setpoint is armed during normal operation when the annulus DP is being controlled at -5.0 inches.

The -0.7 inches water setpoint is armed when the EGTS operation is initiated and the annulus DP transients through the -0.7 inches water setpoint to the -0.5 inches water control point. Once the annulus DP is being controlled at -0.5 inches, a failure which causes the DP to exceed the deadband will cause either the -0.2 or the -1.2 bistable to actuate and transfer automatic control to the standby train.

However, it was discovered that if a single failure occurred in the operating train at the time of an initiating accident or any point before the annulus DP reaching the -0.7 inches water arming setpoint, such that the modulating damper to the Shield Building stack failed open, the bistable logic would not allow automatic swapover to the standby train. If this failure occurred as described, the annulus DP would not reduce to the -0.5 inches water control point as designed, but could continue to discharge full flow (rated at 4000 CFM) out the Shield Building exhaust stack. The maximum design basis flow rate out the Shield Building exhaust stack is 500 CFM during air cleanup subsystem operation. The remaining flow is recirculated in the annulus in a manner that promotes mixing, dilution, and holdup of the containment vessel leakage. This design limits concentration of radioactive nuclides released to the environment to levels sufficiently low that the site boundary dose rates as well as low population zone dose rates are below the requirements of 10 CFR 100.

The cause of this condition can be attributed to a design oversight in that this specific type of failure was not anticipated in the initial design. Failure of design personnel to anticipate all possible accident scenarios contributed to the present incomplete system design.

Safety Implications

Due to an initial design oversight of the single failure scenario described above, a condition exists in which the occurrence of the single failure could result in an unmodulated open path of annulus air discharged to the environment. This situation could result in the site boundary whole body gamma dose exceeding 10 CFR 100 limits.

Corrective Action

TVA will prepare required design changes to add a time delay relay to back up the pressure switches that arm the transfer to the standby exhaust path. The time delay relay will initiate a transfer to the standby exhaust path in a specified time limit if the annulus pressure fails to pass through the -0.7 inches water (increasing) setpoint which arms the automatic switchover logic. Field modification to the present pressure switch logic to preclude any single failure occurrence on the discharge damper arrangement will be completed before fuel load of the respective unit.

TVA has already implemented control actions necessary to prevent recurrence of this deficiency and other conditions involving designs that do not anticipate all system requirements or problems in the initial design phase. Nuclear Engineering procedures have been implemented to insure that design output is based on sound requirements and methods for preparation, review, and approval of new designs or design changes to existing designs.

The unit 2 field work is being placed on hold status at this time.

ENCLOSURE 2

LIST OF COMMITMENTS

1. Prepare required design changes to add a time delay relay to back up the pressure switches that arm the transfer to the standby exhaust path.

2. Field modification to the present pressure switch logic to preclude any single failure occurrence on the discharge damper arrangement will be completed before fuel load of the respective unit.