UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

# SUPPLEMENTAL SAFETY EVALUATION

# BY THE OFFICE OF NUCLEAR REACTOR REGULATION

# WATTS BAR UNIT 1 RESPONSE TO NRC BULLETIN 88-08

# DOCKET NO. 50-390

## 1.0 BACKGROUND

In Reference 1, the Tennessee Valley Authority (TVA) provided an additional response to Action 3 of the section on "Actions Requested" in Bulletin 88-08 (Reference 2), as applicable to Watts Bar Nuclear Plant (WBN), Units 1 and 2. TVA stated that it had completed the implementation of a program for WBN Unit 1, and the engineering evaluation for WBN Unit 2, to address concerns of potential stratification and thermal cycling that could cause fatigue failure in unisolable sections of piping connected to the reactor coolant system (RCS). The program implementation and the evaluations were done by TVA in conjunction with Aptech Engineering Services, Inc. (APTECH).

APTECH identified all lines connected to the reactor coolant system (RCS) in both units which contain unisolable sections, and evaluated these lines for susceptibility to in-leakage or out-leakage according to guidance provided by the staff in Reference 3. Based on the operating conditions for each system, APTECH identified a number of lines which were potentially susceptible to the phenomena described in the bulletin.

In Reference 4, the staff provided a review of the APTECH evaluation, and concluded that the requirements of Action 3 of the bulletin were satisfactorily addressed for all unisolable lines subjected to in-leakage or out-leakage, except for the auxiliary pressurizer spray line, the letdown line to the excess letdown heat exchanger, and the residual heat removal supply line. In Reference 5, TVA submitted additional information, addressing the requirements for these lines.

## 2.0 EVALUATION

### 2.1 Auxiliary Pressurizer Spray Line

In Reference 1, APTECH considered the auxiliary pressurizer (PZR) spray line as not susceptible to in-leakage because the check valve is located outside the PZR spray line "turbulent penetration zone." No supporting documentation was provided for this assertion, since the concept of "turbulent penetration" has as yet not been found acceptable by the staff as a basis for the exclusion of unisolable lines to susceptibility of the phenomena described in the bulletin. In Reference 5, APTECH provided further justification, based on the

operating time intervals and the flow velocity in the PZR spray line. APTECH stated that the PZR spray line is essentially stagnant during normal operating conditions and that, based on heat transfer calculations, the conditions for cyclic thermal stratification and stresses are highly unlikely. Other conditions, under which the PZR spray line experiences design flow, occur with insufficient frequency and are of short duration such that any thermal cycling effects in the unisolable portion of the auxiliary PZR spray line are minimal and not significant. The staff has evaluated these arguments and finds them plausible and acceptable for satisfying the requirement of Action 3 for this line.

## 2.2 Excess Letdown Line

In Reference 1, APTECH identified the 1-inch excess letdown line to the excess heat exchanger to be potentially susceptible to out-leakage since the pressure upstream of the heat exchanger is lower than the RCS pressure. In Reference 5, APTECH stated that this line is isolated by a normally closed block valve, and that there are also two other normally closed valves located downstream from the block valve. In Reference 6, TVA provided additional clarification and stated that the excess letdown block valve is normally open, and that downstream there are three additional block valves, all normally closed. All valves are air-operated globe valves with double packing and no stem leak-off connections. APTECH also stated that cyclic leakage due to thermal expansion and contraction of the valve disc would be highly unlikely since an air operator is designed to exert a continuous closing force on the valve disc. Leakage through a path along the valve stem would thus require failures at the valve seat and the two packing sets, which is highly unlikely. This valve design effectively eliminates the likelihood of leakage along the valve stem and through the valve seat. As a result of the valve design features and the redundant valve configuration, this line is significantly different from the configuration discussed in Supplement 3 to the bulletin, and is therefore not considered susceptible to potential thermal stratification and cycling. The staff finds these arguments plausible and acceptable as a basis for satisfying the requirement of Action 3 for this line.

## 2.3 Fourteen-Inch Residual Heat Removal Line

In Reference 1, APTECH stated that the 14-inch residual heat removal (RHR) line is isolated by two motor-operated valves. APTECH stated that these valves are closed by torque setting, and will remain closed whether the valve discs are hot or cold, and therefore concluded that this line is not susceptible to the phenomena described in Supplement 3 of the bulletin. This approach was considered by the foreign plant mentioned in Supplement 3 as a means for preventing intermittent valve leakage in RHR lines, but was rejected since no assurance could be provided that the valve would open on demand. This consideration is feasible if sufficient torque is exerted to assure that the disc seats tightly. However, no assurance was provided that, if the valves were closed and seated under the required torque to prevent leakage, these valves would open on demand as required.

APTECH also indicated that the isolation valves on these lines are within the RCS "turbulent penetration" zone, which is essentially at RCS temperature. As

stated above, the application of the concept of "turbulent penetration" as a basis for satisfying the requirement of Action 3 has as yet not been accepted by the staff.

In References 5 and 6, TVA provided additional information regarding the isolation valves on the RHR line. There are two normally-closed block valves on this line, and each valve has a 10-inch bypass line with a normally-closed valve. All four valves are torque-seated motor-operated flexible wedge gate valves, and have double packing and no stem-leakoff connections. By seating these motor-operated valves (MOVs) with preselected torque rather than normal seating torque, the valve disc is wedged into the seat, which effectively seals the valve seating surfaces. Leakage through a path along the valve stem would thus require two failures (i.e., at the valve seat and at the double packing) which is highly unlikely. This valve design effectively eliminates the likelihood of leakage along the valve stem and through the valve seat. The capability to reopen these MOVs will be addressed in response to Generic Letter (GL) 89-10 (Reference 7), and is not addressed in this safety evaluation. These MOVs are also subject to valve seat leakage testing pursuant to the requirements stated in the ASME Code, Section XI. Based on these considerations, the valve design features and the redundant valve configuration, this line is significantly different from the configuration discussed in Supplement 3 to the bulletin, and is therefore not considered susceptible to potential thermal stratification and cycling. The staff finds these arguments plausible and acceptable as a basis for satisfying the requirement of Action 3 for this line.

## 3.0 CONCLUSION

The staff finds that TVA has provided the requested assurance necessary to satisfy the requirements of Action 3 of the Bulletin. The issues described in Bulletin 88-08 and Supplement 3 have been acceptably addressed for the auxiliary pressurizer line, the excess let-down line and the RHR line, for Watts Bar Unit 1, and are therefore considered resolved.

Contributors: M. Hartzman
H. J. Rathbun

Dated: June 23, 1995

REFERENCES


1. Letter of March 29, 1994, from W. J. Museler, Tennessee Valley Authority (TVA), to the USNRC Document Control Desk, with enclosed engineering report "Watts Bar Nuclear Plant Response to NRC Bulletin 88-08," by Aptech Engineering Services, Inc. (APTECH), March 1994.

2. NRC Bulletin 88-08 "Thermal Stresses in Piping Connected to Reactor Coolant Systems," with three supplements.

3. Letter of September 19, 1991, from P. S. Tam, USNRC, to D. A. Nauman, TVA, with enclosure titled "Evaluation Criteria for Responses to NRC Bulletin 88-08, Action 3, and Supplement 3."

4. Letter of October 21, 1995, from P. S. Tam, USNRC, to O. D. Kingsley, Jr., with enclosed report "Request for Additional Information and Partial Safety Evaluation Report, by the Office of Nuclear Reactor Regulation."

5. Letter of January 10, 1995, from D. E. Nunn, TVA, to the USNRC Document Control Desk, with enclosed APTECH report, "Response to US Nuclear Regulatory Commission Request for Additional Information on Watts Bar Bulletin 88-08 Evaluation," December 1994.

6. Letter of April 24, 1995, from R. R. Baron, TVA, to the USNRC Document Control Desk, with enclosure.

7. Generic Letter No. 89-10, "Safety Related Motor-Operated Valve Testing and Surveillance," June 28, 1989.