ENCLOSURE

SAFETY EVALUATION REPORT
WATTS BAR NUCLEAR PLANT, UNITS 1 AND 2
COMPLIANCE WITH ATWS RULE 10 CFR 50.62
DOCKET NO. 50-390/391

1.0 INTRODUCTION

On July 26, 1984, the Code of Federal Regulations (CFR) was amended to include Section 10 CFR 50.62, "Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants" (known as the ATWS Rule). The requirements of Section 10 CFR 50.62 apply to all commercial light-water-cooled nuclear power plants.

An ATWS is an anticipated operational occurrence (such as loss of feedwater, loss of condenser vacuum, or loss of offsite power) that is accompanied by a failure of the Reactor Trip System (RTS) to shut down the reactor. The ATWS Rule requires specific improvements in the design and operation of commercial nuclear power facilities to reduce the probability of failure to shut down the reactor following anticipated transients and to mitigate the consequences of an ATWS event.

Paragraph (c)(1) of 10 CFR 50.62 specifies the basic ATWS mitigation system requirements for Westinghouse plants. Equipment, diverse from the RTS, is required to initiate the auxiliary feedwater (AFW) system and a turbine trip for ATWS events. In response to paragraph (c)(1), the Westinghouse Owners Group (WOG) developed a set of conceptual ATWS mitigating system actuation circuitry (AMSAC) designs generic to Westinghouse plants. WOG issued Westinghouse Topical Report WCAP-10858, "AMSAC Generic Design Package," which provided information on the various Westinghouse designs.

The staff reviewed WCAP-10858 and issued a safety evaluation of the subject topical report on July 7, 1986 (Ref. 1). In this safety evaluation, the staff concluded that the generic designs presented in WCAP-10858 adequately meet the requirements of 10 CFR 50.62. The approved version of the WCAP is labeled WCAP-10858-P-A.

During the course of the staff's review of the proposed AMSAC design, the WOG issued Addendum 1 to WCAP-10858-P-A by letter dated February 26, 1987 (Ref. 2). This Addendum changed the setpoint of the C-20 AMSAC permissive signal from 70% reactor power to 40% power. On August 3, 1987, the WOG issued Revision 1 to WCAP-10858-P-A (Ref. 3), which incorporated Addendum 1 changes and provided details on changes associated with a new variable timer and the C-20 time delay. For those plants selecting either the feedwater flow or the feedwater pump/valve status logic option, a variable delay timer is to be incorporated into the AMSAC actuation logics. The variable time delay will be inverse to reactor power and will approximate the time that the steam generator takes to boil down to the low-low level setpoint upon a loss of main feedwater (MFW) from any given reactor power level between 40% and 100% power. The time delay on the C-20 permissive signals for all logics will be lengthened to incorporate the maximum time that the steam generator takes to boil down to the low-low level setpoint upon a loss-of MFW with the reactor operating at 40% power. The staff considers the Revision 1 changes to be acceptable.

Paragraph (c)(6) of the ATWS Rule requires that detailed information to demonstrate compliance with the requirements be submitted to the Director, Office of Nuclear Reactor Regulation (NRR). In accordance with paragraph (c)(6) of the ATWS Rule, Tennessee Valley Authority (TVA) (licensee) provided information by letter dated February 28, 1989 (Ref. 4). The letter forwarded the detailed description of the ATWS mitigating system actuation circuitry proposed for installation at the Watts Bar Nuclear Plant, Units 1 and 2 (WBN).

The staff held a conference call with the licensee to discuss the AMSAC design. As a result of the conference call, the licensee responded to the staff concerns by letter dated August 30, 1989 (Ref. 5).

2.0. REVIEW CRITERIA

The systems and equipment required by 10 CFR 50.62 do not have to meet all of the stringent requirements normally applied to safety-related equipment. However, the equipment required by the ATWS Rule should be of sufficient quality and reliability to perform its intended function while minimizing the potential for transients that may challenge the safety systems, e.g., inadvertent scrams.

The following review criteria were used to evaluate the licensee's submittals:

1. The ATWS Rule, 10 CFR 50.62.

2. "Considerations Regarding Systems and Equipment Criteria," published in the Federal Register, Volume 49, No 124, dated June 26, 1984.

3. Generic Letter 85-06, "Quality Assurance Guidance for ATWS Equipment That Is Not Safety Related."

4. Safety Evaluation of WCAP-10858 (Ref. 1).

5. WCAP-10858-P-A, Revision 1 (Ref. 3).

3.0 DISCUSSION AND EVALUATION

To determine that conditions indicative of an ATWS event are present, the licensee has elected to implement the WCAP-10858-P-A AMSAC design associated with monitoring the steam generator water level and activating the AMSAC when the water level is below the low level setpoint established for the reactor protection system (RPS). The AMSAC at WBN will contain two low-low level setpoints. The first setpoint will be set at 12 percent of steam generator level when the reactor power is between 40 and 80 percent power as indicated

by the turbine first stage impulse pressure. The second steam generator low-low level setpoint will be set at 25 percent of steam generator level when reactor power is above 80 percent. Also, the licensee will implement the new time delay (as described in the introduction section) associated with the C-20 permissive. However, the calculation to establish the time setpoint for this delay is not completed at this time and that Watts Bar committed to produce the setpoint for the AMSAC time delay during the design phase and to complete it before startup.

Many details and interfaces associated with the implementation of the final AMSAC design are of a plant-specific nature. In its safety evaluation of WCAP-10858, the staff identified 14 key elements that require resolution for each plant design. The following paragraphs provide a discussion on the licensee's compliance with respect to each of the plant-specific elements.

1. Diversity

The plant design should include adequate diversity between the AMSAC equipment and the existing Reactor Protection System (RPS) equipment. Reasonable equipment diversity, to the extent practicable, is required to minimize the potential for common-cause failures.

The licensee has provided information to confirm that the AMSAC logic circuits will be diverse from the logic circuits of the RPS in the areas of design, equipment, and manufacturing. Where similar types of components are used, such as relays, the AMSAC will utilize a relay of a different make and manufacturer.

2. Logic Power Supplies

Logic power supplies need not be Class 1E, but must be capable of performing the required design function upon a loss of offsite power. The logic power must come from a power source that is independent from the RPS power supplies.

The licensee has provided information verifying that the logic power supplies selected for the Watts Bar AMSAC logic circuits will provide the maximum available independence from the RPS power supplies. The AMSAC power will be provided by a 120 VAC preferred power board which will be independent of the RPS and capable of operating upon a loss of offsite power. This power supply is non-safety related, noninterruptable, and battery backed.

3. Safety-Related Interface

The implementation of the ATWS Rule shall be such that the existing RPS continues to meet all applicable safety criteria.

The proposed AMSAC design interfaces at its input with the existing Class 1E circuits of the steam generator level instrumentation. At its output, the AMSAC will interface with the Class 1E circuits of the plant's AFW pumps. Connections with these Class 1E circuits will be made through the use of approved Class 1E isolation devices. The licensee has confirmed to the staff that the existing safety-related criteria that are in effect at the plant will continue to be met after the implementation of AMSAC (i.e., the RPS will continue to perform its safety functions without interference from AMSAC). Refer to Item 9 for further discussion of this issue.

4. Quality Assurance

The licensee is required to provide information regarding compliance with Generic Letter (GL) 85-06, "Quality Assurance for ATWS Equipment That is Not Safety Related."

The licensee stated that the quality assurance practices at Watts Bar, as applicable to the nonsafety-related AMSAC equipment, will comply, as a minimum, with the quality assurance guidance as set forth in GL 85-06.

5. Maintenance Bypasses

Information showing how maintenance at power is accomplished should be provided. In addition, maintenance bypass indications should be incorporated into the continuous indication of bypass status in the control room.

The licensee provided information showing how maintenance will be accomplished at power. The staff was informed that maintenance at power will be provided by inhibiting the operation of AMSAC's logic output, which will block the output signal and, thus, prevent it from reaching the final actuation devices. The continuous indication of bypass status will be provided in the main control room through the use of built-in status indication. The licensee further stated that a human-factors evaluation of the subject indication consistent with the plant's control room design process has been performed.

6. Operating Bypasses

The operating bypasses should be indicated continuously in the control room. The independence of the C-20 permissive signal should be addressed.

The AMSAC inhibit/permissive signal (C-20) will be generated by the turbine first stage impulse chamber pressure signals. The AMSAC will be blocked (inhibited) whenever these pressure signals indicate the reactor power is below 40 percent and the AMSAC will be armed (permissive) when the reactor power is at or above 40 percent power. The C-20 signal will be maintained for a period of time within the boundaries as set in WCAP 10858. The time delay setpoint will be calculated during the design phase of the AMSAC.

The C-20 signal will be generated by AMSAC dedicated pressure transmitters and instrumentation and as such will be independent from the RPS. The C-20 status will be indicated in the main control room via the switch module status monitor windows.

7. Means for Bypasses

The means for bypassing shall be accomplished by using a permanently installed, human-factored, bypass switch or similar device. Disallowed methods for bypassing mentioned in the guidance should not be used.

The licensee's response stated that bypassing AMSAC during testing and maintenance will be performed through the use of a permanently installed control switch. The disallowed methods for bypassing such as lifting leads, pulling fuses, blocking relays, or tripping breakers will not be used. The licensee has conducted a human-factors review of the bypass controls consistent with the plant's detailed control room design review process.

8. Manual Initiation

Manual initiation capability of the AMSAC mitigation function must be provided.

The licensee discussed how manual turbine trip and auxiliary feedwater actuation are accomplished by the operator. In summary, the operator can use existing manual controls located in the control room to perform a turbine trip and to start auxiliary feedwater flow should it be necessary. Thus, no additional manual initiation capability will be required as a result of installing the AMSAC equipment.

9. Electrical Independence From Existing Reactor Protection System

Independence is required from the sensor output to the final actuation device, at which point nonsafety-related circuits must be isolated from safety-related circuits by qualified Class 1E isolators.

The licensee discussed how electrical independence is to be achieved. The proposed design requires isolation between the non-Class 1E AMSAC and the Class 1E circuits associated with the steam generator level input signals and the AMSAC output signals to the AFW pumps.

The licensee had informed the staff that the required isolation will be achieved using electrical isolation devices that have been qualified and tested to Class 1E electrical equipment requirements. In addition, the licensee will perform calculations during the design phase to determine that the AMSAC will not present a greater challenge to the isolation devices than that to which they were qualified. The implementation of the AMSAC design will be consistent with the electrical separation criteria established for the plant.

10. Physical Separation from Existing Reactor Protection System

The implementation of the ATWS mitigating system must be such that the separation criteria applied to the existing RPS are not violated.

The licensee stated that the AMSAC circuitry will be physically separated from the RPS circuitry. In addition, the ATWS equipment cabinets will be located so that there will be no interaction with the protection system cabinets. The licensee also stated that the RPS design will continue to meet (subsequent to the implementation of AMSAC) the physical separation criteria originally established for the Watts Bar Plant as stated in the plant's FSAR.

11. Environmental Qualification

The plant-specific submittal should address the environmental qualification of ATWS equipment for anticipated operational occurrences.

The licensee stated that AMSAC mitigation equipment will be located in areas of the plant that are considered to be a mild environment. The licensee also stated that the equipment will be designed to operate in the environment for anticipated operational occurrences that might occur associated with the respective equipment locations.

12. Testability at Power

Measures to test the ATWS mitigating system before installation, as well as periodically, are to be established. Testing may be performed with the system in the bypass mode. Testing from the input sensor through the final actuation device should be performed with the plant shut down.

The licensee has stated that the AMSAC will be tested end-to-end at each refueling outage. The AMSAC is capable of being tested while the plant is at power. The at power test frequency will be based upon the manufacturer's recommendations.

It is the staff's understanding that the licensee will conduct a human-factors review of the controls and indications used for testing purposes that is consistent with the plant's detailed control room design review process.

13. Completion of Mitigative Action

The licensee is required to verify that (1) the protective action, once initiated, goes to completion and (2) the subsequent return to operation requires deliberate operator action.

The licensee responded that the AMSAC system design will be such that the AMSAC action will be consistent with the circuitry of the auxiliary feedwater and turbine trip control systems. Once initiated, the design will ensure that protective action goes to completion. Following completion of the mitigative action, deliberate operator action will then be required to return the actuated devices to normal operation.

14. Technical Specifications

The plant-specific submittal should address technical specification requirements for AMSAC.

The licensee stated that no technical specification action is proposed with respect to the AMSAC and that normal administrative controls are sufficient to ensure AMSAC operability.

The equipment required by the ATWS Rule to reduce the risk associated with an ATWS event must be designed to perform its functions in a reliable manner. A method acceptable to the staff for demonstrating that the equipment satisfies the reliability requirements of the ATWS Rule is to provide limiting conditions for operation and surveillance requirements in the technical specifications.

In its Interim Commission Policy Statement of Technical Specification Improvements for Nuclear Power Plants [52 Federal Register 3788, February 6, 1987], the Commission established a specific set of objective criteria for determining which regulatory requirements and operating restrictions should be included in technical specifications. The staff is presently reviewing ATWS requirements to criteria in this Policy Statement to determine whether and to what extent technical specifications are appropriate. Accordingly, this aspect of the staff review remains open pending completion of, and subject to the results of, the staff's further review. The staff will provide guidance regarding the technical specification requirements for AMSAC at a later date.

4.0 CONCLUSION

The staff concludes, based on the above discussion and pending resolution of the technical specification issue, that the AMSAC design proposed by the Tennessee Valley Authority for the Watts Bar Nuclear Plant, Units 1 and 2, is acceptable and is in compliance with the ATWS Rule, 10 CFR 50.62, paragraph (c)(1).

Even though the staff review regarding the use of technical specifications for ATWS requirements is incomplete, the licensee should continue with the scheduled installation and implementation (planned operation) of the ATWS design utilizing administrative controlled procedures.

5.0 REFERENCES

1. Letter, C. E. Rossi (NRC) to L. D. Butterfield (WOG), "Acceptance for Referencing of Licensing Topical Report," July 7, 1986.

2. Letter, R. A. Newton (WOG) to J. Lyons (NRC), "Westinghouse Owners Group Addendum 1 to WCAP-10858-P-A and WCAP-11233-A: AMSAC Generic Design Package," February 26, 1987.

3. Letter, R. A. Newton (WOG) to J. Lyons (NRC), "Westinghouse Owners Group Transmittal of Topical Report, WCAP-10858-P-A and WCAP-11233-A, Revision 1, AMSAC Generic Design Package," August 3, 1987.

4. Letter, R. Gridley (TVA) to U.S. NRC, "Watts Bar Nuclear Plant (WBN) - Anticipated Transient Without Scram Mitigation System Actuation Circuitry (AMSAC) - Response to NRC's Request for Additional Information," February 28, 1989.

5. Letter, R. H. Shell (TVA) to U.S. NRC, "Watts Bar Nuclear Plant (WBN) Units 1 and 2 - Circuitry (AMSAC) - Supplemental Response to NRC's Request for Additional Information," August 30, 1989.