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FEB 28 1989

U.S. Nuclear Regulatory Commission
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Gentlemen:

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

WATTS BAR NUCLEAR PLANT (WBN) - ANTICIPATED TRANSIENT WITHOUT SCRAM MITIGATION SYSTEM ACTUATION CIRCUITRY (AMSAC) - RESPONSE TO NRC'S REQUEST FOR ADDITIONAL INFORMATION

References:
1. Letter from R. H. Shell, TVA, to H. R. Denton, NRC, dated October 11, 1985, which refers to WBN's efforts to meet the requirements of 10 CFR 50.62
2. Letter from T. J. Kenyon, NRC, to S. A. White, TVA, dated November 7, 1986, "Anticipated Transients without Scram - Watts Bar Nuclear Plant, Units 1 and 2"

Reference 1 informed NRC of TVA's intent to install AMSAC at WBN, based on the generic functional design developed by the Westinghouse Owners Group (WOG). Reference 2 provided the results of NRC's staff review of the WOG Topical Report WCAP-10858, "AMSAC Generic Design Package," in the form of a safety evaluation (SE) which requested plant-specific additional information to allow NRC to complete their review.

Enclosure 1 provides the WBN plant-specific information as requested by the SE. Enclosure 2 summarizes the commitments made by this submittal.

If there are any questions, please telephone T. W. Horning at (615) 365-3381.

Very truly yours,

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Enclosures
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ENCLOSURE 1

ANTICIPATED TRANSIENT WITHOUT SCRAM MITIGATION SYSTEM
ACTUATION CIRCUITRY (AMSAC) PLANT-SPECIFIC DESIGN

RESPONSE TO NRC SAFETY EVALUATION AND REQUEST
FOR PLANT-SPECIFIC INFORMATION

1.0 Introduction

In response to 10 CFR 50.62, "Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants," Westinghouse, on behalf of the Westinghouse Owners Group (WOG), submitted for review WCAP-10858, "AMSAC Generic Design Package." This document details WOG's proposed generic AMSAC designs for compliance with 10 CFR 50.62.

2.0 Background

On June 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). An ATWS is an expected operational transient (such as loss of feedwater, loss of condenser vacuum, or loss of offsite power) which 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 likelihood of failure to shut down the reactor following anticipated transients, and to mitigate the consequences of an ATWS event.

3.0 Criteria

The basic requirement for Westinghouse plants is specified in paragraph (c)(1) of CFR 50.62, which states: "Each pressurized water reactor must have equipment from sensor output to final actuation device, that is diverse from the reactor trip system, to automatically initiate the auxiliary (or emergency) feedwater system and initiate a turbine trip under conditions indicative of an ATWS. This equipment must be designed to perform its function in a reliable manner and be independent (from sensor output to the final actuation device) from the existing reactor trip system."

4.0 Design Description

The TVA Watts Bar AMSAC design shall generally conform to the WOG Topical Report WCAP-10858P-A, revision 1 and addendum 1, "AMSAC Generic Design Pagkage," which includes the NRC safety evaluation (SE) comments.

The AMSAC signal will be generated by low water level signals from the four steam generators using existing level transmitters and isolators in the auxiliary feedwater system. The AMSAC coincidence logic will be 3/4 (three out of four) low-low level signals with one signal channel for each steam generator. AMSAC will automatically be inhibited (blocked) based on when 1/2 (one out of two) turbine first-stage impulse pressure signals are below 40-percent power. The arming (permissive) will automatically take place when 2/2 (two out of two) turbine first-stage pressure signals are above 40-percent power. A second arming signal will be provided at 80-percent power to shift the program level setpoints in the steam generator logic.

The AMSAC actuation will be delayed (0 - 60 seconds) to permit the reactor protection system (RPS) to respond first. The turbine above 40-percent power permissive and the turbine above 80-percent setpoint signal will be maintained (0 - 420 seconds) after dropout (turbine below 40- percent). This time delay to deenergize the arming function is intended to cover the ATWS event "Turbine Trip from Full Power." For the turbine trip ATWS event, the auxiliary feedwater can be started when the 3/4 steam generator logic output is present before the arming signal deenergizes. After this permissive dropout delay, the AMSAC is reset since the output logic AND gate requires both steam generator level and turbine power logic signals for an actuation output.

The steam generator low-low level trip point will be set at 12-percent for turbine between 40- and 80-percent power and a trip point of 25-percent level for turbine above 80-percent power.

The NRC SE of Topical Report "AMSAC Generic Design Package" (WCAP-10858) required discussion of key elements of the plant-specific design and interfaces. These items are discussed below in the same order and under the same title as in the SE. Note that the AMSAC equipment vendor contract has not been awarded and details of the equipment design, therefore, are limited.

WBN Design Criteria WB-DC-40-57 has been developed to control implementation of the WOG Topical Report WCAP-10858. The discussion that follows details the preliminary design. TVA will review the final AMSAC design and inform NRC of any significant changes which could impact compliance with WCAP-10858 and the associated NRC safety evaluation (as described by this submittal) before startup.

5.0 Plant Specific Key Elements

1. Diversity

The AMSAC will be a microprocessor-based system diverse in design, piece parts, and components from the existing Foxboro H line and Westinghouse reactor protection system. This represents the maximum diversity possible with up-to-date digital electronics.

Additional diversity will be insured by the selection of the input signal sources. The Reactor Protection System sensors will not be used for inputs to AMSAC. The AMSAC steam generator level signals will be taken from the auxiliary feedwater system sensors and will be independent from the Reactor Protection System. These level sensors and senselines will be selected to avoid possible interactions with the feedwater level control system since they utilize different steam generator taps.

The AMSAC turbine first-stage pressure inputs will be new dedicated pressure transmitters. The dedicated transmitters will utilize existing senselines of the turbine first-stage pressure transmitters 1-PT-1-72 and 1-PT-1-73. No adverse interactions are expected from this installation.

2. Logic Power Supplies

The AMSAC logic power will be provided by the 120-volt AC preferred power board one. This is a battery-backed, noninterruptable, non-1E power supply. The batteries as well as the inverter and power distribution panel are independent of the reactor protection system.

3. Safety-Related Interface

There will be no AMSAC interfaces to the Reactor Protection System. The four steam generator level signals will be taken from the nondivisional side of existing isolators in the auxiliary feedwater system and the two turbine first-stage pressure signals will be from dedicated AMSAC transmitters. The nonsafety-related AMSAC outputs to the auxiliary feedwater pump start circuits will be isolated from the safety-related portion by class 1E safety grade separation relays in existing auxiliary separation relay racks in the auxiliary instrument room.

4. Quality Assurance

The Watts Bar Nuclear Plant will comply with the quality assurance guidance for ATWS equipment that is not safety related as set forth in Generic Letter 85-06.

Watts Bar shall consider the following to be within the scope of that quality assurance guidance.

a. The AMSAC cabinet and hardware, including all internal instrumentation, computer parts, internal power conditioners, internal wiring, relays, input and output modules, and other miscellaneous parts within the AMSAC cabinet.

b. The main control room switch and status light module, all internal wiring, and main control panel wiring associated with the test/block operable switch module.

c. The dedicated pressure transmitters and associated tubing.

d. The associated power cables and signal cables, including their conduit systems and their terminations.

Existing nonsafety-related interface points, power supplies, annunciators, and other equipment not included in the Appendix B quality assurance program will not be included in the scope of the AMSAC quality assurance guidance. The nonsafety-related level indicator loops associated with the auxiliary feedwater level control system where the AMSAC steam generator level signals will be acquired are not included in the scope of Appendix B and will not be included in the quality assurance guidance in Generic Letter 85-06. After initial installation of the AMSAC system, any additional modifications to this portion of the level indicator loops shall be done according to the guidance as set forth in Generic Letter 85-06.

The isolated AMSAC signals, down stream of the separation relays, which will start the auxiliary feedwater pumps will be divisional class 1E outputs conforming to the quality assurance requirements of 10 CFR 50, Appendix B.

5. Maintenance Bypasses

Maintenance at power will be accomplished by blocking the output of the AMSAC via the test/block operable switch planned to be mounted on the main control panel 1-M-3. Setting this switch in the test/block state will completely disable all logic outputs so that AMSAC maintenance, testing, or any combination of plant inputs shall not cause inadvertent AMSAC actuation.

The switch shall be chosen as a module which shall contain the AMSAC test/block operable switch as well as the AMSAC operating status indicating lights. Consistent with human factor considerations, grouping this information onto a single module will centralize the operator's focus when obtaining AMSAC status or setting the block function.

The test/block operable switch will be a push-on, push-off type, two-state switch with built-in status indication. The lens of the switch will have two windows which will be separately illuminated by switching provided by the AMSAC cabinet blocking function. The windows will be labeled to indicate whether the switch is in the test/block or the operable state; they will provide the operator with continuous positive action feedback that the pushbutton switch has engaged or disengaged the blocking function as required. Color coding of the lenses shall be chosen consistent with other status lights displaying similar information.

In addition to the test/block status indication, the AMSAC failed/inoperable alarm also will actuate when the blocking function is engaged.

6. Operating Bypasses

The AMSAC permissive/inhibit shall be determined by turbine first stage impulse pressure. Two dedicated pressure transmitters will provide power level inputs to the AMSAC logic. The AMSAC will generate a permissive (armed) above turbine 40-percent power and an inhibit (blocked) below 40-percent power. The logic shall be set for 1/2 (one out of two) pressures below 40-percent for inhibit and 2/2 (two out of two) pressures above 40-percent for permissive. The basis for this setpoint is the Westinghouse AMSAC generic design package (WCAP-10858P-A, revision 1 and addendum 1). This permissive, referred to as C-20, will be diverse and independent from the Reactor Protection System by reason that the signal will be generated by AMSAC dedicated pressure transmitters and instrumentation.

To compensate for the Reactor Protection System's program level setpoint on the low-low steam generator level trip, Watts Bar must implement a two-stage level setpoint for the AMSAC. This two-stage level setpoint will be controlled by the turbine first stage impulse pressure power level. The AMSAC logic will be configured to switch the steam generator level setpoint from 12-percent, between 40-percent and 80-percent power, to 25 percent from 80-percent power and beyond.

These operating bypasses and setpoint changes will be monitored by the operator via the switch module discussed in section 5. A three-window indicator status monitor panel will be installed in the test/block operable switch module. The status monitor windows will show that AMSAC is blocked less than 40 percent, armed at 40 percent, and armed at 80 percent. Color coding of the lenses has been chosen consistent with other status lights displaying similar information.

Grouping this information onto a single switch module will centralize the operator's focus when obtaining AMSAC status or setting the block function.

7. Means for Bypassing

The maintenance or test manual bypass was discussed in paragraph 5 and the operating bypass in section 6. Lifting leads, physically blocking relays, pulling fuses, or tripping breakers will not be required to perform maintenance or testing at power.

8. Manual Initiation

A manual turbine trip and auxiliary feedwater actuation can be accomplished by the operator using the following controls. The auxiliary feedwater pumps can be manually started via hand switches 1-HS-3-118A and 1-HS-3-128A. The turbine-driven auxiliary feedwater pump can be started by hand switch 1-HS-46-56A. The turbine can be tripped by manual actuation of hand switch 1-HS-47-24. The AMSAC system will not impact any of the existing manual controls.

9. Electrical Independence of Existing Reactor Protection System

There will be no AMSAC connections to the Reactor Protection System, including sensors and isolation devices. However, the auxiliary feedwater level loop components are electrically fed from the reactor protection system power supplies. A loss of power to these loops will cause a low steam generator level signal. Other plant systems or dedicated devices will be utilized to afford maximum diversity. Refer to section 3 for discussion of AMSAC input signal sources. Since there shall be no interfaces to the Reactor Protection System, the information requested in Appendix A is not required.

10. Physical Separation from Existing Reactor Protection System

The reactor protection racks D, E, F, and G, and the solid state protection system cabinets A and B are all physically separated from each other so AMSAC separation is not required. However, the AMSAC equipment, including sensors, isolators, and cabling, will be physically separated from the Reactor Protection System equipment. Cabling from the steam generator auxiliary feedwater isolation devices will be nondivisional and non-1E. AMSAC cable routing will be independent using nondivisional trays and conduits. The AMSAC cabinet and Reactor Protection System will be located in the same auxiliary instrument room. However, they will not be located adjacent to each other.

11. Environmental Qualification

The AMSAC cabinet will be located in the mild environment of the auxiliary instrument room. The dedicated pressure transmitters will be located in the Turbine Building in a mild environment. The existing auxiliary feedwater level transmitters are located in the reactor containment and have already been qualified for harsh environment and for accident conditions as required by 10 CFR 50.49.

12. Testability at Power

The equipment vendor will be required to implement the AMSAC design with a manual test feature and fault isolation panel. The test/block-operable switch (section 5) will prevent inadvertent actuation by inhibiting the output relays before enabling the test function. At the same time, the AMSAC bypassed indication will be transmitted to the control room to inform the operator that AMSAC actuation is bypassed. As part of the test, the AMSAC system will actuate an alarm located in the main control room as well as an indicator on the test panel. The actuated alarm will be located in the turbine first out panel consistent with other alarms which tripped the turbine.

A detailed, on-line functional test sequence cannot be defined at this time because the AMSAC equipment contract has not been awarded. TVA will submit a detailed, on-line functional test sequence for the AMSAC system by June 17, 1990.

13. Completion of Mitigative Action

This item requires that, once the AMSAC is actuated, the protective action goes to completion, and return to operation requires deliberate operator action. The AMSAC turbine trip and auxiliary feedwater (AFW) actuation signals will be in parallel with the Reactor Protection System signals required to perform the same functions. Once initiated, the turbine trip and auxiliary feedwater start functions will go to completion, even if the trip or start signal is subsequently removed. Returning to operation will therefore require deliberate operator action.

AMSAC will reset automatically after a time delay (0 - 420 seconds) for turbine arming to deenergize. This time delay to deenergize the arming function is intended to cover the ATWS event, "Turbine Trip from Full Power." For the turbine trip ATWS event, the AFW can be started when the 3/4 steam generator logic output is present before the arming signal deenergizes. After this drop-out delay, the AMSAC will reset since the output logic AND gate requires both steam generator level and turbine arming signals for an actuation output.

14. Technical Specifications

TVA supports the WOG position that technical specifications for AMSAC are unnecessary and do not enhance the overall safety of nuclear power plants (OG-171 dated February 10, 1986). Normal nuclear plant administrative controls are sufficient to control AMSAC.

ENCLOSURE 2

For the Watts Bar Nuclear Plant (WBN), TVA commits to:

- Review the final Anticipated Transient Without Scram Mitigation System Actuation Circuitry (AMSAC) design and inform NRC of any significant changes which could impact compliance with WCAP-10858 and the associated NRC safety evaluation (as described by this submittal) before startup.

- Submit a detailed, on-line functional test sequence for the AMSAC System by June 17, 1990.