Alabama Power Company
600 North 18th Street
Post Office Box 2641
Birmingham, Alabama 35291-0400
Telephone 205 250-1835

R. P. McDonald
Senior Vice President

Alabama Power
the southern electric system

10CFR50.62

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Docket Nos. 50-348
50-364

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

Gentlemen:

Joseph M. Farley Nuclear Plant - Units 1 and 2
Anticipated Trip Without Scram (AWTS)

On February 9, 1988 a telephone conversation was held between the NRC and Alabama Power Company to discuss Alabama Power Company's December 9, 1987 submittal. This submittal addressed the fourteen key elements of plant-specific design for the Westinghouse AMSAC system as defined by the NRC in their letter dated September 23, 1986. The result of this conversation was a request by the NRC to provide more information on several areas of concern. Provided as an attachment to this letter is a response to each of the NRC's requests.

If there are any further questions, please advise.

Respectfully submitted,

W. S. Harrat— III

R. P. McDonald

RPM/BHW:dst-TS1-8.7

Attachment

cc: Mr. L. B. Long
Dr. J. N. Grace
Mr. E. A. Reeves
Mr. W. H. Bradford

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ATTACHMENT

Provided below are responses to questions raised by the NRC regarding the Farley Nuclear Plant design for the installation of the Westinghouse generic AMSAC system.

1. **NRC Request**

Provide a description of the testing that was performed on the output relays that isolate the non-Class 1E AMSAC circuits from the Class 1E safety-related final actuation device circuits. Verify that this testing bounds the plant-specific maximum credible faults that could occur in the Farley AMSAC circuits.

APCo Response

Relays are provided at the output of AMSAC for isolating the non-Class 1E AMSAC circuits (relay coil) from the Class 1E safety-related final actuation device circuits (relay contacts). These isolation relays are located in two separate wall mounted relay panels. The relays are Struthers-Dunn Type 219 plug-in, with four single-break double-throw contacts, for 120VAC. Three Struthers-Dunn Type 219 relays have been subjected to a series of tests at the Westinghouse Instrumentation Technology and Training Center.

The relays have been tested with a voltage of 590VAC applied to the relay coil in the transverse mode. The fault voltage applied to the relay coil and the induced voltage on the relay contacts were measured and recorded. The fault current passed through the relay coils was in the range of 0.38 to 1.08A and was limited by the coil impedence itself. Based upon the performed tests Westinghouse concludes that the subject relays clearly demonstrated their isolation capability by limiting any propagation of the faulted condition from the non-1E coil to the 1E contacts to a negligible value (maximum of 1.4 volts).

The Farley AMSAC is an energize-to-actuate system, and as such the output relays are energized (from the 120VAC power supply provided to the AMSAC system) on AMSAC actuation.

The configuration of the AMSAC power supply is as follows:

> Power to the AMSAC system is provided from a dedicated uninterruptible power supply (UPS). A 208VAC normal supply and a 120VAC alternate supply are provided from 600 V MCC's through 600/208 V step-down transformers. The normal power supply has a 48VDC battery back-up. The UPS Inverter output provides the normal 120VAC supply to the AMSAC system, through a line regulator.

The cables carrying the power supplies to the AMSAC UPS, the cables between the UPS and the AMSAC logic cabinet, as well as the cables connecting the AMSAC output relay panels to the AMSAC logic cabinet are routed in cable trays containing cables with maximum voltage levels of 208VAC and 125VDC.

From the configuration of the AMSAC power supply and the routing of the associated cable it can be concluded that the maximum credible fault the AMSAC output relays can be subjected to is 208VAC.

The tests performed by Westinghouse, and the above analysis of the Farley AMSAC configuration demonstrate that the Struthers-Dunn Type 219 relays provide acceptable isolation devices for the Class 1E portion of the AMSAC System.

Compliance with Appendix A of the ATWS SER dated September 23, 1986 is provided herein and in Alabama Power Company letter dated February 27, 1987. This information is available at Farley Nuclear Plant for inspection by the NRC Staff.

2. <u>NRC Request</u>

Provide a specific reference within the FSAR that describes the separation criteria that was employed in the design for the installation of the AMSAC system.

<u>APCo Response</u>

The AMSAC is a nonsafety-related system which provides a back-up to the Reactor Protection System (RPS) for initiating turbine trip and auxiliary feedwater.

The AMSAC system installed in each unit of Farley Nuclear Plant is independent and diverse from the existing RPS, with the exception of the final actuation devices. The interfaces between the AMSAC outputs and the existing safety-related turbine trip and the auxiliary feedwater pump start circuits are achieved through qualified Class 1E isolation relays. This design ensures that the existing safety-related systems, including RPS, continue to meet all applicable safety criteria.

Electrical independence, isolation, and physical separation have been provided in the design to assure and maintain independence between the nonsafety-related AMSAC system and the existing safety-related RPS.

The electrical independence and isolation of the AMSAC system from the RPS is achieved by the following means:

a) The input sensors for AMSAC are not part of the RPS. The AMSAC steam generator water level inputs are derived from the existing non-Class 1E narrow range steam generator level transmitters. For the turbine first stage pressure inputs, two dedicated transmitters have been added.

b) Power to the AMSAC logic and the new pressure transmitter loops is provided from a dedicated uninterruptible power supply (UPS) in each plant unit, independent of the power supplies for the RPS. The AMSAC-UPS has battery and diesel back-up. The station battery supplying power to the AMSAC is independent of those used for the RPS.

c) Qualified Class 1E isolation relays are provided to isolate the non-Class 1E AMSAC outputs from the Class 1E safety-related turbine trip and auxiliary feedwater pump start circuits.

d) Qualified Class 1E circuit breakers are provided to isolate the non-Class 1E AMSAC dedicated UPS from the Class 1E safety-related power distribution system.

The physical separation of the AMSAC system from the RPS is achieved as follows:

a) The locations of the AMSAC equipment have been selected to provide physical separation from the existing RPS hardware, to ensure that there is no interaction with the RPS cabinets. The AMSAC logic cabinet is located in the cable spreading room, and the train oriented A and B output relay panels, in the respective train A and B 4160V switchgear rooms.

b) The output signal cables from the AMSAC logic cabinet to the train A output relay panel are routed separately from the output signal cables from the AMSAC logic cabinet to the train B output relay panel. These circuits are routed in accordance with FSAR paragraph 8.3.1.4.5. The cables connecting the isolated AMSAC actuation signals to the Class 1E safety-related systems were routed in accordance with FSAR paragraphs 8.3.1.4.3, 8.3.1.4.8 and 8.3.1.5. The Class 1E portion of the AMSAC system complies with Regulatory Guide 1.75, as do the existing Class 1E safety-related systems.

3. NRC Request

Verify that Quality Assurance requirements specified in Generic Letter 85-06 for the AMSAC system are being met.

APCo Response

The purchase order's Quality Assurance (QA) requirements for the AMSAC system addresses each applicable area described in Appendix B of 10CFR Part 50. Control of special processes was not required since AMSAC is not a pressure boundary system. Generic Letter 85-06 provides guidance for the QA requirements for the AMSAC system and is based upon 10CFR50 Appendix B. Therefore, in meeting the applicable requirements of 10CFR50 Appendix B, Alabama Power Company exceeds the QA requirements listed in Generic Letter 85-06. Plant QA practices for the AMSAC system, which is nonsafety-related, are similar to those for a safety-related system. Quarterly surveillance testing is performed on the system to ensure its continued reliability. The quarterly test is an internal system diagnostic which is performed in semi-automatic mode. This test checks the internal calibration and functioning of the AMSAC test maintenance processor, actuation logic processors, input processing, processor logic, voter and output relays, and the deadman circuit (System Failure Monitor). This test utilizes internally generated calibration signals, and is performed with the system in "bypass".

4. NRC Request

Provide a description of the AMSAC system annunciators and alarms, and describe when these annunciators and alarms are actuated. Also state the location of the bypass switch.

APCo Response

In addition to the system status displayed locally on the AMSAC test panel, AMSAC produces status outputs for remote indication and alarm. The main control room indication including bypass indication was reviewed against the control room design conventions. These remote indications and alarms are as follows:

Main Control Board Annunciator

Two windows have been assigned in each plant unit to alarm AMSAC status on the Main Control Board (MCB) Annunciator System.

a) Window G-61 "AMSAC TURB. TRIP AFW START" located on the First Out Panel G of the MCB Annunciator System. This annunciator window is initiated when AMSAC actuation is the initiating event.

b) Window E-35 "AMSAC SYS TRBL" located on Panel E of the MCB Annunciator System. This annunciator window is actuated when the AMSAC General Warning output is initiated. The AMSAC abnormalities are internally diagnosed and indicate that either a test is in progress or that fault conditions exist. The following is a list of conditions that will generate an AMSAC General Warning output:

- loss of any system power supply including incoming AC supplies.
- the Mode Selector switch out of the Normal position
- the System Bypass switch (located on the logic cabinet in the cable spreading room) out of the Normal position
- a partial trip
- an on-line diagnostic error
- any Actuation Logic Processor malfunctions
- any Test/Maintenance Processor malfunctions
- any input common to the Actuation Logic Processors, determined to be inconsistent
- the cabinet temperature exceeding a high temperature setpoint

In addition to the AMSAC General Warning, the annunciator window E-35 is actuated on AMSAC-UPS trouble. The following is a list of conditions that will generate an AMSAC-UPS trouble signal:

- ground leakage
- battery low voltage
- inverter failure
- AC input and/or charger failure
- auto bypass not ready

Main Control Board Bypass and Permissive Status Indication

AMSAC has one window (window 2.7 "LOW TURB IMPULSE PRESS AMSAC TRIP BLOCKED") in the Bypass and Permissive Light Box (BPLB) located on the MCB - area A3. This window is actuated (ON) when turbine load drops below the predetermined setpoint, which disables AMSAC actuation.

Plant Computer

AMSAC produces outputs to indicate in the plant computer. The computer of each plant unit receives status on each steam generator level channel (3 inputs), both turbine load channels (2 inputs), AMSAC actuation (1 input) and AMSAC General Warning (1 input) to indicate any abnormal conditions.

5. **NRC Request**

Verify that the Farley-specific C-20 permissive time delay of 260 seconds is consistent with WCAP-10858, Rev. 1.

APCo Response

Westinghouse has performed an analysis for Alabama Power Company to determine the proper value for the C-20 permissive signal time delay. Westinghouse determined that a 260 seconds time delay on de-energizing the AMSAC system will ensure that the AMSAC actuation logic can be satisfied for a sufficient period of time. The 260 seconds value differs from the 360 seconds value stated in WCAP-10858, Rev. 1; however, 360 seconds is a conservative generic value that falls within the range of 180-420 seconds shown in Figures 1-1, 1-2 and 1-3 of WCAP 10858. The Farley-specific value of 260 seconds is within this range and has been reviewed and determined to be conservative

6. **NRC Request**

State whether the AMSAC system is tested from end-to-end each refueling outage.

APCo Response

The AMSAC system has been functionally tested from the turbine impulse pressure and steam generator level transmitters to the output relays that initiate the turbine trip and auxiliary feedwater pump start. This test was accomplished by a combination of three separate testing procedures: 1) the individual transmitters were calibrated through the AMSAC cabinet to verify their outputs were within an expected tolerance, 2) using simulated inputs the AMSAC logic was verified to generate the proper actuation signal to the output relays, and 3) surveillance tests verified that the output relays properly initiate the mitigative actions. These tests will be repeated at each refueling outage.

7. **NRC Request**

State the frequency of surveillance testing of the AMSAC system.

APCo Response

The AMSAC system is functionally tested using simulated inputs once per quarter. A description of this test is provided in response to NRC Question No. 3

8. **NRC Request**

Provide details on the completion of mitigative actions. Describe how the actuation circuits are sealed in once an AMSAC system signal is received.

APCo Response

AMSAC mitigative actions, once actuated, go to completion. Completion of the AMSAC mitigative actions is accomplished at the actuated component level, through the existing circuits, as described below:

Turbine Trip

The AMSAC turbine trip signal is latched in at the turbine electro-hydraulic control system. Deliberate operator action is then necessary to clear the turbine trip signal using the main control board turbine trip reset switch.

Motor Driven Auxiliary Feedwater Pump and Associated Valves

AMSAC actuation provides closing signals to the 4KV motor breakers associated with the auxiliary feedwater pumps. The 4KV breaker once closed remains latched in this position regardless of the status of the signal which initiated the closing. Deliberate operator action is required to terminate the operation of any motor driven auxiliary feedwater pump, by tripping its associated 4KV breaker, using the main control board breaker control switches.

The elementary diagram of the auxiliary feedwater pump motor breaker shows that any breaker closing signal energizes relays 95 and SGBX and that these relays remain energized (sealed-in through a contact of SGBX in series with a breaker contact) for as long as the breaker remains closed, regardless of the status of the signal which initiated the closure of the breaker.

Relays 95 and SGBX initiate the opening of the motor driven auxiliary feedwater discharge valves and the isolation of the steam generator blowdown and sample lines. Completion of these actions is accomplished through relays 95 and SGBX which, once energized, remain energized regardless of the status of the AMSAC actuation signal. Deliberate operator action is required to change the position of the subject valves.

<u>Turbine Driven Auxiliary Feedwater Pump and Associated Valves</u>

AMSAC actuation provides opening signals to the turbine driven auxiliary feedwater pump steam admission and discharge valves. The steam admission valves HV 3235A and HV 3235B are "energize to open", while HV 3236 is "de-energize to open". Once the opening signals are initiated, HV3235A AND HV3235B energize and open, and remain energized through the valve limit switch contact and a contact of the control switch, regardless of the status of the signal which initiated the opening of these valves. Once the opening signal is initiated the existing seal-in of HV3226 breaks, HV3226 de-energizes and opens, and remains de-energized (due to the valve limit switch contact and the seal-in circuit which opens when the valve opens), regardless of the status of the signal which initiated the opening of this valve. Deliberate operator action is required to terminate the operation of the turbine driven auxiliary feedwater pump, by closing the steam admission valves.

Turbine driven auxiliary feedwater pump discharge valves open once the opening signal is initiated. Completion of this action is accomplished by an electrically reset lock-out relay which seals-in the initiating signal at the component level. As a result, these discharge valves remain open regardless of the status of the AMSAC initiating signal, and deliberate operator action is required to reset the lock-out relay and change the position of these valves.