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NUCLEAR PRODUCTION DEPARTMENT

April 22, 1982

U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

Attention: Mr. Harold R. Denton, Director

Dear Mr. Denton:

SUBJECT: Grand Gulf Nuclear Station
Units 1 and 2
Docket Nos. 50-416 and 50-417
File 0260/0840/L-350.0
Transmittal of Evaluation for Control Systems Failures; SER License Condition Item 1.11(10)
AECM-82/159

In response to your request for additional information (NRC letter dated April 16, 1981, from R. L. Tedesco to J. P. McGaughy), Mississippi Power & Light Company is submitting the enclosed materials updating information pertaining to the above SER item (NUREG-0831, September 1981).

If you have any questions or require further information, please contact this office.

Yours truly,

L. F. Dale
Manager of Nuclear Services

JTB/JGC/JDR:lg
Attachment: 1. Control Systems Failure Evaluation

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CONTROL SYSTEMS FAILURES EVALUATION

The evaluation discussed in this attachment was performed in response to the NRC letter dated April 16, 1981 (MAEC-81/80), from R. L. Tedesco to J. P. McGaughy.

A. Methodology

This evaluation covers the spectrum of all non-safety control systems whose failures could have the potential to cause the consequences of transients or accidents evaluated in FSAR Chapter 15 analysis to be more severe.

The evaluation was developed in accordance with the steps described below:

1. A list of non-safety control systems was developed whose failure could have the potential to impact reactor pressure, reactor water level or change the critical power ratio. The list consisted of the following:

    a. Reactor Feedwater System
    b. Reactor Turbine Pressure Regulator System
    c. Recirculation Flow Control System
    d. Feedwater Heater System (Condensate and Extraction Steam)
    e. Condenser Vacuum System
    f. Reactor Water Level 8 Turbine Trip
    g. Bypass System Operation
    h. Rod Control and Information System (RC&IS)
    i. Environmental Control Systems (Offgas Vent and Offgas Flow Control System)
    j. Instrument Air System (Isolation Actuation)

2. All supporting components or loads associated with the non-safety control systems were identified by utilizing tables developed in response to I&E Bulletin 79-27. This task was accomplished by listing all supporting electrical components having the same master parts list system number prefix as the ten non-safety control systems defined in Step 1.

3. Using the drawings referenced in Step 2 above, each non-safety control system and supporting component's lowest level power source was identified. The power distribution was then defined by tracing each low level power source to higher level distribution centers and battery busses using the appropriate one line diagrams. All power sources were compiled in order to develop a bus tree table which enabled the grouping of all control systems according to their common bus structures. Bus tree development was limited to certain pre-selected high level busses in the power distribution system (see FSAR Figure 8.1-1). The evaluation of loss of power supply was taken no higher in the distribution system than these pre-selected busses because the loss of the next higher level bus initiates an event that is already bounded by loss of AC power evaluations presented in FSAR Chapter 15.

4. All non-safety control systems and supporting components identified in Steps 1 and 2 which receive input signals from common instrument taps were listed. All control systems were then grouped together according to their common instrument taps.

5. The original loads listed in Steps 3 and 4 above were eliminated from consideration if they met any one of the following criteria:

   a. A component not common to any other control system when grouped according to its highest level bus or instrument tap was eliminated because the component remained exclusively within its own control system and therefore was incapable of interacting with any other control system. Any single non-safety control system loss (e.g. feedwater loss or runaway) resulting from partial or complete loss of its respective component(s) initiates an event which is already bounded by the transient analysis presented in FSAR Chapter 15.

   b. A component which does not provide input or effect the controlling function of its respective non-safety control system(s) (e.g. indicators, alarms and inputs to process computer).

   c. A component whose failure due to the loss of its power source or sensors could not effect one or more of critical reactor parameters. Source documents for this evaluation were provided by the drawings (columns labeled "Primary Effects" and "Secondary Effects") referenced in Step 2.

   d. A component whose failure due to the loss of its power source or sensor could possibly create only a long term effect on one or more critical reactor parameters. An example considered, would be the loss of space heater function for a pump or motor. As a result of this loss, condensation would eventually occur creating a potential for equipment failure and subsequent inoperability. Thus, the basis for elimination in this example was the extended time frame required to initiate a transient.

6. The above elimination resulted in a bus tree and sensor tables consisting of only those control systems remaining common at some power or sensor level and whose failures were shown to have a short term effect on one or more critical reactor parameters. Further analysis was performed to determine the combinational effects of multiple control systems failure where applicable due to the loss of a lowest common level power source or common sensor and for the effects of cascading power losses extending from lowest common level power sources to higher level distribution centers and battery busses.

The conclusions resulting from this step are presented in the following section. The final bus tree and sensor tables developed and evaluated at this step are currently in draft form and are undergoing a quality review and a final verification of the evaluation of power supply and sensor loss. These bus tree and sensor tables will be provided for NRC staff review no later than May 21, 1982. Based on the results of this review to date, it is anticipated that there will be no change to the conclusions presented in the following section.

B. CONCLUSIONS

As described below, the most severe combinational effects which resulted from power losses were shown to occur for busses 12HE and 14AE, (see Grand Gulf power supply structure, FSAR Figure 8.1-1).

The worst consequence of the loss of individual busses fed from bus 12HE, or loss of 12HE itself, is a possible loss of some feedwater heating. The most severe event has been identified to be the loss of condenser vacuum in conjunction with the partial loss of feedwater heating. Timing would be an important factor to determine the severity of the consequence. The worst combination of these two events would be that the low vacuum induced turbine trip occurs prior to the thermal power monitor (TPM) scram or at the maximum power level if the TPM scram setpoint has not ever been reached.

A transient analysis using the ODYN code was performed to simulate this event for the Grand Gulf initial core. The maximum temperature reduction resulting from the single power source failure was identified to be 68°F, which was used in this analysis. The result showed that the thermal power leveled off at 110% NBR power prior to the turbine trip. The peak heat flux at the turbine trip was approximately 110% NBR. The change in CPR is estimated to be only 0.06 compared to 0.12 for the loss of feedwater heater event evaluated in FSAR Chapter 15. The maximum dome pressure was 1212 psia which was bounded by the Chapter 15 turbine trip with bypass failure case (1217 psia). Thus, the loss of bus 12HE event is bounded by the FSAR Chapter 15 analysis.

The effects of the total failure of bus 14AE are the loss of some feedwater heating and a Turbine Trip. This event is identical to the bus 12HE failure and is bounded by the Chapter 15 analysis.

Regarding sensor failure and related combinational effects, there were no events revealed in the evaluation that required additional transient code analysis.

In conclusion, this evaluation revealed no power supply or sensor failure which initiated an event not bounded by the current transient analyses presented in FSAR Chapter 15. Therefore, no equipment or procedure changes are required as a result of this evaluation.