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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FINAL DESIGN AND IMPLEMENTATION OF SAFETY-GRADE ANTICIPATORY

REACTOR TRIP (ART's) ON TURBINE TRIP OR LOSS OF MAIN FEEDWATER

OCONEE NUCLEAR STATION, UNITS 1, 2 & 3

DOCKETS NOS. 50-269, 270 & 287

I. INTRODUCTION

The licensee, Duke Power Company, in its submittals of August 18 and October 7 1980, forwarded the information necessary to complete our Safety Evaluation (SE) of their final design and implementation of the safety-grade ART's on turbine trip or loss of main feedwater. These ART's are intended to provide additional protection and conservatism beyond that provided by the existing Reactor Protection System (RPS). We previously approved the licensee's preliminary design for upgrading this system in our SE of December 20, 1979. We also requested additional information on the final design.

II. EVALUATION

In performing our evaluation, we reviewed the information in the recent licensee submittals of August 18 and October 7, 1980 and their previous submittals of May 21 and October 5, 1979 relating to this system.

Our review of the preliminary design and the final design drawings for installation of the safety-grade ART's on Oconee Unit 2, indicates that the licensee has incorporated the previously approved logic design concept into the ART's design for Oconee Units 1, 2 and 3. For the most probable causes of turbine trip or loss of main feedwater, these anticipatory trips will operate in advance of the Reactor Coolant System (RCS) high pressure reactor trip to reduce the peak RCS pressure and thus reduce challenges to the Power Operated Relief Valve (PORV). This will alleviate these concerns as reported in NUREG-0560.

The ART's design utilizes four redundant and independent channels to monitor the main feedwater pumps (MFWP) and the main turbine for trip conditions. This safety-grade ART equipment will initiate reactor trips when the MFWPs trip or the turbine trips. The cabinet mounted equipment will be installed in and be an integral part of the existing four channel RPS and will interface as new trips in the present bistable trip string. As such, this additional equipment will be designed in accordance with the design bases of the RPS and will conform with the acceptance criteria and design requirements of the RPS as described in Section 7 of the Oconee Nuclear Station FSAR. The added modules contain contact buffers, bistables and auxiliary relays, which have been tested and qualified for use in a safety system. Thus, the previous conclusion of the RPS failure analysis, performed by the licensee, that any single failure in the RPS will not prevent performance of its protection action when required, is still valid.

Our review included the final drawings which include the inputs, outputs and logic of the new trip functions, and their integration into the existing RPS. Each channel of the RPS accepts five new pressure switch inputs. The sensors monitor hydraulic fluid pressure for the main turbine and each of the two MFWP turbines, and the discharge pressure for each MFWP. The RPS logic is designed such that a channel trip will occur due to low hydraulic fluid pressure for the main turbine or due to either a low hydraulic fluid pressure or lowpump discharge header pressure for both MFWPs. Upon a trip of any two of the four channel inputs, the RPS will initiate a reactor trip. An automatic inhibit is included in the logic circuitry to prevent tripping of the reactor when the unit is operated at power levels below 20% since the main turbine and both feedwater pumps are not required to be operating at these power levels.

The redundant sensors are separated both electrically and physically for independent operation. Individual termination enclosures are provided to protect against grounding, shorting and environmental conditions. The interlocked armor cables, transmitting the sensor signal to the control room will be routed in conduit or cable trays with redundant channels being physically separated. The sensor inputs are provided with the 500 volt isolation buffer. Thus, the effects of credible faults on the sensor circuit will not propagate back to the RPS. Further, a single failure will not prevent the sensors from performing their intended function. We, therefore, find that the ART system satisfies the RPS criteria for redundancy, independence and single failure.

The licensee's August 18, 1980 submittal also included seismic and environmental qualification test reports. Our review of this report is incomplete. The installation and operation of the system, prior to completion of this review, is desirable as the ART safety-grade system will enhance the existing RPS by more rapidly causing a reactor trip for an event that could challenge the RCS relief or safety valves.

The licensee will test the ART circuits following installation and subsequently during the monthly RPS surveillance tests. Testability of the ARTs will be performed at power by isolating each sensor and simulating trip conditions for the main turbine and/or both MFWPs. This will be done by removing the pressure from the sensors and verifying that a trip signal is received by the RPS and that proper control room indications are displayed. Each pressure switch and channel will be tested and evaluated in this manner. We find the design to include the necessary provisions to permit periodic testing of the RPS while the reactor is in operation and is thus acceptable. We also find the functional checkout procedures for demonstrating the operability of the ART's to be acceptable. The testing will be accomplished prior to placing the ART systems in service.

III. CONCLUSION

Based on our review of the design of ART's on main turbine trip or loss of main feedwater, we conclude that the proposed design modifications satisfy the RPS safety requirements and criteria for redundancy, independence, single failures and testability. We also conclude that the upgraded RPS will provide a greater degree of protection and conservatism beyond that provided by the existing RPS. Therefore, we find that the design is acceptable.

Dated: December 4, 1980