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February 28, 1980

Power Generation Department

Georgia Power
the southern electric system

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

NRC DOCKET 50-366
OPERATING LICENSE NPF-5
EDWIN I. HATCH NUCLEAR PLANT UNIT 2
THERMAL POWER MONITOR

Gentlemen:

Pursuant to 10 CFR 50.90, as required by 10 CFR 50.59(c)(1), Georgia Power Company hereby proposes amendments to the Plant Hatch Unit 2 Technical Specifications (Appendix A to the Operating License). The proposed change will modify the Average Power Range Monitor (APRM) high-high flux scram trip logic. A description of the modification and ef t on the plant saf ty analysis is provided in Enclosure 3. As discusse , the flow referenced logic design will be modified with a new logic scheme that will minimize inadvertent scrams caused by neutron flux spikes without reducing plant safety. This new design feature was previously approved for the Hatch Nuclear Plant Unit 1 by Amendment No. 69 to Facility Operating License DPR-57.

The Plant Review Board and Safety Review Board have reviewed and approved these proposed changes to the Plant Hatch Unit 2 Technical Specifications and have determined that they do not involve an unreviewed safety question. This modification to the APRM results in the maintenance of adequate thermal margins for fuel cladding integrity and the reduction of the cyclic duty of the reactor vessel and fuel by minimization of the number of spurious scrams. Thus, it can be concluded that the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety is not increased, nor is the possibility of a new accident or malfunction of equipment important to safety created. The margin of safety, as defined in the Technical Specifications, is not reduced due to this change because no safety limits have been affected.

This modification will be completed prior to startup following our March 1980 maintenance outage. Therefore, your review of this submittal in a timely manner will be appreciated.

Yours very truly,

W. A. Widner

W. A. Widner
Vice President and General Manager
Nuclear Generation

MRD/mb
Enclosures

Sworn to and subscribed before me this 28th day of February, 1980.

Mark R. Dorgh

Notary Public

Notary Public, Georgia, State at Large
My Commission Expires Sept. 20, 1983

xc: Mr. Ruble A. Thomas
George F. Trowbridge, Esquire
R. F. Rogers, III

8003070392

ATTACHMENT 1

NRC DOCKET 50-366
OPERATING LICENSE NPF-5
EDWIN I. HATCH NUCLEAR PLANT UNIT 2
PROPOSED DETERMINATION OF AMENDMENT CLASS

Pursuant to 10 CFR 170.12 (c), Georgia Power Company has evaluated the attached proposed amendment to Operating License NPF-5 and have determined that:

a) The proposed amendment does not require the evaluation of a new Safety Analysis Report or rewrite of the facility license.

b) The proposed amendment does not contain several complex issues, does not involve ACRS review, or does not require an environmental impact statement;

c) The proposed amendment does not involve a complex issue, an environmental issue or more than one safety issue;

d) The proposed amendment does involve a single issue; namely, the modification of the Average Power Range Monitor (APRM) high-high flux scram trip logic by the addition of a thermal power monitor;

e) The proposed amendment is therefore a Class III amendment.

ATTACHMENT 2

NRC DOCKET 50-366
OPERATING LICENSE NPF-5
EDWIN I. HATCH NUCLEAR PLANT UNIT 2
PROPOSED CHANGES TO TECHNICAL SPECIFICATIONS

The proposed changes to the Technical Specifications (Appendix A to Operating License NPF-5) would be incorporated as follows:

Remove Page	Insert Page
2-4	2-4
2-6	2-6
B 2-9	B 2-9
B 2-10	B 2-10
3/4 2-5	3/4 2-5
3/4 3-2	3/4 3-2
3/4 3-6	3/4 3-6
3/4 3-7	3/4 3-7
3/4 3-8	3/4 3-8

ATTACHMENT 3

NEW APRM SCRAM TRIP LOGIC
FOR THE
EDWIN I. HATCH NUCLEAR PLANT UNIT 2

1. PURPOSE

This report describes the new APRM scram trip logic and discusses the impact of this logic on plant safety analyses. This APRM logic is being installed in the Edwin I. Hatch Nuclear Plant Unit 2 for operation during the initial and all subsequent cycles. This report shows that the new APRM scram trip logic will reduce fuel and reactor cycle duty without compromising the safety of the plant.

2. BACKGROUND

Scrams have been reported at operating BWRs as a result of momentary anomalous neutron flux spikes which exceeded the high-high APRM flow referenced trip setting. Frequent causes of these flux spikes are momentary flow changes in the recirculation system flow and small pressure disturbances during turbine stop valve and turbine control valve testing. Although many of these scrams occurred during operation with less than rated core flow, the neutron flux did not exceed the 100% flow flux scram trip value (120%) assumed in the transient safety analysis. These small neutron flux spikes represent no danger to the fuel because their duration is less than the fuel thermal time constant. Therefore, the fuel surface heat flux does not increase sufficiently to challenge the fuel cladding integrity safety limit. The new APRM scram logic will reduce the number of spurious scrams occurring along the power-flow line without reducing the fuel safety margins for any accidents or abnormal operational transients for which the plant is licensed.

3. DESCRIPTION

The APRM flow referenced scram feature was designed and installed on Hatch 2 as noted in subsection 7.6.2.2.4, of the Final Safety Analysis Report. The trip setpoint is varied as a function of reactor recirculation driving loop flow relative to a value of 120% of nuclear-boiler rated power at full flow.

There are six APRM channels, three for each reactor protection trip system. The trip unit for one of these three channels can supply the trip signal to the associated reactor protection trip system. At least one APRM channel in each trip system must trip to cause a scram. Presently, each APRM channel derives its trip signal from LPRM neutron flux measurements. The APRM scram trip setpoints given in the technical specifications* are varied as a function of reactor recirculation driving loop flow. To obtain the proper reference signal, each APRM channel is supplied with two redundant and isolated flow signals associated with the trip system.

Although the present APRM flow reference scram system accurately predicts the thermal power level for steady-state operation, it overpredicts the fuel heat powerlevel during power increase events. During such events, the neutron flux leads the reactor thermal power because of the fuel time constant. Therefore, neutron flux trip levels are reached before the reactor thermal power has significantly increased. While this anticipatory response in the APRM scram provides additional protection to the core during abnormal operational transients or accidents, it results in many unnecessary scrams for small neutron flux disturbances along the flow control line (Figure 1).

Many of these unnecessary scrams will be avoided by replacing the present APRM trip logic with a Thermal Power Simulator and an APRM Simulated Thermal Power (STP) trip unit. The APRM signal for the scram trip will be processed through a Thermal Power Simulator consisting of a time constant delay circuit. This circuit represents the fuel dynamics which will approximate the reactor thermal power during a transient or steady state condition. A faster response trip unit on APRM neutron flux utilizing a non-flow referenced 120% neutron flux scram trip setpoint has also been added. Figure 3 illustrates the new APRM scram trip logic.

Figure 2 shows the response of the new APRM scram trip logic to the same flux spike as shown in Figure 1. In this case, a scram does not occur, since the transient peak of the simulated thermal power is below the flow referenced scram setpoint.

The total recirculation drive flow signal to the APRM STP trip unit remains the same. Therefore, an APRM channel trip could be initiated from either a non-flow referenced APRM neutron flux trip unit or the flow referenced APRM STP trip unit.

4. CONFORMANCE TO GUIDES AND STANDARDS

The electrical components used in the new APRM scram trip logic circuitry are in conformance with all applicable IEEE Standards, with all applicable NRC Regulatory Guides, and with the Code of Federal Regulations, Title 10, Chapter 1, Part 50, Appendix A.

The new APRM scram trip logic was qualified to the following codes by which Hatch 2 was licensed:

a) IEEE 279-1971 - Criteria for Protection Systems for Nuclear Power Generating Stations.

b) IEEE 323-1971 - General Guide for Qualifying Class 1 Electrical Equipment for Nuclear Power Generating Stations.

*Technical Specifications 2.2.1, 3.2.2, 3.3.1, and 4.3.1.

c) IEEE 344-1971 - Recommended Practices for the Seismic Qualification of Class 1 Electric Equipment for Nuclear Power Generating Stations.

Both AC and DC APRM power supplies remain the same.

The Average Power Range Monitor (APRM) system is one subsystem of the neutron monitoring system. The APRM subsystem is augmented to include the Simulated Thermal Power Trip (STPT). The APRM subsystem has 6 APRM channels, each using input signals from a number of LPRM channels. Three APRM channels are associated with each of the trip systems of the Reactor Protection System. The APRM subsystem is designed to meet the requirements of IEEE-279 as documented in Subsection 7.6.2.3.4 of the FSAR.

The STPT augments each of the 6 APRM channels such that each APRM channel has a 120% neutron flux trip whose setpoint is not recirculation flow biased. The new thermal power upscale trip has a setpoint that is flow biased and is obtained by filtering the APRM signal to obtain a signal which represents the thermal flux of the fuel. This time delay is accomplished by conditioning the APRM neutron flux through a first order low pass filter that has a 6 second RC time constant. Since each of the 6 APRM channels was identically modified to add the STPT, and the independence between the 6 APRM channels was not altered, the redundancy requirements of IEEE-279 are still maintained.

5. EFFECTS ON SAFETY ANALYSIS

Cumulative fatigue damage analyses are performed for the fuel assembly, the reactor and reactor internals. The cyclic loads considered in these analyses include coolant pressure and thermal gradients. Details of the methodology used for the fuel analysis are given in Reference 1. Reactor and reactor internal analyses are addressed in Subsection 3.9 of the FSAR. Avoidance of spurious scrams will reduce the plant cyclic duty and will, therefore, provide additional margin to the fatigue damage limits. Because the present limiting abnormal operational transient analyses do not account for the present flow-reference APRM scram setpoints, the only transient which is affected by the new APRM scram trip logic is the loss-of-feedwater heating transient. Because the flow referenced scram with the new APRM scram trip logic has a maximum setting at 113.5% neutron flux, a scram will occur earlier for slow transients, before the fixed APRM scram setpoint of 118% neutron flux is reached. Therefore the transient ΔCPR will be less for the most limiting slow transient, a loss-of-feedwater heating. No credit for this reduction is taken in cycle 1.

At less than rated power conditions, the new APRM scram trip logic provides greater thermal margins to the fuel cladding integrity safety limit than at rated power. As reactor power is reduced, total steam generation decreases. In the loss-of-feedwater heating transient, the reduced steam flow at low power results in a decrease in both feedwater flow and the maximum temperature rise across a given heater. The core subcooling change, as well as the positive reactivity insertion, will then be less severe. Therefore, the change in critical power ratio (ΔCPR) will decrease with decreasing power. Thus, the difference between the safety limit and the transient MCPR increases with decreasing power, irrespective of the scram systems logic.

In addition, at any given recirculation loop flow rate, the STPT logic is designed to maintain a relatively constant margin between the reactor power and the STP trip setting. This margin, or power difference, between the reactor power and the thermal power trip setting is established by the STPT setpoint specification:

$$S \leq \text{minimum of} \begin{cases} 0.66w + 51\% \\ 11\ .5\% \end{cases}$$

where "W" is the recirculation loop flow rate as a percent of rated. This specification requires that the STPT setpoint be reduced as the recirculation loop flow rate (and hence reactor power) is reduced. The characteristic decrease in ΔCPR with decreasing power, and the reduction in APRM STPT setpoint with decreased recirculation loop flow (and hence reactor power), both act to assure that the fuel cladding integrity Safety Limit is not violated during the loss of feedwater heating transient at less than rated power.

Analyses for Hatch Unit 2 initial core have demonstrated that with only the 120% trip setting, none of the abnormal operational transients analyzed violates the fuel cladding integrity safety limit, and that there is substantial margin from fuel damage. Therefore, the use of the flow referenced trip setpoint, with the fixed setpoint as backup, provides adequate thermal margins for fuel cladding integrity.

6. APPLICATION TO CURRENT OPERATING PLANTS

At present, Brunswick Units 1 and 2 and the James A. FitzPatrick Nuclear Power Plant are operating with the new APRM scram trip logic. This logic was an integral part of the Brunswick Units 1 and 2 APRM scram trip system when these plants were initially licensed (see Section 7.5.7, Average Power Range Monitor Subsystem, in the Brunswick Units 1 and 2 FSAR). The new APRM scram trip logic was licensed as a retrofit margin improvement option on the James A. FitzPatrick plant.

Field experience from these plants has shown that scrams from recirculation system excursions have been reduced by 50 to 75% due to this modification. A similar reduction on spurious scrams is expected when the new APRM scram trip logic is installed in the Hatch Unit 2 plant.

7. SUMMARY AND CONCLUSIONS

This document has discussed the design and safety aspects of the new APRM scram trip logic. By reducing the cyclic duty on the plant, greater margins to cumulative fatigue damage limits exist. In addition, the effects of slow loss of coolant transients are less severe. Therefore, the safety of the plant will be increased by operation of the plant with the new APRM scram trip logic.

8. REFERENCES

1. "Generic Reload Fuel Application", NEDE-24011-P-A, August 1978.

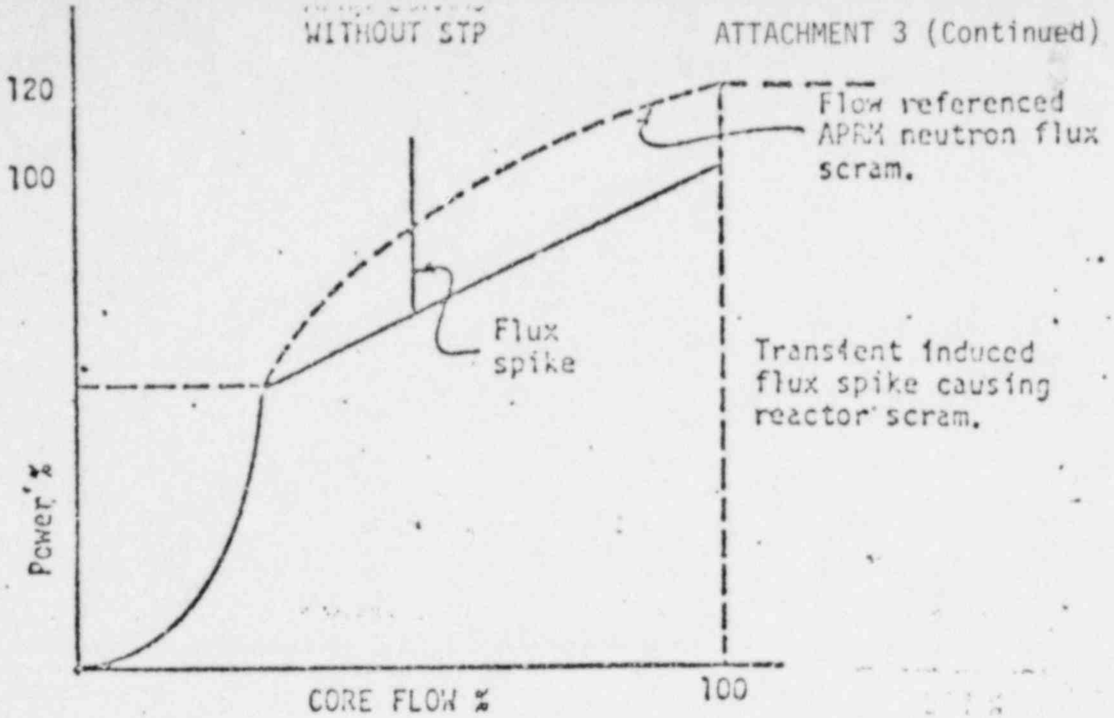

FIGURE 1

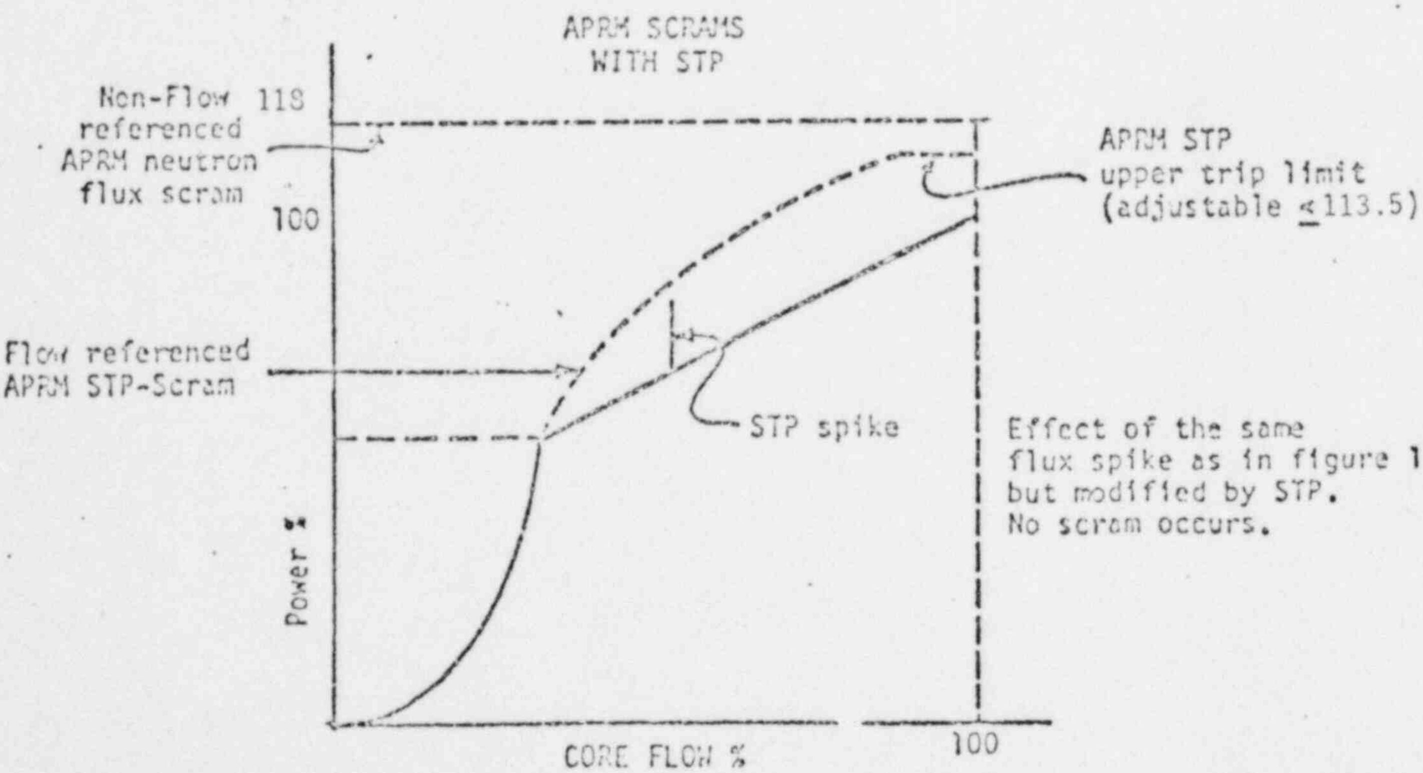

FIGURE 2