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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 9 TO

FACILITY OPERATING LICENSE NO. R-97

GEORGIA INSTITUTE OF TECHNOLOGY

DOCKET NO. 50-160

1.0 INTRODUCTION

By letter dated June 5, 1990 and supplements dated July 31, September 20, and October 23, 1990, the Georgia Institute of Technology (Tech) requested changes to the Technical Specifications for Facility Operating License No. R-97 for the Georgia Tech Research Reactor (GTRR). The Georgia Institute of Technology operates a NRC-licensed non-power nuclear reactor on its campus in Atlanta, Georgia. The principal purpose and use of the reactor are to support nuclear-related research. The licensee has proposed performing a new experiment that requires an amendment to the Technical Specifications of the facility license. The amended Technical Specifications have been proposed by the licensee for the performance of the proposed Fast Shutdown System Experiments (FSSE).

2.0 DISCUSSION

The proposed experiment requires the installation of a hollow capsule at a high flux position in the core of the reactor. This capsule is connected by piping outside the reactor shield, through an explosive valve, to a reservoir containing pressurized helium-3 gas, which is a strong absorber of thermal neutrons. The experiment involves operating the reactor at steady state full power level, and explosively opening the valve so that helium-3 gas rapidly enters the capsule. The negative reactivity insertion of the gas is designed to drive the reactor strongly sub-critical, causing a rapid decrease in operating power level. The FSSE are designed to measure the nuclear characteristics of this reactor shutdown method.

Because the Georgia Tech reactor safety system includes a reactor period scram that functions on both positive and negative periods, the rapid decrease in power level during the FSSE would initiate a scram signal and rapid insertion of all shim-safety rods. This rapid insertion of rods would obviate the purpose of the FSSE, that is, to measure the core's nuclear response to the

helium-3 injection. Therefore, the licensee requested authorization to insert a one second time-delay in the negative reactor period scram circuitry so that neutron flux data can be recorded for interpretation of the reactor's transient behavior during the FSSE. The licensee's submittal of June 5, 1990, and supplements, described the FSSE in detail, included safety analyses and proposed Technical Specification changes, and showed that other applicable license and regulatory conditions were still fulfilled during performance of the FSSE.

3.0 EVALUATION

3.1 Operational and Transient Assessments

As previously outlined, the FSSE would require installation of a hollow capsule in the reactor core. The capsule would be connected by piping through an explosive-driven valve to a reservoir of helium-3 gas, a strong thermal neutron absorber. The helium gas would be rapidly injected into the capsule and the nuclear response of the core monitored. The strong negative reactivity addition of the helium gas would be expected to result in a negative period reactor scram. This scram will be delayed for approximately one second to allow measurement of core conditions without the influence of shim-safety rod insertion. The helium gas would remain in the capsule after reactor shutdown, and not be removed unless all shim-safety rods were fully inserted.

For the proposed experiment, the licensee analyzed changes in both the rate and magnitude of reactivity, and the reactor's response to the negative reactivity insertion. The licensee's analyses also included evaluation of potential accidents related to the FSSE. This analysis showed that neither the FSSE nor any credible accident during the FSSE would lead to damage of the reactor or its fuel.

The proposed time-delay in the negative period scram will in no way affect the function of other reactor scrams. Furthermore, the negative period scram at the Georgia Tech reactor is unique at NRC-licensed non-power reactors, and is only intended to mitigate the reactivity effects in the event of a very unlikely failure in a safety rod scram mechanism. The licensee has analyzed appropriate accident scenarios, and has shown that for the proposed time-delay of one second before release of rods, reactor safety limits would not be exceeded, or even approached.

The FSSE will include, and will terminate with, the automatic scramming of the reactor. Non-power reactors in the United States, including the Georgia Tech reactor, were designed and built so that release and gravity insertion of the shim-safety rods to cause reactor shutdown is a benign and non-damaging action. Scramming of the reactor is a normal and usual shutdown procedure. Therefore, the inclusion of a reactor scram in the FSSE introduces no new risks to the facility or to the public.

3.2 Radiological Considerations

In the production of helium-3, there is normally a small residual amount of hydrogen-3 (tritium), which is radioactive. Furthermore, when helium-3 absorbs a neutron, tritium is formed. The licensee's Technical Specifications limit the amount of radioactive material that may be included in an experiment.

The licensee analyzed the potential radiological impact of the tritium associated with the experiment under both normal and postulated accident conditions. The conclusions are that the potential risks to both the reactor staff and the public due to the tritium will not be significant, and will comply with the licensee's existing Technical Specifications.

3.3 Technical Specification Changes

The licensee's supplemental submission, dated September 20, 1990, proposed leaving almost all parts of the current Technical Specifications intact, but includes adding a section that applies only when the proposed FSSE are in progress. This approach avoids the possibility of misinterpretation of revised Technical Specifications by the operator during usual operation of the reactor. Further, this change limits reactivity conditions to those expected for the FSSE, requires that shim-safety rods be inserted prior to removal of the helium-3 gas, sets limits on the delay of the negative period scram, and precludes conduct of other experiments during conduct of the FSSE.

The other part of the Technical Specifications that the licensee proposed changing deals with the quantity of explosive material that is allowed in the reactor containment building. The reason for the change is to allow the use of the explosive switches that initiate injection of the helium-3 gas. The switches to be used are routinely commercially available, complying with restrictive industrial standards. The explosive material in these switches remains effectively encapsulated at all times, and would at no time be near the reactor core or within the biological shield of the reactor.

3.4 Evaluation Summary

The staff reviewed the licensee's analyses, and proposed operational modes and associated Technical Specifications. The staff concluded that the licensee acceptably addressed all operations and safety issues related to the performance of the proposed FSSE, and there is reasonable assurance that no significant increase in hazards to the public will result from performance of these experiments, as proposed.

4.0 ENVIRONMENTAL CONSIDERATION

This amendment involves changes in the installation or use of facility components located within the restricted area as defined in 10 CFR Part 20. The staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released

offsite, and there is no significant increase in individual or cumulative occupational radiation exposure. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no Environmental Impact Statement or Environmental Assessment need be prepared in connection with the issuance of this amendment.

5.0 CONCLUSION

The staff has concluded, based on the considerations discussed above, that: (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously evaluated, or create the possibility of a new or different kind of accident from any accident previously evaluated, and does not involve a significant reduction in a margin of safety, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by the proposed activities, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or the health and safety of the public.

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Dated: December 12, 1990