PURDUE UNIVERSITY SCHOOL OF NUCLEAR ENGINEERING

June 8, 1981

Mr. James G. Keppler, Director
Region III
United States Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

RE: Report of violation of Technical Specifications

Dear Mr. Keppler:

This letter is in response to the telephone call and telegram dated June 2, 1981 in which we reported that tests made on June 2, 1981 indicated that reactor scram times may be in possible violation of the Technical Specifications.

Problem

Procedures developed at the time of the installation of the reactor in 1962 measured the rod drop times, the time from interruption of the magnet current to the full insertion of the safety control rods. This time initially was specified as less than 500 milliseconds but was found to be too short and the specification was subsequently changed to be less than 600 milliseconds. Measured rod drop times, as published in the annual reports, fall between 593 and 563 milliseconds. This parameter, the rod drop time, was considered important for the safe operation of the reactor, since any increases in the drop times would indicate a possible binding of a control rod in the guide channel.

During the development of the Technical Specifications, filed in 1975, the rod drop times were inadvertantly used as "The time from initiation of a scram condition in the scram circuit until the shim-safety rod reaches the rod lower limit switch." (Sec 3.2.c). The Purdue University Reactor has two scram systems. The "fast" scram anticipates either an over power condition or a short period and reduces the magnet current in the control rod drive mechanisms until the magnet can no longer support the rod and it drops. Since this is an electronic circuit, response times are short and new procedures developed to measure the scram time ("the time from the initiaiton of a scram condition in the scram circuit until the shim safety rod reaches the rod lower limit switch") give the same results as the rod drop time, within the reproducability of the experiment.

West Lafayette, Indiana 47907

The "slow scram, initiated by any one of a variety of conditions, interrupts the 110 volt power to the regulated power supplies for the control rod magnets. Thus, the energy stored in the regulated power supply must drain off before the magnet current is reduced below the holding current and the control rods are released. According to measurements made for the first time on June 2, 1981, the time delay for the regulated power supplies to reduce their current to the point at which the control rods will drop averages about 60 milliseconds. This, coupled with the rod drop times gave "scram times" between 663 and 629 milliseconds, which exceeds the limits in the Technical Specification.

Hazard Analysis

The only accident analysis performed for the preliminary Hazards Report that involved the reactor scram time, was a postulated ramp reactivity increase by withdrawing all control rods simultaneously with a failure of the period interlocks, control rod interlocks to allow withdrawal of all control rods simultaneously, set back trips, and period scrams. Assuming a maximum allowable excess reactivity in the reactor of 0.006 $\frac{\Delta K}{K}$, the reactor period at the time the Limiting Safety System setting of 1.20 kw is reached is 3 seconds. Assuming the high level fast scram is inoperable, and the slow scram would allow the power level to increase for an additional 60 milliseconds, before the shim safety rods would drop. This would correspond to a trip point of 1.22 kw rather than 1.20 kw. Even if the reactor should be placed on a 1 second period (corresponding to a reactivity change of 0.006 $\frac{\Delta K}{K}$), the maximum power would be 1.27 kw, well below the Safety Limit of 50 kw. Therefore, no additional hazard is considered to exist.

Action

Since no additional hazard is considered to exist and since the reactor has operated safely since its startup in 1962 with this condition, it is proposed to continue to operate the reactor with no changes and to request a change in the Technical Specifications to remove the ambiguity between measured rod drop times and reactor scram times.

If we may be of any further assistance in evaluating this problem or can supply additional information, please contact me.

Sincerely,

E. R. Stansberry
Reactor Supervisor

ERS:sab