



December 20, 1996

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Re: Reportable Occurrence: Tech Spec Violation
License R-2, Docket No. 50-005

Dear Sir or Madame:

This letter is to fulfill the 14 day report requirements of sections 6.5.2 and 6.6.2 of the Penn State Breazeale Reactor Technical Specifications (TS), for a reportable occurrence of December 16, 1996. The event was initially reported by telephone and fax to Mr. Tom Dragoun of Region I on December 17, 1996. Due to an up and coming extensive University holiday this "14 day report" is being filed early. An addendum will be filed on or before January 24, 1997.

The reportable occurrence (section 1.1.33.b and 1.1.33.c of the TS) is that the reactor was operated unknowingly in violation of a limiting condition for operation since the fuel element temperature limiting safety system was inoperative during a pre-pulse steady state operation and during a subsequent pulse. See Tables 1 and 2a in section 3.2 of the TS. The steady state and normal pulse peak power were both monitored and recorded as required by Tables 1 and 2a. We believe that the power limiting safety system was operative during the pre-pulse steady state operation.

A series of pulses was being performed for an experimenter who was monitoring a pulse peak power signal from the reactor console as an input parameter to his experiment. The peak power range of data for the first thirteen pulses was from 1148 MW to 1204 MW. The peak temperature range of data for the first thirteen pulses was from 488°C to 502°C for fuel temperature channel #1 and from 487°C to 500°C for fuel temperature channel #2. The following is a time line for events during and following the thirteenth pulse (#6658) and the fourteenth pulse (#6659).

Occurrence Timeline Detail

<u>Time</u>	<u>Activity</u>
19:41:37	Pulse # 6658 complete Peak Power = 1176 MW, Fuel Temp #1 = 495°C, Fuel Temp #2 = 494°C
19:47	Startup for Pulse # 6659
19:47:23	Fuel #1 = 13.6°C Fuel #2 = 15.4°C
19:48:21	Fuel #1 = 30.2°C Fuel #2 = 31.9°C
19:51	Reactor critical at 100 watts

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19:57 Pulse # 6659 initiated, Peak Power = 1168 MW, Fuel Temp #1 = 33.7°C,
Fuel Temp #2 = 32.5°C

20:00 Phone call to Electronic Engineer to inquire what historical trends are most
important for his trouble-shooting

20:10 Event Evaluation Report initiated; Maintenance/Repair initiated; Do Not Operate
Tag in place

20:14 Reactor Secured

20:39:25 Fuel #1 = 30.2°C Fuel #2 = 33.1°C

20:40:23 Fuel #1 = 10.1°C Fuel #2 = 12.4°C

As indicated above, between the last two pulses in a series of fourteen pulses, a step change occurred in both fuel temperature readouts between 19:47:23 and 19:48:21. When the fourteenth pulse was performed, the fuel temperatures remained essentially unchanged. Therefore, the reactor was operated at approximately 100 watts with an inoperative limiting safety system for several minutes and then pulsed with inoperative fuel temperature displays in violation of the TS. At the time of the step change in fuel temperatures at approximately 19:48 and again at 20:40, it is believed that the experimenter made a parameter change in his equipment which affected the reactor safety system even though the experimental equipment was isolated from the fuel temperature and power safety systems.

Analysis of the Cause of the Occurrence

A series of pulses was being performed for an experimenter who was monitoring a pulse peak power signal from the reactor console as an input parameter to his experiment. The signal being provided is proportional to power in the range of 0-2000 MW. The signal comes to the point where it is being monitored by way of the gamma ion chamber, peak pulse power amplifier, and high speed isolation board. The signal goes from the isolation board to the IO of the control and monitoring computer. The control and monitoring computer records the data during a pulse and provides a peak power display for the operator, as required by the TS. The signal being provided to the experimenter was taken from between the isolation board and the control and monitoring computer. That signal went to an experimenter provided multiplexed IO board with very high input impedance. The Staff had determined that the added demand on that signal was no different than that imposed by the control and monitoring computer. The Staff felt that the isolation was as adequate for the experimenter as it was for the control and monitoring computer.

Just prior to the last pulse the experimenter changed a parameter voltage on his apparatus. This parameter was also being monitoring by the experimenter's multiplexed IO board. The Staff believes that there was a failure in the multiplexed IO board when the parameter was changed which allowed a high frequency signal to be imposed on the line provided to the experimenter from the reactor console. The immediate response, which was not noticed by the operator, was an approximately 15 °C step increase to approximately 30° C in both instrumented fuel element thermocouple indications as seen by the control and monitoring computer. When the subsequent pulse was performed the thermocouple level as seen by the control and monitoring computer did not change as expected. Since the fuel temperature indication did not change during the pulse it is likely that the limiting safety system (fuel temperature) was not operational prior to the pulse when the reactor was operating at the preparatory 100 watts critical.

The Staff have been investigating various scenarios to try to duplicate the conditions and the effect while the reactor is shutdown, testing all related equipment and instrumentation, interviewing the

manufacturers of the equipment in question, interviewing the experimenter, and pursuing other experimental avenues to increase our understanding and analysis of the occurrence. As yet the root cause or causes have not been found. A vigorous pursuit of information is being made on the isolator board performance, the thermocouple safety system performance and possible avenues of extraneous signal introduction.

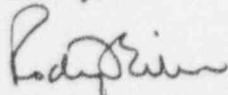
Efficacy of Corrective Action

Reactor operations are suspended. Until the above analysis has been completed corrective actions are being held in abeyance and likewise their efficacy.

Recommendations for Measures to Prevent or Reduce the Probability of Recurrence

The reactor will remain secured until this event is thoroughly understood and steps taken to prevent a recurrence.

Sincerely,



Dr. Rodney A. Erickson
Interim Vice President for Research

RAE:TLF/DEH/WFW/ldb4096.96

pc: Region I Administrator
T. Flinchbaugh, PSBR

