



UNITED STATES DEPARTMENT OF COMMERCE  
National Bureau of Standards  
Washington, D.C. 20234

August 15, 1979

Mr. Robert Reid  
Chief, Operating Reactors Branch No. 4  
U. S. Nuclear Regulatory Commission  
Washington, DC 20555

Subject. Docket No. 50-~~180~~

Dear Mr. Reid:

On the afternoon of August 7, 1979, with the reactor operating at 10 MW, the NBSR shim arms were being routinely adjusted to compensate for the movement of the regulating rod which had reached its upper control limit as a result of normal burnup and xenon buildup. The adjustment began by withdrawing shim No. 1 which was at 28.5°. After commencing withdrawal, the operator noted no downward movement of the regulating rod and no power deviation as normally would be expected. Glancing at shim No. 1 indicator, it was then reading about 28.8°. Subsequently he noted a jump in the indicator reading to approximately 29.2°. This was followed by an alarm and momentary rundown. A rundown takes place at 115% of power on two of three instruments. Reactor scram occurs at 125% of power on two of three instruments. Examination of relevant recorder charts showed a momentary power spike. One of the three safety channel (NC-8) selected to be recorded at the time showed a spike from about 105 to 132 recorder indication. The automatic control channel (NC-5) which was also being recorded showed a momentary rise from about 94 to 109. The fact that only a rundown occurred and a fast scram did not occur indicate that another safety channel reached 115 to cause the rundown but not 125 to cause a scram. There was no change indicated in the thermal power or  $\Delta T$ . The reactivity associated with shim No. 1 movement from 28.5° to 29.2° is approximately 10 cents. The entire safety system including trip points had been checked the day before as part of preoperational checks required prior to startup. Following the short rundown which restored power to normal, shim No. 1 was tested and was found to be normal and smooth in the affected region. The previous occurrence could not be duplicated.

The following morning, further checks were made by comparing the response of the regulating rod to the movement of each of the four shims in the affected region. While the response of the regulating rod to the movement of each of the shims was different as expected, that for shim No. 1 appeared to be considerably different indicating a possible problem

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in shim No. 1 movement in that region. The reactor was shutdown for more detailed checks.

To date, the following additional checks have been made.

1. The withdrawal and insertion times of shim No. 1 were measured and compare well with previous times.

2. The shim was scrambled to measure release and drop times and to examine the drop trace. Both the times and the trace were normal.

3. The electronics associated with shim No. 1 and with the automatic control system were checked and found to be normal.

4. Finally a trace of the movement of each of the shims as they were being driven up and down throughout their length of travel was made. The trace for shim No. 1 showed irregularities in certain areas, i.e., it was not completely uniform over its length of travel. The irregularities can best be described as hesitations. Both the withdrawal and insertion times compared well with previous times. (Shim speed is about  $2\frac{3}{4}^{\circ}$  per minute). The traces for the other three shims appear to be uniform over their length of travel.

5. Shim No. 1 drive unit was removed and checked. Everything was found to be normal. Certain components in the drive that could possibly cause movement irregularities were changed and another trace of the movement of shim No. 1 was obtained. There was no significant change in the trace with the same irregularities indicated.

None of the above positively identified the problem. Subsequent to the preparation of this letter, additional information was obtained as a result of continuing checks including viewing shim No. 1 movement with a periscope. There appears to be a definite binding in the movement of shim No. 1 over a short range in the neighborhood of  $25^{\circ}$ . The cadmium blade appeared to be normal. It is suspected that the problem may be in one of the bearings on the shim arm shaft.

Further, tests, checks and examinations are planned to positively identify the problem and to correct it. The reactor will continue to be shutdown.

*Robert S. Carter*  
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Chief, Reactor Radiation Division

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