Nuclear Reactor Laboratory
The University of Michigan

Ford Nuclear Reactor
Phoenix Memorial Laboratory
2301 Bonisteel Boulevard

November 25, 1992

Docket 50-2
License R-28

United States Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Reportable Occurrence No. 16
Reactor Startup with Power Level Deviation Interlock Out of Commission (Technical Specifications, Table 3.2)

Gentlemen:

This letter is Reportable Occurrence No. 16, startup of the Ford Nuclear Reactor with the power level deviation interlock as required by Technical Specifications, Table 3.2, out of commission. The event occurred on the afternoon of November 24, 1992, during a startup to check core reactivity that followed the performance of reactor pre-startup Checklist A. The fact that the interlock was out of commission was discovered during a subsequent performance of Checklist A on the midnight shift, November 25, 1992.

Sequence of Events

On Tuesday, November 24, 1992, during a routine maintenance period, the shim range - control rod interlock system was removed from the reactor control system. The modification had been reviewed and approved by the facility Safety Review Committee on October 6, 1992.

Following the wiring modifications, a reactor pre-startup Checklist A was conducted to test the modification and to confirm the operation of the reactor control system. A wiring error had been made during the modification that disabled the interlock that drops the reactor out of automatic control if the Linear Level neutron detection system indicated power is five percent below the automatic control setpoint.

The fact that this interlock was disabled was not discovered during the performance of Checklist A. A reconstruction of the performance of the checklist revealed the possible reason. A copy of step 33 of Checklist A is enclosed for reference.

1. Step 33 is the drop-out-of-auto test.

2. A senior reactor operator was at the console; a trainee was assisting with the checkout.

3. In step 33.a, the Linear Level selector switch is set to CALIBRATE which gives a power indication of 100%.

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4. In step 33.b, the servo control setpoint is set to 97% which permits the control rod to be put in automatic control. Indicated power must be at least 2% above the automatic control setpoint to go into automatic.

5. In Step 33.c, the control rod is manually withdrawn to 17 inches. Zero to 24 inches is the full stroke of the rod.

6. In step 33.d, the reactor is placed in automatic control. Since the indication (100%)is above the setpoint(97%), the rod will begin to insert.

7. In step 33.e, when the control rod is at 15 inches and going in, the operator increases the setpoint. When the setpoint reaches 100%, control rod motion stops. As the setpoint is increased above 100%, the control rod withdraws. At a setpoint of 105%, the control rod drops out of automatic, satisfying the interlock.

8. In this case, the trainee must have increased the setpoint too slowly. It takes approximately 28 seconds for the control rod to travel from 15 inches to 0 inches. If she did not reach a 100% setpoint within that 28 seconds, the control rod would reach the lower limit (0 inches) and the control rod would drop out of automatic. Reaching the lower limit is accompanied by a rundown (automatic insertion) of the shim-safety rods.

9. In fact, the drop-out-of-auto was observed by the senior reactor operator, as was a rundown. He misinterpreted the rundown and believed the drop-out-of-auto was due to the Linear Level indication being five percent below the setpoint, thus satisfying step 32.

Following the "successful" completion of Checklist A, the reactor was started up to approximately 5 kw to perform a shutdown margin and excess reactivity check. The control rod was withdrawn to 24 inches and the shim rods to criticality. The reactor was never placed in automatic control. Following the reactivity measurement, the reactor was shutdown and secured.

The midnight shift, November 25, 1992, performed a Checklist A in preparation for power operation. The crew was not able to successfully complete Step 33. The Assistant Manager and the Electrical Engineer were notified. Between 2 a.m. and 8 a.m., the procedure was retried, the wiring mistake was discovered and corrected, and Checklist A was satisfactorily completed.

The personnel who had conducted the original Checklist A were interviewed and the series of errors and misinterpretations were resolved. At 9 a.m., November 25, 1992, the Reactor Manager gave permission to startup the reactor for power operation.

Consequences of Operating With the Power Level Deviation Interlock Out of Commission

The worst possible consequence of operating with the power level deviation interlock out of commission would be failure of the automatic control system followed by continuous withdrawal of the control rod. If the control rod were withdrawn from zero to 24 inches, 0.00475 delta K/K reactivity would be inserted. The resultant stable period would be 6 seconds. At a period of 10 seconds, an automatic rundown of the shim-safety rods occurs. The period scram setpoint is 5 seconds.

Corrective Action

The following changes to Checklist A will be made to ensure proper performance of Step 33.

33.c Withdraw the control rod to 23 incnes.

33.e As the control rod begins to insert, increase the setpoint to 106%.

33.g Verify final control rod position above 5 inches.

Step 33.c will provide more time to adjust the setpoint. Step 33.g will ensure that a control rod lower limit drop-out-of-auto is not misinterpreted as a power level deviation drop-out-of-auto.

As a more general corrective action, when a modification is made, the functional changes related to the modification will be tested and verified by the quality assurance team members directly responsible for the modification. The Electrical Engineer was present during the initial performance of Checklist A, but neither he nor any other member of the quality assurance team was observing the performance of the checklist step-by-step.

Sincerely,

Ronald F. Fleming

Ronald F. Fleming
Director

xc: Dr. William C. Kelly, Vice President for Research
Safety Review Committee Members
Reactor Operations Staff

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FNR CONTROL SYSTEM STARTUP CHECKLIST "A" (continued)

Initial

_____ 30. Energize Linear Level automatic control unit.
_____ 31. Perform Log N channel tests:
_____ a. Turn LOG N test switch to positions 1, 2, and 3 to check calibration of Log N meter and recorder.
_____ b. Return Log N test switch to OPERATE.
_____ c. Turn Log N period test switch from OPERATE to CALIBRATE and check the calibration of the period meter and recorder.
_____ d. Press SCRAM RESET button.
_____ e. Switch period recorder OFF while withdrawing control rod and verify control rod withdrawal inhibit.
_____ f. Return period recorder switch to the ON position.
_____ g. Turn Log N TRIP TEST ADJUST slowly to an indicated 30 second period and verify control rod withdrawal inhibit.
_____ h. Check auto rundown at 10 seconds.
_____ i. Return Log N test circuitry to OPERATE.
_____ 32. Perform Linear Level rundown test.
_____ a. Simultaneously press TEST button and adjust potentiometer to read 115%.
_____ b. Note auto rundown.
_____ c. Adjust potentiometer to read 95% and release TEST button.
_____ d. Depress auto rundown RESET button.
_____ 33. Perform drop-out-of-auto test.
_____ a. Set Linear Level range selector switch to calibrate. |21
_____ b. Set servo control setpoint at 97%.
_____ c. Withdraw control rod to 17.0 inches.
_____ d. Depress AUTO ON push button on console.
_____ e. When control rod inserts to 15.0 inches move setpoint to 106.
_____ f. Note drop out of auto control.
_____ 34. Perform control rod lower limit rundown test.
_____ a. Set auto-control setpoint at 97%. |16
_____ b. Depress AUTO ON button.
_____ c. Note auto rundown when control rod reaches lower limit.
_____ d. Depress auto rundown RESET button.
_____ e. Set Linear Level range selector switch to lowest possible operating range.
_____ 35. Perform Linear Level abnormal test.
_____ a. Press and hold LINEAR LEVEL ABNORMAL TEST button.
_____ b. Note LIN LEV ABN alarm.
_____ c. Note 110% reading on console Linear Level meter.
_____ d. Release TEST button.
_____ 36. Return magnet contact simulator switches to OFF.
_____ 37. Return shim range bypass switch to NONE BYPASSED.
_____ 38. Unbypass SHIM RANGE DEFEATED scram function.
_____ 39. Verify D_2O LOW LEVEL alarm unbypassed.
_____ 40. Check pool lev l functions.
_____ a. Test alarm at 5 inches.
_____ b. Test auto rundown at 12 inches.