The University of Michigan

MICHIGAN MEMORIAL – PHOENIX PROJECT
PHOENIX MEMORIAL LABORATORY FORD NUCLEAR REACTOR
ANN ARBOR, MICHIGAN 48109-2100

EXEMPT No. 36514

FAXED 15Dec99 2210 NRC Emergency Response Center

15 December 1999

Docket 50-2, License R-28

U.S. Nuclear Regulatory Commission
Attn: Document Control Room
Washington, DC 20555

Re: **Reportable Occurrence No. 22 – Violation of Technical Specification 3.2 *Reactor Safety System*.**

This is the report on a violation of Technical Specification 3.2.1. Due to the incorrect connection of the high voltage to the compensated voltage connection of a compensated wide range ion chamber, the Log N Channel required in Table 3.1, *Required Safety Channels,* was inoperable during the reactor startup on 14 December 1999. Review of the power level indication from the other nuclear instrumentation channels shows that no limiting safety system settings were approached during the reactor startup.

*Description of Occurrence*

13 Dec 1999 – a channel test was performed on the Log N channel using a calibrated current source. The compensated ion chamber was disconnected at the reactor bridge for connection of the source. Following successful completion of the channel test, the chamber's compensating voltage connection was connected to the high voltage supply. As a result only the gamma detecting portion of the detector was providing a signal to the Log N instrument.

14 Dec 1999

2012 - a reactor startup was performed to a power level of 6 kW and the core excess reactivity and shutdown margin were determined.

2048 - a reactivity check at 6 kW was completed and startup continued to raise power level to 1 MW.

2108 - as reactor power passed through 500 kW, a channel check of all nuclear instruments, Safety Channels A and B, Log N and Linear Level was performed. The Log N circuit indicated 20%, within specification but below the normal of approximately 25 - 35%.

2110 - reactor power was leveled at 1 MW for a heat balance.

2240 - the heat balance was completed. A channel check of Safety Channels A and B and Linear Level was made. A channel check of Log N was not performed although specifically identified in the procedure. The Log N circuit was indicating 25%. The overlooked channel check in the procedure specified a minimum acceptable level of 40%.

2243 - reactor power was raised to 2MW.

2249 - reactor power was leveled at 2 MW at which time the operator identified that the Log N was reading 35% with a minimum acceptable power level of 80%.

2252 - reactor operator shut the reactor down due to the improper Log N reading.

*Safety Implications*

Indications from the operable nuclear instruments and temperature system indicate that no limiting safety system settings were approached. Determination of the response of the period portion of the Log N system compared to the periods derived from other properly responding nuclear instrument channels indicates that the period circuit was measuring periods of similar magnitude and that the 30 second period for reactor control rod withdrawal inhibit was not challenged.

*Root Causes*

The Reactor Manager and Operations Manager reviewed the Log N, Linear Level, and Log Count Rate (source range instrument) strip charts, reactor log, reactor log book, procedures, and maintenance history and conducted interviews of personnel involved and not involved in the event. Three root causes have been identified:

IE22

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Human Factor Deficiencies – the Log N circuit and the linear level circuit are both compensated ion chambers but the reactor bridge connections for the compensating voltage and high voltage leads from the detectors are opposite. The operators used the linear level circuit as a check that they properly connected the Log N detector. The signal, high voltage and compensating voltage connectors are all the same type of connector, as such they can be mechanically interchanged. The wording of the labels on the Log N detector leads does not match the labels on the fixed connectors for the Log N circuit.

Inadequate Knowledge of Operation Personnel – licensed personnel performing the reactor startup were aware that maintenance had occurred during the shutdown period. The reactor startup procedure requires that the 500 kW channel check be performed using power of a non-maintained channel as the reference. Operator are aware that the purpose of this statement is to emphasize that channels upon which maintenance has been performed are suspect. As such, the licensed personnel knew or should have known that an abnormal reading of the Log N circuit was possible. The licensed personnel, however, believed that since the reading was low but in spec, the Log N channel was operating properly.

Procedural Compliance – The reactor startup procedure specifies that licensed personnel are to "Hold" power at 500 kW to perform the checks. It has become acceptable practice to slowly run through the 500 kW point and record the measurements to perform the channel checks. Also, the calorimeter procedure specifies that after a 1 MW calorimetry, the Log N channel should indicate 40 – 100%. The non-channel check of the Log N circuit may also have resulted from operational history that the channel has never required adjustment.

*Immediate Corrective Actions*

The reactor was shut down and will not be restarted for sustained operation until an operational review of this reportable occurrence, Reportable Occurrence 21, *Violation of Technical Specification 3.5, Airborne Effluents,* and other recent operational, but non-reportable events is made and presented to the Safety Review Committee. An outside review of recent operations is being sought and is hoped to be completed prior to requesting permission from the Director and the Safety Review Committee for sustained operation. Reactor startups, reactivity checks and calorimetry will be performed for training during this time period.

*Actions to Prevent Recurrence*

Based on the root causes identified above, the corrective actions to prevent recurrence are:

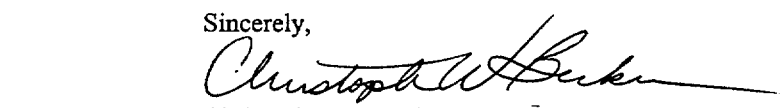
Labeling of the bridge connections for all the nuclear instrument detectors will be reviewed and improved. Further evaluation of 1) design change for changing the connectors so that signal, compensating voltage and high voltage leads each have a different mechanical connectors, 2) color coding the connections, and 3) mechanical connection (chain) of the lead connector to the fixed connector, or a combination of these methods will be pursued.

Operational training will be given on reactor startup, reactivity check, and calorimeter procedures with an emphasis on how these procedures are used meet technical specifications and the intent of the steps performed.

Following this operational training each licensed operator will perform a reactor startup, reactivity check and calorimetry. Following each activity a critique will be held specifically looking for knowledge level, procedural, and documentation improvements. This will give each operator the opportunity to perform, observe and critique each evolution.

This written report is intended to satisfy the reporting requirements for the initial 24 hour report and the 14 day report required in Technical Specification 6.6.2.a, *Reportable Occurrence Reports.*

Sincerely,



Christopher W. Becker
Reactor Manager Ford Nuclear Reactor

CC: Theodore Michaels, Reactor Project Manager Thomas Dragoun, Reactor Inspector
Safety Review Committee, Ford Nuclear Reactor

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