26 JAN 1988

MEMORANDUM FOR: William T. Russell, Regional Administrator

THROUGH: William F. Kane, Director, Division of Reactor Projects

FROM: E. C Wenzinger, Chief, Projects Branch No. 2

SUBJECT: NINE MILE POINT 2 AUGMENTED INSPECTION TEAM FINDINGS

For your benefit and that of other senior NRC managers, the following is a summary of the findings of the Nine Mile Point 2 Augmented Inspection Team (AIT).

The AIT was on site from January 21 through January 24, 1988 to perform an inspection of the causes, safety implications and associated operator actions during the reactor vessel overfill on January 20, 1988. The overfill occurred immediately following a reactor scram on low vessel level.

The event was initiated by an auxiliary operator (non-licensed) who closed one valve in the instrument air system. Instrument air was cut off to several valves that consequently failed open and allowed feedwater to flow to the condenser rather than the reactor vessel. A low reactor water level resulted. Reactor trip (from 41%) occurred as designed at 110 inches of vessel level.

As a result of the reactor trip, the High Pressure Core Spray (HPCS) and Reactor Core Isolation Cooling (RCIC) system operated as designed. This provided large quantities of cold (outside) water from the Condensate Storage Tanks to the reactor vessel. As a result, vessel level increased quickly and pressure decreased to about 600 psi. As level was reaching the automatic shutoff point for RCIC, which did trip as designed, the control room operators shut down the HPCS system.

Following shutdown of the HPCS and RCIC systems, vessel level continued to rise. Operators attempted to stop the rise by attempting to close the feedwater control system valves, which stopped closing at about 80% open. Condensate booster pumps remained running, as designed, providing a makeup water source to the vessel. Vessel pressure reduction allowed this water to flow to the vessel. MSIVs remained open, as designed.

The feedwater control valves stopped at 80% open because of a unique characteristic of the manual portion of the feedwater control valves' control circuits combined with a change in the set point of the valve lockup circuit. The change in the set point was initially diagnosed as set point drift. It was later thought to have been caused by a problem in the set point calibration circuit connections. The actual cause is still under investigation.

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Operators could have manipulated the controls to avoid their stopping at 80% open. However, they had not been informed of the circuit's characteristic nor how to cope with a change in the valve lockup circuit setpoint. Not closing those valves nor taking other actions (e.g. reopen bypass to condenser) to reduce feed flow resulted in vessel overfill and introduction of water into the main steam lines. The operators did not realize, until it was too late, that feedwater was continuing to flow and that the feedwater valves were still open.

Test data taken on 1/22/88 disclosed that the voltage setpoint for lockup of the feedwater control valves had changed significantly such that certain manipulations of the manual control stations for the valves were able to actuate the lockup (signal from manual station less than lockup setpoint). Had the setpoints not changed, the operators could not have caused valve lockup.

The fact that operators were not informed of the feedwater control valve design characteristic was due to a breakdown in communications between the General Electric Operations Superintendent and the Niagara Mohawk Assistant Operations Superintendent a week earlier (1/13/88). The Assistant Operations Superintendent failed to understand the meaning and significance of the deficiency in the feedwater control valve circuitry. He was given a poorly worded "Problem Report" to approve and pass along to GE engineering personnel in San Jose. The "Problem Report" was prepared by the GE Operations Superintendent. The Niagara Mohawk Assistant Operations Superintendent is a licensed SRO at NMP2.

In my opinion, it was not reasonable to expect the operators to be informed of this unique circuit characteristic, irrespective of the fact that the setpoint change did occur. The setpoint change is only one of several ways the circuits' unique characteristic could precipitate valve lockup. All involve malfunctions of active components or errors in setpoint calibration. At the time this hypothetical problem was postuated by GE on-site personnel, it was not reasonable to predict that such a circuit malfunction (e.g., drift) would occur prior to its being modified to eliminate this particular unique characteristic.

Regardless of the technical merits of the above, the Niagara Mohawk Assistant Operations Superintendent should have understood the problem and then decided whether or not to inform the operators. He did not understand the problem when he signed off on the associated documentation.

Reactor operators closed the feedwater isolation valves to terminate the increasing vessel level. Level stopped at 333 inches. Steam lines bottom are 250 inches.

Operator instructions in operating procedures and emergency procedures regarding how to cope with loss of feedwater events are satisfactory. EOPs and operating procedures do not address how to cope with reactor vessel water levels that are too high.

During the event, the vessel level reached a low value at about 110 inches, near which containment isolation valves whould have closed (at 108.8 inches - the nominal setpoint value). The setpoint for this function was found to have been misset at 103.8 due to an error in calculating the setpoint electric signal in milliamps. The set point allowable value for this function is 101.8 inches. Other low level setpoints were similarly misset between the nominal and allowable valves. All will be corrected.

No hardware failures occurred other than the feedwater control valves lockup setpoint change described above.

All safety related equipment performed as designed, except for containment isolation valve setpoints, as described above. The main steam isolation valves were kept open by operator action for pressure control and heat removal purposes. Control air at these valves did not decay sufficiently during the event to cause them to close. The setpoint for automatic MSIV closure was not reached.

No hardware damage due to the overfilling of the steam lines appeared to have occurred. The licensee stated that a snubber inspection is not required in accordance with Technical Specifications section 4.7.5.d. The licensee's analysis of thermal, deadweight and dynamic stresses for the steam lines is still being prepared. Results of these analyses could prompt the need for additional inspection. NRR and DRS will review the data when received (expected 1/27/88).

The licensee commited to the following:

1. Modify the feedwater lockup circuit or setpoint calibration procedure as needed.

2. Correct the setpoints of the lo lo and lo lo lo trip function for containment isolation on low vessel water level.

3. Revise the setpoint procedure for setting the lo lo and lo lo lo trip function for containment isolation on low vessel water level.

4. Review operating procedures and EOPs for coping with:
   a. Low vessel level
   b. Hi vessel level
   c. Loss of instrument air (full or partial)

   and revise those procedures as required

5. Provide operator training on the revised procedures.

6. Provide a written analysis of the stresses experienced by the vessel, steam line nozzles and steam lines as a result of the overfill transient on 1/20/88.

7. Complete items 1-6 above prior to restart.

E. C. Wenzinger, Chief
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