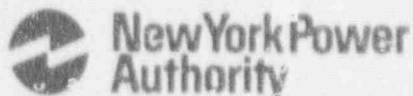


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William Fernandez II
Resident Manager

May 13, 1991
JAFF-91-0297

United States Nuclear Regulatory Commission
Document Control Desk
Mail Station P1-137
Washington, DC 20555

SUBJECT: DOCKET NC. 50-333
LICENSEE EVENT REPORT: 91-005-00
Torus Water Average Temperature
Monitor Inoperable

Dear Sir:

This report is submitted in accordance with 10 CFR 50.73
(a)(2)(i)(B).

Questions concerning this report may be addressed to Hamilton Fish
at (315) 349-6013.

Very truly yours,

W. Fernandez by direction
WILLIAM FERNANDEZ

WF:HCF:mac

Enclosure

cc: USNRC, Region I
USNRC, Resident Inspector
INPO Records Center
American Nuclear Insurers

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LICENSEE EVENT REPORT (LER)

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TITLE (4)																																																	
TORUS WATER TEMPERATURE INSTRUMENTATION INOPERABLE DUE TO 3.5 DEGREE INSTRUMENT CHANNEL UNCERTAINTY																																																	
EVENT DATE (5)										LER NUMBER (6)										REPORT DATE (7)										OTHER FACILITIES INVOLVED (8)																			
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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)																																																	
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YES (If yes, complete EXPECTED SUBMISSION DATE)																				NO																													

ABSTRACT (Limit to 1400 words) is approximately fifteen single-space typewritten lines (15)

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The primary containment [NH] suppression pool (torus) water temperature instrumentation was modified in 1981 to provide for one dual element resistance temperature detector (RTD) in each of the 16 bays of the torus. An evaluation of the system on 4/11/91 found that a maximum of one degree of non conservative error could be introduced during conditions of nonuniform addition of heat to the torus providing torus cooling mode of Residual Heat Removal System was in operation. This data was then included in an instrument channel uncertainty calculation performed on 4/12/91. A conservative maximum instrument channel uncertainty of 3.52 fahrenheit degrees was calculated. However, this is within a calculated 4 degree margin to the NUREG 0783 peak local temperature limit. Conservatively, the torus water temperature instrumentation is being reported as inoperable. The torus water temperature instrument software was reprogrammed to add a 4 degree bias so that the calculated bulk (average) temperature would be displayed at a value of 4 degrees above the water temperature actually sensed by the RTDs. Analysis shows that even if this maximum uncertainty had occurred in the non conservative (low) direction, the resulting indicated temperature would not have had an adverse effect on operator actions if events managed by the emergency operating procedures had occurred.

Related LER 90-029

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO 3150-0104

EXPIRES 8/31/85

FACILITY NAME (1) JAMES A. FITZPATRICK NUCLEAR POWER PLANT	DOCKET NUMBER (2) 0 5 0 0 0 3 3 3	LER NUMBER (4)			PAGE (3) 0 2 OF 0 6
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TEXT (If more space is required, use additional NRC Form 305A's) (17)

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Description

An error introduced into the instrument software program for calculation and display of the bulk (average) water temperature for the primary containment [NH] suppression pool (torus) was discovered on 12/7/90. The error failed to exclude the signal from an RTD which was not installed and resulted in an indicated average temperature which was on the order of 3 to 4 fahrenheit degrees less than the actual average temperature. The event is described in LER 90-029 submitted on 2/13/91. An unrelated event (LER-91-004) resulted in a plant shutdown on 3/18/91. Prior to plant startup, a thorough investigation of the torus water temperature instrumentation was conducted.

The plant was originally designed and initially operated for 7 years with 4 resistance temperature detectors (RTDs) installed in two locations. In response to NUREG 0661, a new system using 16 RTD locations was installed in 1982. One of the 16 RTDs was not installed. An evaluation was written in March 1982 to support plant startup and operation with 15 (instead of 16) RTDs. When this evaluation was re-examined in April 1991, it was determined that it was not sufficiently rigorous to meet the standards for safety evaluations which have subsequently evolved during the intervening decade. Accordingly, a new evaluation was performed by the NSSS vendor and completed on April 11, 1991. The new evaluation considered the modification made to the system on 12/7/90 (LER 90-029) in which the signal from one of the 15 operable RTDs was jumpered to be averaged in twice with the other 14 RTD signals and divided by 16 to obtain the torus average temperature. The evaluation examined possible errors in the average temperature during nonuniform (i.e., due to a single safety relief valve discharge or high pressure coolant injection system initiation) addition of heat to the torus pool. The estimate of error was based on empirical data from the Monticello BWR safety relief valve (SRV) [AD] tests. The evaluation found a potential for no more than a 1 degree error below the actual bulk pool temperature during nonuniform or localized addition of heat to the torus with residual heat removal (RHR) [BO] system providing pool circulation. This finding applied to RTD configurations with 15 or 16 RTDs in operable condition. Thus operation with one RTD not installed had no measurable effect on torus water average temperature.

A second analysis considered the possible instrument average deviations from true average water temperature which could result from an assumption of NO torus water circulation coupled with non-uniform addition of heat to the torus. Application of temperature profiles from Monticello to the FitzPatrick plant with 16 RTDs operational indicated the calculated average temperature could be expected to be as much as 12 fahrenheit degrees lower than the actual bulk temperature. With 15 RTDs operating the calculated average could be

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expected to be as much as 13 degrees lower than actual. However, FitzPatrick procedures insure torus water circulation by requiring initiation of the torus cooling mode of the RHR system during a stuck open SRV discharge, high pressure coolant injection turbine (HPCI) [BJ] or rise in torus water temperature above 95 degrees fahrenheit.

The installation of the 16 RTD temperature monitoring system was accomplished in 1982 in response to NUREG 0661. Subsequent to this installation NUREG 0783 "Suppression Pool Temperature Limits for BWR Containments" was issued. Among the criteria in this document was guidance that "Operating procedures and alarm set points shall consider the relative accuracy of the measurement system." Accordingly on 4/12/91 an instrument loop accuracy and setpoint uncertainty calculation (JAF-Calc-PC-00246), which included the results of the new NSSS vendor evaluation, was completed for the torus water temperature instrumentation. The calculation concluded that a maximum uncertainty of 3.52 fahrenheit degrees could exist for the indicated temperature displayed by the instrumentation. A modification (M1-91-088) and nuclear safety evaluation (JAF-SE-91-038) were prepared to conservatively change the instrument software program to provide an indicated temperature to the operators which is 4 degrees higher than the temperature measured by the RTDs. The conservative change to the instrument software program was completed at 0330 on 4/12/91. The instrument was declared to be operable at 1723 upon completion of post work testing using an instrument surveillance procedure (ISP-28).

Cause:

One RTD was not installed in 1982 because a drill bit broke off in a thermowell during attempts to remove a burr which had prevented installation of the RTD. The broken bit could not be removed without risk of penetration through the thermowell wall into the torus which was filled with approximately 800,000 gallons of water. The torus has not been drained from the date of installation through the current date.

If torus cooling circulation is not initiated as required by procedure, the absence of one of 16 RTDs may cause a potential primary element error of 1 fahrenheit degree in average torus temperature. This is in addition to the 12 degree error caused by lack of circulation during the nonuniform addition of heat. Nonuniform addition of heat includes events such as the actuation of a single safety relief valve [AD] or initiation of the high pressure coolant injection system turbine [BJ]. The absence of one of the 16 RTDs has no measurable effect on average torus temperature calculations during localized heat addition so long as the procedurally required torus cooling circulation is initiated.

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TEXT (If more space is required, use additional NRC Form 305A's.)

The new analysis by the NSSS vendor concluded that (with suppression pool circulation and localized heat addition) the existing system is expected to provide bulk torus temperatures no more than 1 fahrenheit degree below the actual value. The cause of this potential error is in the analysis extrapolations from the Monticello plant data to the FitzPatrick plant. This included consideration of differences in minimum and maximum torus radius, discharge quencher submergence, and the elevation location of the RTDs relative to both quencher discharge and total submergence. The FitzPatrick RTDs are located approximately 2 feet below the midpoint of normal torus water level. This is required because the discharge quenchers are also located at a greater submergence level. This analytical uncertainty is designated as the primary element uncertainty. This was one input into the channel uncertainty calculation.

The total calculated instrument channel uncertainty of 3.5 degrees includes the primary element uncertainty of 1 degree in addition to the uncertainties introduced by the test and measuring equipment, and the instrument electronic components including summers, voltage to current converters, and resistance to voltage converters. These uncertainties are inherent in the design of the electronic components and represent the limits of accuracy of the instrument system.

Analysis

LER 90-029 reported both torus water temperature channels as being inoperable from 10/26/89, the date on which the instrument software program was changed and a calculation error introduced, through 12/7/90 when a temporary modification was made to bypass the error. During that period the average temperature displayed by the instrument was lower than the actual temperature by 3 to 4 fahrenheit degrees. Accordingly in that event both channels were reported as being inoperable.

In the event now being reported, there was no actual occurrence of an erroneous temperature display. There was only the possibility for such an error. The maximum 3.5 degree low reading could only have occurred if there had been a nonuniform addition of heat to the torus accompanied by a simultaneous drift of multiple electronic components in the same low temperature direction to the maximum limit of instrument tolerance.

Although such an event is unlikely, it is being conservatively reported under the provisions of 10 CFR 50.73(a)(2)(i)(B) as if both channels were inoperable. This would be an operation prohibited by Technical Specification Table 3.2-6 which requires a minimum of one operable channel.

An analysis (EAS-094-1288) has previously been performed which demonstrated a 4 degree margin between the calculated maximum local

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pool temperature and the limiting temperature calculated in accordance with NUREG 0738. The recently calculated potential maximum instrument channel uncertainty of 3.5 degrees is within this 4 degree margin.

In addition the instrumentation was checked and calibrated at six month intervals through use of an instrument surveillance procedure. The amount of drift (which is one component of uncertainty) found during these checks was generally negligible and did not approach as much as 1 fahrenheit degree. The almost total lack of instrument drift documented during this interval confirms the inherent stability of the instrument and provides assurance that the maximum uncertainty of 3.5 degrees is an unlikely extreme.

As reported in LER 90-029, during the period from 10/26/89 through 12/7/90 the instrument calculated average temperature was 3 degrees less than the actual torus temperature. This was caused by the introduction of errors into the instrument software program which resulted in averaging a false 30 degree temperature signal from the missing RTD with the current readings of the 15 remaining RTDs. This condition was corrected on 12/7/90.

An analysis of the safety significance of a the 3 to 4 degree error that existed from 10/26/89 through 12/7/90 was prepared in March 1991. The report concluded that the actual error would not have had a safety significant effect on emergency operating procedure implementation and that the safety design bases were met. An informal review of this analysis on 5/9/91 was made to encompass the possibility of the additional non conservative uncertainty error of 3.5 degrees (for a total of 7.8 degrees). This second review reached the same conclusion.

During the periods from 12/88 (date the current torus water temperature instrumentation began to be used to meet technical specifications) through 10/26/89 (date of the introduction of a program error), and from 12/7/90 (date of mitigating the program error) through 4/12/91 (date of introducing a conservative 4 degree bias into the program), the maximum 3.5 degree uncertainty was within the 4 degree margin to the calculated NUREG 0783 limit.

A review of the operating records found that the highest recorded torus water temperature during the period from 10/26/89 to date was 86 degrees. The addition of the 3.5 degree program error and the 3.5 degree uncertainty results in a maximum temperature of 93 degrees. This is 2 degrees less than the technical specification limit of 95 degrees. This provides assurance that the actual average temperature of the torus was at all times within the Technical Specification limits.

Therefore, actual torus temperature was at all times within acceptable limits and there was never an actual or potential adverse effect on plant safety.

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TEXT (If more space is required, use additional NRC Form 3054's) (17)

Corrective Action

1. A conservative 4 degree bias was installed in the torus water instrumentation software program so that the displayed temperature will be four degrees higher than the actual temperature as sensed by the RTDs. This temperature bias provides an additional 4 degrees margin to the limiting 4 degree margin evaluated in EAS-094-1288.
2. A temporary change was made to operating procedure OP-15 "High Pressure Coolant Injection" on 4/12/91 to required initiation of torus cooling following initiation of the HPCI system.

Related LER: 90-029