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SUBJECT: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Licensee Event Report No. 50-368/90-002-01

Gentlemen:

In accordance with 10CFR50.73(a)(2)(i)(B) and 10CFR50.73(a)(2)(vii), attached is the subject report concerning low Steam Generator (SG) water level trip values being less than allowed by Technical Specifications due to errors in calculations used to establish the calibration data for the SG level transmitters. This report is being supplemented to provide a correction to the original issued report.

Very truly yours,

E. C. Ewing
General Manager,
Technical Support
and Assessment

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U.S. Nuclear Regulatory Commission
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L I C E N S E E E V E N T R E P O R T (L E R)

FACILITY NAME (1) Arkansas Nuclear One, Unit Two DOCKET NUMBER (2) PAGE (3)
0510101 31 61 8110F104

TITLE (4) Low Steam Generator Water Level Trip Values Less than Allowed by Technical Specifications due to Errors in Calculations Used to Established the Calibration Data for the Steam Generator Level Transmitters

| EVENT DATE (5) | | | LER NUMBER (6) | | REPORT DATE (7) | | | OTHER FACILITIES INVOLVED (8) | |
|----------------|-----|------|-------------------|-----------------|-----------------|-----|------|-------------------------------|------------------|
| Month | Day | Year | Sequential Number | Revision Number | Month | Day | Year | Facility Names | Docket Number(s) |
| 01 | 31 | 1990 | 002 | 01 | 01 | 01 | 1990 | | 0510101 |

OPERATING MODE (9) 1 THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §:

| OPERATING MODE (9) | 20.402(b) | 20.405(a)(1)(i) | 20.405(a)(1)(ii) | 20.405(a)(1)(iii) | 20.405(a)(1)(iv) | 20.405(a)(1)(v) | 20.405(c) | 50.36(c)(1) | 50.36(c)(2) | 50.73(a)(2)(iv) | 50.73(a)(2)(v) | 50.73(a)(2)(vii) | 50.73(a)(2)(viii)(A) | 50.73(a)(2)(viii)(B) | 50.73(a)(2)(x) | 73.71(b) | 73.71(c) | Other (Specify in Abstract below and in Text, NRC Form 366A) |
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L I C E N S E E C O N T A C T F O R T H I S L E R (1 2)

| Name | Telephone Number |
|--|--------------------|
| Dana Millar, Nuclear Safety and Licensing Specialist | 5101191641-1311010 |

C O M P L E T E O N E L I N E F O R E A C H C O M P O N E N T F A I L U R E D E S C R I B E D I N T H I S R E P O R T (1 3)

| Cause | System | Component | Manufacturer | Reportable to NPRDS | Cause | System | Component | Manufacturer | Reportable to NPRDS |
|-------|--------|-----------|--------------|---------------------|-------|--------|-----------|--------------|---------------------|
| | | | | | | | | | |

S U P P L E M E N T R E P O R T E X P E C T E D (1 4)

| EXPECTED SUBMISSION DATE (15) | Month | Day | Year |
|---|-------|-----|------|
| <input type="checkbox"/> Yes (If yes, complete Expected Submission Date) <input checked="" type="checkbox"/> No | | | |

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On January 31, 1990, several errors were identified in the calculation used to establish the calibration tables for the Steam Generator (SG) water level transmitters. A preliminary evaluation identified an incorrect assumption for the effect of static pressure on the span of the level transmitters. This resulted in the actual SG water level being less than the minimum allowable value required by Technical Specifications for a low SG water level reactor trip. To compensate for this error, the reactor trip setpoint bistable for low SG water level in the Plant Protective System was increased. This provided an assurance that the reactor would trip when actual SG water level was greater than the minimum allowable value of Technical Specifications. After a thorough evaluation of the calculation was completed, two additional errors were identified. The result of the combined errors was that the actual SG water level was .92 percent less than the indicated water level, above the minimum allowable value of Technical Specifications. The safety functions provided by the low SG water level reactor trip were therefore not challenged and no safety concerns existed. The root cause of this condition was personnel error. The errors in the original calculation had not been identified. The calculation errors were corrected and the calibration procedures for the SG water level transmitters revised.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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| | | Sequential | Revision | | |
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TEXT (If more space is required, use additional NRC Form 366A's) (17)

A. Plant Status

At the time of discovery of this condition, Arkansas Nuclear One, Unit Two (ANO-2) was at 100 percent of rated thermal power operating in Mode 1 (Power Operation). Reactor Coolant System (RCS) [AB] pressure was approximately 2250 psia and RCS temperature about 580 degrees Fahrenheit.

B. Event Description

As a result of identifying an assumption error associated with static pressure shift in a calculation used to establish the calibration tables for a High Pressure Injection (HPI) [BJ] flow transmitter on ANO-1, a review of the calculations used to establish calibration tables for other safety related transmitters was performed. It was identified that the calculation associated with the calibration tables used for the Steam Generator (SG) [SG] water level transmitters were in error. The SG water level transmitters provide input into the Plant Protective System (PPS) [JC]. There are four channels of PPS, each receiving input from two SG water level transmitters, one from each SG. A reactor trip and an Emergency Feedwater Actuation Signal (EFAS) are generated by the PPS when SG water level reaches a preselected trip bistable setpoint of 23 percent. A reactor trip is also generated when a SG water level of 93.7 percent is reached.

At approximately 0910 hours on January 31, 1990, a preliminary evaluation of the calculation was completed. It was concluded that a compensation factor for static pressure effects of the fluid in the SGs at normal plant operating conditions had not been correctly included in the calculation. This resulted in incorrectly calibrating the transmitters and an inaccurate SG water level measurement. ANO determined that with an indicated level of 23.25 percent, actual SG water level could be 21.8 percent which is less than the allowable value stated in Technical Specifications. The four PPS low level SG channels were declared inoperable and Technical Specification 3.0.3 entered at 0910 hours. Technical Specification 3.0.3 allows one hour to satisfy the requirements of the actions associated with the Limiting Condition for Operation. At 1006 hours, a power reduction was commenced to comply with Technical Specifications. As required by Station Emergency Plan procedures, a Notification of Unusual Event (NUE) was declared.

In order to compensate for the calculation errors a decision was made to conservatively increase the PPS trip setpoints to approximately 25 percent by adjusting the low SG level trip bistable in each PPS channel. This provided assurance that a reactor trip would be generated when actual water level in the SGs was greater than or equal to 23 percent. By approximately 1129 hours, the trip setpoint in each PPS channel had been increased to 25 percent to ensure compliance with Technical Specifications. The Technical Specification action statements were exited and the NUE terminated.

In the afternoon of January 31, 1990, a comprehensive review of the calculation used to establish the calibration tables for the SG water level transmitters was completed. Two additional input assumptions, other than the effects of static pressure, were identified. The original calculation had assumed the water in the SG level reference leg was in a saturated condition, the compressed water tables should have been used. The other error was an incorrect interpolation included in the calculation. The low level trip setpoint in the PPS is set at 23.25 percent by procedure. Considering the effects of the three errors identified in the calculation, the total errors were approximately .92 percent. Therefore, when indicated water level was 23.25 percent, actual water level could be approximately 22.33 percent, which is above the minimum value allowed by Technical Specifications.

The high SG water level trip setpoints were evaluated in regard to the calculational errors and found to be conservative. Therefore, no adjustments were made to the high SG water level trip setpoints.

C. Safety Significance

The SG low water level reactor trip provides protection against a loss of feedwater flow incident and assures that the design pressure of the RCS will not be exceeded due to loss of SG heat sink. The specified setpoint ensures sufficient water inventory in the SG at the time of the reactor trip generation to provide margin before emergency feedwater is required. The specified setpoint also functions to initiate an EFAS to automatically provide emergency feedwater flow to the SG.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

After a thorough review and evaluation of the calculation used to establish the calibration tables for the SG water level transmitters was completed, it was determined that the total effect of the errors resulted in an indicated water level of 22.33 percent, a .92 percent error in SG water level indication. The Technical Specification allowable value for low SG water level is 22.111 percent. Therefore, the actual water level was not less than the Technical Specification allowable value and the safety functions provided by the low SG water level reactor trip were not challenged. No safety concerns existed.

D. Root Cause

The root cause of this event was personnel error. The individual who performed the original calculation did not correctly account for the effects of static pressure on the transmitter output. It was assumed that the effect of static pressure on the span shift would effect only the upper end of the measurement band. The level transmitter is calibrated at an ambient condition. When the transmitter is placed in service at an operating static pressure of approximately 900 psia, a span shift in the transmitter output actually occurs at both ends of the measurement band. With the transmitter calibrated to account for a span shift only at the upper measurement band, the actual SG water level measurement was inaccurate when the transmitter was placed in service at normal SG operating conditions.

E. Basis for Reportability

The four Low SG Water Level PPS channels were declared inoperable and Technical Specification 3.0.3 was entered. This condition is, therefore, reportable pursuant to 10CFR50.73(a)(2)(i)(B), operation prohibited by Technical Specifications. This condition is also reportable pursuant to 10CFR50.73(a)(2)(vii), where a single cause resulted in four independent channels to become inoperable in a multiple channel system designed to shut down the reactor and maintain it in a safe shutdown condition.

This event was reported to the NRC Operations Center via the Emergency Notification System pursuant to 10CFR50.72(a)(1)(i) and 10CFR50.72(b)(1)(i)(A) at approximately 1021 hours at January 31, 1990.

F. Corrective Actions

The calculation was corrected considering the effect of the static pressure of the fluid in the SGs and the other identified errors. The result after a thorough review was that the actual water level in the SGs was 22.33 percent when the indicated water level and the PPS bistable values were at 23.25 percent.

The calibration tables in the calibration procedures for the SG level transmitters have been revised to correct the calculational errors which were identified. The SG level transmitters will be recalibrated using the revised procedures during a forced outage or refueling outage, whichever is more appropriate. After the level transmitters are recalibrated the PPS low SG level trip setpoint bistables will be returned to approximately 23 percent as allowed by Technical Specification.

A review of other Rosemount "Q" differential pressure loops was completed on January 31, 1990. The calibration procedures for the "Q" Rosemount differential pressure transmitters which would be exposed to pressures greater than 200 psig were reviewed to determine if static pressure effects had been considered. Each of the procedures reviewed appeared to consider static pressure effects with the exception of four, 2PDT-4602, 2PDT-4603 (ANO-2 differential pressure transmitters which are not used during power operation and provide no safety related indications or interlocks) and PDT-2400 and PDT-2401 (ANO, Unit One indications and alarm for the discharge flow for the Reactor Building Spray pumps). Each of the transmitters is classified as "Q" only to insure RCS pressure boundary integrity. The ANO-2 transmitters do not provide safety related indications or interlocks. The ANO-1 transmitters provide information to indicate the operation of an individual safety system. Since the Reactor Building Spray system is redundant (single failure proof), gross performance diagnostics are all that is necessary to maintain operator awareness of system status. Therefore, the failure to incorporate static pressure and span correction factors into the calibration of these loops does not affect the system capability to provide its function and/or maintain design basis conditions.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

Four calibration procedures were verified for the proper application of the static pressure effects. Of these, one was identified to have used an incorrect correction factor for static pressure. AND concluded that the discovered error was not significant.

The SG level transmitters have been calibrated using incorrect calculational assumptions since 1979 when the transmitters were originally installed in the plant. A cursory review of the results of previous calibrations was performed. Assuming corrections for the calculational errors, only two times were identified when the transmitters were calibrated and left at values less than the allowable value established by Technical Specifications.

G. Additional Information

The SG level transmitters are model 1153DA manufactured by Rosemount [R369].

There have been no previously reported similar events.

Energy Industry Identification System (EIIIS) codes are identified in the text as [XX].