UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W., SUITE 2900
ATLANTA, GEORGIA 30323-0199

Report Nos.: 50-400/95-03

Licensee: Carolina Power and Light Company
P. O. Box 1551
Raleigh, NC 27602

Docket Nos.: 50-400 License Nos.: NPF-63

Facility Name: Shearon Harris Nuclear Power Plant Unit 1

Inspection Conducted: February 6-10, 1995

Inspector: N. L. Salgado 3/2/95
N. L. Salgado Date Signed

Accompanying Personnel: J. Hanek, Idaho National Engineering Laboratory

Approved by: M B Shymlock 3-7-95
M. B. Shymlock, Chief Date Signed
Plant Systems Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope:

This routine, announced inspection was conducted in the area of maintenance of instrumentation and control (I&C) systems. The inspectors verified the licensee's actions implemented pursuant to NRC Bulletin 90-01, Supplement 1, Loss Of Fill-Oil In Transmitters Manufactured By Rosemount. Temporary Instruction (TI) 2515/122, Evaluation of Rosemount Pressure Transmitter Performance and Licensee Enhanced Surveillance Programs, provided guidance for conducting the inspection.

Results:

In the areas inspected, violations or deviations were not identified.

The inspectors determined that effective controls had been established and maintained to prevent the inadvertent installation of a transmitter susceptible to fill-oil loss. There were five Rosemount transmitters in the licensee's enhanced surveillance program. All the other Rosemount

Enclosure

transmitters that were originally in the program had been replaced or reached the appropriate maturity criteria recommended by Rosemount. The licensee continues to test, trend, and monitor all five Rosemount transmitters consistent with the recommendations of Supplement 1 to NRC Bulletin No. 90-01, as documented in the NRC Safety Evaluation Report (SER). The inspectors concluded that the licensee's trending program, technician training, and calibration procedures were effective for identifying loss of fill-oil in Rosemount transmitters.

REPORT DETAILS

1.0 Persons Contacted

*B. Christensen, Maintenance Manager
*L. Costello, Engineering
*J. Donahue, Plant General Manager
*J. Dority, Project Specialist
*R. Duncan, Technical Support, Manager
*D. McCarthy, Regulatory Affairs, Manager
*W. Robinson, Vice-President, Harris
*G. Rolfson, Harris Engineering Support Section, Manager
*T. Wagoner, Engineer
*R. Zula, Technical Support

Other licensee employees contacted during this inspection included engineers, technicians, craftsmen, and administrative personnel.

NRC Resident Inspectors

*S. Elrod, Senior Resident Inspector

*Attended exit meeting

Abbreviations and acronyms are listed in paragraph 9.0.

2.0 Background

On December 22, 1992, the NRC issued NRC Bulletin 90-01, Supplement 1, "Loss of Fill-Oil in Transmitters Manufactured by Rosemount," to inform licensees of actions taken by the NRC staff and the industry in evaluating loss of fill-oil in Rosemount transmitters and to request licensees to take actions to resolve the issue. Licensees were requested to develop an enhanced surveillance program for Model 1153, Series B and D, and Model 1154 transmitters manufactured before July 11, 1989. The purpose of the surveillance program was to ensure that installed Rosemount transmitters meet current design criteria as highly reliable components for which failures can be readily detected. Model 1151, 1152, and 1153A transmitters were excluded from the actions requested in the supplement due primarily to few confirmed oil loss failures and differences in the oil sensor design. Similarly, due to transmitters design and process improvements and few confirmed failures, Model 1153B/D and 1154 transmitters that were manufactured after July 11, 1989, were also excluded from supplement actions. Additional data collected on those transmitters that are outside of the scope of the Supplement will be used to verify failure reports, determine to what extent licensees notify Rosemount of transmitter failures, and to confirm that actions requested by the bulletin supplement are sufficient.

3.0 Disposition of Stored Transmitters

The disposition of stored Rosemount transmitters was to ensure that the Rosemount transmitters, suspected of loss of fill-oil would be identified and properly tracked to prevent their installation or ensure their inclusion in the licensee's enhanced surveillance program. This inclusion would require additional monitoring for early detection of transmitters failure.

The licensee sent all spare pre-July 11, 1989, Model 1153 B/D and 1154 Rosemount transmitters to Rosemount to be refurbished. Therefore; all spare Rosemount transmitters were upgraded with sensors manufactured after July 11, 1989. The inspectors sampled twenty stored transmitters and verified each transmitter had a serial number greater than 500,000 or was designated with an "A" suffix to the serial number indicating the installation of an new designed sensor element.

The licensee had established controls to prevent suspect lot Rosemount transmitters from being procured for use. Any Rosemount transmitter being procured for use was required upon receipt to be inspected to verify that the date of manufacture was not prior to July 1989. Should a suspect lot Rosemount transmitter serial number be identified, technical support staff were to be consulted. The inspectors determined that the licensee's actions were adequate to prevent future procurement of suspect transmitters.

The inspectors concluded that the licensee had established effective controls to prevent the inadvertent installation of a transmitter susceptible to fill-oil loss.

4.0 Surveillance Program

To verify the acceptability of actions taken by the licensee in response to NRC Bulletin 90-01, Supplement 1, the inspectors reviewed the administration of the enhanced surveillance program, the monitoring techniques, the testing interval, applicable plant procedures, transmitter calibration records, and training of technical support personnel.

4.1 Enhanced Surveillance Program

The licensee had established an enhanced surveillance program to monitor the performance of Models 1153 B/D and 1154 Rosemount transmitters. An engineer within the component engineering group, a branch of the Harris Engineering Support Section had the responsibility for administration of the enhanced surveillance monitoring program. The component engineer was responsible for maintaining the computerized database and for the evaluation of the data to determine if there are any trends that may be indicative of fill-oil loss. If the data for a Rosemount transmitter showed evidence of potential fill-oil loss, the engineer would request through a work order that the transmitter be bench tested or replaced.

4.2 Trending Program

The inspectors reviewed the licensee's trending program to determine if the scope of the transmitters included in the program was consistent with the recommendations of NRC Bulletin 90-01, Supplement 1 as documented in the SER.

The licensee had five transmitters corresponding to Category 1.d (> 500 psig and ≤ 1500 psig operating pressure) of NRC Bulletin 90-01, Supplement 1, used in safety-related systems but not installed in reactor protection trip systems, engineered safety feature actuation systems or anticipated transient without scram systems. These transmitters were in the licensee enhanced surveillance monitoring program and were evaluated at each refueling cycle (not to exceed 24 months).

The licensee had twenty-three transmitters corresponding to Category 1.e (> 500 psig and ≤ 1500 psig operating pressure) of NRC Bulletin 90-01, Supplement 1, that had reached the 60,000 psi-month criterion recommended by Rosemount and seventy-six transmitters corresponding to Bulletin Category 1.f (≤ 500 psig operating pressure). Transmitters in these categories could be excluded from an enhanced surveillance monitoring program at the discretion of the licensee. However, the licensee was to retain a high level of confidence that a transmitter failure due to loss of fill-oil could be detected. The licensee's response to NRC Bulletin 90-01, Supplement 1, indicated appropriate personnel would receive training to ensure their ability to recognize and appropriately address sluggish transmitter response during normal calibration intervals, thereby maintaining confidence that transmitter failures could be detected.

The scope of transmitters included in the licensee trending program was in accordance with the requested actions of NRC Bulletin 90-01, Supplement 1.

4.3 Test Interval

The inspectors reviewed the licensee's Rosemount calibration records to determine if appropriate testing intervals for transmitters in the enhanced surveillance monitoring program were utilized at Shearon Harris.

A review of the five transmitters in the enhanced surveillance monitoring program, found that all transmitters required surveillance intervals to be each "refueling (not to exceed 24 months) cycle," in accordance with the requested actions of NRC Bulletin 90-01, Supplement 1.

The licensee's self-assessment program identified one transmitter which exceeded the 24 month maximum surveillance interval by one month. The licensee uses an automated maintenance monitoring system (AMMS) to schedule surveillances. The AMMS used the time from the last scheduled

date of the surveillance to establish the next scheduled surveillance date. However, the previous surveillance was completed three months earlier than scheduled which resulted in the next scheduled surveillance exceeding the maximum allowed interval. To preclude repetition of this situation, the licensee modified the AMMS software to schedule the next surveillance based on the actual date the surveillance was last performed. A review of the transmitter calibration zero drift data by the inspectors indicated it was within its limits. The corrective action on this item by the licensee was adequate.

The licensee's overall enhanced surveillance monitoring program test interval for all transmitters required to be in the enhanced surveillance monitoring program, was in accordance with NRC Bulletin 90-01, Supplement 1.

4.4 Monitoring Techniques

The inspectors verified, based on discussions with licensee personnel and during reviews of applicable documents, which monitoring techniques were used to obtain data for assessing transmitter performance and the suitability of those techniques.

The licensee trends the transmitter calibration data for zero drift as outlined in Section 3 of Rosemount Technical Bulletin Number Four, to detect loss of fill-oil.

For the five transmitters included in the enhanced surveillance monitoring program the licensee trends the accumulated zero shift as a percent of Upper Range Limit (% URL) versus time. Using information supplied by Rosemount Technical Bulletin Number Four, limitations for acceptable cumulative zero drift were calculated based on the transmitter model calibration span.

The licensee does not record and trend actual operating data on processes with redundant transmitters as a means of identifying suspect transmitters for loss of fill-oil. Also, the licensee does not include noise analysis as a monitoring technique in the enhanced monitoring program to detect loss of fill-oil.

The licensee's enhanced surveillance monitoring program used the methods recommended by the Rosemount Technical Bulletins and was in accordance with NRC Bulletin 90-01, Supplement 1.

4.5 Review and Trending of Calibration Data

The inspectors performed a detailed review of the licensee's trending program with respect to the guidelines provided in TI 2515/122 Appendix D and Appendix E.

The inspectors reviewed the licensee's trending data for all five transmitters in the enhanced monitoring program. The amount of data gathered over various periods of time was considered adequate to

indicate statistically valid trends. The trending data reviewed represented calibration drift over at least a five year period and in most cases back to 1988.

The calibration data on which the trending was based were accurate to three decimal places. Thus, the data had sufficient accuracy to determine a failure caused by the loss of fill-oil.

The measuring and test equipment (M&TE) used to monitor transmitter calibration data, provided accuracy sufficient to obtain data accuracy in volts to three decimal places. This was commensurate with calibration acceptance criteria and drift data tolerances. Review of instrument calibration procedures confirmed that the M&TE utilized for monitoring transmitter calibrations was required to have an accuracy better than or equal to that of the transmitter under calibration. This ensured that the M&TE accuracy was commensurate with transmitter calibration tolerance and drift analysis requirements.

Trending of transmitter calibration data was performed in accordance with Rosemount Technical Bulletin Number Four. The licensee had developed an adequate program for the review and trending of calibration data.

4.6 Observation of Transmitter Calibration and Transmitter Calibration Procedure Review

The inspectors observed field calibration of a Rosemount Model 1153 transmitter per Loop calibration procedure LP-P-9209B, Service Water Inlet Loop B Auxiliary Building Chiller WC-2 (B) Pressure, Revision 4. The calibration was performed by knowledgeable and experienced I&C technicians. The I&C technicians were trained to observe the transmitter response time. The transmitter did not exhibit slow response to increasing or decreasing step or ramp test pressures. The transmitter properly responded over the entire measuring range. The instrumentation used to measure data for comparison with the drift criterion was as required by the procedure, and had the required accuracy range needed for comparison to the drift data limits. There was no indication of zero drift or span shift.

During calibration the I&C technician applied a pressure signal from zero to 100% of the calibration range while the other I&C technician monitored the output voltage of the transmitter at a remote location using a digital volt meter (DVM). The technicians used two-way radio to communicate. They monitored the response of the transmitter output. The inspectors discussed the licensee's method of monitoring for a sluggish transmitter using two-way communication with an I&C Supervisor. The I&C Supervisor stated that two-way communication was acceptable when monitoring for a sluggish transmitter because the technician inputing the pressure signal gave a "mark" exactly at the required input, at which time the other technician recorded the transmitter output voltage. The transmitter output voltage must be within the required tolerance at the "mark" to be acceptable.

The inspectors also reviewed the following calibration procedures (including LP-P-9209B) to determine if there was adequate guidance for identifying symptoms of loss of fill-oil:

LP-F-2002B3, Revision 1	Feedwater Isolation Bypass Line Flow - Steam Generator B
LP-F-2002A3, Revision 1	Loop Calibration of Feedwater Isolation Bypass Line Flow - Steam Generator 1
MST-I0094, Revision 3	Auxiliary Feedwater Flow Loop (F-2050B) to Steam Generator B
MST-I0095, Revision 3	Auxiliary Feedwater Flow Loop (F-2050C) to Steam Generator C

The procedures indicated the following for MT&E accuracy, "DVM with 4 1/2 digit display (minimum) and accuracy of < ±0.010 VDC such as Fluke Model 45 (2 required)." Thus, the M&TE used for transmitter calibrations had the required accuracy range of 1% mentioned in TI2515/122.

The calibration procedures included five point calibrations, both increasing and decreasing. Thus, if the transmitter exhibited an inability to respond over the entire measuring range, the I&C technician could observe any abnormal condition.

The calibration data sheets included the as-found and the as-left data from the current calibration and the allowable range (tolerance band). The as-found data sheet was compared against the as-left data sheet from the previous calibration by the component engineer for Rosemount transmitters and a cumulative zero drift was calculated and plotted. The I&C technician performing the calibrations would have an indication of zero drift or span shift if any data point was outside the allowable range.

Sixteen of the licensee's Rosemount transmitter calibration procedures contained the following step:

> "If transmitter OUTPUT fails to perform either of the following during performance of step 2, notify I&C Supervisor or Component Engineer:
>
> a. Does not change within 5 seconds of changing INPUT.
>
> b. Does not stabilize within 5 seconds of stopping INPUT."

The sixteen calibration procedures which contain this step are for range code 4, 5, and 9 transmitters and encompass all five of the transmitters included in the enhanced surveillance monitoring program. The information conveyed to the I&C technicians by this step in the procedure did not coincide to the information presented in the I&C continuing training program. Rosemount's Technical Bulletin Number Four indicated that "for range codes 5 through 9, the transmitter should always follow the input pressure within 1 second. Range 4 should respond within 6 seconds and range 3 should respond within 35 seconds." The inspectors discussed the five seconds indicated in the transmitter calibration procedures with the licensee. The licensee indicated to the inspectors that this step would be revised, to be consistent with the I&C Technician training and Rosemount Technical Bulletin Number Four. For the remaining calibration procedures which contained this step it would be deleted entirely, relying on the training of the I&C technicians to detect a sluggish transmitter, indicative of a loss of fill-oil. Training provided to the technicians would have allowed them to detect sluggish or failed transmitter operation.

It was confirmed that the licensee's transmitter calibration methods and procedures would be adequate to detect a sluggish or failed transmitter. The M&TE used for transmitter calibration had the required accuracy range of 1% needed for comparison. This was in conformance with NRC Bulletin 90-01 Supplement 1.

4.7 Training

The training of technicians was an important element of the program because the licensee had declared training of I&C technicians to be the basis of the capability to detect transmitter failures when transmitters matured and became exempt from enhanced monitoring. The inspectors reviewed training documentation and interviewed personnel to determine if acceptable training had been provided to key personnel in support of the program requirements.

The licensee had two lesson plans which covered the Rosemount loss of fill-oil problem. Lesson plan EN202G, Electronic Transmitters was for new I&C technicians. The second lesson plan IC7C03H/94, Third Quarter 1994 Continuing Training, Westinghouse 7300 Controller, Rosemount Loss of Fill Oil was part of the licensee's continuing training program. The inspectors verified that both lesson plans contained material addressing the loss of fill-oil problem.

The inspectors interviewed technicians to assess their sensitivity to the loss of fill-oil problems. The I&C technicians interviewed indicated that they were aware of their responsibility to inform the component engineer if there were indication of a problem during instrument calibrations. These indications of problems would be sluggishness and poor repeatability.

The licensee's training program for I&C technicians on the subject of Rosemount transmitter loss of fill-oil problems was adequate to support the program requirements.

5.0 Review of Model 1151, 1152, and 1153A Rosemount Transmitters

The inspectors reviewed licensee records to obtain information for Model 1151, 1152, and 1153A Rosemount transmitters in safety-related application excluding pressure boundary applications to determine if any transmitters have failed calibration. The inspectors review of licensee records identified that no model 1151, 1152, or 1153A Rosemount transmitters were installed in safety related applications at Harris. Attachment 1 of this report contains completed TI2515/122 Enclosure 1.

6.0 Model 1153B/D and 1154 Transmitters Manufactured After July 11, 1989

The inspectors reviewed licensee records to obtain information for Model 1153 and 1154 Rosemount transmitters manufactured after July 11, 1989, to determine if any transmitters have failed calibration. For those transmitters that have failed calibration, the inspector assessed the licensee's identified cause of the failures.

The licensee had a total of ten Model 1153B/D and twenty-one Model 1154 Rosemount transmitters currently installed with sensor modules manufactured after July 11, 1989. To date, none of the transmitters have failed a calibration. Therefore, no loss of fill-oil failures have occurred at Harris. Information on these transmitters is enclosed as Attachment 1 which followed the format indicated in TI2515/122 Enclosure 2.

The operation of model 1153B/D transmitters with sensors manufactured after July 11, 1989, has been reliable with no failures attributed to loss of fill-oil.

7.0 Transmitter Failure Analyses and Reporting

The inspectors evaluated the licensee's criteria for identifying and evaluating loss of fill-oil in Rosemount transmitters. Additionally, the inspectors reviewed the licensee's policy for reporting transmitter failures and returning the failed transmitter and/or calibration data to Rosemount for failure analysis.

The licensee did not have a documented generic criteria for identifying a loss of fill-oil failure on a Rosemount transmitter. However, the licensee suspected a loss of fill-oil failure if a transmitter:

A. Exhibits sustained drift approaching the drift limits as detected by calibration trending.

B. Exhibits sluggish response during normal calibration.

Upon determination of a suspected loss of fill-oil failure the licensee would bench test the transmitter as described in Rosemount Technical Bulletin Four, Appendix B, "Guideline Bench Test for Confirmation of Oil Loss," and/or send the transmitter to Rosemount for failure analysis. The inspectors reviewed a calibration failure record in which the licensee suspected a loss of fill-oil failure on a transmitter. The transmitter was sent to Rosemount for failure analysis where it was determined that the transmitter's failure was not caused by loss of fill-oil.

The inspectors concluded that the licensee had established an acceptable basis for confirming transmitter fill-oil loss failures.

8.0 Exit Meeting

The inspection scope and results were summarized on February 10, 1995, with those persons indicated in Section 1. The inspector described the areas inspected and discussed in detail the inspection results. Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

9.0 Abbreviations and Acronyms

AMMS - Automated Maintenance Monitoring System
I&C - Instrumentation and Control
M&TE - Measuring and Test Equipment
NRC - Nuclear Regulatory Commission
PSI - Pounds Per Square Inch
TI - Temporary Instruction
URL - Upper Range Limit

ATTACHMENT 1

PERFORMANCE SURVEY FOR ROSEMOUNT MODEL 1151, 1152, AND 1153A TRANSMITTERS IN ACCORDANCE WITH TI 2515/122, ENCLOSURE 1.

Based on a review of licensee records, the following general information on Model 1151, 1152, and 1153A, transmitters in safety-related (non-pressure boundary application) is provided:

1. Total number of 1151 transmitters currently installed..... 0

   Total number of 1152 transmitters currently installed..... 0

   Total number of 1153A transmitters currently installed 0

2. Total number of transmitters installed as of January 1991..... 0

For those Model 1151, 1152, and 1153A transmitters that show symptoms of oil loss based on the trending results, provide the following information:

3. Total number of transmitters that exhibit loss of fill-oil symptoms . 0

4. Total number of transmitters (identified by licensee or inspector) that exhibit loss of fill-oil symptoms which were not previously identified by the licensee 0

5. Total number of transmitters identified above in Item 3 which were also confirmed by Rosemount as loss of fill-oil 0

PERFORMANCE SURVEY FOR ROSEMOUNT MODEL 1153B/D AND 1154 POST-JULY 11, 1989 MANUFACTURED TRANSMITTERS IN ACCORDANCE WITH TI 2515/122, ENCLOSURE 2

Based on a review of licensee records, the following general information on Model 1153B/D and 1154,post-July 11, 1989, manufactured transmitters in safety-related (non-pressure boundary applications):

1. Total number of 1153B/D transmitters currently installed..... 10

   Total number of 1154 transmitters currently installed..... 21

2. Total number of transmitters installed as of January 1991..... 31

For those Model 1151, 1152, and 1153A transmitters that show symptoms of oil loss based on the trending results, provide the following information:

3. Total number of transmitters that exhibit loss of fill-oil symptoms . 0

4. Total number of transmitters (identified by licensee or inspector) that exhibit loss of fill-oil symptoms which were not previously identified by the licensee 0

5. Total number of transmitters identified above in Item 3 which were also confirmed by Rosemount as loss of fill-oil 0