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

Report No.: 50-416/95-01

Licensee: Entergy Operations, Inc.
Jackson, MS 39205

Docket No.: 50-416 License No.: NPF-29

Facility Name: Grand Gulf Nuclear Station Unit 1

Inspection Conducted: January 23-27, 1995

Inspector: N. L. Salgado 2/13/95
N. L. Salgado Date Signed

Accompanying Personnel: A. Udy, Contractor, Idaho National Engineering Laboratory

Approved by: M. B. Shymlock 2-15-95
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 2514/122, 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 no Rosemount transmitters in the licensee's enhanced surveillance program because they had either been replaced or reached the appropriate psi-month criteria recommended by Rosemount. The licensee continued to test, trend, and monitor all Rosemount transmitters used in safety-related applications consistent with the recommendations of Supplement 1 to NRC Bulletin No. 90-01, as documented in the NRC Safety Evaluation Report. The inspectors concluded that the licensee's voluntary trending program, technician training, and calibration procedures were effective for identifying loss of fill- oil in Rosemount transmitters.

REPORT DETAILS

1.0 Persons Contacted

*C. Abbott, Quality Assurance Supervisor
*B. Blanche, Nuclear Safety and Regulatory Affairs Supervisor
*C. Bottemiller, Superintendent, Plant Licensing
*C. Brooks, Nuclear Safety and Regulatory Affairs
*D. Cupstid, Technical Coordinator, Performance and System Engineering
*J. Dimmette, Manager, Performance and System Engineering
*C. Dugger, Manager, Plant Operations
*C. Hayes, Director, Quality Assurance
*C. Hicks, Operations Superintendent
*M. Humphries, System Engineering Supervisor
*E. Langley, Maintenance Coordinator
*T. Matson, System Engineer
*R. Moomaw, Manager, Plant Maintenance
*D. Pace, General Manager, Operations
*R. Patterson, Nuclear Safety and Regulatory Affairs Supervisor
*R. Ruffin, Plant Licensing Specialist
*S. Saunders, System Engineering Superintendent

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

NRC Resident Inspectors

*C. Hughey, 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 confir 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's response to Bulletin 90-01 had a commitment to tag non-installed suspect lot Rosemount transmitters in the warehouse to prevent their installation into the plant. The licensee acted in a more conservative manner by having the suspect Rosemount transmitters refurbished or removed. The inspectors sampled thirty-nine 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 a new designed sensor element.

The licensee had established controls to prevent suspect lot Rosemount transmitters from being procured for use. The controls included a quality program that required a receipt inspection to verify that the date of manufacture was not prior to July 1989. 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, training of technical support personnel, applicable plant procedures, and transmitter calibration records.

4.1 Enhanced Surveillance Program

The licensee response "Confirmation of Actions Requested by NRC Bulletin 90-01, Supplement 1, Loss of Fill-Oil in Transmitters Manufactured by Rosemount," dated December 21, 1993, addressed completed actions concerning their enhanced surveillance monitoring program. It documented that all, but four of the identified suspect Rosemount transmitters had been removed from the enhanced surveillance monitoring program because they had either been replaced, or had reached the maturity (psi-month) criteria recommended by Rosemount. It documented

that four medium pressure transmitters (normal operating pressure greater than 500 psi and less than or equal to 1500 psi, and not installed in reactor protection trip system, engineered safety feature actuation system, or anticipated transient without scram systems) remained in the enhanced surveillance monitoring program. They would continue to be monitored on a 18 month frequency until the appropriate maturity criteria recommended by Rosemount was achieved. At the time of this inspection, the maturity criteria had been reached for these four transmitters, and they were removed from the enhanced surveillance monitoring program.

4.2 Test Interval

As previously discussed all medium-pressure safety-related Rosemount transmitters exceeded their maturity threshold, and were not required to be under the enhanced surveillance monitoring program. However, the licensee continued to maintain a voluntary trending program for all Rosemount transmitters in safety-related applications. The inspectors found all transmitter surveillance intervals to be a nominal 18 months, coinciding with refueling interval calibrations. The recommended test interval recommended in the Supplement was "on a refueling (not to exceed 24 months) basis," therefore the licensee's voluntary trending program was in accordance with the Supplement.

4.3 Monitoring Techniques And Trending Program

The licensee performs drift analysis on the transmitters included in the Rosemount trending program based on calibration data trending. The inspectors reviewed the following three Administrative Procedures that encompass the Rosemount Trending Program:

01-S-17-18, Rev. 0 PREDICTIVE MAINTENANCE PROGRAM, SAFETY RELATED

17-S-01-12, Rev. 4 PREDICTIVE MAINTENANCE (PDM) TRENDING PROGRAM, NON-SAFETY RELATED

17-S-06-03, Rev. 1 ROSEMOUNT ENHANCED MONITORING PROGRAM, SAFETY RELATED

These procedures described the methodology and requirements of the trending program. The program for calibration trending covered under Procedure 17-S-06-3 satisfied the Requested Actions of the Supplement.

The inspectors noted that operational trending of redundant channels was used as a tool if a transmitter shows calibration data drift that was thought abnormal, but not beyond the Rosemount established drift limits. Through discussions with the system engineer, it was determined that operational trending of redundant Rosemount transmitters can be accomplished using installed computer points or panel mounted instruments for the safety-related channels. This monitoring technique was determined effective in identifying fill-oil loss, and was included in the methods recommended by the NRC staff.

The inspectors concluded that the licensee's Rosemount transmitter monitoring techniques for transmitter calibration data trending were suitable for detecting loss of fill-oil. The licensee also trends calibration data to detect abnormal zero drift or span shifts.

4.4 Review and Trending of Calibration Data

The licensee's voluntary Rosemount trending program was controlled by Administrative Procedure 17-S-06-3. The data obtained had accuracy sufficient to determine failure due to the loss of fill-oil. The procedure incorporated the guidance of Rosemount Technical Bulletin No. 4.

The inspectors reviewed trending data for the transmitters included in the voluntary Rosemount trending program. The trending data reviewed represented calibration drift over at least a 3 year period.

The measuring and test equipment (M&TE) used to monitor transmitter calibration data provided accuracy commensurate with calibration acceptance criteria and drift data tolerances specified in the drift analysis. 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 ensures the M&TE accuracy was commensurate with transmitter calibration tolerance and drift analysis requirements.

The inspectors concluded that the trending of transmitter calibration data was performed using an appropriate amount of calibration data to establish statistically valid trends. The data obtained had sufficient accuracy requirements to determine failure due to loss of fill-oil. The licensee's transmitter calibration data reviewed by the inspectors was trended in accordance with Rosemount Technical Bulletin No. 4, and the overall program was in conformance with the Supplement.

4.5 Observation of Transmitter Calibration and Transmitter Calibration Procedure Review

The inspectors observed the only ongoing field calibration of a Rosemount Model 1152 transmitter per procedure 07-S-53-E12-22, Loop Calibration Instruction, Residual Heat Removal System - Minimum Bypass Flow, Safety Related, 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, however, there was no step in the procedure to record the 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.

The inspectors also reviewed the following calibration procedures to determine if there was adequate guidance for identifying symptoms of loss of fill-oil:

07-S-53-38, Rev. 6	MAINTENANCE CALIBRATION INSTRUCTION, ROSEMOUNT 1151, 1152, AND 1153 PRESSURE TRANSMITTER, SAFETY RELATED
07-S-03-30, Rev. 3	MAINTENANCE PROCEDURE, CALIBRATION OF PLANT I&C EQUIPMENT, SAFETY RELATED
07-S-33-5, Rev. 5	CORRECTIVE MAINTENANCE INSTRUCTION, REPLACEMENT AND SEALING OF ROSEMOUNT 1151, 1152 AND 1153 PRESSURE TRANSMITTERS, SAFETY RELATED
07-S-33-3, Rev. 2	CORRECTIVE MAINTENANCE INSTRUCTION, REWORK OF ROSEMOUNT 1151, 1152 AND 1153 PRESSURE TRANSMITTERS, SAFETY RELATED
17-S-06-3, Rev. 1	PERFORMANCE AND SYSTEM ENGINEERING INSTRUCTION, ROSEMOUNT ENHANCED MONITORING PROGRAM, SAFETY RELATED
07-S-53-E12-22, Rev. 4	LOOP CALIBRATION INSTRUCTION, RESIDUAL HEAT REMOVAL SYSTEM - MINIMUM BYPASS FLOW, SAFETY RELATED

Section 6.4.1 of Procedure, 07-S-03-30, indicated that M&TE accuracy "shall be greater than the plant equipment being tested." Certain exceptions are allowed, such as state of the art equipment, however, for any exceptions, justification must be documented and approved by the System Engineering Supervisor. Procedure, 07-S-53-38 specifies the use of a specific digital voltmeter, Fluke 8600A or Fluke 45. Either of these instruments have an accuracy of 0.25% or better. This exceeds the accuracy of 1% mentioned in TI2515/122.

The calibration procedures included a 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 would observe any abnormal condition.

The calibration data sheets include the as-found data from the current calibration and the as-left data. The data sheet allows the direct comparison of the two values from a total of nine measuring points, both increasing and decreasing. This gives the I&C technician any indication of zero drift or span shift.

The inspectors observed the requirements for the PDM Trending Coordinator to receive the completed calibration data sheets and enter the data in a spreadsheet for each transmitter. The PDM Trending Coordinator was also responsible for informing the System Engineer when the trend data was beyond the limits established for that transmitter.

The PDM Trending Coordinator also maintained the Rosemount trending program log book. The System Engineer ensured that all Safety-related Rosemount 1153 Series B/D and Model 1154 transmitters were included. The System Engineer determined the trend limits for each transmitter based on the criteria in Table A1, "Maximum Allowable Cumulative Drift for 1153/1154 Oil Loss Transmitters," of Rosemount Technical Bulletin No. 4. The System Engineer initiated corrective action and documented any failure in a Material Non Conformance Report (MNCR). The System Engineer held any failed transmitter for disposition analysis, and reported all suspect oil-loss failures to Rosemount.

The inspectors concluded that the licensee's calibrations provided data with accuracy sufficient to detect drift trends. No data was taken on the transmitter time response.

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. For those transmitters that have failed calibration, the inspectors reviewed the licensee's assessment of the cause for the failures.

Review of licensee records identified 20 Model 1151 and 82 Model 1152 transmitters. The licensee has no Model 1153A installed at Grand Gulf. The licensee has not identified any transmitter failures caused by fill-oil leakage. Information on these transmitters is enclosed as Attachment 1 which followed the format indicated in TI2515/122 Enclosure 1.

The licensee's Model 1151 and 1152 transmitters have been reliable, and no failures were attributed to a loss of fill-oil.

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 cause for the failures.

The licensee had a total of forty-seven Model 1153B/D Rosemount transmitters currently installed with sensor modules manufactured after July 11, 1989. There were no model 1154 transmitters used at Grand Gulf. The inspectors reviewed all failed calibrations, and identified no loss of fill-oil failures at Grand Gulf. Information on these transmitters is also provided on Attachment 1.

The operation of model 1153B/D transmitters with sensors manufactured after July 11, 1989 have 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's generic criteria for suspecting a transmitter of loss of fill-oil is the following:

A. The Transmitter exhibits sustained drift approaching the drift limits as detected by calibration or operating data trending.

B. The transmitter exhibits sluggish response during normal calibration.

Any transmitter suspected of having a loss of fill-oil failure was to be documented on an MNCR and be replaced at the earliest opportunity. If possible, the failed transmitter would be bench tested as described in Rosemount Technical Bulletin 4, Appendix B, "Guideline Bench Test for Confirmation of Oil Loss." The System Engineer was required to report all suspected oil loss transmitters to Rosemount to determine if the calibration data or the tailed transmitter should be sent to Rosemount for 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 acceptable criteria for confirming transmitter fill-oil loss failures.

8.0 Exit Meeting

The inspection scope and results were summarized on January 27, 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

I&C - Instrumentation and Control
MNCR - Material Non-Conformance Report
M&TE - Measuring and Test Equipment
NRC - Nuclear Regulatory Commission
PDM - Predictive Maintenance
PSI - Pounds Per Square Inch
TI - Temporary Instruction

ATTACHMENT 1
GRAND GULF

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..... 20

   Total number of 1152 transmitters currently installed..... 82

   Total number of 1153A transmitters currently installed 0

2. Total number of transmitters installed as of January 1991..... 104

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 TRANSMITTTERS 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..... 47

   Total number of 1154 transmitters currently installed..... 0

2. Total number of transmitters installed as of January 1991..... 47

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