



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
LOSS OF FILL-OIL IN TRANSMITTERS MANUFACTURED BY ROSEMOUNT  
NUCLEAR REGULATORY COMMISSION (NRC) BULLETIN 90-01, SUPPLEMENT 1  
DUKE POWER COMPANY  
OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3  
DOCKET NOS. 50-269, 50-270, 50-287

1.0 INTRODUCTION

NRC Bulletin 90-01 Supplement 1, was issued by the NRC on December 22, 1992, to inform addressees of activities taken by the NRC staff and the industry in evaluating Rosemount transmitters and to request licensees to take actions to resolve this issue. The Supplement requests utilities to review the information for applicability to their facilities, perform testing on the transmitter commensurate with its importance to safety and demonstrated failure rate, and modify as appropriate their actions and enhanced surveillance programs. The Supplement also requested that the licensee provide a response that included a statement as to whether the licensee will take the actions requested, a list of specific actions that the licensee would complete, and the schedule for completing the actions. Additionally, when the specific actions committed to in the licensee's response were completed, the licensee was required to provide a statement confirming said completion. If the licensee did not plan to comply with all of the Requested Actions as delineated in the Supplement, a statement was required identifying those Requested Actions not taken, as well as an evaluation which provided the bases for Requested Actions not taken.

2.0 DISCUSSION AND EVALUATION

The licensee for Oconee Nuclear Station, Units 1, 2, and 3, Duke Power Company, responded to NRC Bulletin 90-01, Supplement 1, in submittals dated February 22, 1993, May 24, 1993, and March 27, 1995. The Requested Actions delineated in Supplement 1 asked that licensees review plant records and identify any Rosemount Model 1153 Series B, Model 1153 Series D, and Model 1154 transmitters manufactured before July 11, 1989, that are used or may be used in the future in either safety-related systems or systems installed in accordance with 10 CFR 50.62 (the ATWS rule). Additionally, the licensee was to commit to a specified enhanced surveillance monitoring frequency that corresponded to the normal operating pressure of the transmitters identified. Furthermore, the licensee was requested to evaluate their enhanced surveillance monitoring program.

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ENCLOSURE

A detailed evaluation of the licensee's response is documented in the attached contractor's report.

### 3.0 CONCLUSION

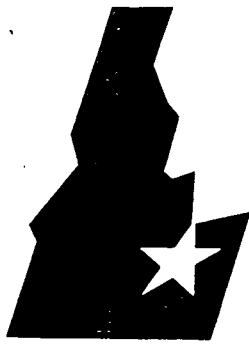
The staff has reviewed the licensee's response to NRC Bulletin 90-01, Supplement 1, and concluded that the licensee conforms to the Requested Actions and has completed the reporting requirements. Compliance with applicable Commission requirements may be the subject of NRC audits or inspections in the future.

Attachment: Technical Evaluation  
Report

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Date: May 19, 1995

April 1995



**Idaho  
National  
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**Evaluation of Utility Response to  
Supplement 1 to NRC Bulletin 90-01:  
Oconee-1/-2/-3**

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TECHNICAL EVALUATION REPORT

Evaluation of Utility Response to Supplement 1 to NRC Bulletin 90-01:  
Oconee-1/-2/-3

Docket Nos. 50-269, 50-270, and 50-287

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TAC Nos. M85416, M85417, and M85418

## SUMMARY

This report documents the Lockheed Idaho Technologies Company review of the Duke Power Company submittals that respond to Supplement 1 to NRC Bulletin 90-01 for the Oconee Nuclear Station, Unit Nos. 1, 2, and 3. This NRC Bulletin provides information regarding the loss of fill-oil in certain pressure and differential pressure transmitters manufactured by Rosemount, Inc. This report finds the licensee complies to the requested actions and the reporting requirements of the Supplement.

FIN No. L1695, Task No. 11a  
B&R No. 320-19-15-05-0  
Docket Nos. 50-269, 50-270, and 50-287  
TAC Nos. M85416, M85417, and M85418

## PREFACE

This report is supplied as part of the "Technical Assistance in Support of the Instrumentation and Controls Systems Branch." It is being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Reactor Controls and Human Factors, by Lockheed Idaho Technologies Company, National Nuclear Operations Analysis Department.

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Evaluation of Utility Response to Supplement 1 to NRC Bulletin 90-01:

Oconee-1/-2/-3

1. INTRODUCTION

The NRC issued Bulletin 90-01 on March 9, 1990 (Reference 1). That Bulletin discussed certain Rosemount pressure and differential pressure transmitter models, identified by the manufacturer as prone to fill-oil leakage. The bulletin requested licensees to identify whether these transmitters were or may later be installed in safety-related systems. Actions were detailed for licensee implementation for certain identified transmitters installed in a safety-related system. These same actions apply to those identified transmitters presently held in inventory for later installation in a safety-related system.

With the gradual leakage of fill-oil, the transmitter would not have the long term accuracy, time response, and reliability needed for its intended safety function. Further, this condition could go undetected over a long period. Redundant instrument channels are subject to the same degradation mechanism. This increases the potential for a common mode failure. Thus, this potential failure mechanism raised concern for the reliability of reactor protection systems (RPS), engineered safety features (ESF) actuation systems, and anticipated transient without scram (ATWS) mitigating systems. To achieve high functional reliability, there must be a low probability of component failure while operating, with any failures readily detectable.

Supplement 1 to NRC Bulletin 90-01 (Reference 2) was issued on December 22, 1992. The Supplement informed licensees of NRC staff activities regarding the subject transmitters, and noted continuing reports of transmitter failures. The NRC requested licensee action to resolve the issue. The Supplement also updated the information contained in the original bulletin. The licensee was requested to review the information and determine if it was applicable at their facility. Further, the licensee was requested to modify their actions and enhanced surveillance monitoring programs to conform with the direction given. Finally, the licensee was instructed to



respond to the NRC. The Requested Actions in Supplement 1 to NRC Bulletin 90-01 supersede the original NRC Bulletin 90-01 Requested Actions.

In responding to Supplement 1 to NRC Bulletin 90-01, the licensee is directed to address three items.

1. A statement either committing the licensee to take the NRC Bulletin 90-01, Supplement 1, Requested Actions or taking exception to those actions.
2. Addressing the actions committed to in the above statement, provide:
  - a. a list of the specific actions, including any justifications, to be taken to complete the commitment,
  - b. a schedule for completion, and
  - c. after completion, a statement confirming the actions committed to are complete.
3. A statement identifying the NRC Bulletin 90-01, Supplement 1, Requested Actions not taken, along with an evaluation providing the basis for exemption.

In implementing the replacement option of the NRC Requested Actions, plant shutdown exclusively for replacing the transmitters is not required. This allowance infers that replacements can be scheduled. With replacement in a timely manner, enhanced surveillance monitoring for interim operation is not required.

The Duke Power Company is the licensee for Unit Nos. 1, 2, and 3 of the Oconee Nuclear Station. The licensee responded to Supplement 1 of NRC Bulletin 90-01 with a letter dated February 22, 1993 (Reference 3). The licensee completed their response on May 24, 1993 (Reference 4). The licensee submitted additional information on March 27, 1995 (Reference 5). This technical evaluation report evaluates the completeness of those submittals.

It also determines whether proposed surveillance methods are adequate to determine fill-oil loss-caused degradation of the transmitter. Finally, this report addresses the interval of surveillance proposed by the licensee for any transmitters included in the enhanced surveillance monitoring program.

Many Rosemount transmitter failures have been attributed to the use of stainless steel "O"-rings between the sensing module and the process flanges. Rosemount improved the manufacturing process for transmitters manufactured after July 11, 1989. Those improvements included a limit of the torque applied to the flange bolts. This limits the stress caused in the sensing module by the "O"-ring. Post-production screening, including pressure testing of the sensing module for this potential latent defect, was also implemented at that time. Therefore, as described in Supplement 1 of NRC Bulletin 90-01, those Rosemount transmitters manufactured after July 11, 1989, are not subject to this review.

## 2. NRC SPECIFIED REQUESTED ACTIONS

The NRC staff specified the following Requested Actions of licensees of operating reactors.

1. Review plant records and identify the following Rosemount transmitters (if manufactured before July 11, 1989) that either are used in or may be used in either safety-related or ATWS mitigating systems.

- Rosemount Model 1153, Series B
- Rosemount Model 1153, Series D
- Rosemount Model 1154

Following identification, the licensee is to establish the following:

- a. For those identified transmitters having a normal operating pressure greater than 1500 psi, and are installed as part of reactor protection trip systems, ESF actuation systems, or ATWS mitigating systems, either replace the transmitter in an expedited manner, or monitor monthly, for the life of the transmitter, using an enhanced surveillance program.

If the identified transmitter exceeds the 60,000 psi-month or the 130,000 psi-month criterion (depending on the range code of the transmitter) established by Rosemount, enhanced surveillance on a refueling (not exceeding 24 months) basis is acceptable. Under this option, justification must be based on the service record and the specific safety function of the transmitter. That justification can be based on high functional reliability provided by redundancy or diversity.

- b. For those identified transmitters having a normal operating pressure greater than 1500 psi, and are installed as part of a safety-related system other than reactor protection trip systems, ESF actuation, or ATWS mitigating systems, either replace the transmitter or monitor quarterly, for the life of the transmitter, using an enhanced surveillance program.

If the identified transmitter exceeds the 60,000 psi-month or the 130,000 psi-month criterion (depending on the range code of the transmitter) established by Rosemount, enhanced surveillance on a refueling (not exceeding 24 months) basis is acceptable. Under this option, justification must be based on the service record and the specific safety function of the transmitter. That

justification can be based on high functional reliability provided by redundancy or diversity.

c. For boiling water reactors (BWR)--

For those identified transmitters having a normal operating pressure greater than 500 psi and less than or equal to 1500 psi, and are installed as part of reactor protection trip systems, ESF actuation systems, or ATWS mitigating systems, either replace the transmitter, or monitor monthly with an enhanced surveillance monitoring program, until the transmitter reaches the designated (by Rosemount) psi-month criterion (60,000 psi-month or 130,000 psi-month, depending on the transmitter range code).

For transmitters that provide signals to the RPS or ATWS trips for high pressure or low water level, the enhanced surveillance must be monthly. For other transmitters in this classification, enhanced surveillance on a refueling (not exceeding 24 months) basis is acceptable. Under this option, justification must be based on the service record and the specific safety function of the transmitter. That justification can be based on high functional reliability provided by redundancy or diversity.

For pressurized water reactors (PWR)--

For those identified transmitters having a normal operating pressure greater than 500 psi and less than or equal to 1500 psi, and are installed as part of reactor protection trip systems, ESF actuation systems, or ATWS mitigating systems, either replace the transmitter, or monitor with an enhanced surveillance monitoring program, until the transmitter reaches the designated (by Rosemount) psi-month criterion (60,000 psi-month or 130,000 psi-month, depending on the transmitter range code) on a refueling (not exceeding 24 months) basis.

- d. For those identified transmitters having a normal operating pressure greater than 500 psi and less than or equal to 1500 psi, and are installed as part of a safety-related system other than reactor protection trip systems, ESF actuation, or ATWS mitigating systems, either replace the transmitter or monitor with an enhanced surveillance monitoring program, until the transmitter reaches the designated (by Rosemount) psi-month criterion (60,000 psi-month or 130,000 psi-month, depending on the transmitter range code) on a refueling (not exceeding 24 months) basis.

- e. Those transmitters having a normal operating pressure greater than 500 psi and less than or equal to 1500 psi, and have accumulated sufficient psi-month operating history to exceed the criterion established by Rosemount, may be excluded from the enhanced surveillance monitoring program at the discretion of the licensee. However, the licensee should retain a high level of confidence that a high level of reliability is maintained and that transmitter failure due to loss of fill-oil is detectable.
  - f. Those transmitters having a normal operating pressure less than or equal to 500 psi may be excluded from the enhanced surveillance monitoring program at the discretion of the licensee. However, the licensee should retain a high level of confidence that a high level of reliability is maintained and that transmitter failure due to loss of fill-oil is detectable.
2. Evaluate the enhanced surveillance monitoring program. The evaluation is to ensure the measurement data has an accuracy commensurate with the accuracy needed to compare the data to the manufacturers drift data criteria. It is this comparison that determines the degradation threshold for loss of fill-oil failures of the subject transmitters.

The Supplement also states the NRC may conduct audits or inspections in the future to verify compliance with the established requirements.

### 3. EVALUATION

The licensee completed their response to Supplement 1 of NRC Bulletin 90-01 on May 24, 1993. The licensee provided additional information on March 27, 1995. Those responses were compared to the Bulletin Reporting Requirements and Requested Actions as described below. The licensee, in their May 24, 1993, response, reports having 81 Rosemount transmitters at the Oconee Nuclear Station that are subject to the Requested Actions of the Supplement. Other Rosemount transmitters are outside the scope of the Supplement due to replacement or refurbishment.

#### 3.1 Evaluation of Licensee Response to Reporting Requirements

The licensee states they will take the Requested Actions detailed in Supplement 1 of NRC Bulletin 90-01. Included in the May 24, 1993, submittal is clarification, interpretation, and the limits placed on that commitment. The March 27, 1995, submittal provided additional details. The licensee described the specific actions taken to implement the Requested Actions.

The licensee, in Reference 4, provided a schedule for the completion of the Requested Actions. Reference 5 reports the Requested Actions are complete. The licensee will perform further transmitter replacements under their environmental qualification program on nearing the end-of-qualified life of the transmitter. The submittal identifies where licensee actions deviate from the requirements of the Supplement. The licensee provides evaluation and justification supporting the deviation.

With the above exception, the licensee submittal conforms with the Reporting Requirements of Supplement 1 of NRC Bulletin 90-01.

### 3.2 Evaluation of Licensee Response to Requested Actions

Supplement 1 of NRC Bulletin 90-01 requested licensee action to resolve the issue of fill-oil leakage in Rosemount transmitters. This Technical Evaluation Report summarizes the Requested Actions and the associated transmitter criteria in Section 2. The licensee identified a total of 81 Rosemount transmitters at the Oconee Nuclear Station in the scope of this review. The licensee response to the Supplement is discussed in the following sections.

#### 3.2.1 Licensee Response to Requested Action 1.a

The licensee lists 34 Rosemount transmitters from this transmitter classification at the Oconee Nuclear Station. All participate in an enhanced surveillance monitoring program monthly. The licensee states, in Reference 4, that they may perform evaluations to support extending the surveillance interval after the transmitters achieve maturity. As of May 1993, 16 transmitters from this transmitter classification exceed the psi-month maturity threshold established by Rosemount and endorsed by the NRC. The determining factor used by the licensee to extend the surveillance interval are:

1. The transmitter time in service exceeds the appropriate time-at-pressure (psi-months) based on the range code as stated in Rosemount Technical Bulletin No. 4.
2. Trending of calibration data shows reliable performance, that is, the cumulative drift is less than the drift limits established in Rosemount Technical Bulletin No. 4.
3. Redundancy in the design, with four transmitters all sensing the same parameter.

However, the licensee notes there are no plans to extend the surveillance interval for these transmitters. Replacement of these transmitters is controlled by the licensee's environmental qualification program as the transmitters approach end-of-qualified life. The licensee states they will

monitor transmitters in this transmitter classification monthly until transmitter replacement. The enhanced surveillance monitoring program for this transmitter classification is acceptable.

### 3.2.2 Licensee Response to Requested Action 1.b

The licensee states there are 14 Rosemount transmitters from this transmitter classification at the Oconee Nuclear Station. The licensee replaced five transmitters stated to be subject to pressure only eight hours a year. Replacement removes these five transmitters from the concerns of the Supplement. Reference 5 informs the NRC of the completion of this replacement.

The licensee will monitor nine other Rosemount transmitters in this transmitter classification at the Oconee Nuclear Station at least once per refueling cycle. They have exceeded the psi-month maturity threshold established by Rosemount and endorsed by the NRC. They provide signals for indication of the Unit 1 pressurizer level, one pressurizer pressure indication per unit, and reactor coolant system pressure for each unit for display at the standby shutdown facility. Based on the information and justification presented, we find these actions acceptable for these nine transmitters.

### 3.2.3 Licensee Response to Requested Action 1.c

The licensee states there are no Rosemount transmitters from this transmitter classification at the Oconee Nuclear Station.

### 3.2.4 Licensee Response to Requested Action 1.d

The licensee states there are 16 Rosemount transmitters from this transmitter classification at the Oconee Nuclear Station. These 16



transmitters do not exceed the psi-month maturity criteria. The licensee includes these transmitters in the enhanced surveillance monitoring program. Surveillance will occur at least once per refueling cycle. The licensee actions satisfy the Supplement requirements for this transmitter classification.

### 3.2.5 Licensee Response to Requested Action 1.e

The licensee states there are no Rosemount transmitters from this transmitter classification at the Oconee Nuclear Station.

### 3.2.6 Licensee Response to Requested Action 1.f

The licensee states there are 17 Rosemount transmitters from this transmitter classification at the Oconee Nuclear Station. At the discretion of the licensee, these 17 transmitters are not part of the enhanced surveillance monitoring program. The Supplement permits this discretionary action.

The Supplement requires the licensee to maintain a high degree of confidence that these transmitters remain highly reliable. The licensee states they maintain this confidence in a transmitter after removal from the enhanced surveillance monitoring program by technician awareness of the oil-loss symptoms, observation of the transmitter under calibration, and anomalies detected by comparison and trending of redundant transmitters.

Each unit has a transmitter, HP1PT0223, which does not have a redundant transmitter. The normal pressure is atmospheric. The normal system operating pressure is less than 35 psig. This is far below the threshold where pressure drives the oil-loss phenomena. We find the licensee's actions for transmitters in transmitter classification 1.f acceptable.

### 3.2.7 Enhanced Surveillance Monitoring Program

The licensee states that their enhanced surveillance monitoring program incorporates Rosemount Technical Bulletin No. 4. The licensee trends the calibration data of each transmitter in the program. The trended data are compared to the Rosemount drift limits. The licensee requires response time testing of the transmitter if its accumulative drift is beyond the limits of Rosemount Technical Bulletin No. 4. Additionally, all range code 9 (zero to 3000 psig with range down capability of zero to 500 psig) transmitters have response time testing as part of their calibration procedure. The licensee states the data from the enhanced surveillance monitoring program has the accuracy needed for comparison to drift data criteria.

We find the licensee's description of their enhanced surveillance monitoring program meets the requirements of the Supplement. Therefore, the licensee's enhanced surveillance monitoring program for Rosemount transmitters is acceptable.

#### 4. CONCLUSIONS

Based on our review, we find that the licensee has completed the reporting requirements of Supplement 1 of NRC Bulletin 90-01. Further, the licensee conforms to the requested actions of Supplement 1 to NRC Bulletin 90-01.

## 5. REFERENCES

1. NRC Bulletin No. 90-01: "Loss of Fill-oil in Transmitters Manufactured by Rosemount," March 9, 1990, OMB No. 3150-0011.
2. NRC Bulletin No. 90-01, Supplement 1: "Loss of Fill-oil in Transmitters Manufactured by Rosemount," December 22, 1992, OMB No. 3150-0011.
3. Letter, Duke Power Company (H. B. Tucker) to NRC, "NRC Bulletin 90-01, Supplement 1: Loss of Fill-Oil in Transmitters Manufactured by Rosemount," February 22, 1993.
4. Letter, Duke Power Company (H. B. Tucker) to NRC, "NRC Bulletin 90-01, Supplement 1, Loss of Fill-Oil in Transmitters Manufactured by Rosemount," May 24, 1993.
5. Letter, Duke Power Company (J. W. Hampton) to NRC, "Request for Additional Information Regarding Rosemount Transmitters," March 27, 1995.