

TECHNICAL EVALUATION REPORT

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

Docket Nos. 50-454 and 50-455

Alan C. Udy

Published October 1994

Lockheed Idaho Technologies Company  
Idaho National Engineering Laboratory  
Idaho Falls, Idaho 83415

Prepared for the  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555  
and for the  
U.S. Department of Energy  
Under DOE Idaho Operations Office  
Contract DE-AC07-94ID13223  
FIN No. L1695, Task No. 11a  
TAC Nos. M85366 and M85367

9411140039 XA

### SUMMARY

This report documents the Lockheed Idaho Technologies Company review of the Commonwealth Edison Company submittals that respond to Supplement 1 to NRC Bulletin 90-01 for Unit Nos. 1 and 2 of the Byron Station. 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 conforms with 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. 50-454 and 50-455  
TAC Nos. M85366 and M85367

## 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.

## CONTENTS

|   |     |
|---|-----|
| SUMMARY .....   | ii  |
| PREFACE .....   | iii |
| 1. INTRODUCTION .....   | 1   |
| 2. NRC SPECIFIED REQUESTED ACTIONS .....                          | 4   |
| 3. EVALUATION .....   | 7   |
| 3.1 Evaluation of Licensee Response to Reporting Requirements ... | 7   |
| 3.2 Evaluation of Licensee Response to Requested Actions .....    | 7   |
| 4. CONCLUSIONS .....  | 11  |
| 5. REFERENCES .....   | 12  |

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

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 Commonwealth Edison Company, the licensee for Unit Nos. 1 and 2 of the Byron Station, responded to Supplement 1 of NRC Bulletin 90-01 with a letter dated March 5, 1993 (Reference 3). The licensee provided additional information on September 10, 1994 (Reference 4). 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 responded to Supplement 1 of NRC Bulletin 90-01 on March 5, 1993. The licensee provided additional information on September 10, 1994. Those responses were compared to the Bulletin Reporting Requirements and Requested Actions as described below. The licensee reports, in Reference 3, having 42 Rosemount transmitters 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 agree to comply with the Requested Actions detailed in Supplement 1 of NRC Bulletin 90-01. Included with that statement is clarification, interpretation, and the limits placed on that commitment. The licensee described the specific actions taken to implement the Requested Actions.

A statement that the Requested Actions are complete is included in Reference 3. The licensee states that their actions meet or exceed the Supplement recommendations. Further, the licensee states that the enhanced surveillance monitoring program will continue until all suspect transmitters have been replaced through normal maintenance and attrition.

The licensee submittals conform to 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 42

transmitters that are in the scope of this review when initially responding on March 5, 1993. The licensee response to the Supplement is discussed in the following sections.

3.2.1 Licensee Response to Requested Action 1.a

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

3.2.2 Licensee Response to Requested Action 1.b

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

3.2.3 Licensee Response to Requested Action 1.c

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

3.2.4 Licensee Response to Requested Action 1.d

The licensee states there are two Rosemount transmitters from this transmitter classification at the Byron Station. These transmitters are included in the enhanced surveillance monitoring program. The accumulated zero shift is trended each refueling outage, adding new calibration data to the historical data. This satisfies the requirements of the Supplement and is acceptable.

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

The licensee states there are 6 Rosemount transmitters from this transmitter classification at the Byron Station. At the discretion of the licensee, these transmitters will remain in the enhanced surveillance monitoring program until replaced for normal maintenance or other attrition causes. This enables the licensee to maintain a high degree of confidence that these transmitters remain highly reliable as required by the Supplement.

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

The licensee states there are 34 Rosemount transmitters from this transmitter classification at the Byron Station. At the discretion of the licensee, these transmitters will remain in the enhanced surveillance monitoring program until replaced for normal maintenance or other attrition causes. This enables the licensee to maintain a high degree of confidence that these transmitters remain highly reliable as required by the Supplement.

Of these 34 Rosemount transmitters, 16 transmitters are used intermittently. These transmitters provide control signals for the auxiliary feedwater control valves and indication of auxiliary feedwater flow on the main control board. During normal operation, these transmitters are exposed to the pressure head of the condensate storage tank, some 15 psig to 30 psig. The transmitters are exposed to system pressure, about 2000 psi, for about an hour a month, during surveillance. Thus, the licensee considers these transmitters in standby service, appropriate to transmitter classification 1.f.

While not normally at pressure, when the auxiliary feedwater system is operating (during system testing, startup, and shutdown operations) these transmitters are exposed to approximately 2000 psi. With this minimum time at pressure, these transmitters will not soon exceed the established psi-month maturity threshold. Neither will they have sufficient time at pressure to lose a significant amount of fill-oil, causing the output signal to degrade.

Rosemount Technical Bulletin No. 4 notes that transmitters in such 'standby' service are acceptable without enhanced monitoring.

### 3.2.7 Enhanced Surveillance Monitoring Program

The licensee states their enhanced surveillance monitoring program monitors the parameters that indicate a loss of fill-oil with the required accuracy. The program trends the accumulated zero drift observed between calibrations at refueling intervals. The licensee described this method in greater detail in Reference 4.

The licensee uses computer software to trend the zero drift as a percentage of the nominal calibrated span. This uses the range-down factor and the percent upper range limit described in Rosemount Technical Bulletin No. 4. The accumulative zero drift is compared to the Rosemount drift limits. Should a transmitter exceed the cumulative drift limit or if an instrument technician qualitatively assesses a transmitter as sluggish during calibration, it is removed from service. Failed transmitters returned to Rosemount for evaluation and are either repaired or replaced.

The enhanced surveillance monitoring program meets the recommendations of the Supplement and Rosemount Technical Bulletin No. 4 and is, therefore, acceptable.

#### 4. CONCLUSIONS

Based on our review, we find 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.

## 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, 1991, OMB No. 3150-0011.
3. Letter, Commonwealth Edison Company (D. J. Chaznowski) to NRC (T. E. Murley), "NRC Bulletin 90-01 Supplement 1, 'Loss of Fill-oil in Transmitters Manufactured by Rosemount', dated December 22, 1991," March 5, 1993.
4. Letter, Commonwealth Edison Company (D. M. Saccomando) to NRC (W. Russell), "Byron Units 1 and 2, NRC Docket Numbers 50-454 and 50-455," September 10, 1994.