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TECHNICAL EVALUATION REPORT

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

Docket No. 50-346

Alan C. Udy and LeRoy C. Meyer

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EG&G Idaho, Inc.  
Idaho National Engineering Laboratory  
Idaho Falls, Idaho 83415

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## SUMMARY

This report documents the EG&G Idaho, Inc., review of the Centerior Energy submittals that respond to Supplement 1 to NRC Bulletin 90-01 for the Davis-Besse Nuclear Power Station, Unit No. 1. This NRC Bulletin provides information regarding the loss of fill-oil in certain pressure and differential pressure transmitters manufactured by Rosemount, Inc. This report identifies areas of non-conformance to the requested actions and the reporting requirements. Exceptions to the requested actions and the reporting requirements are evaluated.

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## 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 EG&G Idaho, Inc., DOE\NRC Support Programs Unit.

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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 identified transmitters installed in a safety-related system. These same actions apply to 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 included 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 that confirms the actions committed 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.

Centerior Energy, the licensee for the Davis-Besse Nuclear Power Station, Unit No. 1, responded to Supplement 1 of NRC Bulletin 90-01 with a letter dated March 5, 1993 (Reference 3). The licensee augmented that information with an additional submittal dated April 29, 1994 (Reference 4). This technical evaluation report evaluates the completeness of these

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 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 provided a response to Supplement 1 of NRC Bulletin 90-01 on March 5, 1993. Supplemental information was provided by the licensee on April 29, 1994. Those responses were compared to the Bulletin Reporting Requirements and Requested Actions as described below. The licensee reports they have 37 Rosemount transmitters that are subject to the Requested Actions of the Supplement. The licensee also reports nine of the subject transmitters are classified safety-related for pressure boundary integrity purposes only. These nine transmitters are excluded from further review. The purpose of NRC Bulletin 90-01 is to identify and repair, before the safety function of the transmitter is compromised, those Rosemount transmitters where the safety-related signal deteriorates due to the loss of the transmitter fill-oil. Therefore, the exclusion of those nine transmitters (that do not provide a safety-related signal) from review for the Requested Actions of the Supplement is appropriate. Thus, there are 28 Rosemount transmitters in the scope of this review.

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

In Reference 3, the licensee committed to complete their actions that respond to the Supplement by the end of refueling outage BRFO. In Reference 4, the licensee states they have completed the actions required to meet 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.

The licensee submittals conform 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. In this Technical Evaluation Report, the Requested Actions and associated transmitter criteria are summarized in Section 2 of this report. The licensee identified a total of 28 transmitters that are in the scope of this review. The licensee response is discussed in the following sections.

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

The licensee states there are two Rosemount transmitters from this classification at Unit No. 1 of the Davis-Besse Nuclear Power Station. Transmitter PT6365A was scheduled for replacement during the (then current) refueling outage, 8RFO. The transmitter had already exceeded the psi-month maturity threshold criterion established by Rosemount and endorsed by the NRC. That transmitter and a redundant transmitter, PT6365B, measure the reactor coolant system loop pressure. Signals are distributed to the diverse scram (ATWS mitigation) system, the remote shutdown panel, and the post-accident monitoring indication. After replacement, PT6365A will be outside the scope of the enhanced surveillance monitoring program. The licensee informed the NRC, in Reference 4, that the replacement of transmitter PT6365A had been completed.

The redundant transmitter PT6365B, will not be replaced. It will participate in the enhanced surveillance monitoring program. Calibration data will be obtained every refueling cycle. That calibration data will be trended, and compared to the zero and span drift limits that show a potential loss of fill-oil. Additionally, the plant computer will compare the signals from the redundant transmitters (PT6365A and PT6365B) weekly. Divergence between the two signals shows a potential loss of fill-oil. PT6365B has exceeded the psi-month maturity threshold criterion. The enhanced surveillance monitoring program for this transmitter is acceptable.

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

The licensee states there are five safety-related Rosemount transmitters from this classification at Unit No. 1 of the Davis-Besse Nuclear Power Station. Transmitter LT5448A monitors the level in a hot leg. It has not exceeded the psi-month maturity threshold criterion established for it. The licensee will include this transmitter in the enhanced surveillance monitoring program. The plant computer will compare the signals from redundant transmitters (LT5448A and LT5448B) weekly. Divergence between the two shows a potential loss of fill-oil. LT5448B has exceeded the psi-month maturity threshold criterion. Additionally, calibration drift data will be trended every refueling cycle.

The four other transmitters in this classification have accumulated sufficient operational history to exceed the psi-month maturity threshold criterion. These transmitters will participate in the enhanced surveillance monitoring program. Calibration drift data will be trended every refueling cycle.

- Transmitter LT5448B is redundant to LT5448A and monitors the hot leg level. It has shown no indication of loss of fill-oil since the enhanced surveillance monitoring program was established in response to NRC Bulletin 90-01.
- Transmitters LTRC14-1 and LTRC14-3 are redundant transmitters, monitoring the pressurizer level. The signals provide indication, alarms, and interlocks. One signal provides level control for the normal makeup line flow control valve MU-32. Either transmitter can be selected for the control function should the other fail.
- Transmitter FTMU31 monitors the wide-range makeup flow. It has no redundant transmitter. However, the same flow element is used with a narrow-range transmitter, FTMU34. The licensee states the makeup system will not be adversely affected should FTMU31 fail.

The enhanced surveillance monitoring program for these transmitters is acceptable.

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

The licensee states there are no Rosemount transmitters from this classification at Unit No. 1 of the Davis-Besse Nuclear Power Station.

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

The licensee states there are six Rosemount transmitters from this classification at Unit No. 1 of the Davis-Besse Nuclear Power Station. Transmitters LTSP9A3, LTSP9A4, LTSP9B3, and LTSP9B4 will exceed the 60,000 psi-month maturity threshold criterion in October 1993. At that point they will be removed from the enhanced surveillance monitoring program. Transmitters LTSP09A2 and LTSP09A5 already exceed the 60,000 psi-month maturity threshold criterion, and are no longer included in an enhanced surveillance monitoring program. See Section 3.2.5.

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

The licensee states there are no Rosemount transmitters from this classification at Unit No. 1 of the Davis-Besse Nuclear Power Station. However, the licensee has six Rosemount transmitters that meet the classification requirements for Requested Action 1.d., and either exceed or will soon exceed the psi-month maturity threshold criterion. At the discretion of the licensee, these six transmitters will be excluded from the enhanced surveillance monitoring program after the maturity threshold is reached. This is permitted by the Supplement.

The Supplement requires the licensee maintain a high degree of confidence that these transmitters remain highly reliable. The licensee states these transmitters will continue with a weekly computer point trend analysis to maintain that confidence.

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

The licensee states there are 15 Rosemount transmitters from this classification at Unit No. 1 of the Davis-Besse Nuclear Power Station. The Supplement requires the licensee maintain a high degree of confidence that these transmitters remain highly reliable. The licensee states these transmitters will continue with a weekly computer point trend analysis (comparing redundant channels to each other) to maintain that confidence.

### 3.2.7 Enhanced Surveillance Monitoring Program

The licensee states that calibration data has sufficient accuracy to compare to the zero and span drift limits identified in Rosemount Technical Bulletin No. 4. Another part of the enhanced surveillance monitoring program is to trend computer point data of redundant transmitters weekly. Statistical data such as variance and deviation from the average will be used periodically to identify symptoms of the loss of fill-oil.

#### 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 either conforms to or has adequate justification for deviating from 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, Centerior Energy (D. C. Shelton) to NRC, "Response to NRC Bulletin 90-01, Supplement 1, 'Loss of Fill-Oil in Transmitters Manufactured by Rosemount'," March 5, 1993, Serial Number 1-1005.
4. Letter, Centerior Energy (D. C. Shelton) to NRC, "Supplemental Response to NRC Bulletin Number 90-01, Supplement 1, 'Loss of Fill-oil in Transmitters Manufactured by Rosemount'," April 29, 1994.