TECHNICAL EVALUATION REPORT

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

Docket No. 50-440

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SUMMARY

This report documents the EG&G Idaho, Inc., review of the Perry Nuclear Power Plant submittals that respond to Supplement 1 to NRC Bulletin 90-01. 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.

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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 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.

Centerior Energy, Incorporated, the licensee for the Perry Nuclear Power Plant, responded to Supplement 1 of NRC Bulletin 90-01 with a letter dated March 11, 1993 (Reference 3). The Cleveland Electric Illuminating Company provided notification that certain actions were complete on December 21, 1993 (Reference 4). The licensee provided additional information in a letter dated September 20, 1994 (Reference 5). 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 responses for the Perry Nuclear Power Plant, Unit No. 1, to Supplement 1 of NRC Bulletin 90-01 on March 11, 1993, and September 20, 1994. Those responses were compared to the Bulletin Reporting Requirements and Requested Actions as described below. The licensee reports they have 202 Rosemount Model 1153, Series B, transmitters that are subject to the Requested Actions of the Supplement. The licensee states there are no Rosemount Model 1153, Series D, or Model 1154 transmitters at the Perry Nuclear Power Plant, a BWR. The responses also address Unit 2 Rosemount transmitters, both installed and in the Unit 2 construction warehouse. On December 21, 1993, the NRC was notified that the Unit 2 Rosemount transmitters have been tagged and segregated per the non-conformance program.

3.1 Evaluation of Licensee Response to Reporting Requirements

The licensee states they will take the applicable 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 and the associated schedule for completion.

The licensee states, in Reference 3, that a statement that the Requested Actions are complete will be submitted separately after the scheduled items are complete. Reference 4 provides notification that the last action committed to is complete. Reference 3 identifies where no licensee action is taken and provides evaluation and justification supporting the position that the action is not necessary. All Unit 1 and Unit 2 spare Rosemount transmitters and Unit 2 installed transmitters were reviewed for inclusion within the scope of the Supplement. Those manufactured before July 11, 1989, were tagged as non-conformance items. This prevents these transmitters from being installed in Unit 1 unless refurbished first. The licensee states administrative controls assure any replacement transmitters will be

manufactured after July 11, 1989, or refurbished with a sensor manufactured after July 11, 1989.

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. The licensee identified a total of 202 transmitters that are in the scope of this review. The licensee has no Rosemount Model 1153, Series D, or Model 1154 transmitters that are included 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 no Rosemount transmitters from this transmitter classification at the Perry Nuclear Power 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 Perry Nuclear Power Station.

3.2.3 Licensee Response to Requested Action 1.c

The licensee states there are 68 Rosemount transmitters from this transmitter classification at the Perry Nuclear Power Station. Fourteen

initiate RPS or ATWS mitigation trips on high reactor pressure or low reactor vessel water level. For these 14 transmitters, the surveillance will be monthly. Data for transmitters 1B21N078A, 1B21N078B, 1B21N078C, and 1B21N078D will be gathered from the emergency response information system computer. Data for transmitters 1B21N080A, 1B21N080B, 1B21N080C, and 1B21N080D will be gathered from the voltages on the front panel. Data for transmitters 1B21N402B, 1B21N402E, 1B21N403A, 1B21N403B, 1B21N403E, and 1B21N403F will be recorded from the digital display indication. The trending of this data will be governed by an instrument maintenance instruction. The licensee states the collection of this data will not impact the systems involved, will create no alarms, and will not generate any trip signals. This monitoring method was developed by Rosemount and endorsed by the NRC, and is acceptable for these fourteen transmitters.

Of the 68 Rosemount transmitters from this classification at the Perry Nuclear Power Station, 54 do not initiate RPS or ATWS mitigation trips on high reactor pressure or low reactor vessel water level. For these transmitters, an enhanced surveillance monitoring program will be performed on a refueling basis. The 14 transmitters included in the monthly enhanced surveillance monitoring program will also be monitored under the refueling basis enhanced surveillance monitoring program. The refueling basis enhanced surveillance monitoring program is based on the trending of calibration drift data, a monitoring method recommended by Rosemount and endorsed by the NRC.

Supplement 1 to NRC Bulletin 90-01 requires specific justification to use a refueling interval for using a refueling interval for the enhanced surveillance monitoring program for the 54 transmitters not monitored monthly. The licensee presented detailed justifications for the relaxation of the monitoring frequency requirements.

a. The enhanced surveillance monitoring program has shown the ability to detect a transmitter that exhibits loss of fill-oil symptoms on a refueling basis. The identification is early enough so that a replacement can be scheduled before the transmitter fails to function. As of January 1993, 14 transmitters had been replaced as a result of the refueling basis enhanced surveillance monitoring program.

b. The 54 transmitters in question have shown no history of or tendency toward a loss of fill-oil.

c. Of these 54 transmitters, 31 are expected to reach the 60,000 psi-month criteria for exclusion from the enhanced surveillance monitoring program by February 1994. Other of these 54 transmitters have varied lengths of operational history.

d. Rosemount characterizes 46 of these 54 transmitters with a slow drift characteristic where a refueling interval drift surveillance adequately identifies transmitters with a loss of fill-oil. The remaining 8 transmitters have a faster shift of span in response to the leakage. Four of these (main steamline low pressure) have a channel check every 12 hours. This provides a cross-calibration (data gathering only) for these channels. A span shift is observable from this data. The other four transmitters (turbine first stage pressure bypass) would, on failure of two or more, result in not bypassing the trip function. Fill-oil loss would not prevent a trip.

e. The safety function of each of the above 54 transmitters was described. The safety function of each corresponds to the allowance for a refueling basis enhanced surveillance monitoring program given in the Supplement.

f. The licensee discussed functional redundancy and diverse safety systems for these transmitters.

Based on the justification presented by the licensee, the 54 identified Rosemount transmitters are acceptable when included in the enhanced surveillance monitoring program on a refueling basis.

3.2.4 Licensee Response to Requested Action 1.d

The licensee states there are ten Rosemount transmitters from this transmitter classification at the Perry Nuclear Power Station. These ten transmitters are included in the enhanced surveillance monitoring program with a refueling frequency as directed by the Supplement.

3.2.5 Licensee Response to Requested Action 1.e

The licensee states there are no Rosemount transmitters from this transmitter classification at the Perry Nuclear Power Station. This amount is expected to increase. The Rosemount transmitters mature with time in service and will exceed the psi-month criteria established by Rosemount and endorsed by the NRC. At the discretion of the licensee, these transmitters that exceed the psi-month criteria will not continue as part of the enhanced surveillance monitoring program. This option is permitted by the Supplement. The licensee states that the transmitters will be excluded from the enhanced surveillance monitoring program on a case-specific basis after the psi-month criteria has been achieved. As of September 20, 1994, Reference 5 reports that none of the Rosemount transmitters are excluded from the enhanced surveillance monitoring program under this exclusion option.

The Supplement requires the licensee to maintain a high degree of confidence that those transmitters excluded from the enhanced surveillance monitoring program remain highly reliable. The licensee states, in Reference 5, that they will maintain this confidence in transmitters excluded from the enhanced surveillance monitoring program. This confidence is maintained by the following.

- Training of operators and I&C technicians on the loss of fill-oil symptoms.
- Calibration procedures have (and will continue to have) a pressure transient check specifically to detect this loss of fill-oil symptom.
- Routine channel checks for most of these channels.

These factors enable the licensee to identify fill-oil loss in transmitters no longer included in the enhanced surveillance monitoring program. Currently, all subject transmitters are included in the enhanced surveillance monitoring program. With this capability, the licensee response for this transmitter classification is acceptable.

3.2.6 Licensee Response to Requested Action 1.f

There are 124 Rosemount transmitters from this transmitter classification at the Perry Nuclear Power Station. The Supplement permits, at the discretion of the licensee, the exclusion of these transmitters from the enhanced surveillance monitoring program. The licensee states their experience to date supports excluding the transmitters in this transmitter classification from the enhanced surveillance monitoring program. However, Reference 5 states that none of the Rosemount transmitters are excluded from the enhanced surveillance monitoring program under this exclusion option.

The Supplement requires the licensee to maintain a high degree of confidence that those transmitters excluded from the enhanced surveillance monitoring program remain highly reliable. The licensee states, in Reference 5, that they will maintain this confidence in transmitters excluded from the enhanced surveillance monitoring program. This confidence is maintained by the following.

- Training of operators and I&C technicians on the loss of fill-oil symptoms.
- Calibration procedures have (and will continue to have) a pressure transient check specifically to detect this loss of fill-oil symptom.
- Routine channel checks for most of these channels.

These factors enable the licensee to identify fill-oil loss in transmitters no longer included in the enhanced surveillance monitoring program. Currently, all subject transmitters are included in the enhanced surveillance monitoring program. With this capability, the licensee response for this transmitter classification is acceptable.

3.2.7 Enhanced Surveillance Monitoring Program

The licensee's enhanced surveillance monitoring program monitors 14 Rosemount Model 1153, Series B, transmitters monthly. These transmitters are included in the licensee response to Requested Action 1.c that discusses transmitters that initiate RPS or ATWS mitigation trips on high reactor pressure or low reactor vessel water level. This monthly monitoring trends operating data as directed by Rosemount Technical Bulletin No. 4. The transmitter operating data is charted and compared between channels. As these 14 transmitters reach the psi-month criteria established by Rosemount and endorsed by the NRC, the licensee makes a case-by-case determination on whether to keep that transmitter in the enhanced surveillance monitoring program.

The licensee's enhanced surveillance monitoring program monitors all Rosemount transmitters subject to the Supplement on a refueling interval. The licensee has justified the refueling frequency monitoring of these transmitters. The refueling interval enhanced surveillance monitoring program is based on the guidance of Rosemount Technical Bulletin No. 4. The licensee monitors and trends the calibration data of each transmitter. The licensee states that Rosemount reviewed their refueling interval enhanced surveillance monitoring program and found it acceptable. The measurement data gathered has a stated accuracy consistent with the drift data criteria identified in Rosemount Technical Bulletin No. 4.

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.

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 (R. A. Stratman) to NRC, "Response to NRC Bulletin 90-01, Supplement 1: Loss of Fill-Oil in Transmitters Manufactured by Rosemount," March 11, 1993, PY-CEI/NRR-1601 L.

4. Letter, Cleveland Electric Illuminating Company to NRC, "Completed Action in Response to NRC Bulletin 90-01, Supplement 1 (TAC #M85426)," December 21, 1993, PY-CEI/NRR-1717 L.

5. Letter, Centerior Energy (R. A. Stratman) to NRC, "Additional Information in Response to NRC Bulletin 90-01, Supplement 1 (TAC #M85426)," September 20, 1994, PY-CEI/NRR-1861L.

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10. SUPPLEMENTARY NOTES

11. ABSTRACT (200 words or less)

This report documents the EG&G Idaho, Inc., review of the Centerior Energy, Incorporated, submittals that respond to Supplement 1 to NRC Bulletin 90-01 for the Perry Nuclear Power Plant. This NRC bulletin provides information regarding the loss of fill-oil in certain pressure and differential pressure transmitters manufactured by Rosemount, Incorporated. This report finds the licensee conforms to the requested actions and the reporting requirements of the Supplement.

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