TECHNICAL EVALUATION REPORT

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

Docket No. 50-443

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SUMMARY

This report documents the EG&G Idaho, Inc., review of the North Atlantic Energy Service Corporation submittals responding to Supplement 1 to NRC Bulletin 90-01 for the Seabrook Station. This NRC Bulletin provides information on 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.

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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 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 North Atlantic Energy Service Corporation, the licensee for the Seabrook Station, responded to Supplement 1 of NRC Bulletin 90-01 with a letter dated March 3, 1993 (Reference 3). That response referred to a previous response to the Bulletin dated July 17, 1990 (Reference 4). The licensee provided additional information in a letter dated July 15, 1994 (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 responded to Supplement 1 of NRC Bulletin 90-01 on March 3, 1993. That response incorporated information from a July 17, 1990, letter. The licensee provided additional information on July 15, 1994. Those responses were compared to the Bulletin Reporting Requirements and Requested Actions as described below. The licensee reported starting an enhanced surveillance monitoring program for Rosemount transmitters that are subject to the Requested Actions of the Supplement in May 1990. The licensee states their enhanced surveillance monitoring program satisfies the Requested Actions of the Supplement. Other Rosemount transmitters are outside the scope of the Supplement due to replacement, refurbishment, or use in non-safety applications.

3.1 Evaluation of Licensee Response to Reporting Requirements

The licensee states the actions taken in response to the original NRC Bulletin 90-01 satisfy the Requested Actions detailed in Supplement 1 of NRC Bulletin 90-01. Included with that statement is clarification, interpretation, and the limits placed on their actions. The licensee described the specific steps taken to comply to the Requested Actions of the Supplement in References 3, 4, and 5. Reference 3 includes a commitment to include any subject Rosemount transmitters installed in the future (presently held as spares) in the enhanced surveillance monitoring program.

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 states they are not replacing any Rosemount Model 1153, Series B and D, or Model 1154 transmitter, either installed or held as spare stock, in response to the Supplement. Instead, an enhanced surveillance program operates at the Seabrook Station. The licensee states that the enhanced surveillance program covers the 61 Rosemount transmitters that are included in the scope of this review. The following sections discuss the licensee response to the Supplement.

3.2.1 Licensee Response to Requested Action 1.a

The licensee states they will systematically monitor all Rosemount Model 1153 Series B, Model 1153 Series D, and Model 1154 transmitters in this transmitter classification for the installed life of each transmitter. The monitoring includes trending of calibration and operational data, and performance of monthly (or more frequent) channel checks. The program specifies corrective actions should a transmitter display behavior indicative of sensor oil-loss. The licensee description of their enhanced surveillance program for this transmitter classification satisfies this requested action and is acceptable.

3.2.2 Licensee Response to Requested Action 1.b

The licensee states they will systematically monitor all Rosemount Model 1153 Series B, Model 1153 Series D, and Model 1154 transmitters in this transmitter classification for the installed life of each transmitter. The monitoring includes trending of calibration and operational data, and performance of channel checks at least quarterly. The program specifies corrective actions should a transmitter display behavior indicative of sensor oil-loss. The licensee description of their enhanced surveillance program for this transmitter classification satisfies this requested action and is acceptable.

3.2.3 Licensee Response to Requested Action 1.c

The licensee states they will systematically monitor all Rosemount Model 1153 Series B, Model 1153 Series D, and Model 1154 transmitters in this transmitter classification for the installed life of each transmitter or until the transmitter reaches the appropriate psi-month maturity threshold recommended by Rosemount and endorsed by the NRC. The monitoring includes trending of calibration and operational data, and performance of channel checks. The licensee will monitor these transmitters at least once every refueling cycle, with a maximum interval not exceeding 24 months. The program specifies corrective actions should a transmitter display behavior indicative of sensor oil-loss. The licensee description of their enhanced surveillance program for this transmitter classification satisfies this requested action and is acceptable.

3.2.4 Licensee Response to Requested Action 1.d

The licensee states they will systematically monitor all Rosemount Model 1153 Series B, Model 1153 Series D, and Model 1154 transmitters in this transmitter classification for the installed life of each transmitter or until the transmitter reaches the appropriate psi-month maturity threshold recommended by Rosemount and endorsed by the NRC. The monitoring includes trending of calibration and operational data, and performance of channel checks. The licensee will monitor these transmitters at least once every refueling cycle, with a maximum interval not exceeding 24 months. The program specifies corrective actions should a transmitter display behavior indicative of sensor oil-loss. The licensee description of their enhanced surveillance program for this transmitter classification satisfies this requested action and is acceptable.

3.2.5 Licensee Response to Requested Action 1.e

The licensee states they will systematically monitor all Rosemount Model 1153 Series B, Model 1153 Series D, and Model 1154 transmitters in this transmitter classification for the installed life of each transmitter. The monitoring includes trending of calibration and operational data, and performing channel checks. The licensee will monitor these transmitters at least once every refueling cycle, with a maximum interval not exceeding 24 months. The program specifies corrective actions should a transmitter display behavior indicative of sensor oil-loss. The licensee description of their enhanced surveillance program for this transmitter classification satisfies this requested action and is acceptable.

3.2.6 Licensee Response to Requested Action 1.f

The licensee states they will systematically monitor all Rosemount Model 1153 Series B, Model 1153 Series D, and Model 1154 transmitters in this transmitter classification for the installed life of each transmitter. The monitoring includes trending of calibration and operational data, and performing channel checks. The licensee will monitor these transmitters at least once every refueling cycle, with a maximum interval not exceeding 24 months. The program specifies corrective actions should a transmitter display behavior indicative of sensor oil-loss. The licensee description of their enhanced surveillance program for this transmitter classification satisfies this requested action and is acceptable.

The licensee notes that after demonstrating stable transmitter performance through six monthly channel checks and six quarterly channel checks, the licensee will discontinue the channel checks for this transmitter classification. Drift trending of calibration data will continue.

3.2.7 Enhanced Surveillance Monitoring Program

The licensee reviewed their enhanced surveillance program for Rosemount transmitters in response to the Supplement. The licensee concluded the enhanced surveillance program satisfies the requested actions of the Supplement. Further, the licensee states the calibration accuracy and the repeatability of measurements taken on-line are adequate to compare to the Rosemount drift limits.

The licensee described their enhanced surveillance program in Reference 4. The program uses the guidelines of Rosemount Technical Bulletin No. 4 and consists of the following.

1. Training instrument and controls engineering, maintenance, and technical support personnel on the Rosemount fill-oil loss history, symptoms, and the need for prompt identification of failed transmitters.

2. Channel checks using data from the plant computer for redundant channels are performed weekly. Channel checks using test instruments are performed monthly. The monthly channel checks are on low pressure transmitters and transmitters in standby service, such as the emergency feedwater flow transmitters. The licensee trends this data to look for possible signs of fill-oil loss.

3. Trending zero and span shift using calibration data.

4. Scheduling additional transmitter calibrations in response to noted drift that does not exceed the Rosemount drift limits.

5. Review of plant computer post-mortem reports following unit transients that result in reactor trips or safety injection actuations. This compares the response times for:

   2 charging pump discharge flow transmitters
   4 pressurizer pressure transmitters

   3 pressurizer level transmitters

   12 steam generator level transmitters

6. Technicians look at transmitter response time when calibrating the transmitters.

7. A quantitative response time test is performed on suspect transmitters to verify the loss of fill-oil. This test incorporates the guidelines of Rosemount Technical Bulletin No. 4.

The licensee description of their enhanced surveillance program meets the reporting requirements of the Supplement and is acceptable

The licensee states, in Reference 3, that the enhanced surveillance program identified three Rosemount transmitters which had experienced loss of sensor fill-oil. The licensee later confirmed these transmitters had failed due to loss of fill-oil.

Based on the surveillance program described by the licensee, the enhanced surveillance program is 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.

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, North Atlantic Energy Service Corporation (T. C. Feigenbaum) to NRC, "Response to NRC Bulletin 90-01, Supplement 1, (TAC M85441)," March 3, 1993, NYH-93037.

4. Letter, New Hampshire Yankee Division of Public Service Company of New Hampshire, "Response to NRC Bulletin No. 90-01, 'Loss of Fill-oil in Transmitters Manufactured by Rosemount'," July 17, 1990, NYH-90139.

5. Letter, North Atlantic Energy Service Corporation (T. C. Feigenbaum) to NRC, "Response to Request for Additional Information (TAC M85441)," July 15, 1994, NYH-94076.