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EVALUATION OF UTILITY RESPONSE TO
SUPPLEMENT 1 TO NRC BULLETIN 90-01:
WOLF CREEK

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TECHNICAL EVALUATION REPORT

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

Docket No. 50-482

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SUMMARY

This report documents the EG&G Idaho, Inc., review of the Wolf Creek Nuclear Generating Company submittals that respond to Supplement 1 to NRC Bulletin 90-01 for the Wolf Creek Generating 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 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.

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	8
4. CONCLUSIONS	13
5. REFERENCES	14

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

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 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 Wolf Creek Nuclear Operating Company, the licensee for the Wolf Creek Generating Station, responded to Supplement 1 of NRC Bulletin 90-01 with a letter dated March 4, 1993 (Reference 3). The licensee provided clarification and additional information on March 8, 1994 (Reference 4). This technical evaluation report evaluates the completeness of those submittals. It also determines whether the 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 provided a response to Supplement 1 of NRC Bulletin 90-01 on March 4, 1993. The licensee supplemented that information on March 8, 1994. Those responses were compared to the Bulletin Reporting Requirements and Requested Actions as described below. In Reference 3, the licensee reports having 135 Rosemount transmitters that are subject to the Requested Actions of the Supplement. The licensee included two transmitters that are not safety-related in this count of transmitters. Other Rosemount transmitters are outside the scope of the Supplement due to replacement or refurbishment. In Reference 4, the licensee reported adding an additional Rosemount transmitter to the enhanced surveillance monitoring program. This additional transmitter replaced a Barton transmitter before the NRC issued Supplement 1 to Bulletin 90-01. It was not refurbished before use.

3.1 Evaluation of Licensee Response to Reporting Requirements

The licensee states they have implemented 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 accomplish the Requested Actions.

The licensee states, in Reference 3, that where they do not meet the Supplement requirements, they will increase the surveillance to meet the requirements. A statement that the Requested Actions are complete is included in Reference 3. The two submittals identify where the licensee actions deviate from the Supplement requirements and provide evaluation and justification supporting the appropriateness of the deviation.

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. In this Technical Evaluation Report, the Requested Actions and associated transmitter criteria are summarized in Section 2. The licensee identified a total of 135 transmitters that are in the scope of this review, including two nonsafety-related Rosemount transmitters. The licensee has no Rosemount model 1154 transmitters installed at the Wolf Creek Generating Station. 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 12 Rosemount transmitters from this classification at the Wolf Creek Generating Station. The licensee states that the transmitters in this classification exceed the maturity threshold recommended by Rosemount and endorsed by the NRC. The licensee monitors these transmitters each refueling outage. This methodology uses calibration data obtained using surveillance procedures, with trending of data back to plant startup in September 1985, or the first calibration after installation. The licensee states that all these transmitters use redundant, two-out-of-three, logic. This surveillance methodology is acceptable per Rosemount Technical Bulletin No. 4.

We find that the licensee actions for this transmitter classification are acceptable.

3.2.2 Licensee Response to Requested Action 1.b

In Reference 3, the licensee stated there are four Rosemount transmitters from this classification at the Wolf Creek Generating Station. In Reference 4, the licensee states they replaced one of these transmitters with a transmitter manufactured after July 11, 1989. That replacement is

outside the scope of the Supplement. The licensee replaced one other transmitter in this transmitter classification. However, that transmitter used a Rosemount transmitter manufactured before July 11, 1989. It was not refurbished before use. The licensee monitors this transmitter quarterly. Monitoring consists of comparison and trending between computer point data that represents the signals of redundant transmitters. If the monitored signals show an increasing difference between channels that monitor the same process, the licensee investigates the potential for fill-oil loss further. This monitoring will continue until the transmitter exceeds the maturity threshold with no symptoms of fill-oil leakage. After achieving maturity, this transmitter will be monitored on a refueling basis as described in the next paragraph for two other transmitters in this transmitter classification. Both surveillance methodologies are included in Rosemount Technical Bulletin No. 4.

The remaining two transmitters in this transmitter classification have an operational history that exceeds the psi-month maturity threshold. The licensee monitors these two transmitters each refueling outage. This surveillance also uses calibration data obtained by surveillance procedures. The licensee states that all these transmitters use redundant, two-out-of-three, logic. This surveillance methodology is acceptable per Rosemount Technical Bulletin No. 4.

Reference 4 documented an additional Rosemount transmitter in this classification. This transmitter replaced a Barton transmitter. The licensee includes this transmitter in their enhanced surveillance monitoring program. The calibration data, taken quarterly, is entered into the computer trending program. The licensee reviewed that data for excessive or consistent drift that indicates a transmitter may have lost fill-oil. The licensee will continue review of additional calibration data and trending for loss of fill-oil symptoms as the enhanced surveillance monitoring program continues.

We find that the licensee actions for this transmitter classification are acceptable.

3.2.3 Licensee Response to Requested Actions 1.c and 1.d

The licensee did not distinguish between transmitters in these two classifications. However, the licensee states there are five Rosemount transmitters from these classifications at the Wolf Creek Generating Station. The licensee will monitor these transmitters in this classification that have an operational history that do not exceed the psi-month maturity threshold each refueling outage. This methodology obtains calibration data using surveillance procedures. The licensee trends data back to plant startup in September 1985. This methodology is acceptable per Rosemount Technical Bulletin No. 4.

3.2.4 Licensee Response to Requested Action 1.e

The licensee has 14 Rosemount transmitters meeting the classification requirements for Requested Actions 1.c and 1.d, and exceeding the psi-month maturity threshold. Additionally, the licensee has two Rosemount transmitters that are not safety-related grouped in this classification. At the discretion of the licensee, these 16 transmitters are not part of an enhanced surveillance monitoring program. The Supplement permits this option.

The Supplement requires the licensee to maintain a high degree of confidence that these transmitters remain highly reliable. The licensee states they accomplish this through training of the I&C technicians and operators. Their awareness of symptoms of loss of fill-oil allows the personnel to screen transmitters during calibrations and operations.

3.2.5 Licensee Response to Requested Action 1.f

The licensee states there are 98 Rosemount transmitters from this classification at the Wolf Creek Generating Station. As permitted by the Supplement, the licensee does not include transmitters from this classification in the enhanced surveillance monitoring program.

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 by a combination of I&C technician training and operator awareness of the symptoms of the loss of fill-oil. This training allows personnel to screen transmitters during calibrations and normal operations.

3.2.6 Enhanced Surveillance Monitoring Program

For those transmitters in the enhanced surveillance monitoring program, the licensee uses either of two methodologies. Rosemount Technical Bulletin No. 4 describes both methods. For two transmitters from transmitter classification 1.b monitored quarterly, the operating transmitter data is compared to operating data from redundant transmitters. This data comes from computer monitoring points. For other transmitters included in the enhanced surveillance monitoring program (including one transmitter in transmitter classification 1.b that is monitored quarterly), the licensee establishes the accumulated zero drift trend using calibration data taken from surveillance records. The licensee establishes the drift trends using a computer trending program.

The computer trending program determines the accumulated zero and span drift over time. The licensee obtains surveillance data on a refueling basis, except one transmitter in classification 1.b with quarterly calibrations. The licensee compares the drift for each transmitter to the drift limits of Rosemount Technical Bulletin No. 4. Table A-1, Maximum Allowable Cumulative Drift for 1153/1154 Oil Loss Transmitters, provides limits on the allowable accumulated zero and span shift before the response time deteriorates. The licensee reviews the trended data for anomalies, sustained drift in the same direction, or exceeded zero or span shifts limits. Such anomalies trigger additional actions such as a review of time response data, time response testing, replacement, or additional monitoring.

The licensee monitors two transmitters from transmitter classification 1.b quarterly, using computerized monitoring and trending of drift between redundant channels. This drift is also compared to drift limits established in Rosemount Technical Bulletin No. 4. This surveillance methodology will continue until the transmitters exceed the maturity threshold. The licensee will then use refueling interval calibration data to monitor these transmitters.

We find that the licensee actions for monitoring transmitters in an enhanced surveillance monitoring program are 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 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, Wolf Creek Generating Company (F. T. Rhodes) to NRC, "Response to NRC Bulletin 90-01, Supplement 1: 'Loss of Fill-Oil in Transmitters Manufactured by Rosemount'," March 4, 1993, ET 93-0029.
4. Letter, Wolf Creek Generating Company (F. T. Rhodes) to NRC, "Response to Request for Additional Information Concerning NRC Bulletin 90-01, Supplement 1," March 8, 1994, ET 94-0023.

ENCLOSURE 3

SALP INPUT

FACILITY NAME: WOLF CREEK

SUMMARY OF REVIEW

The staff completed its review of the licensee's response to NRC Bulletin 90-01, Supplement 1 submitted by Wolf Creek Nuclear Operating Company for the Wolf Creek plant. We find the licensee's response for this item acceptable.

NARRATIVE DISCUSSION OF LICENSEE PERFORMANCE - FUNCTIONAL AREA

The initial response provided to the staff was supplemented with additional information to meet the requested actions.

Author: D. Spaulding
Date: April 6, 1994