

EGG-ERTP-11234

TECHNICAL EVALUATION REPORT

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

Docket No. 50-461

Alan C. Udy

Published March 1994

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

Prepared for the
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
Under DOE Contract No. DE-AC07-76ID01570
FIN No. L1695, Task No. 11
TAC No. M85373

SUMMARY

This report documents the EG&G Idaho, Inc., review of the Illinois Power Company submittal that responds to Supplement 1 to NRC Bulletin 90-01 for the Clinton Power 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 where the licensee deviates from the requested actions and the reporting requirements. Exceptions to the requested actions and the reporting requirements are evaluated.

FIN No. L1695, Task No. 11
B&R No. 320-19-15-05-0
Docket No. 50-461
TAC No. M85373

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	7
4. CONCLUSIONS	15
5. REFERENCES	16

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

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 Illinois Power Company, the licensee for the Clinton Power Station, responded to Supplement 1 of NRC Bulletin 90-01 with a letter dated March 5, 1993 (Reference 3). The licensee provided additional information on January 27, 1994 (Reference 4). This technical evaluation report evaluates the completeness of those submittals. It also determines whether proposed surveillance methods are adequate to determine fill-oil loss-caused

degradation of the transmitter. Finally, this report addresses the interval of surveillance proposed by the licensee for any transmitters included in the enhanced surveillance monitoring program.

Many Rosemount transmitter failures have been attributed to the use of stainless steel "O"-rings between the sensing module and the process flanges. Rosemount improved the manufacturing process for transmitters manufactured after July 11, 1989. Those improvements included a limit of the torque applied to the flange bolts. This limits the stress caused in the sensing module by the "O"-ring. Post-production screening, including pressure testing of the sensing module for this potential latent defect, was also implemented at that time. Therefore, as described in Supplement 1 of NRC Bulletin 90-01, those Rosemount transmitters manufactured after July 11, 1989, are not subject to this review.

2. NRC SPECIFIED REQUESTED ACTIONS

The NRC staff specified the following Requested Actions of licensees of operating reactors.

1. Review plant records and identify the following Rosemount transmitters (if manufactured before July 11, 1989) that either are used in or may be used in either safety-related or ATWS mitigating systems.

- Rosemount Model 1153, Series B
- Rosemount Model 1153, Series D
- Rosemount Model 1154

Following identification, the licensee is to establish the following:

- a. For those identified transmitters having a normal operating pressure greater than 1500 psi, and are installed as part of reactor protection trip systems, ESF actuation systems, or ATWS mitigating systems, either replace the transmitter in an expedited manner, or monitor monthly, for the life of the transmitter, using an enhanced surveillance program.

If the identified transmitter exceeds the 60,000 psi-month or the 130,000 psi-month criterion (depending on the range code of the transmitter) established by Rosemount, enhanced surveillance on a refueling (not exceeding 24 months) basis is acceptable. Under this option, justification must be based on the service record and the specific safety function of the transmitter. That justification can be based on high functional reliability provided by redundancy or diversity.

- b. For those identified transmitters having a normal operating pressure greater than 1500 psi, and are installed as part of a safety-related system other than reactor protection trip systems, ESF actuation, or ATWS mitigating systems, either replace the transmitter or monitor quarterly, for the life of the transmitter, using an enhanced surveillance program.

If the identified transmitter exceeds the 60,000 psi-month or the 130,000 psi-month criterion (depending on the range code of the transmitter) established by Rosemount, enhanced surveillance on a refueling (not exceeding 24 months) basis is acceptable. Under this option, justification must be based on the service record and the specific safety function of the transmitter. That

justification can be based on high functional reliability provided by redundancy or diversity.

c. For boiling water reactors (BWR)--

For those identified transmitters having a normal operating pressure greater than 500 psi and less than or equal to 1500 psi, and are installed as part of reactor protection trip systems, ESF actuation systems, or ATWS mitigating systems, either replace the transmitter, or monitor monthly with an enhanced surveillance monitoring program, until the transmitter reaches the designated (by Rosemount) psi-month criterion (60,000 psi-month or 130,000 psi-month, depending on the transmitter range code).

For transmitters that provide signals to the RPS or ATWS trips for high pressure or low water level, the enhanced surveillance must be monthly. For other transmitters in this classification, enhanced surveillance on a refueling (not exceeding 24 months) basis is acceptable. Under this option, justification must be based on the service record and the specific safety function of the transmitter. That justification can be based on high functional reliability provided by redundancy or diversity.

For pressurized water reactors (PWR)--

For those identified transmitters having a normal operating pressure greater than 500 psi and less than or equal to 1500 psi, and are installed as part of reactor protection trip systems, ESF actuation systems, or ATWS mitigating systems, either replace the transmitter, or monitor with an enhanced surveillance monitoring program, until the transmitter reaches the designated (by Rosemount) psi-month criterion (60,000 psi-month or 130,000 psi-month, depending on the transmitter range code) on a refueling (not exceeding 24 months) basis.

d. For those identified transmitters having a normal operating pressure greater than 500 psi and less than or equal to 1500 psi, and are installed as part of a safety-related system other than reactor protection trip systems, ESF actuation, or ATWS mitigating systems, either replace the transmitter or monitor with an enhanced surveillance monitoring program, until the transmitter reaches the designated (by Rosemount) psi-month criterion (60,000 psi-month or 130,000 psi-month, depending on the transmitter range code) on a refueling (not exceeding 24 months) basis.

- e. Those transmitters having a normal operating pressure greater than 500 psi and less than or equal to 1500 psi, and have accumulated sufficient psi-month operating history to exceed the criterion established by Rosemount, may be excluded from the enhanced surveillance monitoring program at the discretion of the licensee. However, the licensee should retain a high level of confidence that a high level of reliability is maintained and that transmitter failure due to loss of fill-oil is detectable.
 - f. Those transmitters having a normal operating pressure less than or equal to 500 psi may be excluded from the enhanced surveillance monitoring program at the discretion of the licensee. However, the licensee should retain a high level of confidence that a high level of reliability is maintained and that transmitter failure due to loss of fill-oil is detectable.
2. Evaluate the enhanced surveillance monitoring program. The evaluation is to ensure the measurement data has an accuracy commensurate with the accuracy needed to compare the data to the manufacturers drift data criteria. It is this comparison that determines the degradation threshold for loss of fill-oil failures of the subject transmitters.

The Supplement also states the NRC may conduct audits or inspections in the future to verify compliance with the established requirements.

3. EVALUATION

The licensee responded to Supplement 1 of NRC Bulletin 90-01 on March 5, 1993. The licensee supplemented that information on January 27, 1994. Those responses were compared to the Bulletin Reporting Requirements and Requested Actions as described below. The licensee reports on 79 Rosemount transmitters that are subject to 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 they comply with Supplement 1 of NRC Bulletin 90-01, with one exception. The licensee is extending the surveillance interval of 20 transmitters included in transmitter classification 1.c to a refueling interval. The licensee provided justification for that extension on January 27, 1994. Included with the licensee submittals are clarification, interpretation, and the limits placed on their commitments. The licensee described the specific actions taken to implement the Requested Actions.

A statement that the Requested Actions are complete is included in Reference 3. The submittals identify where the licensee action deviates from the requirements of the Supplement. 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. This Technical Evaluation Report summarizes the Requested Actions and the associated transmitter criteria in Section 2. The licensee discussed a total of 79 transmitters in the scope of this review. This total did not include additional Rosemount transmitters grouped in transmitter classifications 1.e

and 1.f at the Clinton Power Station. The reason given for this omission was that the Supplement permits licensee discretion in excluding transmitters in these classifications from the enhanced surveillance monitoring program. The following sections discuss the licensee response to the Supplement.

3.2.1 Licensee Response to Requested Action 1.a

The licensee states there are no Rosemount transmitters from this classification at the Clinton Power Station.

3.2.2 Licensee Response to Requested Action 1.b

The licensee states there are two Rosemount transmitters from this classification at the Clinton Power Station. The Supplement requires quarterly surveillance in an enhanced surveillance monitoring program for transmitters in this transmitter classification.

The licensee includes these transmitters in an enhanced surveillance monitoring program. That program compares redundant channels at least quarterly. Thus, the licensee conforms with the requirements of this transmitter classification.

3.2.3 Licensee Response to Requested Action 1.c

The licensee notes three divisions of transmitters, totaling 66 transmitters, at the Clinton Power Station in this transmitter classification.

The licensee discusses 13 transmitters that initiate RPS or ATWS trips for high reactor pressure or low reactor water level. The Supplement requires monthly enhanced surveillance for these transmitters until transmitter replacement.

These 13 transmitters participate in an enhanced surveillance monitoring program. The licensee compares redundant channels at least monthly. Thus, the licensee conforms with the requirements of this transmitter classification for these 13 transmitters.

The licensee discusses 33 transmitters in this classification that do not initiate RPS or ATWS trips for high reactor pressure or low reactor water level. The Supplement requires monthly enhanced surveillance for these transmitters until the transmitter is either replaced or has an operational history exceeding its psi-month maturity threshold. With adequate justification, the surveillance interval can be up to a refueling interval, not exceeding 24 months.

These 33 transmitters participate in an enhanced surveillance monitoring program. The licensee compares redundant channels at least monthly. Thus, the licensee complies with the requirements of this transmitter classification for these 33 transmitters.

The licensee discusses an additional 20 Rosemount transmitters in this transmitter classification. These 20 transmitters either operate off-scale during plant operation or have no redundant transmitter. Thus, comparison between redundant channels is not possible while the unit is operating. Instead, the licensee trends the accumulated zero and span drift at least once per refueling cycle. The licensee provided justification for extending the surveillance interval in Reference 4. The following paragraphs examine those justifications, grouped by application.

High Pressure Core Spray Minimum Flow Valve Control

Transmitters E22N051 and E22N056 provide pressure and flow signals respectively to the high pressure core spray minimum flow valve control system. Neither transmitter has a redundant channel. However, the operator can manually adjust the minimum flow valve from the control room. Sluggish transmitter response (due to the loss of fill-oil) would not prevent the

minimum flow valve from operating. Sluggish transmitter response would cause a corresponding delay in the response of the valve. The minimum flow valve has quarterly testing.

Transmitters E22N051 and E22N056 do not operate at pressure during reactor operation, and have no redundant channels. Hence, comparison to redundant operating channels is not possible. The licensee confirmed the stability of these transmitters. The operational history shows no adjustments since 1936 (E22N051) and 1989 (E22N056). Since the transmitters seldom operate at pressure, their total accumulated psi-month operational history is low. Because of this, the transmitters do not have a large exposure to the loss of fill-oil mechanism.

Based on the justification provided by the licensee, monitoring these two transmitters on a refueling basis is acceptable.

Reactor Water Cleanup Differential Flow Isolation

Transmitter E31N077B is one of six transmitters (two channels of three transmitters) measuring the reactor water cleanup differential flow. The other five transmitters are Rosemount transmitters manufactured after July 11, 1989. Transmitter E31N077B provides a signal (one of three) to channel B. Either channel A or channel B isolates the reactor water cleanup flow on a high differential flow. This transmitter has no local display. Thus, the licensee cannot easily compare the transmitter output signal to a redundant signal. The licensee documented the stability of this transmitter. The operational history shows no adjustments since 1989.

Based on the justification provided by the licensee, monitoring this transmitter on a refueling basis is acceptable.

Reactor Core Isolation Cooling Isolation

Three of four Rosemount transmitters that initiate isolation of the reactor core isolation cooling (RCIC) system and trip the RCIC turbine are subject to the Requested Actions of the Supplement. The fourth (E31N084B), a Series 1152 transmitter, is not subject to the Supplement. Transmitters E31N084A and E31N084B monitor the steam flow to the turbine. As this system is not normally operating, there is no means to compare the operating signals of the redundant channels. Transmitters E31N085A and E31N085B monitor the steam pressure. These redundant transmitters are normally off-scale (high). Thus, there is no means to compare the operating signals of the redundant channels. Either channel will initiate the system isolation and trip the RCIC turbine on decreasing steam pressure. The licensee confirmed the stability of these transmitters. The operational history shows no adjustments since 1990 (E31N084A), 1989 (E31N085A), and 1987 (E31N085B). Either differential temperature (RCIC room/steam tunnel) or high ambient temperature performs the same isolation and trip functions.

Based on the justification provided by the licensee, monitoring these three transmitters on a refueling basis is acceptable.

Main Steamline Isolation Valve Leakage Control

Twelve of the subject transmitters measure pressure after a main steamline isolation valve (MSIV) closure. These transmitters provide a permissive signal to allow the operator to start the MSIV leakage control system. During reactor operation, these transmitters are off-scale (high). There are no redundant transmitters. These transmitters do not initiate an automatic safety function. The operation of the leakage control system is manual. Consequently, immediately following a MSIV closure, the leakage control system is not in operation. Thus, sluggish response (due to the loss of transmitter fill-oil) will not negate the system function. The licensee states these twelve transmitters have shown stability, with no past sustained drift in evidence.

Based on the justification provided by the licensee, monitoring these twelve transmitters on a refueling basis is acceptable.

Low Pressure Core Spray/Low Pressure Coolant Injection -- Injection Valve Permissive to Open

The licensee discussed four transmitters that monitor the reactor pressure. As the reactor pressure drops past 472 psi, the low pressure core spray (LPCS)/low pressure coolant injection (LPCI) injection valves receive a permissive to open. Either of two transmitters (B21N097A or B21N078A) generates a permissive signal to permit the LPCS/LPCI 'A' injection valve to open. Either of two transmitters (B21N097B or B21N078B) generates a permissive signal to permit the LPCS/LPCI 'B' and 'C' injection valves to open. All four transmitters are subject to the Supplement. Wide-range transmitters B21N078A and B21N078B have monthly surveillance as directed in the Requested Actions. Narrow-range transmitters B21N097A and B21N097B operate off-scale (high) during reactor operation. No useful channel comparison is possible during reactor operation for these two transmitters. Therefore, the licensee monitors these two narrow-range transmitters using zero and span drift data, taken during refueling outage calibrations. Sluggish response (due to the loss of fill-oil) of either of these transmitters would have no effect unless the wide-range transmitters (monitored monthly) also failed. The licensee states these transmitters have a stable operating history, with no adjustments since 1987.

Based on the justification provided by the licensee, monitoring these two transmitters on a refueling basis is acceptable.

3.2.4 Licensee Response to Requested Action 1.d

The licensee states there are 11 Rosemount transmitters from this classification at the Clinton Power Station. The Supplement requires surveillance in an enhanced surveillance monitoring program for transmitters

in this transmitter classification on a refueling interval, not exceeding 24 months. These 11 transmitters participate in an enhanced surveillance monitoring program. The licensee trends the accumulated zero and span drift at least once per refueling cycle. The licensee compares the total transmitter drift to the Rosemount drift data criteria. This satisfies the requirements of the Supplement for this transmitter classification and is, therefore, acceptable.

3.2.5 Licensee Response to Requested Action 1.e

At the discretion of the licensee, Rosemount transmitters in this transmitter classification are not part of an enhanced surveillance monitoring program. The Supplement permits this action.

The Supplement requires the licensee to maintain a high degree of confidence that these transmitters remain highly reliable. The licensee states they monitor and trend periodic calibration data. The surveillance program used by the licensee includes channel checks and recording of channel indication. The licensee states that this surveillance provides the needed confidence for transmitters in this transmitter classification. Additionally, the licensee states these actions are consistent with other utilities.

3.2.6 Licensee Response to Requested Action 1.f

At the discretion of the licensee, Rosemount transmitters in this transmitter classification are not part of an enhanced surveillance monitoring program. The Supplement permits this action.

The Supplement requires the licensee to maintain a high degree of confidence that these transmitters remain highly reliable. The licensee states they monitor and trend periodic calibration data. The surveillance program used by the licensee includes channel checks and recording of channel indication. The licensee states that this surveillance provides the needed

confidence for transmitters in this transmitter classification. Additionally, the licensee states these actions are consistent with those of other utilities.

3.2.7 Enhanced Surveillance Monitoring Program

The licensee states they will continue monitoring the subject transmitters in the enhanced surveillance monitoring program until either of two events occur.

- a. A replacement transmitter manufactured after July 11, 1989, is installed.

Transmitters manufactured after July 11, 1989, are outside the scope of the Supplement. Therefore, excluding replacement transmitters from the enhanced surveillance monitoring program is acceptable.

- b. The transmitter reaches its appropriate psi-month threshold.

As clarified in Reference 4, this statement applies to transmitter classifications 1.c and 1.d. The two transmitters in classification 1.b will remain in the enhanced surveillance monitoring program until replaced.

The licensee describes two methods of detecting loss of fill-oil in Rosemount transmitters. Both methods follow the guidance in Rosemount Technical Bulletin No. 4.

- a. Monitoring redundant transmitter channels (monthly or quarterly).
- b. Trending the accumulated zero and span drift (refueling interval).

The licensee states that both methods provide the appropriate measurement data. The licensee states the data accuracy is consistent with the Rosemount drift data criteria. Rosemount Technical Bulletin No. 4 describes both methods. As the licensee follows the recommendations of Rosemount Technical Bulletin No. 4, the enhanced surveillance monitoring program at the Clinton Power Station is acceptable.

4. CONCLUSIONS

Based on our review of the licensee submittals, we find 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, Illinois Power Company (J. S. Perry) to NRC, "Illinois Power's Response to Bulletin 90-01, Supplement 1, 'Loss of Fill-Oil in Transmitters Manufactured by Rosemount'," March 5, 1993, JSP-0102-93.
4. Letter, Illinois Power Company (J. S. Perry) to NRC, "Illinois Power's Supplemental Response to Bulletin 90-01, Supplement 1, 'Loss of Fill Oil in Transmitters Manufactured by Rosemount'," January 27, 1994, JSP-040-94.