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L I C E N S E E E V E N T R E P O R T (L E R)

FACILITY NAME (1) Arkansas Nuclear One, Unit One DOCKET NUMBER (2) / PAGE (3)
01510101 31 1 3110F1017

TITLE (4) Potential Degradation Of Environmental Boundary Seal On Rosemount Instrumentation Transmitters Due To Rotation Of The Electronics Housing After Assembly

EVENT DATE (5)			LER NUMBER (6)		REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)							
Month	Day	Year	Sequential Number	Revision Number	Month	Day	Year	Facility Names	Docket Number(s)						
01	04	01	01	01	01	09	21	01	08	08	ANO-2	01510101	31	01	08
								N/A				01510101			

OPERATING MODE (9) N THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

POWER LEVEL (10)	20.402(b)	20.405(a)(1)(i)	20.405(a)(1)(ii)	20.405(a)(1)(iii)	20.405(a)(1)(iv)	20.405(a)(1)(v)	20.405(c)	50.36(c)(1)	50.36(c)(2)	50.73(a)(2)(i)	50.73(a)(2)(ii)	50.73(a)(2)(iii)	50.73(a)(2)(iv)	50.73(a)(2)(v)	50.73(a)(2)(vii)	50.73(a)(2)(viii)(A)	50.73(a)(2)(viii)(B)	50.73(a)(2)(x)	73.71(b)	73.71(c)	Other (Specify in Abstract below and in Text, NRC Form 366A) Information	

L I C E N S E E C O N T A C T F O R T H I S L E R (1 2)

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C O M P L E T E O N E L I N E F O R E A C H C O M P O N E N T F A I L U R E D E S C R I B E D I N T H I S R E P O R T (1 3)

Cause	System	Component	Manufacturer	Reportable to NPRDS	Cause	System	Component	Manufacturer	Reportable to NPRDS

S U P P L E M E N T R E P O R T E X P E C T E D (1 4)

Yes (If yes, complete Expected Submission Date) No EXPECTED SUBMISSION DATE (15)

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

During a refueling outage on ANO-2, while performing maintenance on an instrumentation transmitter manufactured by Rosemount Incorporated, it was discovered that the environmental qualification (EQ) of the device could be unknowingly affected if the seal on the transmitter sensor module threads, i.e., neck seal, were broken during installation or maintenance activities. The neck seal, established by applying thread sealant (Loctite) to this area can be broken and potentially degraded by rotation of the transmitter electronics housing subsequent to transmitter assembly. Several transmitters were inspected and observed to be misaligned from a nominal orientation indicating the electronics housings may have been rotated. Tests were performed by pressurizing the transmitters internally with nitrogen gas and monitoring for leakage past the neck seal. These tests revealed that some of the transmitters exhibited a small amount of leakage from the seal area. The leaking transmitters were disassembled and repaired by cleaning and applying new thread sealant to the sensor module threads. Prior to this occurrence it was not known that maintenance of the seal formed by the thread sealant was necessary to ensure qualification of transmitters manufactured by Rosemount. These findings are being voluntarily reported for information due to the generic concern related to the discovery of conditions which could affect the EQ of plant equipment.

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LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		Year	Sequential Number	Revision Number	
Arkansas Nuclear One, Unit Two	U 5 0 0 0 3 1 3	8 8 --	0 0 6	0	0 2 0 0 7

TEXT (If more space is required, use additional NRC Form 366A's) (17)

I. Description of Event

A. Plant Status

At the time of discovery of this event, Arkansas Nuclear One, Unit One (ANO-1) was operating at approximately 80 percent power with a reactor coolant system (RCS) pressure of 2155 psig and RCS temperature of 579 degrees Fahrenheit. Arkansas Nuclear One, Unit Two (ANO-2) was shutdown for the sixth refueling outage (2R6).

B. Component Identification

The components discussed in this report are Model Number 1153 and 1154 instrumentation transmitters manufactured by Rosemount Incorporated [R370] and are used for level, flow and pressure measurement and indicating circuits on various plant systems in ANO-1 and ANO-2. The instruments are required to be environmentally qualified to ensure they remain functional during and following d.c. basis events.

C. Sequence of Events

1. ANO-2 Sequence of Events

On April 6, 1988, while performing repairs on an ANO-2 safety injection tank (SIT) water level transmitter [LT], maintenance personnel reviewed the vendor (Rosemount) reassembly procedure in the instruction manual for the transmitter and questions were raised concerning instructions related to sealing requirements for the threaded interface between the transmitter sensor module and electronics housing, i.e., neck seal. Rosemount was contacted for clarification concerning the instruction manual requirements for baking the thread sealant on the neck seal at an elevated temperature following transmitter assembly. During the discussions with Rosemount personnel it was revealed that the neck seal area is an environmental boundary which must be established and maintained to ensure the environmental qualification (EQ) of the transmitter. Additionally, Rosemount also stated that this EQ boundary might be degraded if the electronics housing were rotated after the transmitter was assembled and the environmental boundary seal had been established (see figure 1).

On April 8, inspections of ANO-2 Rosemount transmitter required to be environmentally qualified were initiated to determine if the electronics housing of the installed transmitters were rotated from proper alignment with the sensor module. Sixteen (16) of a total of forty two (42) Rosemount transmitters installed in systems at ANO-2 were determined to exhibit some degree of misalignment (between one degree and nine degrees). To determine if the EQ boundary for the ANO-2 transmitters had been actually affected by misalignment of the sensor module to electronics housing, a work plan was developed to test the transmitters for leakage by pressurizing the electronics housing internally with nitrogen gas and monitoring pressure decay over time. On April 18, two (2) transmitters which were determined to have excessive misalignment were tested, and no leakage was observed. On April 21, a third misaligned transmitter was tested, and a small amount of leakage was observed. A series of leakage tests were then performed on a new spare transmitter at varying degrees of misalignment between the sensor module and electronics housing. The transmitter was tested with orientations of 0 degrees rotation, 2.5 degrees rotation and 5 degrees rotation with leakage being observed at 5 degrees. The remaining 13 ANO-2 transmitters which exhibited some degree of rotation were tested for leakage, and one (1) additional transmitter indicated signs of leakage. Repairs of the ANO-2 transmitters which exhibited leakage were completed on April 24, 1988. On April 30, although not discovered to be misaligned, the remaining Rosemount transmitters on ANO-2 were tested to verify their leak tightness. No additional ANO-2 transmitters were discovered to exhibit leakage.

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FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		Year	Sequential Number	Revision Number	
Arkansas Nuclear One, Unit Two	75010103113	88--	006--	0	03101017

TEXT (If more space is required, use additional NRC Form 366A's) (17)

2. ANO-1 Sequence of Events

On April 25, visual inspections were performed on twenty two (22) of the forty six (46) Rosemount transmitters located in the ANO-1 reactor building which were accessible during power operations, and fourteen (14) were observed to have some degree of misalignment. Five (5) of the misaligned transmitters in the reactor building were tested and no leakage was observed. On April 27, nine (9) transmitters located in the ANO-1 auxiliary building were inspected and five (5) were observed to be misaligned. Leakage testing of the 5 transmitters in the ANO-1 auxiliary building which were misaligned was performed with no leakage noted. The remaining four (4) transmitters in the ANO-1 auxiliary building were tested on May 20 and leakage was noted on one of these transmitters. Repair and subsequent testing of this transmitter was completed on May 26, 1988.

II. Event Cause

A. Event Analysis

The Rosemount transmitters discussed in this report are pressure sensing devices which consist of two major assemblies, the sensor module and the electronics housing. When these parts are assembled at the manufacturing facility, a sealant is applied to the threads of the sensor module, and the electronics housing is then threaded onto the sensor module. Following proper orientation of the two components a jam nut is tightened to prevent further rotation of the electronics housing. When the sealant cured, an environmental boundary seal (neck seal) is formed for the threaded connection. Establishment and maintenance of this boundary is necessary to ensure the EQ of the transmitter.

During the ANO-2 refueling outage it became necessary to replace the sensor module for a SIT water level transmitter. The transmitter was a model number 1154 manufactured by Rosemount Incorporated. Maintenance personnel performing the work were using the instructions contained in Rosemount Instruction Manual 4514, Revision A, for reassembly of the transmitter electronics housing to a new sensor module. The reassembly instructions in the Rosemount manual for 1154 transmitters contained a requirement that following assembly, the unit should be placed in an oven at 200 degrees Fahrenheit and baked for twelve hours to cure the thread sealant on the sensor module neck threads. Review of the maintenance instructions contained in the Rosemount instruction manual for model 1153 transmitters being used by ANO personnel revealed that the requirement to cure the thread sealant at an elevated temperature (200°F) was not contained in that manual. A facility to perform this oven baking step was not readily available and Rosemount Incorporated was contacted to clarify the requirement for curing the thread sealant in this manner. Rosemount personnel stated that the twelve hour baking requirement was a process change in the assembly procedure for the transmitters made at the manufacturing facility in 1984. Rosemount also stated that the baking requirement was not mandatory, because the transmitters which were tested to demonstrate EQ of the instruments had not been baked prior to performance of the qualification tests. It was also noted that the thread sealant manufacturer, Lockite, recommended a twenty four hour cure time at room temperature after applying the sealant and that this technique should be adequate to ensure a proper seal and EQ of the transmitter.

Additional discussions with Rosemount personnel were held concerning the potential for degradation of the neck seal due to rotation of the electronics housing following assembly and curing of the thread sealant (see figure 1). Rosemount indicated that if rotation were to occur the environmental seal provided by the thread sealant could be broken and the EQ of the device could be affected.

It was also noted that a "CAUTION" related to this concern had been added to a subsequent revision of the instruction manual for Rosemount 1154 transmitters in January, 1988. However, at the time of this occurrence, Arkansas Power and Light Company (AP&L) did not have a copy of the revised instruction manual for model 1154 transmitters containing this information and, therefore, prior to these discussions AP&L personnel were not aware of this requirement related to ensuring the EQ of Rosemount transmitters.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (3)			PAGE (3)
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Arkansas Nuclear One, Unit Two	051000313	88	006	0	0140F07

TEXT (If more space is required, use additional NRC Form 366A's) (17)

An inspection of the Rosemount manufacturing facility by AP&L Quality Assurance personnel was performed and revealed that leakage testing of transmitters similar to those used at ANO is performed only on a random basis. Also, although Rosemount does not perform a specific check to ensure alignment of the two major components of the transmitter, inspection of five (5) transmitters at the manufacturing facility and three (3) located in the ANO storeroom at the time of this occurrence indicated that the assemblies are nominally aligned properly, i.e., within one degree.

The pressure test developed to determine if leakage existed on the Rosemount transmitters at ANO consisted of pressurizing the electronics housing internally with nitrogen gas at 60 psig for a minimum of fifteen minutes and observing a test gauge for pressure decay. Also, a leak detection solution was applied to potential leakage paths to identify if leakage existed. The premise of the pressure test was that leakage from inside the electronics housing out to the environment would be similar to leakage into the electronics housing under worst case environmental conditions following an accident.

Pressure tests were performed on forty two (42) ANO-2 Rosemount transmitters which were required to be environmentally qualified. The orientation of the electronics housing to sensor modules for these transmitters varied from 0 degrees rotation to nine degrees rotation. Two of these transmitters leaked slightly. One was rotated 1.5 degrees and the pressure decayed from 60 psig to 21 psig in fifteen minutes during the test. The other transmitter was rotated five degrees and the pressure decayed from 60 psig to 50 psig in 10 minutes.

Pressure tests were also performed on fourteen (14) of the 55 ANO-1 model 1153 and 1154 Rosemount transmitters which are required to be environmentally qualified. The orientation of the electronics housing to sensor modules for these transmitters ranged from 0 degrees to 90 degrees rotation. One of the fourteen (14) transmitters leaked slightly when tested even though the electrical housing was properly oriented (0 degrees) with the sensor module. The pressure decayed from 60 psig to 55 psig in fifteen minutes.

B. Safety Significance

The safety significance of the possible degradation of the environmental boundary seal on Rosemount transmitters relates to the potential for moisture intrusion past the seal (sensor module threads) and into the electronics housing transmitter during postulated accident conditions. Moisture entering this area could affect the operability of the transmitter under these conditions. It is important to clarify that in preceding discussions some emphasis has been placed on the degree of misalignment between the transmitter's sensor module and electronics housing. The specific amount of misalignment between these two components is not by itself critical to the maintenance of EQ of the device. However, since the transmitter components are nominally oriented in a specific manner when the device is assembled at the manufacturing facility and at this time the EQ boundary seal is initially established, subsequent discovery of misaligned components may be indicative of rotation of one of the components which could have degraded the established EQ seal on the threaded portion of the sensor module.

Since ANO-2 was in a refueling shutdown outage at the time of discovery of the potential EQ problem, none of the ANO-2 Rosemount transmitters could be exposed to postulated accident environments, therefore there was no immediate safety significance related to the finding. With respect to the potential safety concern related to plant operation during previous cycles, only two (2) of the total forty two (42) Rosemount transmitters installed on ANO-2 exhibited indication of leakage when pressure tested. The leakage observed on these transmitters during testing was small, indicating that even if the transmitters were postulated to have failed under accident conditions, the time between the initiating event and failure would have been lengthy. Neither of the affected transmitters are required to be operable by the unit's Technical Specifications. Additionally, indications of the parameters monitored by the transmitters would have been available in the control room from other indicating circuits in the unlikely event of an accident and subsequent transmitter failure. Consequently it was concluded that there was no actual safety significance on ANO-2 related to this occurrence.

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FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
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Arkansas Nuclear One, Unit Two	050101313	88--	006--	0	01510107

TEXT (If more space is required, use additional NRC Form 366A's) (17)

ANO-1 was operating at power at the time of discovery of this problem. A total of fifty five (55) Rosemount transmitters which were required to be environmentally qualified were identified as being installed in various systems at ANO-1. Several of the transmitters were inspected and pressure tested, however, because some areas of the reactor building were inaccessible due to radiation levels, it was not possible to inspect or test some of the transmitters. Based on evaluation of the inspections and test results that were performed on both ANO-1 and ANO-2 it was concluded there was reasonable assurance that operability of the transmitters which were not tested was not adversely affected. Factors considered in reaching this conclusion were:

- The required operating time under accident conditions for most of the untested transmitters is a very short period of time such that the devices could perform their safety function well before postulated failures could occur.
- Only a few of the transmitters that were tested had exhibited leakage and the observed leakage rates were small.
- Misalignment of the transmitter components from a nominal orientation did not necessarily indicate that the neck seal had been broken and the EQ of a transmitter had been affected.

Three transmitters required to be operable by the ANO-1 Technical Specifications were identified which had required operating times of thirty days under post accident conditions. Because of the long operating time for these instruments, as a conservative measure, these transmitters were declared inoperable until testing could be performed. The transmitters were pressure tested and verified to have no leakage. Based on the consideration of the factors discussed above there was no actual safety significance on ANO-1 as a result of this occurrence.

The major potential safety concern related to this occurrence is that the operability of several plant instruments relied upon for long term operation under post accident conditions could be comprised because of the previously unidentified requirement to ensure the seal between the sensor module and electronics housing of Rosemount transmitters is maintained. If this requirement is not considered or addressed in the plant's modification process or maintenance program the potential exists to unknowingly affect the EQ of the transmitters during installation or maintenance activities.

C. Root Cause

Although not conclusively determined, rotation of the sensor modules for the Rosemount transmitters most likely occurred during initial installation of the instruments. The root cause was that the need to maintain the neck seal was not clearly identified by Rosemount in either the qualification test reports for the instruments or in the instruction manuals providing guidance on installation and maintenance of the transmitters.

D. Reportability

These findings are being voluntarily reported for information due to the generic concern related to the discovery of conditions which could affect the EQ of plant equipment

III. Corrective Actions

A. Immediate

Upon discovery of this potential problem, Rosemount Incorporated was contacted to determine the specific requirements and basis for establishing and maintaining the transmitter's neck seal and EQ

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FACILITY NAME (1) Arkansas Nuclear One, Unit Two	DOCKET NUMBER (2) 0151010101 1 3	LER NUMBER (6)			PAGE (3) 01610F1017
		Year 81 8--	Sequential Number 0 0 6--	Revision Number 0 0	

TEXT (If more space is required, use additional NRC Form 366A's) (17)

B. Subsequent

Inspections and tests were performed on forty two (42) ANO-2 Rosemount transmitters which are required to be environmentally qualified. The two transmitters discovered to have a small amount of leakage were disassembled, the sensor module threads were cleaned and the transmitter was reassembled with thread sealant applied to the sensor threads. During reassembly the electronics housings were properly oriented with respect to the sensor module. Repairs for the ANO-2 transmitters were completed on April 24.

A list was compiled of fifty five (55) ANO-1 Rosemount transmitters which are required to be environmentally qualified. Inspections were performed on twenty two (22) accessible transmitters located in the reactor building. A pressure test was performed on five (5) of these twenty two (22) transmitters and none were found to exhibit leakage. Inspections and pressure tests were performed on 9 transmitters located in the auxiliary building with one exhibiting a small amount of leakage. This transmitter was disassembled, the sensor module threads were cleaned and the transmitter was reassembled and tested with the electrical housing properly oriented with respect to the sensor module.

AP&L requested and obtained a copy of the most recent revision of the Rosemount Incorporated Instructions Manual for model 1154 transmitters. This manual was placed in the AP&L EQ files for Rosemount transmitters.

C. Future

The ANO-1 Rosemount transmitters required to be environmentally qualified which were not tested will be inspected and tested during the refueling outage currently in progress at this time. Repairs will be made as necessary.

IV. Additional Information

A. Similar Events

There have been no previous similar events reported.

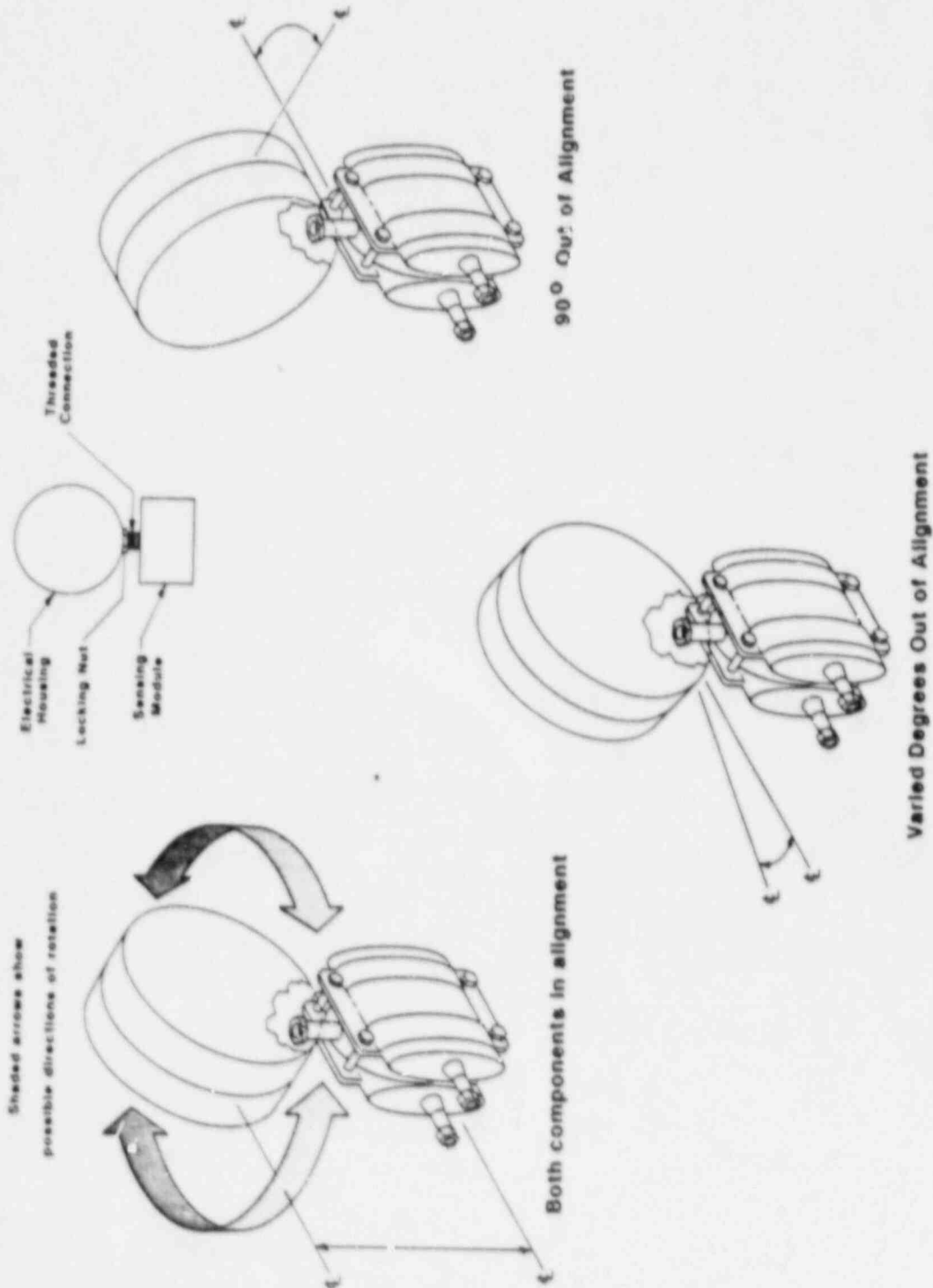
B. Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1) Arkansas Nuclear One, Unit Two	DOCKET NUMBER (2) 05101013113	LER NUMBER (6)			PAGE (3) 017107
		Year 88--	Sequential Number 006--	Revision Number 0	

TEXT (If more space is required, use additional NRC Form 366A's) (17)

FIGURE 1





ARKANSAS POWER & LIGHT COMPANY

September 20, 1988

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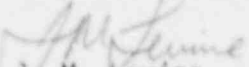
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Document Control Desk
Washington, D. C. 20555

SUBJECT: Arkansas Nuclear One - Units 1 and 2
Docket No. 50-313/50-368
License No. DPR-51 and NPF-6
Licensee Event Report No. 50-313/88-006-00

Gentlemen:

Attached is the subject voluntary report concerning the potential for degradation of an environmental boundary seal on instrumentation transmitters manufactured by Rosemount Incorporated due to rotation of the transmitter electronics housing after assembly.

Very truly yours,


J. M. Levine
Executive Director,
Nuclear Operations

JML:PCR:cp
attachment

cc w/att: Regional Administrator
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(Rev. 4/29/88)