NRC Form 366
(9-83)

U.S. Nuclear Regulatory Commission
Approved OMB No. 3150-0104
Expires. 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Arkansas Nuclear One, Unit Two

DOCKET NUMBER (2) 0|5|0|0|0| 3| 6| 8 PAGE (3) 1 OF 0|9

TITLE (4) Unisolatable Reactor Coolant System Leak Caused By Vibration Induced Fatigue Failure of A Reactor Coolant Pump Seal Instrumentation Line

EVENT DATE (5) Month	Day	Year	LER NUMBER (6) Year	Sequential Number	Revision Number	REPORT DATE (7) Month	Day	Year	OTHER FACILITIES INVOLVED (8) Facility Names	Docket Number(s)
0 8	0 1	8 8	8 8	-- 0 1 1	-- 0 0	0 9	0 8	8 8	N/A	0 5 0 0 0
									N/A	0 5 0 0 0

OPERATING MODE (9): 1

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

POWER LEVEL (10): 1|0|0

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

LICENSEE CONTACT FOR THIS LER (12)

Name	Telephone Number (Area Code)
Larry A. Taylor, Nuclear Safety and Licensing Specialist	5|0|1|9|6|4|-|3|1|0|0

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

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

SUPPLEMENT REPORT EXPECTED (14)

[ ] Yes (If yes, complete Expected Submission Date) [X] No

EXPECTED SUBMISSION DATE (15): Month | Day | Year

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

On 8/1/88, a Notification of Unusual Event was declared and a manual reactor trip and plant cooldown performed following the failure of a reactor coolant pump (RCP) seal cavity pressure sensing instrument line. The sensing line failure, located at the fusion line of a 3/8 inch instrument tubing to 3/4 inch piping reducer socket weld, resulted in a reactor coolant system (RCS) leak of approximately 20 gallons per minute (gpm). The pump shaft seal also degraded following the sensing line failure and contributed to additional RCS leakage. The maximum leak rate during the event was approximately 40 gpm. A high pressure safety injection pump was used in addition to normal charging pump operations to maintain pressurizer level during the rapid, controlled cooldown. The cause of the sensing line failure was low stress, high cycle, fatigue failure of the weld induced by vibration associated with the operating RCP. Corrective actions included RCP seal piping and tubing system configurations reviews which resulted in modifications and weld betterments to reduce susceptability of the systems to vibration induced stress. Long term actions include evaluation of an improved RCP seal design incorporating the use of flexible hoses for process piping connections and other features to minimize the potential for failures of this type and the resulting leaks.

I. Description of Event

A. Status

At the time of occurrence of this event, Arkansas Nuclear One-Unit 2 (ANO-2) was in Mode 1 (Power Operation) with reactor power at approximately 100 percent. Reactor coolant system (RCS) temperature was 580 degrees Fahrenheit and RCS pressure was approximately 2250 psia. The unit had been operating at full power for approximately 36 hours following startup after a maintenance outage unrelated to this event.

B. Component Identification

This event involves the failure of reactor coolant pump (RCP) 2P32A middle seal cavity pressure sensing instrument line. The failure occurred in 3/8 inch instrumentation tubing [TBG] at the fusion line of a tubing to piping reducer socket weld. The tubing/reducer assembly allows connection of a pressure transmitter [PT] to a 3/4 inch ASME Section III Class III pipe connected to the middle seal cavity of the shaft seal for the RCP. The transmitter is used to provide remote indication of middle seal cavity pressure in the control room. The transmitter also provides an input signal to the plant computer.

C. Sequence of Events

At approximately 1635 on 08/01/88, a socket weld on a pressure sensing line connected to the middle seal cavity of the shaft seal for RCP 2P32A developed a leak resulting in a small RCS [AB] leak to the containment atmosphere. At 1645, the controlled bleedoff (CBO) low flow alarm for 2P32A annunciated in the control room alerting the control room operators to the problem. In response to the alarm, the operators monitored the control room indications of the RCP seal parameters and observed that CBO flow from the 2P32A pump seal had decreased from a normal valve of approximately one gallon per minute (gpm) to an indicated value of approximately .5 gpm. Also, the seal cavity pressures were noted to be abnormally low and were starting to oscillate. The problem was diagnosed as being a leak on one of the seal cavity pressure sensing lines. Actions were immediately initiated to prepare for personnel to enter the containment building and isolate the affected line if possible. At approximately 1654, the 2P32A CBO high temperature alarm annunciated indicating excessive temperature of the water in the CBO line. The 2P32A middle seal cavity pressure had decreased to 0 psia and CBO flow was indicating approximately 0 gpm. Based on these indications and continued observation of the seal parameters it was evident that the integrity of the RCP shaft seal was degrading with time. Actions were initiated to perform a controlled plant shutdown. Over the next few minutes the seal continued to degrade and by 1700, pressure in the upper two shaft seal cavities had increased to approximately RCS pressure. At 1702, the control room operators manually tripped the reactor and main turbine in preparation for securing the RCP. At 1703, 2P32A was stopped to prevent further damage to the shaft seal.

The emergency feedwater system [BA] actuated automatically on normal post trip steam generator (S/G) water level response and was used to provide feedwater to the S/G's. Other plant systems responded normally to the trip and the plant was stabilized in hot standby (Mode 3). The RCS leak rate at this time was estimated to be approximately 20 gpm. As a result, at 1725, a Notification of Unusal Event (NUE) was declared due to RCS leakage being greater than the Technical Specification allowable leakage of 10 gpm. The NRC was notified of the manual reactor trip and declaration of a NUE.

An RCS cooldown from the hot standby temperature of 545° Fahrenheit to a temperature of approximately 530° Fahrenheit was initiated to allow depressurization of the RCS in an attempt to decrease the leakage from the seal. At 1754, a licensed operator and health physics technician entered the containment building to attempt to locate and isolate the leak. After entering the containment, these personnel determined that access to the area of 2P32A was not possible due to the amount of steam present in the area from the leak. At 1800, the personnel exited the containment building. At 1850, an RCS cooldown to cold shutdown was initiated at the maximum rate allowed by Technical Specifications, ie, approximately 100 degrees Fahrenheit per hour. The RCS leak rate at this time had increased to a maximum value of approximately 40 gpm.

At 1912, in order to compensate for the combined affects on RCS inventory of the cooldown and mass loss from the RCS leak, a high pressure safety injection (HPSI) pump [BJ] was manually started and one motor operated HPSI cold leg injection valve was throttled open. The HPSI pump, with suction being supplied from the refueling water tank and injecting into an RCS cold leg, was used in conjunction with three operating charging pumps to maintain pressurizer level during the remainder of the cooldown. The plant cooldown was continued and at 2141, the plant entered Mode 4 (Hot Shutdown) with RCS temperature less than 300° Fahrenheit and RCS pressure at approximately 350 psia. At 2304, personnel entered the containment building and were able to access the area around 2P32A. These personnel discovered that the middle seal cavity pressure sensing line for the pump was severed downstream of a manual isolation valve in the line. The manual isolation valve was closed to isolate the leak path, however, at this time it was observed that RCS leakage also existed from the upper seal area around the pump shaft. Following isolation of the broken middle seal cavity pressure sensing line, the RCS leak rate decreased but still remained greater than 10 gpm. The RCS cooldown and depressurization was continued and at approximately 2348, the shutdown cooling system [BP] was placed in service for decay heat removal. Cold shutdown (Mode 5) was reached at 0055 on 8/2/88. At 0144, with RCS pressure at 50 psia the RCS leak rate was estimated to be approximately 12 gpm. By 0535, the RCS leak rate had decreased to less than 10 gpm and the NUE was terminated. The RCS was depressurized to atmospheric conditions and drained down in preparation for seal replacement and repair of the damaged sensing line.

II. Event Cause

A. Event Analysis

The four ANO-2 Reactor Coolant Pumps are Byron Jackson, vertical shaft, single-suction, single stage centrifugal pumps. The pumps are located in a two loop RCS piping arrangement containing two pumps per loop. To prevent RCS leakage from around the pump shaft, the pump is equipped with four series mechanical seals, i.e., a lower, middle, upper and vapor seal (see Figure 1). Three of the seals are used to contain reactor coolant pressure; the fourth, while capable of withstanding full system pressure, is used as a backup vapor seal. Located in parallel with the RCP seals are pressure reducing devices. The purpose of these pressure reducing devices is to divide RCS pressure equally among the seals. The mechanical seals are lubricated and cooled by a controlled one gpm reactor coolant leakage, i.e., controlled bleedoff (CBO) flow. Reactor coolant leakage enters the seal area through a labyrinth located in the hydrostatic bearing area. Also located in this area is a heat exchanger which cools the labyrinth area. This heat exchanger is cooled by component cooling water. Once in the seal area, the reactor coolant leakage is picked up by the seal area recirculation pump and is discharged to the inner tubes of a concentric coil heat exchanger. The seal area recirculation pump has a flow rate of approximately 40 gpm. The outer tubes of the concentric heat exchanger are supplied with component cooling water. Once cooled, the seal recirculation water is used to cool the outer shell of the seals and is returned to the seal recirculation pump. Approximately 39 gallons of the 40 gpm goes through the recirculation system, as described above, and the other gallon is passed to the seals. Of the one gpm that passes into the seal area, less than 1% passes through the seal faces for lubrication, and more than 99% passes through the pressure reducing devices. This one gpm CBO flow is collected in an area above the third seal and routed to the Chemical and Volume Control System [CB] (CVCS) volume control tank (VCT). The water is then returned to the RCS by the charging system as part of normal RCS makeup. A small amount of leakage passes through the vapor seal stage to the reactor drain tank. CBO flow from each RCP is displayed and recorded on chart recorders in the control room. Additionally, other RCP seal parameters such as CBO water temperature and seal cavity pressures are displayed and recorded. Control room alarms (visual and audible annunication) are provided for CBO low/high flow and high temperature conditions. The seal parameter indications are obtained from flow, temperature, and pressure instruments connected to the RCP shaft seal by piping and tubing systems. The following piping systems are attached to each RCP.

- Cavity Pressure Sensing Lines (upper and middle cavity)
- Controlled Bleed-off Line (CBO)
- Seal Injection Line
- Component Cooling Water (CCW)
- Inner Gasket Leak-off Detection Line
- Seal Vapor Stage Leak-off Line

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LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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Arkansas Nuclear One, Unit Two	0|5|0|0|0| 3| 6| 8	8| 8	0| 1| 1	0| 0	0|4 OF 0|9

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

Each pump has separate pressure sensing lines connected to the upper seal cavity, middle seal cavity and CBO line. The purpose of these lines (ASME section III class III piping, seismic category I) is to allow the operator to monitor RCP seal performance. By reading the pressure in the two cavities and CBO line, the operators are able to assess the seal staging performance by determining how much pressure is dropped across the seal stages. Downstream of normally open manual isolation valves, 3/4 inch piping attached directly to the seal assembly is welded to 3/8 inch OD instrumentation tubing which is then routed to the pressure sensing instruments. If the pressure sensing capability is lost for either of the cavities or bleedoff line, CBO flow and temperature indications are available to allow the operator to assess integrity of the seal stages. Failures in the cavity pressure sensing lines resulting in leakage is detected by low CBO flow and high CBO temperature (due to flow diversion from the normal CBO path) and by using other installed RCS leakage detection systems. Each of the pressure sensing lines tap the seal cavities via a 1/4 inch hole in the seal pressure breakdown devices. Under normal operation with RCS pressure at a nominal value of 2250 psia, the middle seal sensing line should see approximately 1475 psia, while the upper cavity would be at approximately 750 psia. Temperature of the reactor coolant in these seal areas is normally approximately 130 degrees Fahrenheit.

A review and analysis of the seal performance data for 2P32A obtained from the control room chart recorder of the seal parameters, indicates that a small leak developed in the 2P32A middle seal cavity pressure sensing line approximately 10 minutes prior to the actuation of the first control room annunciator alarm (CBO flow low) which alerted the operators that a problem existed. The leak apparently started as a partial failure of the 3/8 inch tubing to 3/4 inch pipe weld and eventually propagated to a complete severance of the line approximately 10 minutes after the initial leak. Several small RCP seal sensing line leaks had previously occurred at ANO-2 during plant operation and the control room operators were familiar with the indications produced by such leaks. This past experience led to the prompt and accurate diagnosis of the problem by the operations staff. However, during previous occurrences of this type, sufficient time has been available for personnel to enter the containment building and isolate the leak prior to any significant seal damage occurring. A minimum time period of approximately one hour is usually necessary to prepare for and perform a containment entry with the plant operating at power. Additionally, unlike this event, previous sensing line leaks have not resulted in complete circumferential failures of the associated piping or tubing or prevented an orderly, controlled plant shutdown.

Following the complete severance of the middle seal cavity sensing line, the indicated seal parameters became extremely erratic as pressures, flow and temperature changed in various areas of the seal assembly. The shaft seal capability degraded over the next several minutes due to loss of normal cooling to the seal stages until eventually the last two seal stages (upper and vapor seal) were indicating approximately RCS pressure. With these indications present, the operators followed the guidance contained in the abnormal operating procedure for RCP seal failures and manually tripped the reactor and stopped the affected RCP. The total RCS leak rate at this time was estimated to be approximately 20 gpm and increasing. The leak rate subsequently increased to a maximum value of approximately 40 gpm during the next hour after securing the pump. The cause of this increased leak rate after securing the pump was most likely due to continued degradation of the seal components and increased leakage past the vapor seal to the containment building atmosphere.

Response of plant systems to the reactor trip were normal. An RCS cooldown and depressurization to approximately 530° Fahrenheit was immediately initiated by dumping steam to the main condenser. The cooldown was momentarily terminated at this point to allow for boration of the RCS to the required cold shutdown boron concentration to ensure adequate reactor shutdown margin was maintained. Additionally, personnel were completing preparations to enter the containment building to determine if the leak could be isolated. Upon completing the RCS boration and determining that the area around 2P32A was inaccessible the RCS cooldown was recommenced.

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

Due to contraction of the reactor coolant during the rapid cooldown of the RCS in conjunction with the RCS mass loss from the leak, the use of a high pressure safety injection (HPSI) pump in combination with the three operating charging pumps became necessary to adequately maintain pressurizer level. One HPSI pump was manually started and a motor operated RCS cold leg injection valve was throttled open to provide makeup flow to the RCS. During the cooldown, the RCS leak rate decreased as RCS pressure was reduced. By 2300, with RCS pressure at approximately 320 psia, the leak rate was estimated to be approximately 20 gpm. Following the containment building entry and isolation of the severed middle seal cavity pressure sensing line, the RCS leak rate decreased, however, personnel performing the evolution noted a significant amount of leakage existed past the pumps' vapor seal to atmosphere. The leak rate continued to decrease as RCS pressure was reduced and was eventually terminated when system pressure reached atmospheric and the RCS was drained down below the seal area.

B. Safety Significance

This event represented a challenge to plant safety equipment, operating procedures and especially to the Operations staff of the unit. No major malfunctions of necessary plant equipment occurred during or following the reactor trip from full power or during the subsequent rapid plant cooldown. The guidance provided by the procedures, both abnormal operating and emergency operating, used during the event, was adequate to minimize the consequences of the sensing line failure and subsequent RCP seal degradation. The judgements and decisions made by the Operations personnel during the event were appropriate and timely considering the circumstances. Overall, these factors contributed to successful mitigation of the event without any threat to the health and safety of the public. It is also important to note that the seal sensing line failure and subsequent seal degradation did not result in a loss of coolant accident (LOCA) as defined in 10CFR50.46. The potential safety concerns related to failures of RCP seal piping and shaft seals are addressed below.

A review of the design functions of the RCP shaft seal system as well as piping attached to the RCPs (other than reactor coolant piping) indicates that the most critical challenge to safety upon failure of a seal or piping is the potential for a Loss of Coolant Accident (LOCA).

Arkansas Nuclear One, Unit 2, has been fully analyzed for both small and large break LOCAs in accordance with 10CFR requirements and analysis shows that a large break LOCA (greater than 0.5 square feet) is the most limiting break at ANO-2. Postulated breaks in the RCP seal related piping and tubing fall well within the range of small break LOCAs. For example, if the two cavity pressure sensing lines, the seal injection line, and the CBO line on all four pumps were considered to fail catastrophically at once, the resulting total break area would be less than 0.01 square feet.

The Combustion Engineering Plant Analysis Code (CEPAC) was used to analyze the effect of these four seal piping systems failing simultaneously on all four pumps (16 total lines). The ensuing transient resulted in a reactor trip on low margin to saturation temperature and actuation of safety injection flow. Following the initial depressurization, conditions stabilized after approximately 20 minutes with pressurizer pressure near 1400 psia, RCS temperature approximately 545°F (controlled by steam generator pressure at the 1000 psia set point) and pressurizer level near 25% and rising. Subsequent to this quasi-equilibrium condition the operators would take manual control of the secondary steam bypass control system and initiate a controlled cool down to bring the plant to cold shutdown conditions. Up to three of the 16 lines considered could fail with the resulting leakage remaining within the make-up capacity of the three coolant charging pumps normally available for RCS makeup. Leakage within the capacity of the coolant charging pumps will not necessarily result in an automatic reactor trip, but is governed by Technical Specification leakage limits. Overall the transient analysis results indicate that the failure of RCP seal related lines does not result in conditions outside those previously analyzed for ANO-2.

As a result of the seal sensing line failure at ANO-2 on 8/1/88, a concern also emerged that relates to the possibility that a decrease in the margin to failure of a RCP seal has been introduced by the postulated failure of the sensing lines. To answer this concern, a discussion of those features which provide this margin is needed. As previously stated, the seal cartridge consists of four stages of seals. The lower three stages normally share RCS pressure equally. The fourth, the vapor stage, normally carries only the differential pressure created by VCT backpressure. Each of these four stages is designed to operate with full system pressure for a period of time. Past experience has proven the seals capable of performing under these conditions.

During occurrences of seal degradation, if one of the seals degrades, the other two stages will share the resulting loads. If two seals degrade, the third seal will pick up the dropped pressure. Only if all three lower seals degrade to the point of being fully open or CBO flow is blocked, will full system pressure be applied to the vapor stage. Additional seal features which aid in the margin to safety to gross seal leakage are retaining rings, which tend to hold any damaged carbon seal faces together.

Broken seal faces will hold some pressure because the retaining rings tends to capture these pieces and keep them from jamming other seal faces or blocking the pressure breakdown devices. During past events even when seal faces have experienced significant degradations the resulting seal leakage has been low. Additionally, the 1/4 inch orifice holes for the process piping connections provide a choke point for flow in the event of a shear of an instrumentation line, such as occurred during this event. A choked flow calculation performed following the event concluded that the maximum flow rate from a 1/4 inch orifice would be approximately 37.5 gpm.

In addition to the rugged design of the seals, each reactor coolant pump and its associated piping contains sufficient instrumentation for the operators to monitor performance and diagnose problems rapidly. The instrumentation, plus other installed RCS leakage detection systems are provided to alert the operator to seal malfunctions so that appropriate actions can be taken.

The conclusion reached is that although the failure of a sensing line or some other attached line may cause some seal degradation, it does not present a significant reduction to the margin of safety. A degraded seal still performs its main function by limiting reactor coolant outflow.

C. Root Cause

Following the event, a detailed investigation and review of the piping associated with RCP seals was conducted with the objective of establishing the root cause of the failure associated with this event and also to review the collective history of previous RCP seal piping failures. Based on these reviews it was concluded that both the piping to tubing weld failure of this event and previous piping failures were attributable to vibrational effects. Additional information related to these areas is provided below.

2P32A middle seal cavity pressure sensing line weld failure on 8/1/88.

The cause of the failure of the 2P32A middle seal cavity pressure sensing line was determined to be low stress, high cycle, fatigue failure of the weld material, induced by vibration associated with the operating reactor coolant pump. Investigations of the failure also showed that during a modification made to this line in 1984, field personnel had installed a tubing to pipe connection with an elbow which deviated from standard details and was an unapproved method of routing instrumentation tubing for this application. This was considered to be a significant contributing factor to the failure.

Collective history of RCP seal piping failures including occurrence of 8/1/88.

The cause of RCP seal piping failures at ANO-2 was determined to be that the initial design of the piping system and subsequent design modifications to the system following repeated sensing line failures, relied heavily on dead weight, thermal and seismic considerations and were inadequate to eliminate vibration effects on the piping system caused by the operating RCP. Although vibration effects on the piping system were considered during evaluations of previous failures, the lack of rigorous in-depth vibrational design analyses which would in the design phases of a modification, allow consideration of the combined effects of the piping, the supports and anchor points was considered to be significant. It should be noted that regular, consistent vibration data has not been available in the past.

D. Reportability

This event is being reported per the requirements of 10CFR50.73(a)(2)(i)(A) as the completion of a plant shutdown required by the Technical Specifications and also per 10CFR50.73(a)(2)(iv) as a condition that resulted in the manual actuation of an Engineered Safety Features System (HPSI pump) and the Reactor Protection System (RPS). The NRC was notified of the manual RPS actuation and declaration of Notification of Unusual Event per 10CFR50.72(b) (2)(ii) and 10CFR50.72(a)(1)(i) at 1725 on 8/1/88.

III. Corrective Actions

A. Immediate

Following completion of the plant cooldown and depressurization, the RCS was drained to the required level for RCP seal replacement. A team of personnel was assembled to perform a detailed evaluation of the event. The primary objectives of this group were to:

- Perform a detailed engineering evaluation of the sensing line failure to establish root cause of the failure,
- Review previous problems with RCP piping and tubing systems,
- Develop any necessary modifications identified as being required or desirable based on the results of the evaluations and identification of any necessary long term corrective actions.

B. Subsequent

The 2P32A shaft seal was removed and replaced. Work activities undertaken on the seal piping and tubing systems for all four RCPs consist of system configuration reviews and restoration, modifications, and weld betterments.

Configuration Reviews and Restoration

Each piping system was walked down to validate that all applicable portions of the piping were configured as indicated on approved design drawing and stress calculations. Additionally, any non-standard tubing installations were reviewed and evaluated as acceptable or modified to reflect standard details. Traumatized piping was either corrected or replaced. Vibration isolators were reinstalled or refurbished as needed. Certain welded fittings were replaced with mechanical connectors which have demonstrated improved performance in this application. Vibration isolation shimming and pipe support gaps were verified. Support bolts and clamps were inspected and restored to specifications as necessary.

Modifications

The evaluations resulted in modifications being required on two 3/4-inch piping systems associated with seal injection lines to 2P32C. These modifications were completed prior to plant heatup.

Weld Betterment

Many of the failures of RCP seal piping and tubing have occurred at or near welded connections.

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

All piping systems were inspected for weld failures. NDE was performed on welds with failure histories or with configurations known or suspected to be candidates for cracking. All welds with identified problems were restored to specification. A number of welds were improved by use of weld overlay techniques. Particular attention was given to weld surface finish and contours in an attempt to lower the stress intensification factor associated with those welds. Since failures of welds have been observed to begin at the pipe OD, surface conditioning was improved.

In addition to these improvements, a post-modification testing program was developed to instrument selected lines with strain gages to determine system responses during heatup. Vibration measurements and visual observations were made of certain piping systems to gather both quantitative and qualitative data for valuation of acceptable system response following the work performed on the piping systems during the outage. This information will also serve as design input data for any future modifications to the system.

C. Future

As a result of the detailed, in-depth evaluations and corrective actions taken following the occurrence of this event, the root cause was identified and corrected. Arkansas Power and Light Company is continuing to participate in an industry program established prior to this event which is oriented towards improvements in RCP seal design for use in Byron Jackson pumps. As part of the new seal design, the use of flexible hoses for connecting process sensing lines to the seal cartridge is being pursued. Reviews of design information and vibration test results indicate that connection fittings using flexible hoses should be equal to or better than socket welded piping joints for this application. ANO-1 is currently installing the new seal design in the RCPs on that unit during the refueling outage in progress at this time. It is anticipated that the improved seal will be installed on ANO-2 RCPs following evaluation of their use at ANO-1.

IV. Additional Information

A. Similar Events

Similar events at ANO related to RCS leaks associated with RCP seal piping and tubing systems were previously reported in the following Licensee Event Reports (LERs).

ANO-2	ANO-1
368/78-033	313/74-014
368/80-086	313/75-003
368/82-017	313/77-005
368/83-023	313/78-003
368/83-[illegible]	313/78-021
	313/82-001
	313/83-019

B. Supplemental Information

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

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LICENSEE EVENT REPORT (LER) TEXT CONTINUATIJN

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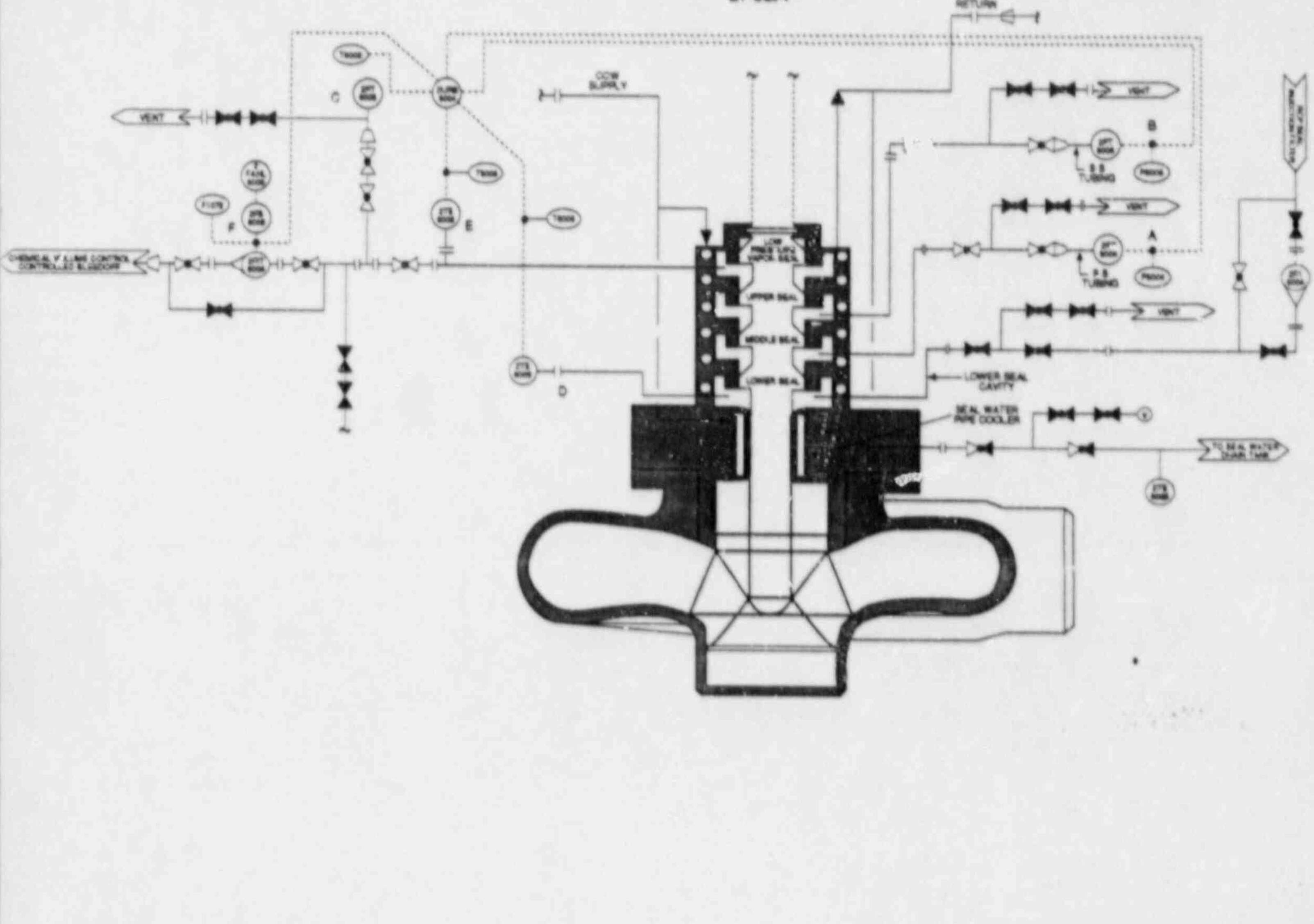
TEXT (If more ;pace is required, use additicnal NRC Form 366A's) (17)

FIGURE 1

REACTOR COOLANT PUMP
2P32A



ARKANSAS POWER & LIGHT COMPANY

September 8, 1988

2CAN098802

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

SUBJECT: Arkansas Nuclear One - Unit 2
Dockets No. 50-368
License No. NPF-6
Licensee Event Report 368/88-011-00

Gentlemen:

In accordance with 10CFR50.73(a)(2)(i) and 10CFR50.73(a)(2)(iv), attached is the subject report concerning an unisolatable reactor coolant system leak caused by vibration induced fatigue failure of a reactor coolant pump seal cavity pressure sensing instrumentation line.

Very truly yours,

J. M. Levine /SRQ

J. M. Levine
Executive Director,
Nuclear Operations

JML:LAT:dan
attachment

cc w/att: Regional Administrator
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IE22
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