

NRC Form 366
(9-83)

U.S. Nuclear Regulatory Commission
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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 Two										DOCKET NUMBER (2) 05010101316181101015		PAGE (3) 05010101	
TITLE (4) Loss of Reactor Coolant System Normal Makeup/Emergency Boration Capability Due to Gas Binding of Charging Pumps Caused by Erroneous Volume Control Tank Water Level Indication													
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)		
05	04	88	008	00	06	06	88				05010101		

OPERATING MODE (9) 3) 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)(vi)	50.73(a)(2)(vii)	50.73(a)(2)(viii)(A)	50.73(a)(2)(viii)(B)	50.73(a)(2)(ix)	73.71(b)	73.71(c)	Other (Specify in Abstract below and in Text, NRC Form 366A)	
				X																			

LICENSEE CONTACT FOR THIS LER (12)

Name	Larry A. Taylor, Nuclear Safety and Licensing Specialist	Telephone Number	501191641-1311010
Area		Code	

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)

EXPECTED SUBMISSION DATE (15)	Month	Day	Year

Yes (If yes, complete Expected Submission Date) No

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

On 5/4/88 at 1010 hours, with the unit in hot standby following a refueling outage, a loss of all Reactor Coolant System (RCS) normal makeup/emergency boration capability occurred. An erroneous indication of water level in the Volume Control Tank (VCT) allowed the VCT to be pumped dry which resulted in a loss of suction and gas binding of the Chemical and Volume Control System (CVCS) charging pumps and system piping. Normal makeup/emergency boration capability was fully restored at 1420 hours. By 1530 hours the VCT was refilled and the CVCS returned to normal operation. The erroneous water level indication was caused by a leak on a threaded fitting for one of two redundant VCT water level transmitters. The leak allowed the transmitters' common reference leg to drain resulting in an indicated VCT water level higher than actual water level. No equipment damage occurred and RCS inventory and boron concentration were maintained throughout the event. Both VCT water level transmitters, 2LT-4857 and 2LT-4861, had been replaced during the outage. No sealant had been used on the transmitters' threaded fittings and no leak check was performed following replacement of 2LT-4857 and prior to placing the instrument in service. A modification to the design of the instrumentation system for VCT water level will be made to provide independent reference legs for each transmitter.

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I. Description of Event

A. Plant Status

On 5/4/88 at 1010 hours, Arkansas Nuclear One, Unit 2 (ANO-2) was in Mode 3 operation with Reactor Coolant System (RCS) pressure at 2250 psia and RCS temperature at 545 degrees Fahrenheit. The sixth refueling outage of the unit had been recently completed and preparations for post refueling reactor startup physics testing were in progress.

B. Component Identification

A leak from a threaded fitting on Volume Control Tank (VCT) water level transmitter 2LT-4857 resulted in an erroneous VCT water level indication which allowed the VCT to be pumped dry resulting in a loss of suction to the Chemical and Volume Control System (CVCS) charging pumps; 2P-36A, 2P-36B and 2P-36C. The transmitter is one of two redundant transmitters used to provide indication in the control room of water level in the VCT. The transmitters share a common reference leg and are connected to the VCT by the use of stainless steel tubing and threaded fittings.

C. Sequence of Events

On 5/4/88 at 1010 hours, a charging header low flow annunciator alarm was received in the control room. A licensed control room operator responded to the alarm and observed that indicated charging flow had decreased to zero. The VCT water level instrumentation was checked which indicated a VCT water level of approximately 70 percent. A non-licensed operator was immediately dispatched to the charging pump area in the auxiliary building. The control room operator started a standby charging pump and secured the operating pump, however, this action did not restore flow. The charging pump suction was then shifted from the VCT to the Refueling Water Tank (RWT) but charging flow still could not be established. At 1020 hours, RCS letdown was isolated and all charging pumps were secured. The operator sent to the charging pump area opened a manual vent valve located on the suction piping to the charging pumps and observed no water flow through the valve. At this time it was concluded that the VCT was empty and that the charging pumps had become gas bound. Venting of system piping was initiated to remove the gas and refill the piping with water. At 1045 hours the charging pump suction was aligned to the Boric Acid Makeup (BAMU) system and a BAMU pump was started to pressurize the piping and accelerate the venting process. Venting of the piping was conducted by opening manual vent valves at several high points on the pump discharge piping and on the pump suction piping until water flow was observed. At 1135 hours, with charging pump suction being supplied from the operating BAMU pump, a charging pump was started and normal charging flow was observed. At 1140 hours charging pump suction was realigned to the RWT to verify the piping in this flow path was adequately vented. After approximately three minutes of operation charging flow was again interrupted. The charging pump was secured and venting efforts recommenced.

Venting of the pumps and piping continued until satisfactory charging flow could be established and maintained from all sources considered to be emergency suction supplies to the pumps, i.e., BAMU system flow paths and RWT flow path. These flow paths were fully restored at 1420 hours. By 1530 hours, a leak on the water level transmitter fitting had been identified and repaired. VCT water level had been restored and the water level indication verified to be operating properly. Pump suction was then shifted to the normal VCT supply and proper charging flow verified. RCS letdown was restored, returning the CVCS to a normal mode of operation.

II. Event Analysis

A. Event Cause - Gas Binding of Charging Pumps and Suction Piping

The cause of the loss of charging flow was due to gas binding of the charging pumps and piping on the suction side of the pumps. A leak on a threaded fitting associated with one of two redundant VCT water level transmitters, 2LT-4857 and 2LT-4861, caused the common reference leg supplying both transmitters to drain. The loss of water from the referenced leg caused the indicated tank water level from the transmitters to be erroneous, i.e., indicated water level higher than actual water level. As the actual water level in the tank decreased over a period of time, the indicated water level did not show any significant change.

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Eventually the VCT was pumped dry allowing hydrogen gas used to pressurize the VCT to enter the pump suction piping and displace the water in this piping. When a sufficient amount of water had been displaced, the gas migrated to the pumps causing them to become gas-bound.

B. Event Cause - Leak on VCT Level Transmitter Threaded Fitting

Several factors were considered to be contributing causes to this event. Those considered most significant were:

- 1) Both of the VCT water level transmitters had been replaced during the recently completed refueling outage. Two separate plant Design Change Packages (DCPs) had been used to replace the transmitters. A review of the DCP used to replace transmitter 2LT-4861 indicated that an Inservice Leak Test (ISLT) of the system had been required and was performed following the transmitter change out. This type of test consists of a visual inspection of the system components, including threaded fittings, to ensure there is no visible indication of water leakage. A review of the DCP used to replace redundant transmitter 2LT-4857 revealed that no ISLT was specified as being required following completion of this work. It is important to note that although failure to specify and perform an ISLT leak following the replacement of 2LT-4857 was considered to be a contributing cause of this event, the existing common reference leg consists of relatively small inside diameter instrumentation tubing which limits the total volume of water available in the leg. This creates a condition such that even an extremely small leak which might not be detected by a rigorous visual examination could cause a significant loss of total reference leg volume over time.
- 2) During the transmitter replacements, the use of a sealant on the threaded portions of certain types of tubing and transmitter fittings had not been specified in the DCPs as being required. The use of thread sealant on these fittings would have minimized the probability of leakage from these locations.

C. Root Cause

Inadequate initial design of the VCT water level instrumentation is considered to be the root cause of this event. The design incorporated a common reference leg for both water level transmitters which allowed a single failure to affect both water level indications. The resulting erroneous indication on both VCT water level channels led to the inadvertent draining of the tank and subsequent loss of charging capability.

D. Safety Significance

Operator actions to mitigate the loss of charging/emergency boration capability and restore CVCS to an operable condition were appropriate and timely. As a result, no equipment damage occurred. RCS inventory was satisfactorily maintained during the time period the CVCS was unavailable. RCS boron concentration was adequate to maintain the required reactor shutdown margin and no conditions existed during the time period the CVCS was unavailable which would have required emergency boration of the RCS.

As a result of this event, it was discovered that no specific plant operations procedure existed related to a loss of normal charging/emergency boration capability. Although procedural guidance for this type of occurrence did exist in the Emergency Operating Procedure (EOP), use of the EOP is normally predicated by the existence of certain plant conditions used as entry conditions to the procedure. None of these entry conditions were met as a result of the loss of charging capability alone. Guidance for specific event type occurrences is typically provided in plant procedures classified as Abnormal Operating Procedures (AOPs). A review of the failure to have an AOP for this type event revealed that an AOP addressing loss of charging capability had existed at one time. However, following the development and implementation of an upgraded EOP as required by NUREG 0737, the AOP for loss of charging capability had been deleted. Personnel deleting the AOP did not recognize that a specific AOP for loss of charging capability occurring as a single event would be

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more appropriate than the EOP for providing guidance for this type of occurrence. Notwithstanding this deficiency, Operations personnel response to the loss of charging capability was not significantly affected and the course of the event was not adversely affected.

It is important to note that the ANO-2 charging system is not a part of the Emergency Core Cooling System for the unit and is not credited for the mitigation of the consequences of any design basis accidents.

E. Basis for Reportability

ANO-2 Technical Specification (TS) 3.1.2.4 requires that two charging pumps be operable in Modes 1 through 4. Technical specification provisions allow for reduction to one operable charging pump provided certain action requirements are met. However, since all charging pumps were rendered inoperable as a result of this event, a condition not addressed by TS 3.1.2.4 existed. Although the appropriate actions to comply with the requirements of TS Limiting Conditions for Operations were accomplished, the plant is considered to be operating with a condition prohibited by the TS and therefore, this event is reportable under the provisions of 10CFR50.73(a)(2)(i)(B).

This event is also being reported per the requirements of 10CFR50.73(a)(2)(ii)(C) as an event that resulted in the nuclear power plant being in a condition not covered by the plant's operating and emergency procedures.

III. Corrective Actions

A. Immediate

Maintenance personnel identified the leak associated with transmitter 2LT-4857 and repaired the threaded fitting. A thread sealant, Loctite (NG) PST, was used during the repair.

B. Subsequent

The two charging pumps which had been operated in a gas bound condition were subsequently tested by performance of normal pump surveillance procedures.

A plant design detail drawing used by personnel as part of the DCP installation process was revised to provide additional details concerning fitting installation, use of thread sealants in certain applications, and ISLTs of systems following modifications.

A review was conducted to determine if the practice of using thread sealants on instrument fittings was addressed during routine maintenance activities. It was concluded that maintenance personnel were aware of the requirements for using sealants on certain types of threaded fittings. A memorandum discussing the loss of charging event was issued to appropriate maintenance personnel to emphasize the importance of this practice as a measure to minimize the potential for fitting leaks.

Maintenance personnel and plant modifications personnel performed a walkdown inspection of all new instrumentation transmitters which had been installed during the refueling outage. Although no additional leaks were discovered during the inspections, the transmitter connections which had been installed without the use of a thread sealant were disconnected and reconnected using a sealant as a precautionary measure.

An AOP has been written and implemented to provide guidance to Operations personnel for loss of charging events.

C. Future

Plant procedures used by personnel as part of the DCP installation process are being revised to include additional instructions related to connection of instrument and tubing fittings. Areas such as techniques for proper assembly, use of thread sealants, and requirements for ISLT of fittings and affected systems are being addressed. Appropriate personnel will receive training on these procedure revisions.

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A DCP to provide independent reference legs for the redundant VCT water level transmitters will be developed. The DCP will be installed during the first outage of sufficient duration following the development of the modification package. A similar modification is planned for the ANO-1 Makeup Tank (the normal suction source for charging on ANO-1) water level instrumentation due to the potential for occurrence of this type event on that unit.

IV. Additional Information

A. Similar Occurrences

A similar loss of charging capability had occurred at ANO-2 in 1982 while the unit was in cold shutdown. The occurrence was not reportable under the reporting criteria existing at that time and therefore, a Licensee Event Report was not submitted for the event. Evaluations conducted at the time of the occurrence revealed a condition similar to that discovered during this event had existed, in that, the reference leg to the VCT water level transmitters had been partially drained causing an erroneous VCT water level indication. However, no leakage was discovered from any system components during the 1982 event. Additionally, no similar events have occurred at ANO-2 since 1982.



ARKANSAS POWER & LIGHT COMPANY

June 6, 1988

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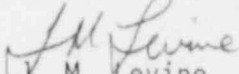
U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

SUBJECT: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Licensee Event Report 50-368/88-008-00

Gentlemen:

In accordance with 10CFR50.73(a)(2)(i) and 10CFR50.73(a)(2)(ii), attached is the subject report concerning a loss of reactor coolant system normal makeup/emergency boration capability due to gas binding of charging pumps caused by erroneous volume control tank water level indication.

Very truly yours,


J. M. Levine
Executive Director,
Nuclear Operations

JML:LAT:sms

attachment

cc w/att: Regional Administrator
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