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2CAN110402

November 29, 2004

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, DC 20555-0001

Subject: Licensee Event Report 50-368/2004-003-00  
Arkansas Nuclear One – Unit 2  
Docket No. 50-368  
License No. NPF-6

Dear Sir or Madam:

In accordance with 10CFR50.73(a)(2)(i)(B), enclosed is the subject report concerning operation in a mode prohibited by technical specifications.

A new commitment contained in this submittal is summarized in Attachment 1.

Sincerely,

A handwritten signature in cursive script that reads "Dennis Boyd".

for Dale E. James  
Manager, Licensing

DEJ/fvb

Attachment  
Enclosure

Handwritten initials "DEJ" in a cursive style, located in the bottom right corner of the page.

cc: Dr. Bruce S. Mallett  
Regional Administrator  
U. S. Nuclear Regulatory Commission  
Region IV  
611 Ryan Plaza Drive, Suite 400  
Arlington, TX 76011-8064

NRC Senior Resident Inspector  
Arkansas Nuclear One  
P.O. Box 310  
London, AR 72847

Institute of Nuclear Power Operations  
700 Galleria Parkway  
Atlanta, GA 30339-5957  
[LEREvents@inpo.org](mailto:LEREvents@inpo.org)

**Attachment 1**

**2CAN110402**

**Commitment Summary**

This table identifies actions discussed in this letter which Entergy Operations, Inc. (Entergy) commits to perform. Any other actions discussed in this submittal are described for the NRC's information and are not commitments.

COMMITMENT	TYPE		SCHEDULED COMPLETION DATE
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
Replace ANO-2 pressurizer proportional heater power panels 2PP5 and 2PP6	X		Prior to the end of the next ANO-2 refueling outage (Estimated date is 4/15/2005)

**LICENSEE EVENT REPORT (LER)**

(See reverse for required number of digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

<b>1. FACILITY NAME</b> Arkansas Nuclear One – Unit 2	<b>2. DOCKET NUMBER</b> 05000 368	<b>3. PAGE</b> 1 OF 4
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**4. TITLE**  
Entry into an Operational Mode Prohibited by Technical Specification due to Inoperable Pressurizer Proportional Heaters

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
09	29	2004	2004	- 003 -	00	11	29	2004		05000
									FACILITY NAME	DOCKET NUMBER
										05000

<b>9. OPERATING MODE</b>  3	<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§:</b> (Check all that apply)																																				
<b>10. POWER LEVEL</b>  000	<table style="width:100%; border: none;"> <tr> <td><input type="checkbox"/> 20.2201(b)</td> <td><input type="checkbox"/> 20.2203(a)(3)(i)</td> <td><input type="checkbox"/> 50.73(a)(2)(i)(C)</td> <td><input type="checkbox"/> 50.73(a)(2)(vii)</td> </tr> <tr> <td><input type="checkbox"/> 20.2201(d)</td> <td><input type="checkbox"/> 20.2203(a)(3)(ii)</td> <td><input type="checkbox"/> 50.73(a)(2)(ii)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(viii)(A)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(1)</td> <td><input type="checkbox"/> 20.2203(a)(4)</td> <td><input type="checkbox"/> 50.73(a)(2)(ii)(B)</td> <td><input type="checkbox"/> 50.73(a)(2)(viii)(B)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(i)</td> <td><input type="checkbox"/> 50.36(c)(1)(i)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(iii)</td> <td><input type="checkbox"/> 50.73(a)(2)(ix)(A)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(ii)</td> <td><input type="checkbox"/> 50.36(c)(1)(ii)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(iv)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(x)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(iii)</td> <td><input type="checkbox"/> 50.36(c)(2)</td> <td><input type="checkbox"/> 50.73(a)(2)(v)(A)</td> <td><input type="checkbox"/> 73.71(a)(4)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(iv)</td> <td><input type="checkbox"/> 50.46(a)(3)(ii)</td> <td><input type="checkbox"/> 50.73(a)(2)(v)(B)</td> <td><input type="checkbox"/> 73.71(a)(5)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(v)</td> <td><input type="checkbox"/> 50.73(a)(2)(i)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(v)(C)</td> <td><input type="checkbox"/> OTHER</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(vi)</td> <td><input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)</td> <td><input type="checkbox"/> 50.73(a)(2)(v)(D)</td> <td style="font-size: small;">Specify in Abstract below or in NRC Form 366A</td> </tr> </table>	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A
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**12. LICENSEE CONTACT FOR THIS LER**

FACILITY NAME Arkansas Nuclear One / Fred Van Buskirk	TELEPHONE NUMBER (Include Area Code) 479-858-3155
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**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	EC	52							

<b>14. SUPPLEMENTAL REPORT EXPECTED</b> <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO	<b>15. EXPECTED SUBMISSION DATE</b> MONTH:      DAY:      YEAR:
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**ABSTRACT** (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On September 29, 2004, with Arkansas Nuclear One, Unit 2 (ANO-2) in mode 4, two AC circuit breakers that supply pressurizer proportional heaters were found in a tripped condition. This condition was discovered during a containment building inspection that was performed in preparation for a plant startup following a forced outage. The tripped circuit breakers rendered one of two proportional heater banks inoperable. The circuit breakers were reset and monitored with no further abnormalities observed. After the monitoring period, the breakers were considered operable and the ANO-2 startup proceeded. ANO-2 entered operational mode 3 at 0513 on September 30, 2004. Once in mode 3, technical specifications require both pressurizer proportional heater groups to be operable. Subsequently, during the performance of a proportional heater surveillance test, the same two breakers were again discovered in a tripped condition. Based on this second failure, it was determined that these breakers would not have been capable of performing their intended function and should not have been considered operable when ANO-2 entered mode 3 from mode 4. Consequently, the mode change was in violation of technical specification 3.0.4 which prohibits entry into an operational mode when the conditions of the limiting conditions for operation are not met. The apparent cause for this condition is degradation of the breaker to bus bar connection. Loose connections resulted in increased line side heating causing the breaker thermal element to trip at a current value less than the breaker rating. Repairs were made to problem circuits in both proportional heater breaker panels. Testing was completed verifying that heater capacity for both groups satisfied technical specification requirements. Thermography testing verified there were no overheating connections after repairs.

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Arkansas Nuclear One – Unit 2	05000368	2004	- 003	- 00	2 OF 4

17. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

A. Plant Status

At the time this condition was discovered, Arkansas Nuclear One, Unit 2 (ANO-2) was in operational mode 3. A plant heatup was in progress following a forced outage to repair a feedwater system [SJ] weld.

B. Event Description

On September 29, 2004, ANO-2 was in operational mode 4, with a plant heatup in progress for completion of a forced outage to repair a feedwater system vent socket weld. During a containment building walkdown inspection, two 480 volt circuit breakers [EC] that supply power to the Reactor Coolant System (RCS) [AB] pressurizer proportional heaters were found to be tripped. The tripped breakers were identified as breakers 1 and 3 located in panel 2PP6. The ANO-2 pressurizer has two redundant groups of proportional heaters powered from essential buses. The purpose of these heater groups is to provide assurance that adequate heater capacity is available during a loss of offsite power event to maintain natural circulation at hot standby conditions. One group is powered through panel 2PP5 and the redundant group through panel 2PP6. Each proportional bank has 13 heaters capable of 12.5 kilowatts (kW) per heater for a total rated capacity of 162.5 kW per group. Technical specification 3.4.4 limiting condition for operation (LCO) requires that both pressurizer proportional heater groups be operable in modes 1, 2 and 3, with a power output of greater than or equal to 150 kW per group. Each of the two circuit breakers found in the tripped condition supplies 3 proportional heaters. Therefore, in the as-found condition, the heater group supplied from panel 2PP6 was inoperable. However, since the unit was in operational mode 4, the requirements of technical specification 3.4.4 were not applicable. The tripped breakers were reset and monitored with no further abnormalities observed. Based on the acceptable performance of the proportional heater banks during this monitoring period, they were determined to be operable. Plant heatup continued and operational mode 3 was entered at 0513 on September 30, 2004.

Subsequently, during the performance of a surveillance test to verify that the power output of the two proportional heater groups satisfied technical specification requirements, group two failed to meet the required output of greater than or equal to 150 kW. Upon investigation, circuit breakers 1 and 3 in panel 2PP6 were again found in a tripped condition. Based on the repeat failure of these breakers, it was concluded that the breakers were not capable of performing their intended function and should not have been considered operable when ANO-2 entered mode 3 from mode 4. Technical specification 3.0.4 prohibits entry into an operational mode when the conditions of the LCO are not met and the associated action requires a shutdown if they are not met within a specified time interval. Thus, the entry into mode 3 when the LCO requirements were not met due to the inoperable proportional heater group resulted in operation prohibited by technical specifications.

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**17. NARRATIVE** (If more space is required, use additional copies of NRC Form 366A)

**C. Root Cause**

An evaluation has been performed to determine the specific cause(s) of the circuit breaker failures. The results of the evaluation have determined that the apparent cause for this condition is the degradation of the breaker to bus bar connections. Degraded connections resulted in increased heating at the connection which was verified by thermograph readings. The increased heat generated was conducted into the breaker resulting in a trip of the breaker thermal element at current values less than the breaker rating. In the past, when the circuit breakers had been removed from their associated circuits and tested, they were found to trip within the specified limits. This finding further supports the conclusion that the condition resulted from excessive heating at the connections.

A contributing cause to this condition was the application of excessive torque to the line-side breaker connection screws. The aluminum bus bar and steel connection screws have different rates of thermal expansion. The combination of assembly stress and thermal stress as the joint heats can result in stresses greater than the yield strength of the tapped bus bar or assembly screw. If this occurs, the connection will become loose when cooled. Additionally, excessive torquing of the breaker connecting screw can also lead to stripping of the aluminum bus straps. This has been experienced at ANO. The causes of this condition are common to both groups of proportional heaters.

Additionally, an evaluation has been performed to determine if the actions taken prior to entering mode 3 from mode 4 were adequate to assess the operability of the breakers that had tripped and been reset. The results of this evaluation concluded that it was inappropriate to consider the circuit breakers operable based only on the ability to successfully reset the breakers followed by a monitoring period. It was determined that the breakers should have been tested and should not have been considered operable until test acceptance criteria were satisfied. It was further concluded that there is a lack of adequate procedural guidance for actions to take upon discovery of tripped breakers in the pressurizer heater panels.

**D. Corrective Actions**

This condition was applicable to both of the pressurizer proportional heater panels (2PP5 and 2PP6). Repairs were made to affected and susceptible circuits in both panels. Breakers 1 and 3 in panel 2PP6 were replaced and their associated connections repaired to minimize future heating concerns. Thermography of both panels was performed and all hot connections were repaired. Heater capacity was verified to be in compliance with technical specification requirements for both proportional heater banks.

Prior to the completion of the next ANO-2 refueling outage (2R17), power panels 2PP5 and 2PP6 will be replaced. In the interim, an on-line monitoring plan has been implemented to provide operability information regarding the state of proportional heater banks 2PP5 and 2PP6 during the current cycle of operation.

Instructions have been issued to ensure that appropriate testing is performed prior to declaring pressurizer heater breakers operable following the discovery of a tripped circuit breaker.

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17. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

**E. Safety Significance**

The function of the pressurizer proportional heaters is to adjust the heat input as required to compensate for steady state losses and to maintain the desired pressure in the pressurizer. To assure sufficient pressurizer control for natural circulation flow at hot standby conditions following a loss of off-site power, the operator re-energizes the proportional heaters from the diesel generator safety buses. The 150kW capacity powered from an assured power source ensures, considering ambient heat losses, that RCS sub-cooling margin will be maintained greater than or equal to 20 degrees F for a period of 45 hours following a loss of off-site power. This time period includes a period of one-half hour at the beginning of the transient in which the heaters are unavailable.

The pressurizer heaters are not credited in any accident analysis. The design supports natural circulation cooldown of the RCS during a loss of off-site power event. Ample time is afforded during the post-trip cooldown phase to establish a backup power supply to one or both banks of proportional heaters. Operation with heater bank output less than 150 kW would only act to decrease the time to reach the 20 degree F margin-to-saturation point or delay the cooldown. Even with no heater capability, the plant could be cooled down to the shutdown cooling operations window without reaching saturated conditions.

In addition, High Pressure Safety Injection [BQ] feed and bleed may be initiated if saturated conditions are reached to maintain core cooling. Therefore, the safety significance of this condition was determined to be minimal.

**F. Basis for Reportability**

This report of a condition prohibited by technical specifications is submitted in accordance with 10CFR50.73 (a) (2) (i) (B).

**G. Additional Information**

There have been no previous similar events reported by ANO as Licensee Event Reports.

Pressurizer proportional heater circuit breaker panels 2PP5 and 2PP6 are Series 4 panels manufactured by ITE Imperial Corporation.

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