LICENSEE EVENT REPORT (LER)

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TITLE (4) High Pressure Reactor Trip While Troubleshooting the Integrated Control System

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
Month	Day	Year	Year	Sequential Number	Revision Number	Month	Day	Year	Facility Names	Docket Number(s)
									N/A	0 5 0 0 0
1 2	3 1	8 6	8 6	0 0 8	0 0	0 2	0 2	8 7	N/A	0 5 0 0 0

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)	0 2 5	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)	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
Patrick C. Rogers, Plant Licensing Engineer	Area Code 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
X	J A	I M O D	B 0 4	Y					

SUPPLEMENT REPORT EXPECTED (14)	EXPECTED SUBMISSION DATE (15)	Month	Day	Year
Yes (If yes, complete Expected Submission Date) X No				

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

On 12/31/86 at 0717 hours, the reactor tripped on high Reactor Coolant System (RCS) pressure from approximately 25 percent power. At approximately 0500, hours when attempting to place the reactor demand control station of the Integrated Control System (ICS) into AUTO, rapid control rod withdrawal occurred. The controls station was immediately returned to manual. At 0553 hours, physics testing at 20 percent power was completed, and power escalation began with the steam generator/reactor control station in manual because of the previous problems encountered with the reactor demand station. At 0716 hours, the reactor demand station was placed in AUTO to facilitate troubleshooting of the aforementioned problem. This removed a feedwater correction signal which had built in during power escalation. A feedwater transient and control rod withdrawal ensued. Manual control was taken to reduce feedwater flow, but the reduction was too rapid. A reactor trip occurred at 0717 hours due to high RCS pressure caused by the reduction of feedwater. After the trip, feedwater was being controlled manually, but steam generator levels were allowed to decrease such that emergency feedwater initiated on low steam generator levels. The plant was brought to Hot Shutdown conditions. A summer/proportional/integral module in the RCS average temperature correction circuitry was replaced. Other similar circuitry was checked. Future actions include operator training, engineering evaluations and procedure review.

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

I. Description of Event

A. Unit Status

Arkansas Nuclear One, Unit One (ANO-1) was operating at approximately 25 percent full power with a reactor coolant system (RCS) average temperature of 579 degrees Fahrenheit and RCS pressure of 2155 psig. ANO-1 was escalating power after completion of 20 percent full power physics testing following refueling outage 1R7.

B. Component Identification

Although not the direct cause of the trip, the following component was a contributing factor to the transient.

Integrated Control System (ICS) module C-46-6-12 which is a summer/proportional/integral unit (model no. 6624151A) in the RCS average temperature (Tavg) correction circuitry of the ICS associated with the reactor demand control station.

EIIS Identifier = JA-IMOD

Vendor Code = B045

C. Sequence of Events

On 12/31/86 at 0503 hours, Operations personnel encountered problems while attempting to place the ICS reactor (RX) demand station into AUTO. A large neutron error was observed, and a rapid control rod withdrawal resulted. The reactor demand station was quickly returned to manual. At 0508 hours a second attempt was unsuccessful so the reactor demand station was again returned to manual. Following completion of physics testing at 20 percent power at 0553 hours, power escalation proceeded using the steam generator/reactor (SG/RX) demand station in manual. In this mode of ICS operation the control of RCS average temperature (Tavg) is switched from the reactor control stations to the feedwater (FW) control station. The increase in power resulted in a mismatch across the control station and a large Tavg to FW correction signal. At 0716 hours, operations personnel placed the RX demand station in AUTO to demonstrate the ICS problem to instrumentation and control (I&C) personnel. Placing the reactor demand station in AUTO removed the large correction signal from the feedwater controls. On this occasion a feedwater transient occurred as well as control rod withdrawal because of the removal of the correction signal. The feedwater transient did not occur on previous attempts to place the RX demand station in AUTO because the Tavg to FW correction signal was small due to stable plant condition required for physics testing. In an attempt to stop the transient, operations personnel took manual control of feedwater valves to lower feedwater flows to pre-transient levels. The reactor demand station remained in AUTO. The feedwater reduction caused an RCS pressure increase which resulted in a reactor trip at 0717 hours. Following the trip, the operators observed that the main feedwater (MFW) pump had not run back to minimum speed as they expected. A design change installed in the recently completed refueling outage called for a MFW pump runback if the steam generator levels had been greater than or equal to 40 inches. Since the SG levels were less than 40 inches (approximately 38.5 inches) the MFW pump did not runback to minimum speed. The operator manually reduced the MFW pump speed to the point where the pump was no longer supplying feedwater to the steam generators. As a result the steam generator levels reduced to the Emergency Feedwater (EFW) actuation setpoint of 14.5 inches. The EFW pumps started at 0721 hours and supplied both steam generators. Steam generator levels were controlled to approximately 25 inches by MFW and EFW. The auxiliary feedwater (AFW) system was placed in service at 0729 hours, and steam generator inventory supply was transferred to the AFW system to maintain Hot Shutdown conditions until restart. The AFW system is used for low power and startup operations and supplies flow through the MFW header.

II. Event Cause

A. Event Analysis

A malfunctioning ICS component prevented the operators from placing the ICS in full automatic mode of operation at the normal time during power escalation. The first attempt to place the RX demand station in AUTO occurred at 0503 hours, and a second unsuccessful attempt was made at

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0508 hours. As a result of the problem with the reactor demand station, the ICS was operated with the SG/RX control station in manual. As power increased, a mismatch resulted across the FW control station, and a large Tavg to FW correction signal built in. This correction circuit provides for control of Tavg when the RX demand control station is in manual. At 0716 hours, when the RX demand station was placed in AUTO to aid troubleshooting, the Tavg to FW correction signal was removed. The removal of the correction signal caused the FW transient. A contributing cause of the FW transient was the fact that there is no direct reading for the correction signal. Placing the RX station in AUTO also induced a control rod withdrawal as previously experienced.

Operations personnel took manual control of FW and reduced flow. The FW flow reduction caused the RCS pressure to increase. The reactor tripped at 0717 on high RCS pressure (2355 psig) as a result.

The EFW actuation resulted because steam generator levels were not maintained above the actuation setpoint by manual operation of the MFW system.

All safety systems functioned as designed. Plant responses to the reactor trip were satisfactory. This event posed no threat to the health and safety of the public.

B. Root Cause

The root cause of the reactor trip was the operator response to the feedwater transient. The response was correct but too rapid for the RCS to follow without reaching the high pressure trip setpoint.

The root cause of the EFW initiation was a failure of the operators to fully understand a newly-installed circuit and failure to maintain generator levels by manual operation of the MFW pumps. It should be noted that training had been conducted regarding the circuitry during requalification training prior to startup after refueling.

C. Basis for Reportability

This event is being reported under the provisions of 10CFR50.73 (a)(2)(iv).

III. Corrective Actions

A. Immediate

Immediate corrective actions consisted of verifying all of the reactor trip safety functions of the emergency operating procedure. This resulted in placing the plant in a safe shutdown condition (Hot Shutdown).

B. Subsequent

The failed ICS module was replaced and tested. Other similar modules were checked for proper operation and found to be operating properly. Operations crews were briefed on the problem in the feedwater correction circuit and the pitfalls of prolonged operation with the steam generator/reactor control station in manual.

C. Future

Operating procedures will be reviewed to determine if additional cautions are needed regarding manual operation of the ICS. Changes will be made if necessary. Classroom and simulator training will be given to operations personnel regarding this event. This training will re-emphasize precautions for manual ICS operation and will review the newly-installed MFW circuitry with special emphasis on low power operation. An engineering evaluation will be performed to determine if the feedwater correction is necessary or can be removed. If it is necessary to retain the feedwater correction, an evaluation will be performed to determine if control room indication of the magnitude of the signal can be provided.

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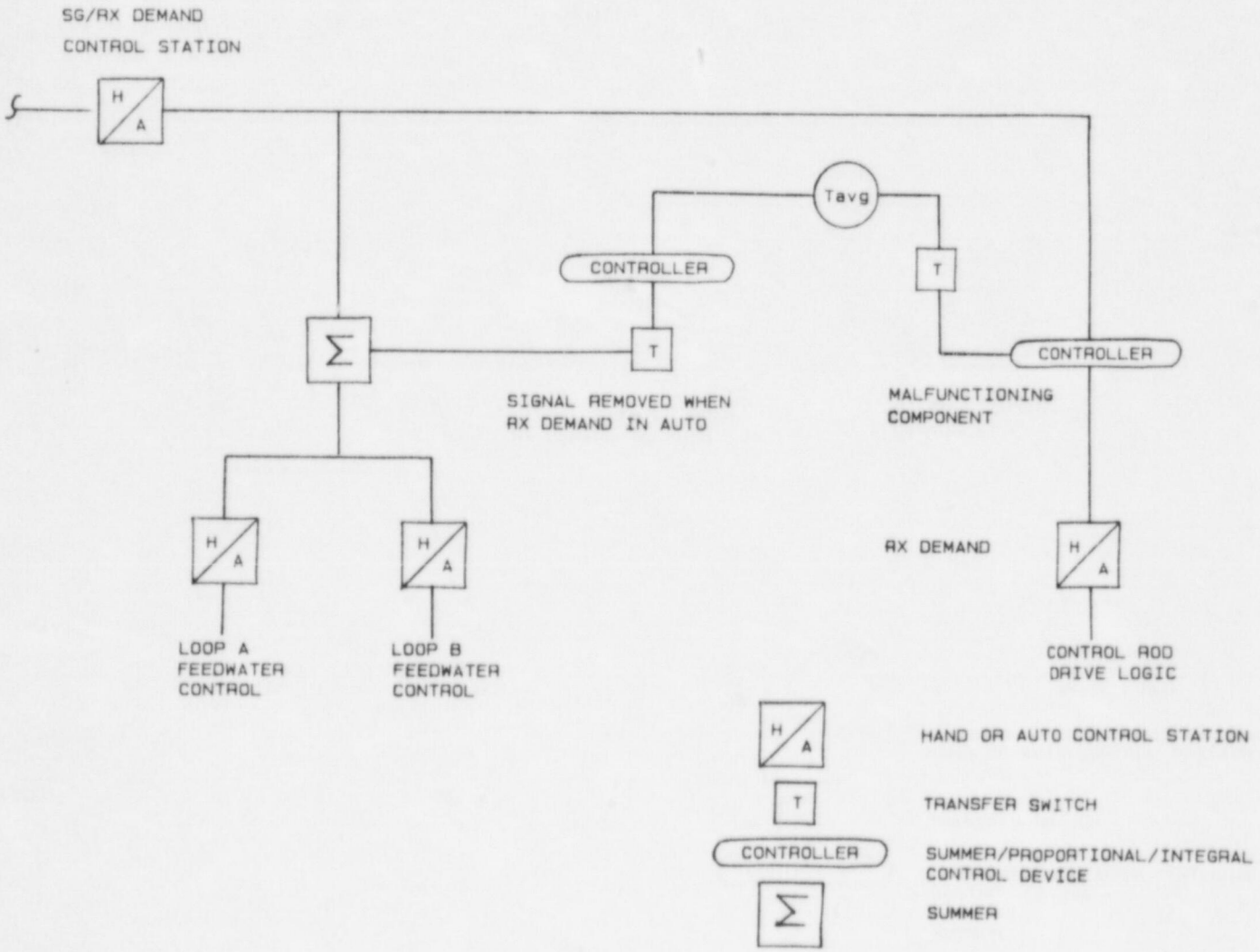
IV. Additional Information

There have been no similar events reported, however, a reactor trip related to an ICS component failure was reported in LER 50-313/85-003. A supplemental report is not planned.

SIMPLIFIED DRAWING OF
RELATED ICS CIRCUITRY



ARKANSAS POWER & LIGHT COMPANY
POST OFFICE BOX 551 LITTLE ROCK, ARKANSAS 72203 (501) 371-4000

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SUBJECT: Arkansas Nuclear One - Unit 1
Docket No. 50-313
License No. DPR-51
Licensee Event Report
No. 86-008-00

Gentlemen.

In accordance with 10CFR50.73(a)(2)(iv), attached is the subject report concerning a reactor trip while troubleshooting the Integrated Control System.

Very truly yours,

J. Ted Enos, Manager
Nuclear Engineering & Licensing

JTE/RJS/ac

Attachment

cc: U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 1000
Arlington, TX 76011

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