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ILLINOIS POWER

U- 601954
L45-92(03-27)-LP
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March 27, 1992
10CFR50.73

Docket No. 50-461

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

Subject: Clinton Power Station - Unit 1
Licensee Event Report No. 92-002-00

Dear Sir:

Please find enclosed Licensee Event Report No. 92-002-00: Lockup of Reactor Feed Pump Control Valve During Transfer of Feedwater Control Channels Results in Feedwater Level Transient and Low Reactor Water Level SCRAM. This report is being submitted in accordance with the requirements of 10CFR50.73.

Sincerely yours,

F. A. Spangenberg, III
Manager, Licensing and Safety

RSF/alh

Enclosure

cc: NRC Clinton Licensing Project Manager
NRC Resident Office, V-690
NRC Region III, Regional Administrator
Illinois Department of Nuclear Safety
INPO Records Center

NRC FORM 366 (6-89) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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TITLE (4) Lockup Of Reactor Feed Pump Control Valve During Transfer Of Feedwater Control Channels Results In Feedwater Level Transient And Low Reactor Water Level SCRAM.

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)
0 2	2 7	9 2	9 2	0 0 2	0 0	0 3	2 7	9 2	None	0 5 0 0 0
										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)	0 7 2	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
O. Villarreal, System Engineer -Extension 3098	AREA CODE 2 1 7 9 3 5 - 8 8 8 1

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	

SUPPLEMENTAL REPORT EXPECTED (14)

X YES (If yes, complete EXPECTED SUBMISSION DATE) ☐ NO

EXPECTED SUBMISSION DATE (15): MONTH 0 6 | DAY 2 2 | YEAR 9 2

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

With the plant at 72 percent reactor power, an automatic reactor scram occurred due to low reactor water level when the "B" Turbine Driven Reactor Feed Pump (TDRFP) control valve (CV) failed to properly control TDRFP speed and, consequently, feedwater flow. During a transfer of reactor feedwater level control from the "A" channel to the "B" channel, the "B" TDRFP controller signaled the "B" TDRFP CV to open. The TDRFP CV locked up after the "B" TDRFP had picked up more of the controller demand to the vessel than the "A" TDRFP. After the TDRFP CV locked up, the controller demand went to a minimum, giving the TDRFP CV a full-close signal. While reducing reactor power and attempting to manually remove the "B" TDRFP from service, the TDRFP CV closed causing the TDRFP speed to decrease and creating a low reactor water level condition which resulted in an automatic reactor scram. The cause of this event is still being investigated; however, a preliminary assessment has identified that the main operating cylinder and gear assemblies for the TDRFP CV did not respond as expected but locked up while trying to respond to the level demand signal. Corrective actions include inspecting the operating cylinder and valve gear assembly of the TDRFP CV.

DESCRIPTION OF EVENT

On February 27, 1992, at approximately 1726 hours, with the plant in Mode 1 (POWER OPERATION) at approximately seventy-two percent reactor [RCT] power, an automatic reactor scram occurred due to low reactor pressure vessel [RPV] water level (Level 3). The scram occurred during a feedwater transient when the "B" turbine [TRB] driven reactor feed pump (TDRFP) [P] control valve [FCV] failed to properly control TDRFP speed and, consequently, feedwater [SJ] flow.

On February 27, Temporary Modification 92-26 was installed because of previous failures of the "B" TDRFP to properly control reactor water level. Because the General Electric Transient Analysis Recording System (GETARS) information for evaluation of the previous failures had not been sufficient to establish whether the failures were caused by problems in electrical controls or mechanical components, a decision was made to initiate and install Temporary Modification 92-26. The purpose of the temporary modification was to allow monitoring of additional components in the TDRFP control valve's hydraulic control mechanism during the power reduction activity that was scheduled to begin later that night for the plant's third refueling outage (RF-3). Temporary Modification 92-26 allows monitoring of the "B" TDRFP pilot valve [V] position and servo valve control signal response. The monitoring would be accomplished with the GETARS.

Because of the previous problems with the control valve, the operations crew discussed the risks of installing Temporary Modification 92-26 and the possibility that this could result in a control system disturbance. This was also discussed with management before the temporary modification was installed. The installation of the temporary modification was completed without incident.

Routine monthly surveillance CPS 9538.03, "Feedwater Reactor Vessel Water Level C34-N004A(B,C) Channel Functional," was scheduled for water level transmitter [LT] 1C34-N004A on February 27. In order to perform this surveillance, feedwater RPV level control had to be transferred from the "A" reactor water level control channel [LC] to the "B" reactor water level control channel of the Feedwater Control System [JB].

The "B" reactor water level transmitter 1C34-N004B normally reads level about 3.5 inches lower than the "A" or "C" reactor water level
nsmitters. Therefore, transferring to the "B" reactor water level
trol channel will automatically cause a minor demand signal change to
a TDRFPs to compensate for the lower level that the control system will see as soon as the "B" channel is selected. The demand will cause the TDRFP control valve to momentarily open more, resulting in increased feed pump speed and more water being pumped into the RPV for a brief time

until a new equilibrium level is reached to match the level setpoint on the Master Level Automatic Controller.

Before transferring level control from channel "A" to channel "B", the operations crew held a briefing to discuss the evolution and decided to leave the feedwater controller in Master Level Automatic while shifting reactor water level control channels.

At 1655 hours, with the plant at about ninety-six percent reactor power, the "A" Control Room Operator (CRO) selected the "B" reactor water level control channel and immediately adjusted the Master Level Controller level setpoint to match the level indicated by the "B" reactor water level transmitter. The "A" CRO adjusted the setpoint from about thirty-five inches (level the "A" reactor water level transmitter was reading) to about thirty-two inches (level the "B" reactor water level transmitter was reading). The transfer of the reactor water level control channels appeared to be successful.

After the transfer of channels, the speed of the "B" TDRFP increased and the "B" TDRFP assumed more of the feedwater flow load than the "A" TDRFP; at this point the speed of the "B" TDRFP was constant. Reactor water level was stable at thirty-three inches.

The "B" TDRFP controller demand signal then went to minimum over several minutes, giving the "B" TDRFP control valve a signal to close to reduce turbine speed to the Low Speed Stop (LSS). The controller remained in the minimum demand position waiting for a response from the "B" TDRFP control valve to balance flow between both reactor feed pumps.

At 1700 hours, Operators notified the Load Dispatcher of the feedwater problems and began reducing reactor power over the next fifteen minutes in preparation for removing the "B" TDRFP from service.

At 1705 hours, operators shut high pressure steam supply valve 1B21-F303E. The area operator slowly shut off low pressure steam to the "B" TDRFP using the local manual handwheel of isolation valve [ISV] 1B21-F310B. The area operator coordinated this evolution with the "A" CRO in the Main Control Room who was reducing reactor power by reducing reactor recirculation flow.

By 1716 hours, reactor power had been reduced to eighty-three percent and operators began a further reduction in power toward seventy-five percent. Valve 1B21-F310B was approximately eighty percent closed when flow through the "B" TDRFP started to decrease and the "A" TDRFP started to pick up more of the feedwater flow load.

At 1726 hours, with reactor power at seventy-two percent and valve 1B21-F310B approximately ninety percent closed, the "B" TDRFP control valve

24, 1991 involved the mechanical components that operate the TDRFP control valve. Severe wear was found in three bearings of the mechanical linkage assembly. Two bearings for the torque bar (pillow block bearings) were cleaned, lubricated and rotated to make contact with the unused surface. A third bearing, on the torque lever, was also cleaned and lubricated. Following completion of these actions, the pump operated properly. The third bearing was scheduled for replacement in RF-3 pending parts availability. On January 30, 1992, the pump locked up for only a few minutes and then restored to normal.

During the May 1 and September 24 events, the "B" TDRFP was successfully isolated in the manner similar to that pursued during this event. The successful isolation of the pump prevented a reactor water level transient that would have caused a reactor scram. Following the January 30 event, the decision was made to install Temporary Modification 92-26.

An action plan has been developed to further investigate the cause of this event. The plan includes disassembly and inspection of the operating cylinder assembly for the low pressure TDRFP control valve and inspection of the TDRFP control valve gear assembly. Components will be replaced as needed. Any additional actions necessary to determine the cause of the lockup will be determined after completion of these activities.

A determination of the root cause and actions necessary to prevent recurrence of the lockup problem is scheduled to be completed by May 9, 1992.

Illinois Power expects to provide a supplemental report to the NRC identifying the root cause, corrective actions, similar reported events, and equipment failures by June 22, 1992.

ANALYSIS OF EVENT

This event is reportable under the provisions of 10CFR50.73(a)(2)(iv) due to the automatic actuation of the Reactor Protection System [JC].

Assessment of the safety consequences and implications of this event indicates that this event was not nuclear safety significant. This event is bounded by the Loss of Feedwater Flow transient discussed in Chapter 15 of the Updated Safety Analysis Report. This event was within the design basis of the plant. The capability of the plant to perform its intended safety functions and achieve and maintain a safe shutdown was not affected by this event.

closed. Reactor water level quickly dropped from 32.5 inches to about 12 inches and then slowly dropped to about 10.7 inches. Level then appeared to be on the verge of recovering. The TDRFP controller demand went to thirty percent. The area operator noted that the "B" TDRFP control valve opened briefly and then closed.

The Shift Supervisor directed that a manual scram be initiated, but before the scram could be initiated, an automatic scram occurred because of low reactor water level (Level 3).

No other automatic or manually initiated safety system responses were necessary to place the plant in a safe and stable condition. No other equipment or components were inoperable at the start of this event such that their inoperable condition contributed to this event.

CAUSE OF THE EVENT/CORRECTIVE ACTION

The cause of this event is still being investigated. However, the lockup of the "B" TDRFP control valve caused the feedwater transient and the low reactor water level scram.

The system engineer has performed a preliminary assessment of the "B" TDRFP control valve lockup based on data from a GETARS trace (via Temporary Modification 92-26). The preliminary assessment determined that the feedwater control signal functioned properly during the event, and the pilot valve response to the servo valve action was consistent with the feedwater control signal. However, the GETARS data indicates that the lockup of the "B" TDRFP control valve was caused by a mechanical restriction which prevented the TDRFP control valve from properly modulating in response to the feedwater control signal.

The sudden closure of the "B" TDRFP control valve was caused by the freeing of the control valve from its locked-up position when the control signal was at a minimum. The reactor water level transient caused the low water level scram.

The preliminary assessment identified that the main operating cylinder and/or gear [GR] assembly of the TDRFP control valve did not respond as expected but instead locked up while trying to respond to the level transient.

Three previous events have occurred involving a lockup of the "B" TDRFP control valve. None of the events were reportable under the provisions of 10CFR50.73. Investigation of an event which occurred on May 1, 1991 provided strong indication that the TDRFP control valve lockup was caused by the servo valve in the operating cylinder assembly of the TDRFP control valve. Following replacement of the servo valve, the pump operated properly. Investigation of an event which occurred on September

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

ADDITIONAL INFORMATION

Since the cause of the event has not been established, previous similar events cannot be determined at this time. Additionally, a determination of specific equipment failures has not been made. This information will be provided in the supplement to this report.

For further information regarding this event, contact O. Villarreal, System Engineer, at (217)935-8881, extension 3098.