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RECIP.NAME RECIPIENT AFFILIATION

DAVIS,A.B. Region 3 (Post 820201)

SUBJECT: LER 90-018-01:on 901003,unexpected load line change observed.Caused by inaccurate core flow indication results. Calibr changed.W/901221 ltr.

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Iowa Electric Light and Power Company

December 21, 1990
DAEC-90- 1064

Mr. A. Bert Davis
Regional Administrator
Region III
U. S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

Subject: Duane Arnold Energy Center
Docket No: 50-331
Op. License DPR-49
Licensee Event Report #90-018 Rev. 1

Gentlemen:

In accordance with 10 CFR 50.73 please find attached a copy of the subject revised Licensee Event Report.

Very truly yours,

Richard Anderson for

Rick L. Hannen
Plant Superintendent - Nuclear

RLH/HT/pwj

cc: Director of Nuclear Reactor Regulation
Document Control Desk
U.S. Nuclear Regulatory Commission
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File A-118a

IE22
1/1

NRC Form 366A (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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Duane Arnold Energy Center	0 5 0 0 0 3 3 1	1 OF 0 5

TITLE (4) Inaccurate Core Flow Indication Results in Reactor Operations in a Region of the Power-to-Flow Map not allowed by Technical Specifications

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)
1 0	0 1	9 0	9 0	0 1 8	0 1	1 2	3 1	9 0	None	0 5 0 0 0
										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 4 7	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(a)(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
Hai Tran, Technical Support Engineer	3 1 9 8 5 1 - 7 4 9 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
X	A D	N O N E	N O N E	N					

SUPPLEMENTAL 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 October 3, 1990, the plant was operating in Single Loop Operation (SLO) following a trip of the "B" recirculation pump on October 1. Following an increase of core flow, an unexpected load line change was observed by Operations personnel and an investigation initiated. A review of all core flow data has since indicated that the actual total core flow prior to the adjustment was lower than the value previously determined. Therefore, prior to the core flow increase, the DAEC had been operating in a region of the Power-to-Flow map restricted by Technical Specifications. No reactor instabilities were noted during the event. The principal cause of the erroneous core flow indication was a recent change in the calibration setpoints of some flow instrumentation. As an immediate corrective action, Operations personnel were informed of the inaccuracies. The inadvertent calibration change has been corrected. The surveillance test used to determine reactor operating limits during SLO has been modified to incorporate an additional factor of conservatism, including recommendations regarding load line operation. The long term corrective actions are to perform instrument loop calibration on the jet pump instruments once every cycle, and to provide greater assurance of consistency regarding use of instrument offsets.

This revised LER is being submitted to update the original LER, detailing further review of the event.

I. DESCRIPTION OF EVENT:

On October 3, 1990, the plant was operating in Single Loop Operation (SLO) at 47% of rated power, 44% of rated total core flow (indicated), and 79% load line with "A" recirculation system in service following a trip of the "B" recirculation pump. Surveillance tests had been performed that indicated reactor operation was within an acceptable region of the Power-to-Flow operating map. At 1335 hours, reactor power was increased with the "A" recirculation pump. Following an increase of core flow to above 45% as indicated in the Control Room, an unexpected load line change was observed. The load line was observed by Operations personnel to rise from 79% to approximately 89% with no corresponding control rod pattern adjustment. While temporary change due to xenon concentration would be expected, this appeared to exceed that value. An investigation was initiated.

A review of the core plate differential pressure (D/P) data versus total core flow was performed. It appeared that the actual total core flow prior to the adjustment could have been nominally 36% of rated versus the 44% indicated and therefore the actual load line had been higher than indicated. This raised the concern that the reactor had been operating in a region of the Power-to-Flow operating map restricted by Technical Specifications. An evaluation of operating records has since indicated that the reactor entered this region at approximately 0032 hours on 10-2-90 and exited at approximately 1439 hours on 10-3-90. This constituted a condition prohibited by Technical Specification 3.6.F.2.b. No reactor instabilities were noted during this time period.

II. SYSTEM OESCRIPTION:

At DAEC, total core flow is determined by a system that measures the D/P between the throat section of each recirculation jet pump and the pressure below the core support plate. There are sixteen jet pumps divided equally between loops "A" and "B". A square root converter processes the D/P for each jet pump. The individual jet pump flow signals are summed to obtain the jet pump loop flows for loops "A" and "B". The loop "A" and loop "B" jet pump flow signals are further processed to produce a total core flow signal. This is indicated in the Control Room and is an input to the process computer, but is not an input to any automatic functions. It is used in the calculation of location on the power-to-flow map.

III. CAUSE OF EVENT

The cause of the event was an incorrect total core flow signal due to an inaccurate idle jet pump loop flow signal. The output of the jet pump flow transmitters each normally contain an offset correction to account for differing instrument line temperatures and fluid densities. Prior to this event the jet pump flow transmitters in the idle "B" jet pump instrument loop were inadvertently calibrated without the offset. This caused the "B" jet pump instrument loop to indicate a flow rate significantly lower than the actual flow occurring through the "B" jet pump loop due to the operation of the "A" recirculation pump. This "reverse" flow must be subtracted from the flow noted within the jet pumps for the running ("A") Recirculation Pump in order to obtain the actual total core flow. The end result of the missing offsets was a total core flow indication significantly higher than actual. This indication was used when plotting the plant's position on the Power-to-Flow map, and ultimately lead to the operation in the region restricted by the Technical Specifications. The intermediate cause of this event was the calibration of the "B" jet pump loop flow transmitters without the needed offsets. The root cause was inadequate control of the instrument offset requirement. Another minor contributing cause of the event was the inherent limitations of the jet pump measurement system at lower core flows.

IV. ANALYSIS OF EVENT

Technical Specifications restrict operation in this region of the power-to-flow map because under these conditions reactor instabilities can occur. An engineering review of the Average Power Range Monitor (APRM) flux level data has concluded that no unusual neutron flux oscillation or unstable reactor condition occurred during the period on October 2-3 when the reactor was operating in this region.

Had unstable reactor behavior (peak-to-peak swings greater than 10% of rated power) occurred during the event, the neutron monitoring system would have indicated as such and operators would have responded by manually scramming the plant. Additionally, the neutron monitoring system is designed to initiate the Reactor Protection System automatically prior to the plant approaching its Minimum Critical Power Ratio (MCPR) safety limit by means of an independent flow-referenced scram on high neutron flux levels. Based on the engineering review and the neutron monitoring system design feature, this event did not effect the safe operation of the plant.

V. CORRECTIVE ACTIONS:

Interim Corrective Action:

1. Operations personnel were informed of the inaccuracies of the core flow instrumentation.

2. The surveillance test for SLO has been modified to include an additional factor of conservatism to ensure any SLO in the near future will remain within limits. Recommendations have been incorporated regarding load line operation and core plate D/P has been added to the reactor flow calculation methodology. A Reactor Engineer is now required to verify the core flow as well as the thermal limits.

3. Jet pump instrument loop calibrations have been successfully completed, and the inadvertent calibration change has been corrected. The results of data obtained during this process were used to help establish the cause of the event.

Long Term Corrective Actions:

1. The interim corrective action #2 has been approved as permanent corrective actions. Guidance to provide an additional factor of conservatism regarding load line operation has been permanently added to the surveillance test for SLO. Core plate D/P versus core flow measurement has been permanently added to the SLO surveillance test and the conservative value among the multiple indications will be used for core flow determination. A Reactor Engineer is now required to verify the core flow as well as the thermal limits.

2. The flow transmitter calibration procedure has been revised to ensure the instruments will be calibrated with the +0.5 mA offset.

3. An enhanced mechanism is now in use to provide greater assurance of consistency regarding use of instrument offsets.

4. A Jet pump instrument loop calibration procedure will be performed following the startup of each cycle to ensure the instrument loops are indicating properly. This procedure will be written and implemented by March 31, 1992.

VI. ADDITIONAL INFORMATION:

A. Previous Similar Events.

A review of previous plant Licensee Event Reports did not identify any similar events.

B. Failed Component Information.

None.

C. Applicable EIIS System Codes.

1. Reactor Recirculation System - AD.
2. Reactor Protection System - JC.

This event is being reported in accordance with 10 CFR 50.73 (a)(2)(i)(B).