LICENSEE EVENT REPORT (LER)

Form Rev 3.0

Facility Name (1)	Docket Number (2)	Page (3)
LaSalle County Station Unit 1	0 5 0 0 0 3 7 3	1 of 0 6

Title (4)

Control Rod Position Indication System Failed Due To Card Failure

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 1	0 5	9 4	9 4	--- 0 0 4 ---	0 0	0 2	2 2	9 4		

OPERATING MODE (9)	1
POWER LEVEL (10)	0 9 8

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10CFR (Check one or more of the following) (11)

	20.402(b)		20.405(c)		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)
	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)
Gerald L. Swihart, Regulatory Engineer, Extension 2794	8 1 5 3 5 7 - 6 7 6 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 A	E C B D		N					
X	A A	E C B D		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)

The LaSalle County Station Unit One Control Rod Position Indication System (RPIS) was determined to be inoperable at 2307 hours on January 4, 1994. Technical Specification 3.1.3.7 requires that the RPIS be returned to operable status within one hour or the unit be placed in at least Hot Shutdown within the following 12 hours.

The RPIS failure was caused by one of two components, a failed Probe Multiplexer Card or a diminished output amplitude from a File Control Card. Both are electronic cards within the RPIS. Repair and operability testing time exceeded the time allowed by Technical Specification 3.1.3.7, Control Rod Position Indication. Commonwealth Edison Co. requested and was granted a Notice of Enforcement Discretion at 1200 hours on January 5, 1994 to not enforce compliance with Technical Specification 3.1.3.7 for a period of 6 additional hours.

At 1340 hours on January 5, 1994 the RPIS was declared Operable following repair and testing. The time allowed to reach at least Hot Shutdown was exceeded by 93 minutes. This violation of Technical Specification 3.1.3.7 is reportable within 30 days per 10CFR50.73(a)(2)(i)(B).

PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor

Energy Industry Identification System (EIIS) codes are identified in the text as (XX).

A. CONDITION PRIOR TO EVENT

Unit(s): 1 Event Date: 01/05/94 Event Time: 2307 Hours

Reactor Mode(s): 1 Modes(s) Name: Run Power Level(s): 98%

B. DESCRIPTION OF EVENT

At 2307 on January 4, 1994, LaSalle County Station Unit 1 entered Action Statement a.4 of Technical Specification 3.1.3.7. due to the inoperability of the Control Rod Position Indication System (RPIS, PI)[AA]. Since no direct control rod position indication was available in the Main Control Room and could not be restored within one hour, action a.4 required Unit 1 to be in Hot Shutdown within the next 12 hours. Repairs were not completed within the 12 hours provided to reach Hot Shutdown. At 1200 hours on January 5, 1994, NRC Region 3 verbally granted a Notice of Enforcement Discretion (NOED), allowing an additional 6 hours prior to requiring Unit 1 to be shut down. This action was documented in a letter dated January 7, 1994 from E.G. Greenman to W.P. Murphy. RPIS repair and operability testing was completed at 1340 on January 5, 1994.

There were no power changes or control rod movements in progress at the time RPIS was lost. The failure of RPIS involved extensive troubleshooting to determine the failed component(s) plus time to repair the system and conduct operability testing. Troubleshooting and repair time exceeded the time allowed to reach Hot Shutdown.

The chronology of this event with actions taken is as follows:

1/4/93

2307 (t_0=0) Control Room Personnel identify that the Rod Worth Minimizer (RWM,RW)[AA] was not updating rod position indication. The Control Room determined that the rod position indication system (RPIS) was not working and called the Instrument Maintenance Department (IMD). This started a 1 hour allowed outage time (AOT) to either restore control rod position indication or Shutdown Unit 1 to at least Hot Shutdown within the next 12 hours per Technical Specification 3.1.3.7 actions a. and a.4.

1/5/93

2307 to 0330 IMD was troubleshooting RWM and RPIS data. The Process Computer printout of rod positions (OD7) showed "some good" and "some bad" groups of rods . Noise was found in a signal cable and corrected, due to suspicion that noise in conjunction with RWM was loading down the output signal and was thus causing the problem. The noise was resolved, but the problem with RPIS remained.

0400 (t=4.9 hrs) Shift Engineer called for additional support.

0500 (t=5.9 hrs) IMD/Engineer swapped computer format for OD7 (software option) to "show all rods with bad data as '-99' ". This printout showed that ALL rod data was bad, not just groups. Based on this information it was decided that the problem was not in the output stream, but towards the input/decoding/control portion of system.

B. DESCRIPTION OF EVENT CONTINUED

0515 (t=6.1 hrs) The IMD Lead Foreman (site RPIS expert) arrived onsite. Troubleshooting shifted to the control portion of system. There was indication that a signal from a multiplexer (MUX) file control was blocking signals. The file control card was swapped with a new card, but no change occurred. A bad driver in the Identification (ID) signal path was found after the swap back to the original card. A new driver card was inserted, and although the ID data was fixed, the problem still existed with RPIS.

0730 (t=8.4 hrs) In order to satisfy the need to obtain rod positions per Technical Specification Surveillance Requirement once per 12 hours, the Engineer/IMD developed a method for determining control rod positions. Extender cards were marked up to allow manually reading RPIS probe reed switch positions with voltmeter(s). The method was verified and techniques were worked out to ensure the correct data would be achieved on the first pass. (There are 185 rods and each probe has 52 reed switches wired in a matrix).

0900 (t=9.9 hrs) All rod positions were verified. All rods were verified to be in the same positions as the previous day.

= 0730 (t=8.4 hrs) Discussion with the NRC began, requested Enforcement Discretion from Technical Specification 3.1.3.7 Action Statement a because completion of repairs and testing might not be completed by the 12:07 timeclock expiration.

0945 (t=10.6 hrs) A phone link was made with General Electric Co. (GE) RPIS Maintenance Training Engineer in San Jose. Troubleshooting was continued over the phone with RPIS prints at both ends, discussing RPIS actions/indications. The consensus was to stick with piece-wise data checking with oscilloscope versus "easter egg" card replacements. The complexity of this system is such that card swapping can sometimes solve it very quickly, but can sometimes cause failures and lead completely off the path. A methodical process is slower, but more certain to reach a solution.

1100 (t=11.9 hrs) The control file card signal blocks were verified to be caused by one of the control cards Input Probe Mux cards (this was actually inserting multiple card data into the data stream).

1115 (t=12.1 hrs) A bad Probe Mux card was found and replaced.

1125 (t=12.3 hrs) Began stepping through control rods in control room. A Control Rod Position check program, 007, verified that the problem was solved.

1135 (t=12.5 hrs) All temporary extender cards were removed, RWM leads were re-landed, and the system was closed up. Control rod position indication operability testing began by exercising each withdrawn control rod one notch.

-1200 (t=12.9 hrs) The NRC verbally granted a Notice of Enforcement Discretion (NOED) using their discretion not to enforce compliance with Technical Specification 3.1.3.7 for a period up to 6 hours starting January 5, 1994 at 1200 (CST), to allow for testing of the RPIS and declaring RPIS operable or bringing Unit 1 to hot shutdown in an orderly manner. This period of enforcement discretion expired at 1800 on January 5, 1994.

B. DESCRIPTION OF EVENT CONTINUED

1207 (t=13 hrs) Technical Specification 3.1.3.7 action a.4 required Unit 1 to be in at least Hot Shutdown. The enforcement discretion allowed continued testing of RPIS without shutting down Unit 1.

~1330 (t=14.4 hrs) The operability testing in accordance with approved surveillance procedures was completed and RPIS was declared Operable approximately 1.4 hours past the end of the time allowed by Technical Specification 3.1.3.7.

C. APPARENT CAUSE OF EVENT

The main problem was a failed Probe Multiplexer (Mux) Card in Module 2 File 1, with the address of 30-23. A Probe Mux Card receives data from the position indicator probes located in the control rod drives. Each card serves four probes associated with the four rod group. The cards are mounted in the Multiplex Files of the Rod Position Indication Cabinet. The control section of the card is continually receiving Address words sent out by the Control File. When the address received matches the identity of the Mux Card as defined by the row and column Identity (Ident) Cards inserted in it, the control circuitry will transfer the contents of one shift register onto the outgoing data line in series form for subsequent recovery by the Control File. The Mux Cards in a file are series connected so that input data, clock and sync signals are passed on to the following card. All cards transfer the data to their neighbors. Since this particular card was faulted, it did not allow the system to function as designed and actually blocked rod position data from being transmitted.

A secondary problem was a diminished output amplitude from a File Control Card of Module 2 File 1. A File Control Card serves as the master control for all cards in a given Multiplexer (MUX) file. It communicates asynchronously with the Control File and neighboring Mux Files. Ident words issued by the Control File are received by the File Control Card in the first Mux File and passed on to the next Mux File. Each File Control Card reformats the Ident word and passes it on to the Mux Cards in its file. Likewise, Probe words originating in Mux Cards are passed to their respective File Control Cards and from there back along a parallel path to the Control File. The oscillator, sync circuit, and program counter on the File Control Card produce synchronous timing signals which are distributed to all cards in the file along with the data derived from each Ident word.

Either failure would have yielded similar results on its own. Therefore it is unknown whether both failures existed simultaneously or whether the File Control Card failure was the result of the troubleshooting process. The File control card failure was discovered first and corrected. Upon replacement of the failed Probe Mux Card, the position indication system was restored to normal working status.

D. SAFETY ANALYSIS OF EVENT

Control Rod Position Indication is provided by the Reactor Manual Control System. The safety function of Control Rods is to provide the primary means for rapid reactivity control (reactor scram), for maintaining the reactor subcritical and for limiting the potential effects of reactivity insertion events caused by malfunctions of the Control Rod Drive (CRD) System. The capability to insert the control rods ensures the assumptions for scram reactivity in the Design Basis Accident (DBA) and transient analyses are not violated. The control rod scram function is not affected by the loss of RPIS. RPIS is used to determine control rod operability and for controlling rod patterns. During the time RPIS was inoperable, movement of a control rod or rods without control room operator knowledge was not directly indicated in the Main Control Room due to the drift alarm also not being available. However, any significant control rod movement would cause a reactivity change and thus a power change. Any power changes could be detected by other means: the APRMs were all Operable as well as indications of Feedwater flow, and Main Generator Output in MWe.

D. SAFETY ANALYSIS OF EVENT CONTINUED

The withdrawn control rods were exercised per Surveillance Requirement 4.1.3.1.2 on the midnight shift 1/4/94. The last known control rod positions from the Control Room were verified on the afternoon shift on 1/4/94. The control rod positions were verified by alternate means at approximately 0830, 1/5/94. All control rods were fully withdrawn except for five control rods, which were fully inserted. If a single control rod drifted, it could not pass the tip of any other rod due to the rod positions. The Control Rods that were full in were high power rods, which would cause a power change if a drift occurred. These 5 full-in control rods were electrically and hydraulically isolated within the time frame required by Technical Specifications.

Technical Specification 3.1.3.7 required LaSalle Station Unit 1 to be in Hot Shutdown by 1207 CST on January 5, 1994. The only means of shutdown available was reducing power using the Reactor Recirculation System to reduce core flow, followed by a manual scram. The probability of an undetected control rod drift with the above compensatory actions was extremely small during the 1.4 hours of enforcement discretion used to restore the RPIS to Operable status per the Technical Specifications. The request for enforcement discretion was necessary to minimize the risk associated with scramming the reactor from approximately 55% to 60% power, which could have placed the plant in a transient condition, subjecting the unit to unnecessary thermal cycles on plant equipment and associated challenges to safety systems.

The safety significance associated with the period of time required to restore RPIS to Operable status was minimal. Multiple indications of reactor power were being monitored for detection of control rod drift. Any indication of control rod drift would have required a manual scram. The reactor also would have been manually scrammed if multiple accumulator alarms are received at the same time.

E. CORRECTIVE ACTIONS

1. The following Compensatory Actions were placed in effect as a commitment in the request for NOED documented in a letter dated January 5, 1994 from G.G. Benes to J.B. Martin:

   a) During the time RPIS was inoperable, Unit 1 power was not changed to aid in the determination of any control rod drifts.

   b) Control Rod positions were verified once per 8 hours using a multimeter in the Aux Electric Equipment Room.

   c) Core Thermal Power and LPRM readings were monitored approximately every 15 minutes via the plant process computer.

   d) The APRMs, Feedwater flow, and Generator MWe were monitored continuously using a dedicated operator.

   e) During the time RPIS was inoperable, scram functional testing (half-scrams) was neither required nor performed.

   f) Control Room Operators were directed to manually scram the reactor if any changes in monitored parameters indicated possible control rod drift(s).

2. Once the problem was identified and corrected, control rod movement (one notch) was performed to verify the operability of RPIS in accordance with plant procedures.

3. In order to assure compliance with reportability requirements the written guidance for NOED requests has been revised to require a Problem Identification Form (PIF) to be initiated for reportability determination.

E. CORRECTIVE ACTIONS CONTINUED

4. Operating Shift Supervisors have been given interim guidance to promptly notify (within two hours) the Nuclear Duty Officer and the NRC Resident Inspector of unscheduled entry into an LCO which requires a shutdown, if the allowed outage time is less than 24 hours. Guidance is in the process of being formalized.

5. At 1500 on January 5, 1994, a training session was held with the Instrument Maintenance Department to discuss the sequence that occurred and ways to improve troubleshooting. Also, the tight time criteria that the RPIS Technical Specification mandates was discussed, and the challenge that short allowed outage time creates due to the complexity of RPIS. The Instrument Technicians requested a "Knowledge Book" to capture the troubleshooting methods and lessons learned. This will be provided. Completion of this task is being tracked under Action Item Record (AIR) 373-180-94-0029601.

F. PREVIOUS EVENTS

A data base search was made and no previous events were found.

G. COMPONENT FAILURE DATA

Manufacturer	Nomenclature	Model Number	MFG Part Number
General Electric	File Control Card	N/A	195B9040AAG001
General Electric	Probe Multiplexer Card	N/A	195B9038BBG001

SHEET 1

EVENT SUMMARY AND CAUSE CODES

373-1B099-00296PIF

DVR Number
__-_-__-___

- ☐ Lost generation
- ☐ Cost > $25,000
- ☐ Hazard or Spill
- ☐ Personnel injury

- ☐ Reactor trip
- ☐ ESF actuation
- ☐ NRC reportable
- ☐ LER
- ☐ PSE

- ☐ NRC violation, level__
- ☐ GSEP event, class____
- ☐ Tech Spec LCO
- ☐ Potential or future lo
- ☐ SALP functional area_

Component type | Failure mode | Department

X | JEL | EL | IM
X | IEL | EL | IM
X | | | |
X | | | |

Licensed? L or blank | Level | Department | Type | Detail code

A | | | | | | | | |
A | | | | | | | | |
A | | | | | | | | |

Type | Detail Code | Department

B | | | | | |
B | | | | | |
B | | | | | |

Type | Detail code

C | | | |

Type of deficiency | Detail code | Procedure type

D | | | | | |
D | | | | | |
D | | | | | |

Type | Detail code | Department

E | | | | | |
E | | | | | |
E | | | | | |