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ComEd

August 25, 2000

LTR: BYRON 2000-0119
File: 3.03.0800

United States Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Byron Station, Unit 2
Facility Operating License No. NPF-66
NRC Docket No. STN 50-455

Subject: Licensee Event Report (LER) 2000-002-00

Enclosed is an LER concerning the Byron Station Unit 2 automatic reactor trip on July 26, 2000. This event is reportable to the NRC in accordance with 10 CFR 50.73 (a)(2)(iv).

If you need any additional information concerning this report, please contact Mr. Brad Adams, Regulatory Assurance Manager, at (815) 234-5441, extension 2280.

Sincerely,

William Levis
Site Vice President
Byron Station

WL/JL/dpk

Enclosure: Byron Station, Unit 2 LER 2000-002-00

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Byron Station

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NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Byron Station, Unit 2	STN 05000455	1 of 8

TITLE (4) Automatic Reactor Trip System Actuation from Low Steam Generator Level Caused by an Inappropriate Operator Response to a Failed Circuit Card in the Feedwater Flow Control Circuitry

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 NAME	DOCKET NUMBER
07	26	2000	2000	002	00	08	25	2000	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9): MODE 1

POWER LEVEL (10): 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(iii)	☐ 73.71(b)
☐ 20.2203(a)(1)	☐ 20.2203(a)(3)(ii)	☒ 50.73(a)(2)(iv)	☐ 73.71(c)
☐ 20.2203(a)(2)(i)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(v)	☐ OTHER
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)	☐ 50.73(a)(2)(vii)	
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(viii)(A)	(Specify in Abstract
☐ 20.2203(a)(2)(iv)	☐ 50.73(a)(2)(I)	☐ 50.73(a)(2)(viii)(B)	below and in Text,
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(ii)	☐ 50.73(a)(2)(x)	NRC Form 366A)

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Brad Adams, Regulatory Assurance Manager	(815) 234-5441 X2280

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
X	FK	LIK	Westinghouse	Yes					

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 July 26, 2000, at 1833 hours, Byron Station, Unit 2 experienced a reactor trip due to Steam Generator 2C low level. The low level was caused by a Protection and Control Instrumentation Rack NTD circuit card failure in the Main Feedwater (FW) Regulating Valve (FRV) circuitry and inappropriate licensed operators' response to the card failure causing the FRV to close. Following the reactor trip, the circuit card was replaced and the unit returned to power operations. A Company wide task force has been formed to evaluate control circuit card issues in an effort to reduce failures. The inappropriate operator actions include not using alternate indications to validate their diagnosis, switching the FW control from automatic to manual, switching back to manual after returning to automatic control, and the delay in identifying the need to initiate a manual reactor trip which resulted in the automatic reactor trip. Procedural and training improvements will be made to help the operator better diagnose and respond to control circuit failures. Operations Management will reinforce the expectation to validate information and to manually trip the reactor prior to exceeding an automatic trip setpoint. This event is reportable in accordance with 10 CFR 50.73 (a)(2)(iv).

A. Plant Conditions Prior to Event:

Event Date/Time: July 26, 2000/1833 hours

Unit 2 - Mode 1 - Power Operation, Reactor Power - 100%

Reactor Coolant System [AB] Temperature/Pressure: Normal operating temperature and pressure.

At the time of the event, no significant work was in progress in the plant. No work was in progress in the Protection and Control Instrumentation Racks [JE]. In the Main Control Room (MCR), no unusual conditions or alarms existed for the 2C Steam Generator (SG) [SB]. The 2C SG level, Feedwater (FW)[SJ] Flow and pressure indications were all normal. The FW Regulating Valve (FRV) 2FW530 for the 2C SG was controlling flow in automatic to maintain the normal full power SG level of approximately 60 percent.

The Unit 2 Boron Dilution Protection System (BDPS) was inoperable as described in Byron Station Licensee Event Report (LER) 454-98-20-00. BDPS is required by Technical Specifications to be operable in Mode 3 (i.e., Hot Standby) through Mode 5 (i.e., Cold Shutdown). No other structures, systems or components were inoperable at the start of the event that contributed to the event.

B. Description of Event:

At 1830 hours operating shift turnover activities were in progress. The incoming licensed Unit Supervisor (US) for Unit 2 was walking down the Main Control Board (MCB) with the outgoing licensed Nuclear Station Operator (NSO). At this time, he observed the red, 100 percent demand light for the Manual/Automatic (M/A) station for FRV 2FW530 illuminated. This light is not normally illuminated during automatic operation and consequently, indicated a possible equipment failure of some type.

Both the NSO and the US stood together and focused their attention on the M/A station. The US observed the demand indication at the M/A station increasing from 60 to 62 percent on the M/A station scale. This scale is about four inches long for zero to 100 percent demand indication. The NSO and the US interpreted the two percent change as increasing FW flow to the 2C Steam Generator. The US and the NSO did not refer to other instruments, such as FW flow or SG level, on the MCB for confirmation of the apparent increased flow to the 2C Steam Generator.

B. Description of Event (continued):

The US directed the NSO to take manual control of the M/A station for the 2FW530 FRV. The direction to take manual control is an expected response based on training and procedural guidance. The NSO concurred and did take manual control. The FRV unexpectedly went to the full closed position. The manual position of the valve should have been tracking the automatic position resulting in a bumpless transfer. Instead the FRV went closed. In addition, the valve would not respond to open commands from the NSO and remained in the full closed position. Subsequently, it was learned that due to the nature of the card failure, the manual demand was full closed.

The US, still standing at the MCB, directed the NSO to return the 2FW530 FRV to automatic mode in order to open the FRV. Following this action by the NSO, the valve was opening in automatic, but too slowly to recover SG level. The US ordered the NSO to return to manual to attempt to open the valve more quickly. Following this action by the NSO, the valve again went full closed and did not respond to open commands. The US and the NSO returned the valve to automatic control and the valve again started to open. The NSO verbally expressed concern that the valve would probably not reopen in time to avoid reaching the reactor trip setpoint for low SG level. This short discussion between the US and the NSO, related to the SG level control, delayed the NSO's action to manually trip the reactor. Normally, the reactor would be manually tripped in anticipation of the automatic trip. However, due to the short delay, the reactor was not tripped manually prior to the automatic Low Steam Generator Level reactor trip. The Sequence of Events Recorder indicated an elapsed time of 36 seconds from the FW Flow Mismatch alarm to the Reactor Trip alarm.

At 1833 hours an automatic reactor trip signal was generated when SG level reached the low reactor trip setpoint. The reactor trip system responded as expected and shut down the reactor. The operators responded to the event using appropriate reactor trip response procedures. A reactor trip from power also causes an immediate entry into Mode 3 and as a result, operators entered the Technical Specification action requirement for BDPS inoperability. This required isolation of unborated water sources and verification that shutdown margin was within limits. These actions were accomplished by 1927 hours on July 26, 2000.

B. Description of Event (continued):

As an expected response to a reactor trip from 100 percent power, the steam generator water levels dropped below the low level setpoint for automatic Auxiliary Feedwater [BA] (AF) actuation. This resulted in the automatic initiation of both the trains of AF. This is considered an Engineered Safety Feature actuation. At 1915 hours on July 26, 2000, operators exited the reactor trip response procedures and entered the normal unit shutdown procedures. All other safety systems operated as expected in response to the reactor trip.

At 1905 hours on July 26, 2000, a NRC Emergency Notification System telephone call was completed in accordance with 10 CFR 50.72 (b)(2)(ii). This reporting criterion requires notification within four hours for any event or condition that results in the manual or automatic actuation of any engineered safety feature, including the reactor protection system. In addition, this event is reportable as an LER in accordance with 10 CFR 50.73 (a)(2)(iv). A root cause investigation into the reactor trip ensued.

C. Cause of Event:

The initiating root cause for this event was due to an equipment failure. The failure of the manual NTD card, 2FCY-0530A, in the 2FW530 control circuitry resulted in illuminating the 100 percent demand light on the 2FW530 M/A station which started the sequence of events that ended with the reactor trip.

Instrument Maintenance Technicians investigated the card failure and found the manual NTD circuit card had failed, such that, while in manual control, the valve would go to the full closed position, not respond to commands to open and the 100 percent demand light would illuminate. These are the symptoms observed by the US and NSO during the event. The automatic function of 2FW530 was found acceptable.

2FCY-0530A experienced an internal component failure that resulted in the card having no electrical output. Instrument Maintenance Technicians were able to determine that Integrated Circuit (IC) chip W28-1 on 2FCY-0530A experienced intermittent internal mechanical failure. The technicians were able to replicate this failure mode by simulating thermal transients on the card. The root cause of IC chip W28-1's failure is unknown.

C. **Cause of Event (continued):**

Subsequent to the initiating equipment failure, four inappropriate human performance actions occurred. The first inappropriate action was the failure of the US and NSO to review other MCB indications, such as FW flow rate or SG Level, to validate their conclusion that the automatic control of the FRV for the 2C SG was failing. The US and NSO became too focused on a single indication. Interviews with the US and NSO following this event failed to determine the rationale of focusing on the single indication. However, a latent organizational problem in procedural guidance may have contributed to the incorrect decision made by the US and NSO. There is no specific procedural guidance to the operators to check alternate indication prior to taking actions that could impact the plant.

The second inappropriate action involved the US and NSO taking the M/A station to manual control. Sufficient alternate MCB indications existed to conclude that an actual SG level transient was not in progress. Urgent actions to stabilize the 2C SG level were not necessary. A latent organizational problem in training provided to licensed operators contributed to the incorrect decision made by the US and NSO. The US and NSO used their training experience to direct the actions that led to going to manual control. Operators are trained on the simulator to respond to the failure of an M/A station by taking manual control. Interviews with simulator trained personnel indicated that, in most cases, taking manual control is the right thing to do especially during FRV transients due to the short time available to take action without resulting in a reactor trip. In addition, the operators are not specifically trained to diagnose the failure of an M/A station.

The third inappropriate action occurred when the US and NSO returned the FRV to manual control when automatic control was not opening the FRV fast enough to avoid the reactor trip. If the failure of the M/A station had been due to a different type of component failure, such as an intermittent equipment failure, this action might have allowed them to regain manual control.

The fourth inappropriate action was the delay in determining the need to manually trip the reactor. The delay was caused by a discussion between the US and NSO concerning the event.

C. Cause of Event (continued):

In addition, Operations Management expressed some concern about the effectiveness of the Command and Control function of the US and the interface between the US and NSO during the event.

D. Safety Analysis:

There were no safety consequences impacting plant or public safety as a result of this event. The reactor trip system responded as intended to the low steam generator level condition and shut down the reactor without incident. The current second quarter 2000 Unit 2 NRC Performance Indicator for unplanned scrams is in the green band (i.e., low safety significance) at a value of 0.9. It is estimated that this reactor trip will change the indicator's value to approximately 1.6. This is still well within the green band.

E. Corrective Actions:

The Automatic NTD card, Manual NTD card and the NCB card for the 2FW530 FRV control circuitry were replaced. The Automatic NTD card and the NCB card were checked, found acceptable, and returned to the storeroom for future use.

A Commonwealth Edison (ComEd) Company Nuclear Generation Group (NGG) Task Force has been formed to evaluate control card failures and reliability. We will review and implement, as appropriate, the NGG Task Force recommendations for preventative maintenance program changes regarding these circuit cards.

The malfunctioning manual NTD card has been sent to ComEd's Component Laboratory for further analysis. The site will evaluate the results of the analysis utilizing the NGG Task Force recommendations.

The Station Operations and Training Departments will improve the operator's ability to correctly respond to instrument and controller failures. Station Management will reinforce, through training, the expectation to use alternate indication prior to decision making and taking action. The Training Department will develop simulator failure scenerios, which will require the operating crew to correctly interpret multiple indications in order to take the correct action or inaction to address the failure.

E. Corrective Actions (continued):

During operator simulator sessions, emphasis will be placed on maintaining the big picture. Management will reinforce, through training, the expectation to maintain Command and Control.

The Operations Department will develop new guidance or revise existing guidance to direct the Operator to use alternate indications, as appropriate.

Classroom training will provide licensed operators with more information on M/A station functions to improve their ability to diagnose M/A station failures from MCB indications.

Instrument Maintenance Department is revising classroom training to provide technicians with more information on M/A station functions to improve their ability to diagnose M/A stations failures.

Operations Management will reinforce expectations with NSOs that they should immediately manually trip the plant when they are convinced that a transient will exceed an automatic trip setpoint.

Operating and Training Management completed a review of M/A station controllers to identify additional controllers that Operating would take to manual (i.e., based on a failure) that could result in a plant transient up to and including a reactor trip. The results of this review will be factored into operator training, as appropriate.

F. Previous Occurrences:

There has been no similar events at Byron Station; however, it should be noted that failure of control circuit cards is an industry issue. Many nuclear stations have experienced transients following the failure of one or more these cards.

G. Component Failure Data:

Manufacturer	Nomenclature	Model Number
Westinghouse	1FCY-0530	2838A45G01/NTD