Entergy

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Site Vice President

NL-11-027

April 25, 2011

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop O-P1-17
Washington, D.C. 20555-0001

SUBJECT: Licensee Event Report # 2011-002-00, "Technical Specification Prohibited Condition Caused by an Inoperable 31 Battery Charger Due to Low Voltage Caused by a Degraded Gate Driver Board"
Indian Point Unit No. 3
Docket No. 50-286
DPR-64

Dear Sir or Madam:

Pursuant to 10 CFR 50.73(a)(1), Entergy Nuclear Operations Inc. (ENO) hereby provides Licensee Event Report (LER) 2011-002-00. The attached LER identifies an event where there was a Technical Specification (TS) prohibited condition for failure to perform TS required actions within the required completion time for an inoperable 31 Battery Charger during past operation, which is reportable under 10 CFR 50.73(a)(2)(i)(B). This condition was recorded in the Entergy Corrective Action Program as Condition Report CR-IP3-2010-03092 and CR-IP3-2011-00098.

There are no new commitments identified in this letter. Should you have any questions regarding this submittal, please contact Mr. Robert Walpole, Manager, Licensing at (914) 734-6710.

Sincerely,

JEP/cbr

cc: Mr. William Dean, Regional Administrator, NRC Region I
NRC Resident Inspector's Office, Indian Point 3
Mr. Paul Eddy, New York State Public Service Commission
LEREvents@inpo.org

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NRR

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES: 10/31/2013

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-I0202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME:	2. DOCKET NUMBER	3. PAGE
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4. TITLE: Technical Specification Prohibited Condition Caused by an Inoperable 31 Battery Charger Due to Low Voltage Caused by a Degraded Gate Driver Board

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV. NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
10	13	2010	2011-	002 -	00	4	25	2011		05000
									FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE

1

10. POWER LEVEL

100%

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER *(Include Area Code)*
Vincent Andreozzi, Supervisor, System Engineering-Electrical & I&C	(914) 734-6816

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	EJ	BYC	E356	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

16. ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced type written lines)*

On October 13, 2010, during performance of the weekly station battery inspection, the float voltage was found to be low but within the operability span but adjustments could not be performed due to a faulty float potentiometer. Subsequently, the control room received a 31 Static Inverter (SI) auto transfer alarm. Investigation determined the 31 SI had reversed transferred then swapped back to forward transfer. The 35 BC was placed in service and the 31 BC shutdown. A troubleshooting plan was prepared for the 31 battery charger (BC), and the 31 SI was verified to be in forward transfer and carrying instrument bus loads. The 31 BC float potentiometer and the Float/Equalize switch were replaced. The 31 BC was re-energized and proper operation of the new potentiometer and switch was verified while unloaded. A post maintenance test (PMT) was performed on the 31 BC but the results were unsatisfactory because the voltage could not be set within the required range. Further troubleshooting identified 31 BC output voltage oscillations. The gate drive board (A14) was replaced on the 31 BC and testing results were satisfactory. The 31 BC was returned to service on October 21, 2010. The direct cause was due to unstable DC input voltage from the 31 BC due to a faulty gate drive board (A14). The apparent cause could not be determined. The most likely cause was random failure of the A14 board. The A14 failure was not likely age related as the A14 board was replaced in 2005. Corrective actions included replacement of the gate drive board (A14) and load testing. The BC vendor was contacted to determine what may have caused the A14 board to malfunction and to provide recommendations. The vendor responded that there has been no history of failures for this component. The event had no significant effect on public health and safety.

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NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

Note: The Energy Industry Identification System Codes are identified within the brackets {}.

DESCRIPTION OF EVENT

On October 13, 2010, at approximately 12:58 hours, while at 100% steady state reactor power, during performance of 3-PT-W013 (Station Battery Weekly Inspection), the as-found float voltage was found to be low (127.6 VDC) but within the operability span (125.7 - 139.8 VDC). Float voltage adjustment could not be performed due to a faulty float potentiometer on the 31 Battery Charger (BC) {BYC}. This condition was recorded in the Indian Point Energy Center (IPEC) Corrective Action Program (CAP) as Condition Report CR-IP3-2010-03092. At approximately 16:18 hours, the Control Room (CR) {NA} received a 31 Static Inverter (SI) {INVT} auto transfer alarm {ALM}. A Nuclear Plant Operator (NPO) was dispatched to investigate the condition and reported to the CR that the 31 SI reverse transfer local alarms "Inverter Undervoltage" and "Load Supplied by Alternate Source" were lit. The 31 SI had auto transferred back to the normal power supply (Forward Transfer). The alarms were reset which cleared the local alarms and the CR alarm. This condition was recorded in the CAP as CR-IP3-2010-03098.

On October 13, 2010, at approximately 21:35 hours, the 35 BC was placed in service and the 31 BC shutdown. A troubleshooting plan was prepared for the 31 battery charger (BC) based on the applicable vendor manual section. Troubleshooting the 31 SI was not considered necessary as the 31 SI alarms reset and there were no indications of a blown fuse. The 31 SI was verified to be in forward transfer and carrying instrument bus loads. It was suspected that the low input voltage from the 31 BC may have caused the 31 SI swap. Troubleshooting of the 31 BC determined the 31 BC was current limited (approximately 105 amps) and as this current value was approached the voltage would drop. On October 14, 2010, Instrumentation and Control (I&C) personnel verified the 31 BC float potentiometer was faulty and the potentiometer was replaced along with the Float/Equalize switch. The 31 BC was re-energized and proper operation of the new potentiometer and switch was verified while unloaded. On October 15, 2010, at approximately 8:40 hours, the 31 BC was started and the load transferred off the 35 BC. A post maintenance test (PMT) was performed to demonstrate the effectiveness of the repairs. The PMT was unsatisfactory because the voltage could not be set within the required range. At 9:25 hours, on October 15, 2010, the 35 BC was placed back in service. Further troubleshooting was performed and on October 19, 2010, a full load test was conducted. During initiation of the load test, performance personnel identified that the 31 BC output exhibited voltage oscillations. The BC voltage under load is normally steady but was fluctuating. Engineering concluded the BC output was abnormal and the BC control module (A1) was replaced. Subsequent testing showed that the control module replacement did not resolve the fluctuating output voltage. I&C personnel reinstalled the original control module and replaced the gate drive board (A14) and the 31 BC was successfully retested. On October 21, 2010, at approximately 10:22 hours, the 31 BC was returned to service and 3-PT-W013 satisfactorily performed.

The 31 BC is part of the 125 VDC electric distribution system (EDS) {EJ} that provides DC power to equipment and components during normal operation and equipment that requires power in the event of a loss of all AC power. The 125 VDC EDS also supplies power to the 118 VAC instrument buses via the SIs. The 125 VDC EDS is composed of Station Batteries (31, 32, 33, 34, 36), Power Panels (31, 32, 33, 34, 36), Distribution Panels (31, 32, 33, 34, 31A, 32A), and Battery Charges (31, 32, 33, 34, 35, 36). The BCs are used to keep the batteries in a fully charged condition, perform periodic equalizing charges and to supply the DC power panels under normal operating conditions. The 35 BC is an installed spare and can supply BC loads for anyone of the 31-34 BCs.

Maintaining the batteries fully charges by their BCs is accomplished by adjusting BC output voltage to a value slightly greater than battery voltage. Float and equalize potentiometers are used to control the output voltages of the BCs which charges the batteries and maintains bus voltages. In case of high DC current demand the current limit control will keep the BC output within safe values without tripping the DC or AC circuit breakers. Whenever a BC is in a current limited condition, the output voltage is automatically reduced to a value below the set float or equalize voltage.

There are four 120 AC vital instrument buses (31, 32, 33, and 34) whose preferred power supply are SIs (31, 32, 33, and 34). SIs 31, 32 and 33 each have an alternate power source (Motor Control Centers via transformers). SI 34 has two alternate power sources (SOLA Transformers). Failure of a SI will cause the automatic static transfer switch to transfer to the alternate power source. When the SI is supplying 118 VAC, the SI is operating in the Forward Transfer Mode. When the static transfer switch shifts and the alternate power source is supplying 118 VAC, the SI is operating in the Reverse Transfer Mode.

The 31 BC is a 400 amp, 3 phase BC rated at 130 volts, manufactured by Exide {E356}, Model SCRF 130-3-400E. Three phase 480 VAC power supplies the BCs through an AC circuit breaker then to a power transformer which provides AC power at the correct voltage to silicon controlled rectifiers (SRC) {SCR}. The magnitude of the DC output is determined by controlling the time during which the SCRs are turned on. A voltage regulator that monitors the DC output voltage controls the time when the SCRs are fired. The output voltage setting is adjusted using a potentiometer on the BC. In case of high DC current demand, the current limit control will keep the charger output within safe values. The BC is supplied with an Auxiliary Gate Drive PC Board (A14) triggering the phase controlled SCR. The A14 board intercepts the SCR gate lead wiring from the control module. The A14 board converts the pulse train from the control module to a DC gating signal for the main SCRs. Industry Operating Events show there have been events regarding BC oscillating voltage, low voltage but none specified the gate driver board as a cause.

Extent of condition review determined that only unit 3 BC 31, 32 and 33 are applicable. The condition discovered for the 31 BC has occurred in the past and could happen again. The condition is self revealing and weekly surveillance testing will detect failures.

Cause of Event

The direct cause of the SI transferring to the alternate power source was due to an unstable DC input voltage from the 31 BC due to degradation of the Gate Driver Board (A14). The Gate Driver Board (A14) intercepts the silicon controlled rectifier (SCR) gate lead wiring from the Control Module (A1). If the Gate Driver Board (A14) corrupts the signal to the SCR, then the SCR will misfire and cause the voltage to oscillate. The apparent cause could not be determined but the most likely cause was random failure. The degraded Gate Driver Board (A14) was not considered age related as the A14 board for the 31 BC was replaced in 2005.

Corrective Actions

The following corrective actions have been performed under Entergy's Corrective Action Program to address the cause:

- Troubleshooting to identify the cause of the low 31 BC output voltage and oscillations, replacement of the 31 BC Gate Driver Board (A14).
- Satisfactory testing of the 31 BC and return to service.
- The BC vendor was contacted to determine what may have caused the A14 board to malfunction and to provide recommendations. The vendor responded that there was no history of failures of this component.

NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

Event Analysis

The event is reportable under 10CFR50.73(a)(2)(i)(B). The licensee shall report any operation or condition which was prohibited by the plants TS. On October 13, 2010, at approximately 12:58 hours, during performance of the weekly station battery inspection, the 31 BC as-found float voltage was found to be low and adjustments could not be performed to increase the voltage. Subsequently at 16:18 hours on October 13, 2010, the 31 SI swapped to reverse transfer and then back to forward transfer. It was concluded the 31 SI was operating normally and that low input voltage from the 31 BC may have caused the SI swap.

On October 19, 2010, during load testing, the 31 BC voltage output was identified as oscillating and the Gate Driver Board (A14) was replaced. Testing was performed and the 31 BC was returned to service on October 21, 2010. At the time of discovery (October 13, 2010), the as-found voltage of 127.6 volts was outside its required float voltage range (129.8-132.8) but within the TS Surveillance Requirement (SR) 3.8.4.1 specification of equal to or greater than 125.7 volts. Operations concluded that the 31 BC and 31 battery were operable. Based on the operability determination the event was not considered reportable. Subsequent questions on the operability of the BCs were recorded in CR-IP3-2011-00098 on January 10, 2011. Engineering assessed the condition for past operability and determined that troubleshooting at the time of the event found the 31 BC was current limited (approximately 105 amps) and as this voltage was approached the voltage would drop. An engineering calculation provides the minimum current for the 31 BC to be operable as 280 amps based on re-charging the 31 BC within 15 hours while carrying a continuous DC load. Because the 31 BC was found to be current limited at a current value below its required operability criteria, engineering concluded the 31 BC was inoperable while that condition existed. Engineering concluded on February 23, 2011, that the 31 BC was inoperable on October 13, 2010 from 12:58 hours to 21:25 hours when it was removed from service for an inoperable period of 8 hours and 27 minutes. Subsequent periods when the 31 BC was in-service was for troubleshooting and testing but were performed within the TS allowed completion time.

TS 3.8.4 has an allowed outage time of 2 hours for one DC electric power subsystem (31 or 32 or 33) inoperable. This event meets the reporting criteria because the inoperable condition during past operation exceeded the 2 hours allowed completion time for TS 3.8.4 and the required actions were not performed.

There was no safety system functional failure reportable under 10CFR50.73(a)(2)(v) as the minimum required safeguards components were available to perform the function during the time the 31 BC was inoperable. In accordance with reporting guidance in NUREG-1022, an additional random single failure need not be assumed in that system during the condition

Past Similar Events

A review was performed of the past three years of Licensee Event Reports (LERs) for events that involved a TS violation for an inoperable BC or SI. No LERs were identified.

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Safety Significance

This event had no significant effect on the health and safety of the public. There were no actual safety consequences for the event because there were no accidents or transients during the period of inoperability. With one BC inoperable, the remaining BCs and EDS were operable and available to perform their safety function. Additionally, the BCs have an installed spare in BC-35 which can supply BC loads for one of the 31-34 BCs. Also, failure to supply power to the vital instrument bus would cause the associated SI automatic static transfer switch to transfer to its alternate source of power. A loss of offsite power could result is stripping the SI power supply but they would be re-energized in accordance with plant procedures.

A risk assessment was performed of the condition assuming the 31 BC was unavailable for 8.5 hours. The baseline Core Damage Frequency (CDF) is 1.466E-5 per year. With BC unavailable for 8.5 hours, the CDF increased to 2.365E-5 per year which results in an incremental CDF (ICDF) of 9.0E-6 per year. Considering 8.5 hours BC unavailability results in an incremental core damage probability (ICDP) of 8.7E-9. This impact is not considered significant.