10 CFR 50.73

Progress Energy

Serial: RNP-RA/11-0037

MAY 18 2011

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

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23

LICENSEE EVENT REPORT NO. 2010-005-01
EMERGENCY DIESEL GENERATOR INOPERABLE DUE TO INVERTER FAILURE

Ladies and Gentlemen:

The attached Licensee Event Report (LER) is provided to include supplemental information and a change in corrective action status for LER 2010-005-00, which was submitted to the Nuclear Regulatory Commission on August 23, 2010. Should you have any questions regarding this matter, please contact Mr. J. Caves at (843) 857-1626.

Sincerely,

Thomas S. Cosgrove
Plant General Manager
H. B. Robinson Steam Electric Plant, Unit No. 2

TSC/psf

Attachment

c: L. A. Reyes, NRC, Region II
B. L. Mozafari, NRC, NRR
NRC Resident Inspector

IE22
NRR

Progress Energy Carolinas, Inc.
Robinson Nuclear Plant
3581 West Entrance Road
Hartsville, SC 29550

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

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

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
H. B. Robinson Steam Electric Plant, Unit No. 2	05000261	1 OF 5

4. TITLE

Emergency Diesel Generator Inoperable Due To Inverter Failure

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
										05000
06	24	2010	2010	- 005	- 01	08	23	2010	FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE

5

10. POWER LEVEL

0%

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

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Ashley Valone	843-857-1256

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
D	EE	INVT	Ametek	N						

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

This revision contains additional information regarding reactor coolant system temperature described in LER 2010-005-00 and reflects revised corrective actions.

At 1433 hours EDT on June 24, 2010, with H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, shutdown in Mode 5 during Refueling Outage 26, a loss of Instrument Bus 3 (IB-3) and Instrument Bus 8 occurred during performance of OST-163, "Safety Injection Test and Emergency Diesel Generator Auto Start on Loss of Power and Safety Injection." The loss of IB-3 resulted in the loss of Residual Heat Removal (RHR) temperature control and resulted in inoperability of the required Emergency Diesel Generator due to loss of the automatic load sequencer. Both trains of RHR continued to operate and reactor coolant system temperature remained in the range of approximately 93 to 97 degrees Fahrenheit. This condition could have prevented the fulfillment of a safety function that is needed to mitigate the consequences of an accident and is reportable under 10 CFR 50.73(a)(2)(v)(D).

The cause of this event has been determined to be the age related failure of an inverter component resulting from the inappropriate closure of a partially completed Preventive Maintenance associated work order.

The corrective actions to prevent recurrence include a revision to a procedure to clarify guidance for partial Preventive Maintenance work order completion. In addition, guidance will be provided to maintenance personnel regarding the completion and coding of partially performed or not performed Preventive Maintenance work orders.

LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REV. NO.	
H. B. Robinson Steam Electric Plant, Unit No. 2	05000261	2010	- 005	- 01	2 OF 5

NARRATIVE

I. DESCRIPTION OF EVENT

At 1433 hours EDT on June 24, 2010, with H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, shutdown in Mode 5 during Refueling Outage 26, a loss of Instrument Bus 3 (IB-3) [BU] and Instrument Bus 8 (IB-8) occurred during performance of OST-163, "Safety Injection Test and Emergency Diesel Generator Auto Start on Loss of Power and Safety Injection." The loss of IB-3 was caused by a failure of the power supply Inverter B [INVT]. The loss of IB-3 and Inverter B occurred during the undervoltage testing being performed on Emergency Bus E-1. Inverter A and Inverter B sync power supply is Instrument Bus 6 (IB-6). During OST-163, IB-6 was de-energized (i.e., loss of sync power) and then re-energized. The re-energization of sync power to Inverter B was the likely event initiator to the failure of Inverter B.

The loss of IB-3 resulted in the loss of power to RHR Heat Exchanger Flow Controller HIC-758 [BP:TC]. The failure of IB-3 resulted in reduced RHR flow to approximately 2,700 gallons per minute (gpm) caused by RHR Heat Exchanger Outlet Flow to Cold Legs valve HCV-758 failing closed. RHR Heat Exchanger bypass valve FCV-605 did not change state during this event. In addition, the loss of IB-3 removed power from 'B' Emergency Diesel Generator (EDG) automatic load sequencer [EK:2], which resulted in the one required EDG [EK] becoming inoperable. The 'A' EDG was inoperable due to the need to complete required post-maintenance testing. At 1449 hours, power was restored to IB-3 by use of an alternate power supply. At 1451 hours RHR temperature control was restored.

The event notification associated with this event (EN 46045) stated that Residual Heat Removal (RHR) valve FCV-605 [BP:FCV], RHR Heat Exchanger bypass valve, and HCV-758 [BP:HCV], RHR Heat Exchanger Outlet Flow to Cold Legs valve, closed due to the loss of power to IB-3. It has been subsequently determined that FCV-605 did not change position. HCV-758 closed due to the loss of control power when the instrument bus power was lost. Both trains of RHR continued to operate and reactor coolant system temperature remained in the range of approximately 93 to 96 degrees Fahrenheit.

The loss of IB-3 could have prevented the fulfillment of a safety function that is needed to mitigate the consequences of an accident and is reportable under 10 CFR 50.73(a)(2)(v)(D), "Any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident."

During this event, the following Technical Specifications (TS) were entered:

(1) TS 3.4.8, "RCS Loops – Mode 5, Loops not Filled," Condition B for required RHR trains inoperable.

(2) TS 3.8.8, "AC Instrument Bus Sources – Shutdown," Condition A for one or more instrument bus sources inoperable.

(3) TS 3.8.2, "AC Sources - Shutdown," Condition B for the EDG 'B' for the required EDG inoperable.

LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REV. NO.	
H. B. Robinson Steam Electric Plant, Unit No. 2	05000261	2010	- 005	- 01	3 OF 5

NARRATIVE

TS LCO 3.4.8, Condition B, was exited at 1451 hours on June 24, 2010, after restoration of IB-3 using the alternate power supply. TS LCO 3.8.2, Condition B, and LCO 3.8.8, Condition A, were exited on June 27, 2010 at 1109 hours, after restoring operability of Inverter B.

II. CAUSE OF EVENT

The cause of the loss of Inverter B was determined to be that the slew rate (the rate in which the inverter output changes to match the sync source) had deteriorated on Inverter B sync board. The deterioration was due to age degradation.

The sync board was not replaced in 2004 along with other internal components as scheduled due to an evaluation that had to be performed on the replacement sync board for compatibility. Replacement was not rescheduled appropriately due to the work order being incorrectly statused as completed satisfactory. Procedure, ADM-NGGC-0104, "Work Management Process," does not explicitly define "complete" when closing Preventive Maintenance work orders. Therefore, the work order was closed as completed even though the entire scope had not been completed. A follow-up work order was not initiated and this allowed the component to exceed its end-of-life expectance.

III. ANALYSIS OF EVENT

This event was investigated in accordance with the HBRSEP, Unit No. 2, Corrective Action Program (CAP) and documented in Significant Adverse Nuclear Condition Report 406834. This reportable event associated with the significant adverse condition investigation was reviewed by the Plant Nuclear Safety Committee on August 18, 2010.

In this event, EDG B was capable of automatically starting and providing power to the associated emergency bus. The automatic loading of the blackout sequence loads was inoperable due to the loss of IB-3. Therefore, manual starting of the required loads would have been required if an actual loss of power had occurred. The service water pumps are needed to maintain cooling water flow to the EDG. Operator action would have been required to restore service water via the control room in accordance with procedure, AOP-020, "Loss of Residual Heat Removal." AOP-020 is a direct entry procedure for a loss of Residual Heat Removal and includes steps to restore service water. The operators validated the procedural guidance based on conditions similar to the event and it was concluded that it would take approximately 25 minutes to restore the required components that would normally be started via the 'B' Train Blackout Sequencer. The EDG can operate without service water under station blackout loads for approximately 40 minutes.

In addition, the loss of power supply to IB-3 resulted in reduced RHR flow to approximately 2,700 gpm caused by valve HCV-758, RHR Heat Exchanger Outlet Flow to Cold Legs, failing closed. The operators took appropriate actions as directed by procedure AOP-020. The power supply to HIC-758 (RHR Heat Exchanger Flow Controller) was restored after power was restored to IB-3 by use of an alternate power supply. During the period while HCV-758 was closed and control of FCV-605 was lost,

an RHR temperature increase from 93.5 degrees Fahrenheit to 96.9 degrees Fahrenheit was observed.

During the performance of OST-163, RHR pump 'A,' which had been idle, started automatically as expected. RHR pump 'A' discharge outlet temperature increased from approximately 94 degrees Fahrenheit to 96 degrees Fahrenheit. The rise in RHR temperature that was observed can be attributed to RHR pump 'A' starting. RHR pump 'B' remained running during this test and RHR pump 'B' outlet temperature (i.e., reactor coolant temperature) remained unchanged at approximately 97 degrees Fahrenheit.

In addition, RHR flow reduced from approximately 3,450 gpm to approximately 2,700 gpm due to the loss of Instrument Bus 3. RHR flow remained approximately 2,700 gpm until 1450 hours on June 24, 2010. During this time, no charging pumps were in operation; therefore there was no boron dilution source to the Reactor Coolant System (RCS) [AB]. Additionally, the measured RCS boron concentration was 2,226 parts per million (ppm). Updated Final Safety Analysis Report (UFSAR), Section 15.4.6, "Chemical and Volume Control System Malfunction That Results in A Decrease in The Boron Concentration in The Reactor Coolant," describes a boron dilution event. The UFSAR event in Mode 5 states that if the RHR flowrate is below 2,800 gpm operators must take action to restore it above 2,800 gpm. The flowrate is to ensure "perfect mixing" as assumed in the analysis. The analysis further assumes all three charging pumps are in operation and delivering 250.5 gpm of primary water and a starting RCS boron concentration of 1,782.1 ppm. With no dilution source present and a significantly higher initial RCS boron concentration, the reduced RHR flow exhibited in this event did not violate the boron dilution analysis as described in UFSAR.

IV. CORRECTIVE ACTIONS

Completed Corrective Actions:

- Power was restored to IB-3 by use of an alternate power supply.
- Inverter B was repaired and restored to operable status at 0803 hours on June 27, 2010.
- Guidance has been provided to personnel regarding the completion and coding of partially performed or not performed Preventive Maintenance work orders. The significance of incomplete work orders was highlighted to ensure work orders are processed in accordance with procedure, ADM-NGGC-0104.

Planned Corrective Actions:

- Procedure, ADM-NGGC-0104, "Work Management Process," is scheduled to be revised by May 31, 2011, to clarify guidance for partial Preventive Maintenance Work Order completion and the associated technical documentation requirements.

LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REV. NO.	
H. B. Robinson Steam Electric Plant, Unit No. 2	05000261	2010	- 005	- 01	5 OF 5

NARRATIVE

V. ADDITIONAL INFORMATION

Previous Similar Events:

License Event Reports (LERs) for HBRSEP, Unit No. 2, were reviewed from the past 10 years. The following event was identified as being similar to the event described in this LER:

- LER 2010-002-00, Plant Trip Due to Electrical Fault. This event involved a loss of power to Instrument Bus 3 for approximately two minutes due to the loss of Inverter B. The cause of the loss and restoration of Inverter B was indeterminate, but the failure mechanism is currently considered to be unrelated to the event described in this LER.