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SOUTHERN COMPANY
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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Edwin I. Hatch Nuclear Plant - Unit 1
Licensee Event Report
Component Failure in Station Service Battery Charger Leads to
Inoperability of the High Pressure Coolant Injection (HPCI) System

Ladies and Gentlemen:

In accordance with the requirements of 10 CFR 50.73(a)(2)(v), Southern Nuclear Operating Company is submitting the enclosed Licensee Event Report (LER) concerning a component failure in the station service battery charger which led to the inoperability of the HPCI system.

Respectfully submitted,

Lewis Sumner

H. L. Sumner, Jr.

JL/eb

Enclosure: LER 50-321/2001-001

cc: Southern Nuclear Operating Company
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NRC FORM 366 (1-2001) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

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

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TITLE (4)
Component Failure in Station Service Battery Charger Leads to Inoperability of HPCI System

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(S)
										05000
03	09	2001	2001	001	00	05	03	2001		05000

OPERATING MODE (9): 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)(ii)		50.73(a)(2)(ii)(B)		50.73(a)(2)(ix)(A)
	20.2201(d)		20.2203(a)(4)		50.73(a)(2)(iii)		50.73(a)(2)(x)
	20.2203(a)(1)		50.36(c)(1)(i)(A)		50.73(a)(2)(iv)(A)		73.71(a)(4)
	20.2203(a)(2)(i)		50.36(c)(1)(ii)(A)		50.73(a)(2)(v)(A)		73.71(a)(5)
	20-2203(a)(2)(ii)		50.36(c)(2)	X	50.73(a)(2)(v)(B)		OTHER
	20-2203(a)(2)(iii)		50.46(a)(3)(ii)		50.73(a)(2)(v)(C)		Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iv)		50.73(a)(2)(i)(A)	X	50.73(a)(2)(v)(D)		
	20.2203(a)(2)(v)		50.73(a)(2)(i)(B)		50.73(a)(2)(vii)		
	20.2203(a)(2)(vi)		50.73(a)(2)(i)(C)		50.73(a)(2)(viii)(A)		
	20.2203(a)(3)(i)		50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(B)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Steven B. Tipps, Nuclear Safety and Compliance Manager, Hatch	(912) 367-7851

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	EJ	BYC	C782	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 15 single-space typewritten lines) (16)

On 03/09/2001 at 0645 EST, Unit 1 was in the Run mode at a power level of approximately 2763 CMWT (100 percent rated thermal power). At that time, the High Pressure Coolant Injection (HPCI) system was rendered inoperable when the DC-to-AC inverter powering the system flow controller began to trip randomly, resetting automatically within a few seconds of tripping. The cycle of random tripping followed within seconds by an automatic reset of the inverter made the controller unreliable and personnel therefore concluded that the HPCI system was inoperable. This cycle continued until 0713 EST when personnel removed 125/250 volt station service battery charger 1R42-S031 from service after having observed fluctuations in charger voltage and current output readings and two alarms on the charger control panel. Removing the battery charger from service restored the HPCI system to an operable status by eliminating the bus voltage fluctuations that had caused the HPCI system inverter to trip.

This event was the result of component failure. A fuse internal to the charger developed an intermittent connection that caused the charger to cycle rapidly off and on. These rapid off-on cycles caused charger output voltage at times to exceed momentarily the HPCI system inverter input voltage trip setpoint. Per its design, the inverter automatically reset when its input voltage, that is, charger output voltage, dropped below the inverter trip setpoint. Corrective actions included removing charger 1R42-S031 from service and replacing the bad fuse. As a precaution, the fuses in the battery chargers will be replaced and a repetitive task to replace the fuses periodically will be established.

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

PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor
Energy Industry Identification System codes appear in the text as (EIIS Code XX).

DESCRIPTION OF EVENT

On 03/09/2001 at 0645 EST, Unit 1 was in the Run mode at a power level of approximately 2763 CMWT (100 percent rated thermal power). At that time, several alarms, including the High Pressure Coolant Injection (HPCI, EIIS Code BJ) system inverter circuit failure alarm, were received in the Main Control Room (EIIS Code NA). The HPCI system inverter circuit failure alarm indicated that a monitoring relay powered by the DC-to-AC power inverter in the HPCI system had de-energized. This, in turn, indicated that inverter output had been lost. The other alarms received also indicated a loss of output from other DC-to-AC inverters. The alarms were received randomly and cleared, indicating that the respective inverter output had returned to normal, within a few seconds of receipt.

The HPCI system DC-to-AC inverter provides power to the system flow controller, two power supplies, and five indicators (pump suction and discharge pressures, turbine inlet and exhaust pressures, and turbine speed). The cycle of random tripping followed within a few seconds by an automatic reset of the inverter made the flow controller unreliable. Consequently, personnel concluded that random tripping of the flow controller power supply rendered the HPCI system inoperable.

Operations personnel investigating the Main Control Room alarms noted fluctuations in voltage and current output readings from 125/250 volt station service battery charger 1R42-S031 (EIIS Code EJ). Personnel sent to the charger also noted two alarms on the charger control panel: AC input failure and high temperature. As a result of these observations, Operations personnel removed battery charger 1R42-S031 from service and placed the standby charger in service, activities completed by 0713 EST. Removing battery charger 1R42-S031 from service removed the cause of voltage fluctuations on the 125/250 volt station service bus (EIIS Code EJ) and prevented further trips of the AC-to-DC inverters powered by this bus. This action therefore restored the HPCI system to an operable status.

CAUSE OF EVENT

This event was the result of component failure. A fuse internal to battery charger 1R42-S031 developed an intermittent connection that caused the charger to cycle rapidly off and on. These rapid off-on cycles, in turn, caused charger output voltage at times to exceed momentarily the HPCI system inverter input voltage nominal trip setpoint of 148 volts. Per its design, the inverter automatically reset when its input voltage, that is, charger output voltage, dropped below the inverter trip setpoint.

Maintenance personnel investigating the problem with battery charger 1R42-S031 discovered that internal fuse F20 was bad. However, personnel found that fuse F20 had not blown; instead, the fuse had broken at

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one of its inner soldered joints. This failure mechanism caused an intermittent loss of continuity across the fuse. The reason the fuse failed at one of its soldered joints was not determined because the fuse was discarded before more detailed examination or testing could be performed. However, it appears possible the failure was age-related. The battery charger was installed and placed into service in October 1991, but there are no records to indicate that fuse F20 has ever been replaced. Hence, it is reasonable to assume the fuse was originally supplied with the charger and, thus, was approximately 9 ½ years old at the time of its failure. It also is reasonable to conclude that a significant manufacturing defect likely would have manifested itself sooner. It follows that the failure of fuse F20 probably was related to its age.

Fuse F20 is located in the power supply for the silicon-controller rectifier (SCR) gate drive circuit, the charger cooling fan motors, and the AC input failure alarm relay. Intermittent loss of continuity across fuse F20 therefore resulted in a loss of both cooling fans and de-energization of the AC input failure alarm relay, leading to a high temperature condition and illumination of the input failure alarm, respectively. The high temperature condition also caused the high temperature alarm on the charger control panel observed by Operations personnel. More importantly, intermittent loss of continuity across the fuse led to a rapid off-on cycle of the SCR gate drive circuit. According to information received from the battery charger vendor, turning off and on the SCR gate drive circuit has the effect of turning off and on the battery charger, a situation that will result in fluctuations in charger output voltage and current. Moreover, repeated and rapid cycling of the SCR gate drive circuit will cause battery charger output voltage to exceed briefly (approximately one second) and significantly its normal output of 130-132 volts. Apparently, charger output voltage exceeded at times the DC-to-AC inverter nominal trip setpoint of 148 volts, causing the inverters supplied by the charger to trip per their design.

REPORTABILITY ANALYSIS AND SAFETY ASSESSMENT

This event is reportable per 10 CFR 50.73 (a)(2)(v) because an event occurred in which the HPCI system, a single train safety system, was rendered inoperable.

The HPCI system consists of a steam turbine-driven pump and the necessary piping and valves to transfer water from the suppression pool or the condensate storage tank (EIIS Code KA) to the reactor vessel. The system is designed to inject water to the reactor vessel over a range of reactor pressures from 160 psig through full rated pressure. The HPCI system starts and injects automatically whenever low reactor water level or high drywell pressure indicates the possibility of an abnormal loss of coolant inventory. The HPCI system, in particular, is designed to replace lost reactor coolant inventory in cases where a small line break occurs which does not result in full depressurization of the reactor vessel.

The backup for the HPCI system is the Automatic Depressurization System (ADS) together with two low pressure injection systems: the Low Pressure Coolant Injection (LPCI, EIIS Code BO) system and the Core Spray (EIIS Code BM) system. The Core Spray system is composed of two independent, redundant, 100 percent capacity subsystems. Each subsystem consists of a motor driven pump, its own dedicated spray sparger located above the core, and piping and valves to transfer water from the suppression pool to the

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sparger. Upon receipt of an initiation signal, the Core Spray pumps in both subsystems start. Once ADS has reduced reactor pressure sufficiently, Core Spray system flow begins.

LPCI is an operating mode of the Residual Heat Removal (EIIS Code BO) system. There are two independent, redundant, 100 percent capacity LPCI subsystems, each consisting of two motor driven pumps and piping and valves to transfer water from the suppression pool to the reactor vessel. Upon receipt of an initiation signal, all four LPCI pumps automatically start. Once ADS has reduced reactor pressure sufficiently, the LPCI flow to the reactor vessel begins. The divisionally separated initiation logic systems for LPCI and Core Spray incorporate “crossover” circuitry allowing each division to trigger an initiation of the other division. With this design, any one operable division of logic can produce a full actuation in both divisions of all the pumps and valves necessary for injection to the reactor vessel.

In this event, the HPCI system was rendered inoperable when the power supply to its flow controller became unreliable due to random and repeated trip-and-reset cycles. During the time the HPCI system was inoperable, however, the Reactor Core Isolation Cooling (RCIC, EIIS Code BN) system was available to inject high pressure water into the reactor vessel. Although not an emergency core cooling system, the RCIC system is designed, maintained, and tested to the same standards and requirements as the HPCI system and therefore should reliably inject water into the reactor vessel when required. If a break exceeded the capacity of the RCIC system (400 gallons per minute), the ADS was available to depressurize the reactor vessel to the point that either the Core Spray or LPCI systems could have been used to provide water to the reactor core. The capacity of one loop of the Core Spray system is equal to that of the HPCI system (4250 gallons per minute each); the capacity of one loop of the LPCI system is approximately three times that of the HPCI system. Therefore, any one of the four loops of the low pressure injection systems would have provided sufficient injection capacity for a small break loss-of-coolant accident.

Based on this analysis, it is concluded that this event had no adverse impact on nuclear safety. This analysis is applicable to all power levels and operating modes in which a loss-of-coolant accident is postulated to occur.

CORRECTIVE ACTIONS

Operations personnel removed battery charger 1R42-S031 from service on 03/09/2001 at 0713 EST; this action returned the HPCI system to an operable status.

Maintenance personnel replaced defective fuse F20 on 03/12/2001 per Maintenance Work Order 1-01-00675. Operations personnel placed charger 1R42-S031 into service on 03/15/2001 and verified proper charger output, an absence of voltage and current fluctuations, and an absence of alarms on the charger control panel and in the Main Control Room. The charger was left in service.

As a precaution, the fuses in the Unit 1 and Unit 2 125/250 volt station service battery chargers will be replaced during the annual charger preventive maintenance activities, which will be completed by

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09/30/2001. Additionally, a repetitive task to replace the fuses in the Unit 1 and Unit 2 chargers approximately once every nine years will be established.

ADDITIONAL INFORMATION

Other Systems Affected: No systems other than those already mentioned in this report were affected by this event.

Failed Components Information:

Master Parts List Number: 1R42-S031
Manufacturer: Cyberex
Model Number: 400R3-S
Type: Charger, Battery
Manufacturer Code: C782

EIIS System Code: EJ
Reportable to EPIX: Yes
Root Cause Code: X
EIIS Component Code: BYC

Commitment Information: This report does not create any permanent licensing commitments.

Previous Similar Events: Previous similar events in the last two years in which a single-train safety system was rendered inoperable were reported in the following Licensee Event Reports:

50-321/2000-007, dated 09/27/2000,
50-321/2000-005, dated 09/15/2000,
50-321/2000-002, dated 02/25/2000,
50-321/1999-002, dated 05/24/1999,
50-366/2001-001, dated mm/dd/2001, and
50-366/2000-001, dated 03/27/2000.

In the first event, the HPCI system was rendered inoperable when its flow control input signal resistor failed causing erratic operation of the controller. In the second event, the HPCI system was rendered inoperable when its turbine stop valve stuck in the open position. In the third event, the HPCI system was rendered inoperable when it failed to trip on high water level following an automatic reactor shutdown. In the fourth event, the HPCI system was rendered inoperable when a barometric condenser vacuum problem prevented the completion of a surveillance test within the time allowed by the Technical Specifications. The vacuum problem prevented the then recently installed condensate pump from pumping sufficient water to control level in the barometric condenser. In the fifth event, the RCIC system was rendered inoperable when one of its steam supply isolation valves closed unexpectedly on a false high steam line differential pressure signal generated during a transmitter calibration. In the last event, the HPCI system was rendered inoperable when water was found in the hydraulic oil system. However, corrective actions for these previous events could not have prevented this event because the events and their causes were completely unrelated to this event or its causes.