



ENTERGY

Entergy Operations, Inc.
P.O. Box 756
Port Gibson, MS 39150
Tel 601 437 2600

C. R. Hutchinson
Vice President
Operations
Grand Gulf Nuclear Station

February 14, 1994

U.S. Nuclear Regulatory Commission
Mail Station P1-137
Washington, D.C. 20555

Attention: Document Control Desk

SUBJECT: Grand Gulf Nuclear Station
Unit 1
Docket No. 50-416
License No. NPF-29
Loss of Shutdown Cooling and ESF Actuation During Unit Outage Due to
Class 1E Bus Voltage Oscillations
LER 93-010-01

GNRO-94/00016

Gentlemen:

Attached is Licensee Event Report (LER) 93-010-01 which is a final report.

Yours truly,

CRH/LFD/BAB
attachment

cc: Mr. R. H. Bernhard (w/a)
Mr. H. W. Keiser (w/a)
Mr. R. B. McGehee (w/a)
Mr. N. S. Reynolds (w/a)
Mr. H. L. Thomas (w/o)

Mr. Stewart D. Ebnetter (w/a)
Regional Administrator
U.S. Nuclear Regulatory Commission
Region II
101 Marietta St., N.W., Suite 2900
Atlanta, GA 30323

Mr. P. W. O'Connor (w/a)
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Stop 13H3
Washington, D.C. 20555

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NRC FORM 366 (5-92)		U.S. NUCLEAR REGULATORY COMMISSION				APPROVED BY OMB NO. 3150-0104 EXPIRES 6/31/95							
LICENSEE EVENT REPORT (LER)						ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503							
FACILITY NAME (1) Grand Gulf Nuclear Station						DOCKET NUMBER (2) 05000-416		PAGE (3) 01 of 04					
TITLE (4) Loss of Shutdown Cooling and ESF Actuation During Unit Outage Due to Class 1E Bus Voltage Oscillations													
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			
10	04	93	93	010	01	02	14	94	N/A	05000			
THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (Check one or more (11))													
OPERATING MODE (9)		5		20.402(b)		20.405(c)		X		50.73(a)(2)(iv)	73.71(b)		
POWER LEVEL (10)		0		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)		X		50.73(a)(2)(vii)	OTHER		
				20.405(a)(1)(iii)		50.73(a)(2)(i)				50.73(a)(2)(viii)(A)	(Specify in abstract below and in text, NRC Form 366A)		
				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 Bruce A. Burke / Licensing Engineer						TELEPHONE NUMBER (include Area Code) 601-437-6333							
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				
B	EJ	BYC	C173	Y									
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-spaced typewritten lines) (16)													
<p>Automatic closure of Grand Gulf Nuclear Station's (GGNS) residual heat removal (RHR) system containment isolation valve 1E12F008 occurred while RHR B was operating in shutdown cooling mode. This automatic closure resulted in RHR B pump tripping. 1E12F008 is the outboard isolation valve on the common suction line for RHR A and RHR B. The closure signal was generated when voltage fluctuated on the Division I Class 1E 125 vdc bus due to a faulty current limiting card in one of two full capacity battery chargers, thereby causing relays to deenergize and initiation of engineered safety features (ESF) equipment.</p> <p>Investigation determined that the event was caused by failure of a current limiting card in the battery charger. The investigation also identified that written communications failed to identify a precaution which contributed to the event. The faulty current limiting card was replaced. The appropriate procedures were modified to warn of precautions and limitations of the affected plant equipment. An NPRDS report was submitted for the faulty card. Maintenance history of the battery chargers was also reviewed.</p> <p>Loss of shutdown cooling events have occurred previously at GGNS due to causes unrelated to this event. LER 90-023, LER 90-022, LER 89-004, LER 87-021, and LER 87-020 discussed details of those events. A similar ESF actuation due to loss of power to the bus as a result of a failed inverter was discussed in LER 85-038.</p> <p>Safety related equipment with exception of charger 1A4 operated as designed. Safety and health of the general public were not compromised by this event.</p>													

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TEXT (if more space is required, use additional copies of NRC Form 366A) (17)				
A. REPORTABLE OCCURRENCE				
<p>Automatic closure of 1E12F008 occurred October 4, 1993 at 1636 hours while the Division II residual heat removal (RHR B) system [BO] was operating in shutdown cooling mode. This isolation resulted in loss of shutdown cooling. 1E12F008 is the outboard containment isolation valve on the common suction line for RHR A and RHR B. RHR A was inoperable prior to this event. The standby gas treatment system (SGTS) [BH] and control room standby fresh air [VI] automatically initiated. Divisional primary containment and secondary containment isolation valves [NH] closed automatically since their associated control logic [JM] is powered by the common ESF bus 11DA. In addition, the reactor protection system (RPS) [JC] generated a half scram signal. This event is reportable per 10 CFR 50.73(a)(2)(iv) and 10 CFR 50.73(a)(2)(vii)(B).</p>				
B. INITIAL CONDITIONS				
<p>The plant was in Operational Condition 5 at zero percent power when shutdown cooling operation was lost. Reactor water was approximately 81 degrees F with the reactor vessel depressurized. Fuel assemblies were approximately 28 feet below water level. Detensioning of reactor vessel head studs was in progress at the time of the event. Station electricians were performing the discharge test for Division I Class 1E 125 vdc battery 1A3. The battery was disconnected from bus 11DA and connected to the load bank at the time of the event. Bus 11DA was powered by Division I battery chargers 1A4 and 1A5, each rated at 100% capacity. Bus 11DA feeds engineered safety feature (ESF) components.</p>				
C. DESCRIPTION OF OCCURRENCE				
<p>While station electricians were performing refueling surveillance 06-EL-1L11-R-0003-1 for the Division I battery bank service test on October 4, 1993, the voltage of Class 1E bus 11DA began to oscillate. Electricians first attempted to stabilize voltage by taking charger 1A4 out of the load sharing configuration (1A5 was not in the load sharing configuration), but the voltage continued to oscillate. The output voltage of 1A5 was adjusted down since its output voltage was 133 vdc. 1A4's output was adjusted to stabilize its voltage, but its output was erratic. The voltage of bus 11DA continued to oscillate.</p>				
<p>Operations personnel were contacted, but the voltage perturbations caused some circuit relays to deenergize and the 125 vdc feeder breaker for inverter 1Y96 to trip. The power source to 1Y96 automatically transferred to the alternate source fed by breaker 52-156122. 1Y96 is the dc-to-ac inverter for Division I Class 1E distribution panel 1Y85 which supplies power to loads including RPS and the neutron monitoring system [JD]. Inverter 1Y87 also switched to its</p>				

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<p>alternate power source. 1Y87 feeds Division I Class 1E distribution panel 1Y89. Power was lost to ESF control logic [JE] for portions of RPS and the primary containment and secondary containment isolation system; automatic closure of the common RHR suction line outboard isolation valve 1E12F008 also occurred. Closure of this valve subsequently tripped RHR B which was in the shutdown cooling mode of operation. RHR A was inoperable prior to the isolation. This isolation resulted in declaring RHR B inoperable. Operation of shutdown cooling was restored in approximately five (5) minutes. Reactor water temperature increased approximately two (2) degrees F.</p>				
<p>D. APPARENT CAUSE(S)</p>				
<p>The battery chargers were the power source for Class 1E bus 11DA. The uninterruptible power supply (UPS) inverter, fed by bus 11DA, was the power supply to the Class 1E distribution panel which contained the subject ESF controls.</p>				
<p>Voltage perturbations are likely to occur in the circuit if the battery is disconnected. Automatic transfer of the UPS to its alternate power source occurs only after a degraded voltage condition is sustained for the time duration specified for the UPS. The UPS is not designed to transfer due to swinging voltages as experienced in this event. However, certain ESF system control relays powered by the Class 1E distribution panel changed state and initiated their control logic function due to the swinging voltage condition.</p>				
<p>Investigation revealed that a current limiting card in the battery charger had failed. The card failure caused the bus voltage to oscillate since the battery was isolated from the bus. Some relays changed state as a result of lower voltages during the oscillations and initiated actuation of subject ESF equipment.</p>				
<p>Investigation also identified that the UPS vendor manual cautioned against operating the UPS without the battery connected. Damage to the UPS or its loads could occur from operating in that configuration. Written procedures had not identified this precaution previously.</p>				
<p>E. CORRECTIVE ACTIONS</p>				
<p>The faulty current limiting card for the battery charger was replaced and retested satisfactorily. The history of failures for this model battery charger was also investigated. The battery charger unit is model number ARR130K400, manufactured by C&D Batteries. A Nuclear Plant Reliability Data System report was submitted for the faulty battery charger card.</p>				
<p>Procedures were revised for surveilling Division I and Division II Class 1E batteries 1A3 and 1B3 and their chargers. The procedure impact statements were modified to warn of system responses to the equipment configuration while performing the surveillance. The impact statements recommend</p>				

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<p>that the power supply breakers for the respective RHR valve(s) be opened. The impact statements also recommend that the respective UPS be powered by its alternate power source while performing the battery test. The battery service test for Division III Class 1E battery 1C3 currently requires that the division be declared inoperable while performing the test.</p>				
<p>Integrated Operating Instruction 03-1-01-5 was revised to specify steps necessary for bypassing applicable ESF components when desired. System operating instructions for the Class 1E 125 vdc system will also be revised to reflect the vendor's recommendations.</p>				
<p>F. SAFETY ASSESSMENT</p>				
<p>The consequences of this event were minimal. Shutdown cooling operation was lost for approximately five (5) minutes. The alternate decay heat removal system was available for removal of decay heat as required by GGNS technical specifications. Temperature of reactor coolant increased from 81 degrees F to 83 degrees F. Other ESF systems including SGTS, RPS, and control room standby fresh air responded as designed. Systems were restored to operation or their standby (i.e., ready-for-service) condition. Safety and health of the general public were not compromised by this event.</p>				
<p>Loss of shutdown cooling events have occurred previously at GGNS due to causes unrelated to this event. LER 90-023, LER 90-022, LER 89-004, LER 87-021, and LER 87-020 discussed details of those events. A similar ESF actuation due to loss of power to the bus as a result of a failed inverter was discussed in LER 85-038.</p>				
<p>G. ADDITIONAL INFORMATION</p>				
<p>Energy Industry Identification System (EIIIS) codes are identified in the text within brackets [].</p>				