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January 30, 1991

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
Deficiencies in HPCS 125 VDC System
LER 90-012-01

GNRO-91/00021

Gentlemen:

Attached is Licensee Event Report (LER) 90-012-01 which is a final report.

Yours truly,

for WTC

WTC/RR/cg
attachment
cc: (See Next Page)

LER90121/SCMPFLR

IE22
1/1

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NRC Form 366 (9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

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TITLE (4): Update To LER 90-012 Deficiencies in HPCS 125 VDC System

EVENT DATE (5) Month	Day	Year	LER NUMBER (6) Year	Sequential Number	Revision Number	REPORT DATE (7) Month	Day	Year	OTHER FACILITIES INVOLVED (8) Facility Names	Docket Number(s)
0 7	2 4	9 0	9 0	0 1 2	0 1	0 1	3 0	9 1	NA	0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 3
POWER LEVEL (10): 0 0 0

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

20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)	73.71(c)
20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
20.405(a)(1)(iii)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
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	TELEPHONE NUMBER
Riley Ruffin / Licensing Specialist	601 437-2167

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

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE) — X NO

EXPECTED SUBMISSION DATE (15): Month / Day / Year

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On July 24, 1990 during a Division III 125 VDC System review, calculations could not demonstrate that all loads would receive the Manufacturer's minimum voltage requirements immediately following the loss of the Class 1E battery charger. Additionally, calculations did not demonstrate that the Division III load profile, as stated in GGNS Technical Specifications, was greater than the actual emergency loads for all periods.

A Material Nonconformance Report was generated to document the nonconformance.

The Division III 125 VDC distribution circuits were modified to ensure adequate voltage levels would be achieved. The GGNS UFSAR was changed to reflect the correct load profile. A Technical Specification Change Request to delete the battery load profile is under review by the NRC.

A review of Division I and II 125 VDC systems was performed by plant design engineers. The review identified several loads which would possibly have had deficient voltage immediately following a loss of the Class 1E battery chargers' power supplies. Subsequent field testing confirmed that all components of the system would function as required. Therefore, the requirements of IEEE Std. 308-1980 were satisfied.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

A. Reportable Occurrence:

On July 24, 1990 during a design basis review of the Division III (Div. III) 125 VDC System (EIIS Code: EJ), it was discovered that calculations currently in progress did not demonstrate that all loads would receive sufficient energy to start and operate under Design Basis Accident (DBA) conditions. Additionally, the calculation did not demonstrate that the GGNS Technical Specifications Load Profile for the Div. III battery was greater than the actual load for all periods. These conditions are reportable pursuant to 10CFR50.73(a)(2)(vi) and 10CFR50.73(a)(2)(i)(B), respectively.

B. Initial Condition:

The plant was in hot shutdown at the time of the discovery.

C. Description of Occurrence:

o Per IEEE Std. 308, Section 6.3.2(5), " Batteries shall be maintained in the fully charged condition. Stored energy shall be sufficient to provide an adequate source of power for starting and operating all required connected loads and for operating all necessary circuit breakers during an interval of time when:

a. Alternating current to the battery charger is lost

b. Alternating current to the battery charger has been restored and the battery is being restored to its fully charged state and power in excess of the capacity of the battery charger is needed."

Per IEEE Std. 308, Section 6.3.2(2), "Each distribution circuit shall be capable of transmitting sufficient energy to start and operate all required loads in that circuit."

UFSAR Section 8.3.2.1.7.5 states in part, "Each distribution circuit is capable of transmitting sufficient energy to start and operate all required loads in that circuit."

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

Calculations, to validate as-built conditions, failed to demonstrate that the as-built system implemented the above requirements. Design engineers discovered two components, the High Pressure Core Spray (HPCS) DC Fuel Oil Pump and the HPCS Emergency Diesel Generator Output Breaker (HPCS EDG BRK) (EIIS Code: EK) Closing Coil, which were receiving less than the manufacturer's minimum voltage requirements under DBA conditions.

A relatively large voltage drop occurs in certain circuits which lowers the terminal voltage of the components, within that circuit, to values below the manufacturer's minimum voltage for those components. This condition exists following a DBA, where the battery charger is lost due to a Loss of Offsite Power (LOP), until the HPCS EDG BRK closes.

Conservative methods used for the calculation produced results which were more conservative than actual values. Conservative assumptions used in the calculation are as follows:

1. Manufacturer's maximum design temperatures were used for cables; the resistance in this case would be higher than the resistance imposed by temperatures encountered following a DBA.

2. Load summations to individual circuits typically form an algebraic sum of loads, which results in higher current contributions in the branches and a higher calculated voltage drop.

3. Load requirements for components of constant wattage were assumed to be the worst case battery terminal voltage (105V), while actual terminal voltages average above this value.

The above assumptions would result in calculated voltage drops which would exceed the actual voltage drops.

Technical Specification Surveillance requirement 4.8.2.1.d.2 states, "The battery capacity is adequate to supply a dummy load of the following profile, which is verified to be greater than the actual emergency load while maintaining the battery terminal voltage greater than or equal to 105 volts."

Division 3

≥ 76 amperes for the first 60 seconds

≥ 16 amperes for the next 59 minutes

≥ 18 amperes for the last 60 minutes

As a part of the review, the installed as-built loads were calculated. The resulting actual emergency load profile was calculated to be:

< 62 amperes for the first 60 seconds

< 18 amperes for the next 119 minutes

The load profile stated in Technical Specification was nonconservative when compared with the actual emergency load profile, during the 1-60 minute interval.

D. Apparent Cause/Corrective Action

- The Div. III 125 VDC Class 1E power system is designed to provide a reliable, continuous and independent power source for the HPCS System. The Class 1E DC system is required for HPCS EDG field flashing, control logic, and control and switching functions of the 4.16 KV breakers. The Class 1E DC system consists of a 125 VDC battery, one Class 1E battery charger, and a distribution center. It is designed so that no single failure in the 125 VDC System will result in conditions that prevent safe shutdown of the plant.

- The ampere-hour capacity and short-time rating of the battery are in accordance with IEEE Std. 308. The battery is designed to store sufficient energy to operate essential loads for a minimum period of two hours following a loss of AC power to the battery charger. The design capacity is large enough to adequately supply energy during LOCA conditions or any other emergency shutdown.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

The duty cycle imposed on the battery by the loss of the battery charger will depend on the DC System design and installation. The GGNS Div III 125 VDC System was designed by General Electric (GE). The design was subsequent to and in accordance with a GE Licensing Topical Report (NEDO 10905, May 1973) which evaluated the HPCS Power supply for BWR/5 and BWR/6 plants. The Topical Report was a generic evaluation which did not take into account the facilities' specific requirements to fulfill essential load demands. The load summaries established in the report did not provide adequate design calculations, specify all essential loads or correct current values to meet GGNS's actual load demand following a loss of AC power to the Class 1E battery charger.

A Material Noncorformance Report (MNCR) was generated to document the deficiency identified in the distribution circuitry. The circuitry did not adequately ensure that all components would receive the manufacturer's minimum voltage values immediately following a DBA. After the discovery a Minor Change Implementation Package was initiated and implemented to correct the deficiency.

Circuits identified in the nonconformance report have been modified to ensure the manufacturer's minimum voltages would be achieved.

A spare conductor, within the power cables, has been used for a parallel feed on the positive leads to reduce the voltage drop on voltage deficient circuits. Additionally, spare conductors of existing Div. III cable were used to reconfigure the HPCS EDG BRK auto close circuit in order to eliminate an excessively long control circuit run.

o The second deficiency identified in the MNCR was the load profile stated in GGNS Technical Specification Surveillance requirements. The load profile was nonconservative when compared with the actual emergency load profile.

The GGNS FSAR used the GE evaluation previously discussed as the basis for the load profile. The data found in GGNS Technical Specifications was verified in accordance with the data found in the FSAR.

The Battery Bank Discharge Test was performed on 07/26/90 and all test data was acceptable.

A design change is not necessary to correct this deficiency. The plant surveillance procedure, which is used to test the Class 1E 125 VDC batteries and associated battery chargers, has been changed to reflect the most conservative value of either the calculated or the actual load profile. GGNS has revised the UFSAR to reflect the correct load profile and is requesting an administrative change to remove the specific load profiles from the Technical Specifications.

o A Review of Div I and Div II 125 VDC Systems design calculations was performed by plant design engineers.

The calculations performed identified several loads which may not receive the Manufacturer's minimum voltage requirements immediately following a loss of the Class 1E battery chargers' power supplies. The calculations did not conclusively show that the as built circuit would not have operated as required by IEEE Std. 308-1980. Therefore, subsequent field testing was performed to evaluate operation of the subject components.

Components identified during the review were demonstrated to have been acceptable by a field test performed in accordance with a plant work order. The field test verified the capabilities of the installed components.

The diesel generator feeder breaker to ESF Bus 15AA was replaced with a breaker which demonstrates additional margin for future operation. The as-built circuit satisfies the requirements of IEEE Std. 308-1980.

The most probable cause of the three 125 VDC system calculations not demonstrating the components would have supplied the manufacturer's minimum voltage requirements immediately following a loss of the Class 1E battery chargers' power supplies is attributed to a less conservative methodology utilized during the original design calculations.

E. Safety Assessment

GGNS Technical Specifications require simulation of LOP and LOP/LOCA conditions which interrupt the Div. III battery charger supply. These tests have been successfully completed during pre-operational testing and commercial operation with no documented failure of the HPCS EDG BRK to close as a result of a low voltage condition.

NRC Form 366A (9-83)

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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APPROVED OMB NO. 3150-0104
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TEXT (If more space is required, use additional NRC Form 366A's) (17)

Div. III battery calculations by design engineers have shown that the battery is capable of delivering the energy required to support HPCS DC System operation. The as-installed system has been surveilled to demonstrate the battery exceeds the nameplate capacity rating.

Even though the Technical Specification Load profile was nonconservative, the difference in the actual and stated values would have been insignificant.

Based on past and present test data from the LOP and LOP/LOCA, and the battery discharge tests, it was concluded that there is reasonable assurance that the deficiencies identified in the Class 1E 125 VDC Systems would not have prevented the fulfillment of the safety functions of the power systems.

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