Enclosure

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

QUALIFICATION TESTING FOR EMERGENCY DIESEL GENERATOR UPGRADE PROJECT

BALTIMORE GAS AND ELECTRIC COMPANY

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2

DOCKET NOS. 50-317 AND 50-318

1.0 INTRODUCTION

By letter dated August 17, 1993, Baltimore Gas and Electric Company (BG&E) submitted a request for NRC review and approval of a proposed qualification testing program for the existing three Fairbanks-Morse (F-M) emergency diesel generators (EDGs) at Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 (Calvert Cliffs). The proposed qualification program would be implemented following completion of planned modifications to the EDGs that will improve their electrical capacity and thereby provide additional margin for the electrical loading of the 4.16 KV safety-related buses. The qualification testing program is intended to provide reasonable assurance of the load capacity and reliability of the modified EDGs.

During its review of the proposed qualification testing program, the NRC staff identified the need to clarify certain aspects of the program related to factory and site testing. The issues requiring clarification were discussed during a conference call between NRC and BG&E staff personnel on December 1, 1993. BG&E subsequently provided the requested clarifications in a letter dated January 7, 1994.

2.0 EVALUATION

BG&E is planning to modify and upgrade the existing three F-M EDGs at Calvert Cliffs to increase their electrical capacity. The present units have a 300 HP/cylinder design. The upgrade will use a 350 HP/cylinder design to increase the continuous rating from 2500 kW to 3000 kW.

The existing and upgraded ratings are listed as follows:

Rating (existing)	Rating (Upgraded)	Time Limit
0-2500 kW	0-3000 kW	Continuous
2501-2700 kW	3001-3300 kW	2000 hour
2701-3000 kW	3301-3500 kW	200 hour
------	3501-3600 kW	30 minutes

The EDG upgrade project consists of two parts: capacity upgrade and qualification testing.

The capacity upgrade consists of the following:

* Upgraded design cylinder liners
* Upgraded design blowers
* Upgraded design pistons
* Larger turbochargers
* Upgraded design combustion air piping

For the qualification testing, BG&E intends to perform factory and site testing and meet the intent of draft Revision 3 of Regulatory Guide (RG) 1.9, "Selection, Design and Qualification of Diesel-Generator Units Used as Standby (Onsite) Electrical Power Systems at Nuclear Power Plants," and Institute of Electrical and Electronics Engineers (IEEE) Standard 387-1984, "Criteria for Diesel-Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations."

The proposed factory testing would utilize a modified diesel engine identical to the installed engines at Calvert Cliffs. BG&E provided F-M with their spare engine and F-M is performing the upgrade on that engine. F-M will run the engine at 3300 kW for 2000 hours, 3500 kW for 200 hours, and then perform an engine inspection.

In addition, BG&E sent a spare generator to the generator manufacturer (Louis Allis) where it was tested for the upgraded ratings. In their letter of January 7, 1994, BG&E confirmed the capability of the generator to accommodate the upgraded ratings.

The following tests will be conducted on-site on each upgraded EDG. These tests will be performed in conjunction with BG&E required post modification acceptance testing. Credit will be taken for any BG&E acceptance test that is essentially identical to a test in the preoperational test program.

A. Start and Load-Run Test

1. Start Test: This testing will demonstrate proper startup from ambient conditions and verify that the required design voltage and frequency is attained. For these tests, the EDG will be prelubricated, have prewarmed oil and water circulating and will reach rated speed on a prespecified schedule that is selected to minimize stress and wear.

2. Load-Run Test: This testing will demonstrate an emergency load carrying capability of not less than 90-100 percent of the EDG's continuous rating (2700 to 3000 kW) for 1 hour after the engine reaches steady state temperature. The loading and unloading of the EDG during this test will be gradual and based on a prescribed schedule that is selected to minimize stress and wear on the EDG.

B. Fast Start Test

BG&E will demonstrate that each EDG starts from ambient (prelubricated) conditions and reaches generator rated voltage and frequency of 4160± 420 volts and 60± 1.2 Hz, respectively, in 10 seconds or less.

C. Combined Safety Injection Actuation Signal and Loss-of-Offsite Power Test

BG&E will demonstrate that: (1) the emergency buses are deenergized and loads are shed from the emergency buses, (2) the EDG starts from its ambient (may be prelubricated) condition and attains the required rated voltage and frequency within the limits and time required by the plant Technical Specifications, (3) auto-connected loads are energized through the load sequencer and, (4) the EDG operates at least 5 minutes loaded with the auto-connected loads.

D. Single Load Rejection Test

BG&E will demonstrate the EDG capability to reject its largest single load (500 HP) and verify that voltage and frequency requirements are met.

E. Full Load Rejection Test

This testing will demonstrate the capability of the EDG to reject a load equal to 90-100 percent of its continuous rating (approximately 2700-3000 kW). During this test BG&E will verify that voltage requirements are met and that the EDG does not trip on overspeed.

F. Endurance and Margin Test

BG&E will demonstrate the full-load carrying capability of the EDG for an interval of 24 hours, of which 2 hours will be at 3150 to 3300 kW (105-110 percent of the continuous rating) and 22 hours at a load of 2700-3000 kW (90-100 percent of the continuous rating). BG&E will verify that voltage and frequency are maintained.

G. Hot Restart Test

The hot restart functional capability at full load temperatures will be verified by restarting the EDG within 5 minutes of shutting it down after the set has run for 2 hours at 90-100 percent of the continuous rating, attaining the required voltage and frequency within the limits and time provided in the Technical Specifications, and operating loaded to 2700-3000 kW (90-100 percent continuous rating) for at least 1 hour.

H. Reliability Tests

BG&E will demonstrate that an acceptable level of reliability has been achieved on each EDG by performing 25 start and load tests as described in Item A. above without a failure. Start and load failures are defined

by RG 1.108, "Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants," and are in accordance with BG&E's existing reliability program. The number of tests was selected in accordance with Regulatory Position 2.3.1 in draft Revision 3 of RG 1.9. This position requires a minimum of 25 valid start and load demands.

3.0 CONCLUSION

Based on the evaluation discussed above, the staff concludes that the proposed qualification testing program is acceptable and will provide assurance that the EDGs will meet the intent of the regulations and the engineering design requirements with respect to capacity, capability and reliability.

Principal Contributor:
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Date: February 10, 1994

outage. Modifications of the other two EDGs are still expected to be accomplished in one step during subsequent outages.

This completes all actions related to TAC Nos. M87249 and M87250.

Sincerely,

Original signed by:

Daniel G. McDonald, Senior Project Manager
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosure:
Safety Evaluation

cc w/enclosure:
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