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MEMORANDUM FOR: O. D. Parr, Chief, Light Water Reactors Branch 3, DPM
FROM: Faust Rosa, Chief, Power Systems Branch, DSS
SUBJECT: GENERAL ELECTRIC TOPICAL REPORT NEDO-10905-3

In response to the December 20, 1979 letter to O. D. Parr from the General Electric Company, the Power Systems Branch has reviewed and evaluated the General Electric Company topical report NEDO-10905, Amendment 3, "High Pressure Core Spray System Power Supply Unit." This report presents the results of the prototype qualification testing of the HPCS Diesel Generator: Diesel Engine GM-EMD Model 20-645E4; Generator Ideal Electric Co. Type-SAB, Frame-M6 36PB. We have reviewed these test results and conclude that the prototype qualification is acceptable.

The topical report includes a prototype qualification test plan, test procedures, acceptance criteria and test results. The purpose of this test was to demonstrate the capability and reliability of the diesel generator (2600 kw) to attain and to stabilize voltage and frequency within acceptable limits while starting the HPCS pump motor (3000 HP) under load and carrying all auxiliary loads in accordance with design requirements.

Our evaluation is summarized as follows:

- (1) The testing was performed in situ (preoperationally) in a nuclear power plant installation, with engine start performed from both cold ambient and hot engine temperature conditions.
- (2) The HPCS pump motor and auxiliary loads automatically started. During loading, the system voltage dipped to about 65% and recovered to 73% within 0.5 seconds. The voltage recovered to 80% within 3.5 seconds and rated voltage within 6 seconds. Also, the HPCS pump motor came up to rated speed in 6 seconds and rated flow was achieved within about 8 seconds. The frequency dropped to 87% of rated frequency at starting loads and recovered to rated condition within 2.5 seconds.

RG 1.9 requires that the diesel generator unit design should be such that at no time during the loading sequence should the frequency and voltage decrease below 95 percent of nominal and 75 percent of nominal, respectively. However, the HPCS diesel generator unit carries a single large HPCS motor-pump load, more than 90 percent of the design load on the HPCS bus, and therefore, a larger decrease in frequency and voltage is acceptable for the HPCS diesel generator unit provided acceptable performance on a system

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basis is demonstrated. During the testing the motor starting transient voltage dipped to 65% and recovered to 73% within 0.5 seconds and to 80% within 3.5 seconds; the frequency drop was 13% of rated and recovered to rated condition within 2.5 seconds. System operation was acceptable throughout. The HPCS power supply system has performed its start and load design function within 23 seconds from the time of the actuation signal. It fully met the design requirement of establishing rated flow within 27 seconds.

- (3) The D-G, with the actual pump and motor, was operated at its continuous rating with the HPCS pump operating at the maximum bhp flow condition. To simulate as close as practical the actual HPCS system configuration, the pump received water supply from the condensate storage tank. Since the reactor was not pressurized, the water flow was returned back to the condensate tank after passing through a set of valves that were set to simulate the reactor pressure. Additional runs were made over a range of flow conditions. A comparison of these runs with the manufacturers pump-head flow curve is in agreement. Therefore the HPCS has the head-flow characteristics designed for.
- (4) The reliability of starting and accepting design load in the required time was fully demonstrated by starting and carrying design load 69 times without failure from both hot and cold engine conditions. This met the objective of establishing a 0.99 reliability for the particular DG design.

On the basis of this review, we conclude that the qualification test results of the HPCS diesel generator unit are acceptable. It is noted that this acceptance is only for the particular design generator unit identified above. Each of the other diesel generators listed in NEDO-10905 (Table 3-1) must undergo similar prototype qualification testing to be acceptable.

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