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Hope Creek Operations

March 8, 1994

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Dear Sir:

Hope Creek Generating Station
Docket No. 50-354
Unit No. 1
Special Report 94-01 Rev. 1

This Special Report is being submitted pursuant to the requirements of Hope Creek Technical Specification 4.8.1.1.3, due to previously declared "D" EDG Load Failures on 1/13/94 and 2/10/94.

On January 13, 1994, during performance of the "D" Emergency Diesel Generator (EDG) monthly surveillance test, the generator experienced fluctuations in kilowatt (kw) output of approximately 1000 kw when synchronized and loaded to 3000 kw. Operations personnel monitoring the diesel run reduced load to minimum, and removed the unit from the grid. It was suspected that the load fluctuations were being caused by binding of the fuel racks due to inadequate lubrication. Personnel present at the time of the test failure stated the racks did not feel well lubricated. The fuel racks were lubricated two days prior to the event, however, between the lubrication and test run a wipe down of the diesels was performed in accordance with station housekeeping requirements and it was suspected that the wipe down may have removed the lubricant. After discussion with the personnel involved in the housekeeping work it was determined the fuel racks were not included in the wipe down. The racks were again lubed, the engine and generator controls were instrumented and the diesel generator was run satisfactorily. The diesels were instrumented to determine if any deficiencies existed in the governor or generator control circuits which could have caused the output fluctuations. The subsequent loading and one hour run was conducted without any observed fluctuations. System Engineering and Operations personnel evaluated the diesel performance following the fuel rack lubrication and along with the satisfactory surveillance results declared the diesel generator operable. The run did not provide any evidence of a malfunction in the control circuits.

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The three redundant diesel generators (A,B, and C) were run in accordance with Tech Spec 3.8.1.1 (ACTION b) after verification that the fuel racks were properly lubricated. Data taken during these runs were used to compare the performance of the "D" diesel control signals with the remaining three operable diesels to determine if any discrepancies existed between the control circuits. No fluctuations were observed in the three EDG's outputs and the data collected did not indicate any differences between the four diesels.

"D" EDG was again run on 1/14/94 to determine if any additional abnormal conditions, identified through a review of nuclear network items and discussions with the vendor, could have existed. The test results again did not identify any abnormal conditions in the control circuits or diesel generator output fluctuations.

The most probable root cause of the event on 1/13/94 had been identified as inadequate lubrication of the fuel racks, but additional monitoring was scheduled for the next regular surveillance run to confirm the original root cause under similar conditions where the diesel has been shutdown for a similar duration (approx 30 days).

On 2/10/94, the "D" diesel was again instrumented and run in accordance with the monthly surveillance test. The initial start and loading proceeded normally. Approximately 25 minutes into the run the EDG output began to swing as previously experienced. When several attempts to manually stabilize generator output were unsuccessful the EDG was shutdown and declared inoperable.

Engineering personnel monitoring the test reviewed test data obtained and found fluctuations in the output of a relay (IDR relay selects droop or isochronous) which selects the control signal to the engine governor. There are two modes of operation for the EDG, droop mode for running in test while synchronized to the grid, and isochronous mode when the EDG is running under emergency conditions connected only to its respective 4.16 kv bus. The failure was isolated to the relay contacts associated with the droop (test mode) portion of the circuit, indicating the EDG was capable of performing its intended function under accident conditions. The isochronous mode controls generator output based on generator frequency, typically 60 cycles. If the generator is connected to the grid, where the frequency may be less than 60 cycles, and the droop mode is lost the generator would attempt to increase speed and load to maintain 60 cycles. This is consistent with the observations of control room personnel monitoring generator output. Interim actions to replace the failed relay have been completed and the "D" EDG was declared operable following satisfactory completion of the surveillance test.

The IDR relay was functionally tested to determine the cause of the failure. The testing included input of simulated signals of similar voltage and current levels present in the control circuits. The testing confirmed that contacts, which provide the governor droop input signal to the fuel rack positioner, exhibited a voltage drop across the closed contact. Several load combinations were attempted with all results indicating degraded contact characteristics. The contact block was then disassembled and inspected. The contacts had enough of an oxidation film to cause the degraded signal condition.

The degraded contact is the only normally open contact in the block. The normally open contact is not in the circuit during isochronous operation of the EDG. The normally closed contacts are closed during isochronous operation; however, the portion of the circuit which utilizes the closed contacts does not affect EDG operation during emergencies in the Hope Creek design. The portion of the logic utilizing the normally closed contacts would be used when two generators are sharing load on a common bus during isochronous operation. The Hope Creek electrical distribution is completely separate with one EDG per vital bus with no load sharing. The failure in this event is prevalent only during EDG testing when connected to the power grid. The contact failure would result in either full or minimum fuel rack position on the engine based on system frequency at the time that the control circuit would be operating in isochronous. EDG Emergency operation (isochronous mode) is not affected by the contacts as the relay is de-energized with the contacts in the positions stated above.

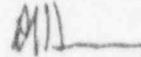
The remaining EDG IDR relays were monitored during their respective runs required by technical specifications on 2/11/94. The voltage traces on two EDG's did indicate some early signs of degraded contacts although the EDG electrical output was stable and the perturbations were significantly smaller in magnitude and frequency. Both IDR relays were replaced.

The use of a high voltage and current contact in a low voltage and current control circuit, in conjunction with the oxidation buildup on the contacts over eight years of operation has been identified as the root cause of this event. The investigation determined that the signal can be monitored periodically to determine when the contacts should be cleaned or replaced. Engineering will also evaluate if different style contacts should be installed in this circuit or if a PM should be established to replace the contact block after a certain period of time.

Based on the determination that the failures were due to oxidized contacts in a relay that is utilized only during testing and does not affect emergency operation, these events were not considered valid failures per regulatory guide 1.108.

The EDG Reliability data base was reviewed to verify that the normal 31 day test interval is in conformance with the schedule of Regulatory Position C.2.d, Regulatory Guide 1.108. Two previous failures were attributed to operator error in that the governor control setting was not set correctly prior to initiating the diesel start and subsequent loading. There have been a total of 189 load demands since the last valid failure. The surveillance test interval will remain at 31 days as set forth in Tech Specs Table 4.8.1.1.2-1.

Sincerely,



R.J. Hovey
General Manager -
Hope Creek Operations

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