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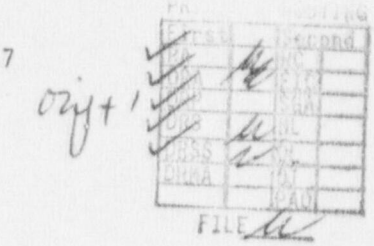
ILLINOIS POWER COMPANY

CLINTON POWER STATION, P.O. BOX 678, CLINTON, ILLINOIS 61727

10CFR50.36

July 8, 1987



Docket No. 50-461

Mr. A. B. Davis
Regional Administrator
Region III
U.S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Subject: Special Report: Division 1 Diesel Generator Slow Start

Dear Mr. Davis:

Clinton Power Station Technical Specification 4.8.1.1.3 requires all diesel generator failures, valid or nonvalid, to be reported to the commission pursuant to Technical Specification 6.9.2., SPECIAL REPORTS, within 30 days.

At 0211 on June 8, 1987, the Clinton Power Station (CPS) Division 1 Diesel Generator (DG1A) failed to reach rated voltage (4160±420V) and rated speed (900±18 RPM) in equal to or less than 12 seconds. During the start, DG1A attained rated voltage in approximately 13.0 seconds, and rated speed in approximately 14.4 seconds. All other characteristics of the start (e.g., breaker closure, load sequencing, and load carrying) were normal.

This diesel start occurred as an automatic response to an actual loss of offsite power induced by Startup Phase Test Procedure STP-31-1, "Loss of Turbine Generator and Offsite Power." Because this was an actual loss of power, it may be classified as an emergency. The diesel start is then classified as a failure, even though no acceptance criteria for diesel start times were explicit within the procedure. In Section B. of Regulatory Guide 1.108, "failure" is defined as the failure to start, accelerate, and assume the design rated load within and for the time prescribed during an emergency or a valid test. The CPS Final Safety Analysis Report (FSAR) Section 9.5.6.1.1, Safety Design Bases, requires that the emergency response time from receipt of the start signal to attainment of rated speed and voltage be equal to or less than 12 seconds.

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Following the identification of the failed start, DG1A was declared inoperable, and a Limiting Condition for Operation was entered, in accordance with Technical Specification 3.8.1.1. The plant was in Operational Condition 3 at 0% power.

Occurrence of the slow start was initially noted during a preliminary assessment of Loss of Offsite Power (LOOP) test results, at approximately 1100 on June 8, 1987. An engineering walkdown conducted shortly thereafter revealed that the linkage connecting the governor actuator output shaft to the fuel rack lay shaft on the left bank of the 16 cylinder engine was out of alignment. This misalignment increased frictional effects, resulting in an intermittent binding during the start such that the actuator would not drive the fuel racks to the full fuel position upon receipt of the start signal. During a normal start sequence, pressurized oil from the booster servomotor causes the governor actuator power piston to move in the increase fuel position, which in turn rotates the output shaft which is connected to the fuel racks as described above. With a binding condition, the initial output torque from the actuator may not be sufficient to overcome frictional effects, and start time will be retarded, since full fuel is required to ensure a prompt ($\leq$ 12 second) start. This binding caused the event. The misalignment which caused the binding was most likely the result of previous maintenance activities on the diesel governor. Plant procedures involving injector and governor maintenance will be revised to ensure proper alignment of the operating mechanism.

Upon de-energization of the Division 1 emergency bus as part of STP-31-1, undervoltage sensing relays initiate relay contact actuations leading to DG1A automatic starting. This portion of the test was normal, with the start relay (K19) receiving the start signal approximately 1.7 seconds following de-energization of the bus. Beginning shortly after initiation of engine cranking, engine RPM began to exhibit a lagging characteristic. Experience has shown that during a normal ramp up, 150 RPM is attained 2-3 seconds after cranking starts. During this start, 150 RPM was reached about 2.9 seconds after the air starters engaged. This fairly normal initiation is attributable to the engines being driven up by the air start motors, which drop out at 125 RPM. Beyond this point, the mechanical governor is controlling acceleration. During a normal start, 450 RPM will be attained 5-6 seconds after cranking starts, or about 3 seconds beyond 150 RPM. During this start, 450 RPM was attained approximately 9.4 seconds into the start. At this point, a delay sufficient to cause the start to fail had already been introduced. Beginning near 450 RPM, the rate of acceleration increased to a near normal rate, with rated speed (900±18 RPM) being attained about 4.7 seconds after the 450 RPM point (4-5 seconds being typical for this part of the ramp up).

This sequence is interpreted as follows:

The initiation and air starter cranking were normal. At the point where ramp up becomes dependent upon fuel (approximately 150 RPM), acceleration decreases due to binding of the rack linkage, causing the failure. As engine speed gradually comes up, governor oil pressure increases, and increasing pressure on the power piston translates into increase in output shaft torque sufficient to

overcome linkage friction at about 450 RPM, allowing acceleration to increase to a normal rate. Beyond this point, the remainder of the start sequence was normal. DG1A assumed and carried plant loads in a satisfactory manner during the Loss of Offsite Power Test.

Following the identification of the linkage misalignment, a maintenance work request (MWR) was issued to rework the assembly. In support of this action, engineering provided information detailing alignment requirements, and the linkage was reworked to meet these requirements. During this activity, the link connecting pin (shoulder bolt) at the connecting rod to hand control lever assembly joint was found to be slightly bent across the threaded portion of the pin. Since a spare pin was unavailable, the Shift Supervisor directed rework of the bent pin, subsequent to Engineering and Quality Assurance reviews of the proposed action. The connecting pin was reworked, and reassembly of the realigned linkage was completed early on June 9, 1987.

At 1414 on June 9, 1987, a surveillance test procedure to the requirements of Technical Specification 4.8.1.1.2.a.4 was accomplished on DG1A. This test successfully demonstrated DG1A operability, and indicated that the rework was satisfactory. DG1A was restored to operable status at 1637 on June 9, 1987.

DG1A was out of service for a total of 29 hours, 29 minutes during the assessment and corrective action periods. The Limiting Condition for Operation action statement limitation of 72 hours was not exceeded.

The Division 2 Diesel Generator (DG1B) and the Division 3 Diesel Generator (DG1C) remained operable during the entire period, as demonstrated by the required accomplishment of Technical Specification Surveillance Requirements 4.8.1.1.2.a.4 and 4.8.1.1.2.a.5. DG1A is currently on a 31-day test interval for demonstration of operability, in accordance with Technical Specification Table 4.8.1.1.2-1. Application of the validity criteria of Reg. Guide 1.108 C.2.3 for DG1A periodic testing under Regulatory Position C.2.c (normal plant operation), began when DG1A was declared operable per Technical Specifications on August 25, 1986. Since that time, 14 valid tests have occurred. The failure discussed above is the first valid failure experienced.

If you have any questions on this event, please contact me.

Sincerely yours,

F. A. Spangenberg, III
Manager - Licensing and Safety

KBR/ckc

cc: B. L. Siegel, NRC Clinton Licensing Project Manager
NRC Resident Office
Illinois Department of Nuclear Safety
Document Control Desk