

TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE
37401



July 30, 1973

Mr. F. E. Kruesi, Director
Directorate of Regulatory Operations
U.S. Atomic Energy Commission
Washington, DC 20545

Dear Mr. Kruesi:

On May 4, 1973, TVA made an initial report to AEC-DRO Inspector W. S. Little of the failure of a governor on emergency diesel-generator B of the Browns Ferry Nuclear Plant unit 1. On June 1, 1973, an interim report was filed with your office. In the meantime, we made an initial report of another failure of this governor on June 13, 1973. We filed an interim report on July 12, 1973, indicating that we would combine these two failure reports. In accordance with 10 CFR 55(e), we are submitting this final report covering both governor failures.

Very truly yours

J. E. Gilleland

Assistant to the Manager of Power

Enclosure

CC (Enclosure):

Mr. Norman C. Moseley, Director
Directorate of Regulatory Operations
U.S. Atomic Energy Commission
Region II - Suite 818
230 Peachtree Street, NW.
Atlanta, Georgia 30303

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ENCLOSURE

Browns Ferry Nuclear Plant

Final Report on Failures of EGB Governor
on Emergency Diesel-Generator B
Model 999-20-645E4

On February 28, 1973, diesel-generator B was found to be unstable when paralleled to the transmission system. The instability decreased somewhat when the load was increased, but the load could not be raised above 1200 kw whereas the continuous rated load is 2600 kw. An investigation uncovered a defective Zener diode in the power supply of the EG-A control box (governor), and it was replaced. Further testing on March 16, 1973, showed the problem persisted. In the process of trouble shooting, the control box was temporarily replaced with the control box from diesel-generator A. Diesel-generator B then performed satisfactorily. The control box for diesel-generator A was replaced and a replacement control box was obtained for diesel-generator B. The B unit was operated satisfactorily with the replacement control box on April 2, 1973.

The defective control box was returned to Woodward Governor Company on April 24, 1973, and Woodward was requested to furnish information as to the exact nature of the failure. Woodward's report identified the source of the malfunction as a grounded Zener diode. The diode, which had been replaced by TVA, was grounded to the chassis rather than insulated from the chassis by sleeves and washers. One of the washers was nicked and the Zener diode was grounded by the mounting screw.

It is postulated that the original defective Zener diode was caused by the same set of circumstances. This is possible because Woodward's test fixture was ungrounded, and therefore, grounded diodes would not be detected except by Woodward's customary checks for grounds with an ohmmeter. However, such checks can easily overlook grounds and Woodward is modifying their fixture so that it is grounded. This should lead to discovery of any grounds that could cause erratic behavior and/or discovery of defective components that would develop from such grounds. Although we had not experienced any additional similar malfunctions, we examined all of the Woodward EG-A control boxes for grounded Zener diodes and none were found.

On June 1, 1973, an intermittent condition developed on diesel-generator B. At first, the governor system failed to respond to remote control and then it responded without any corrective action. Immediately after responding, the signal from the EG-A control box (electronic governor) to the hydraulic actuator was measured and found to be higher than the range specified by the manufacturer. Also, the idling speed was varying over an 80-rpm range.

On June 26, 1973, under the direction of Mr. Edgar Ralls (General Motors Electro-Motive Division field representative), a thorough inspection was made of the diesel-generator B EGB governor system. Following the inspection, the hydraulic components were flushed, cleaned, and the hydraulic oil was replaced. All electrical and mechanical connections in the EGB governor system were checked. As a result of the inspection, the following abnormalities were discovered:

1. Small fragments of foreign material were found in the hydraulic actuator oil.
2. Two loose terminals were found on the EG-A control box.
3. The setscrews on the speed setting adjustment linkage within the EGB governor actuator were not tightened completely.

The intermittent trouble could not be positively attributed to any single malfunction; however, foreign material in the governor oil and loose electrical connections are primary causes of sluggish and/or intermittent governor control.

Although the output signal from the EG-A control box exceeded the manufacturer's specified values, this is an inherent characteristic of the governor system design. The specified range of the EG-A control box signals was correct for the interaction of the mechanical-electronic governors on the hydraulic actuator. This signal range is equivalent to the high-to-low settings of the flyball mechanical governor. The EG-A control box has the capability of providing signals for higher speeds than the mechanical (flyball) governor will permit. When the mechanical governor reaches its high speed setting, the engine speed will stabilize even though the electronic governor generates signals requesting a greater speed.

The erratic low speed operation was attributed to slippage of mechanical stops on the speed setting adjustment linkage within the governor actuator. These mechanical stops were free to move because their setscrews were not properly tightened during assembly or they vibrated loose during operation.

To alleviate such problems, all terminal connections were tightened, the speed setting control linkage was readjusted, and the mechanical stop setscrews were tightened for diesel-generator B. The governors for the other three diesel-generators were checked for loose terminals on all boards and governors, and the setscrews were also checked for tightness. The governor oil was not changed on the three other diesel-generators on the recommendation of Mr. Ralls because there were no indications of dirty oil. After the checks, all the diesel-generators have been verified to operate properly. In the future, additional precautionary measures will be incorporated in our preventative maintenance program which will include cleanliness requirements in the handling of governor oil and more frequent checks of terminal connections.

The safety implication of the diesel-generator problems listed above are identical. Both would lead to a reduction in onsite power capability; however, the plant could still be shut down using only onsite power with one diesel-generator out of service.

TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE
37401



June 1, 1973

Mr. F. E. Kruesi, Director
Directorate of Regulatory Operations
U.S. Atomic Energy Commission
Washington, DC 20545

Dear Mr. Kruesi:

On May 4, 1973, TVA made initial report to AEC-DRO Inspector W. S. Little of the failure of the governor on Browns Ferry Nuclear Plant unit 1 emergency diesel-generator B. In accordance with paragraph 50.55(e) of 10 CFR 50, we submit the following formal report of the failure.

6/7/73
JK
hbc
JS

On February 28, 1973, diesel-generator B was found to be unstable when paralleled to the system. The instability decreased somewhat when the load was increased, but the load could not be raised above 1200 kW; rated continuous load capacity of the unit is 2600 kW. A defective Zener diode was located in the power supply of the governor and replaced. The unit was run again on March 16, 1973; the problem persisted. The governor was then replaced with one from one of the other diesel-generator units. Diesel-generator B then performed satisfactorily. A replacement governor was obtained and installed. The unit operated satisfactorily with the replacement governor on April 2, 1973. The defective governor was returned to the Woodward Governor Company on April 24, 1973. The governor is a type EG-A. The engine is a General Motors EMD-GM Model 999-20.

Woodward has been requested to furnish information as to the exact nature of the failure. We expect to receive this information in time to provide a final report of the incident by July 31, 1973.

Very truly yours,

Godwin Williams, Jr.
Godwin Williams, Jr.
Assistant Manager of Power

CC: Mr. Norman C. Moseley, Director
Directorate of Regulatory Operations
U.S. Atomic Energy Commission
Region II - Suite 818
230 Peachtree Street, NW.
Atlanta, Georgia 30303

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Tennessee Valley Authority
ATTN: Mr. James E. Watson
Manager of Power
818 Power Building
Chattanooga, Tennessee 37401

Docket No. 50-259

Gentlemen:

Thank you for your letters dated July 6, 1973 and July 9, 1973, which forwarded reports pursuant to 10 CFR 50.55(e) regarding the failure of two flow switches, and the failure of couplings in the RWR Service Water System and a gasket in the Emergency Equipment Cooling Water System at the Browns Ferry Nuclear Plant Unit 1. Your reports will be reviewed and evaluated and, should we require additional information concerning this matter, we will contact you.

Your cooperation concerning this matter is appreciated.

Sincerely,

Original signed by
H.D. Thornburg

J. G. Davis, Deputy Director
for Field Operations
Directorate of Regulatory Operations

bcc with copy of letters
dtd July 6 and July 9.
N. C. Moseley, RO:II, w/o encl.
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