TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
5N 157B Lookout Place

JUL 22 A7:3

JUL 15 1986

U.S. Nuclear Regulatory Commission
Region II
ATTN: Dr. J. Nelson Grace, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

Dear Dr. Grace:

BROWNS FERRY NUCLEAR PLANT UNITS 1, 2, AND 3 - NRC-OIE REGION II INSPECTION REPORT 50-259/85-45, -260/85-45, -296/85-45 - DETAILED REPORT OF DIESEL GENERATOR INSPECTION

By letter from H. G. Parris to you dated December 18, 1985, TVA submitted a response to the subject inspection report for BFN. In enclosure 2 of that letter TVA committed to provide a report after completion of diesel generator inspection to describe any observations and problems. That report is enclosed.

If you have any questions, please get in touch with R. E. Rogers at FTS 858-2723.

To the best of my knowledge, I declare the statements contained herein are complete and true.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

R. Gridley, Director
Nuclear Safety and Licensing

Enclosure
cc: Mr. James Taylor, Director (Enclosure)
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

IE01

ENCLOSURE
DETAILED REPORT
MAINTENANCE OF STANDBY DIESEL GENERATORS
BROWNS FERRY NUCLEAR PLANT

This report describes the conditions observed during the maintenance activities and inspections recently performed on Browns Ferry Nuclear Plant's (BFN) eight standby diesel generators. These activities included performance of the manufacturer's applicable 1-, 2-, 3-, 6-, and 12-year maintenance recommendations, replacement of the viscous crankshaft vibration dampers with gear-type dampers, installation of heavy duty turbochargers, and inspection and evaluation of all accessible engine components.

The maintenance items are discussed in the following section in the same sequence used in the technical evaluation submitted by R. L. Gridley's letter to J. Nelson Grace dated February 27, 1986. All applicable inspections and suggested replacements recommended by Electro-Motive's Maintenance Instruction 1742 were completed.

The exhaust manifold screens were removed and examined for damage and accumulation of soot or particulates. The screens had no significant accumulations of residue nor indications of damage. Visual inspection of the engine exhaust manifolds revealed no appreciable accumulation of soot or debris.

The engine aftercoolers were removed during turbocharger replacement and were cleaned with compressed air before reinstallation.

Viscous crankshaft vibration dampers were replaced with gear-type dampers, as recommended by Electro-Motive. Visual examination of the exterior revealed the dampers to be in good condition. The effectiveness of the viscous media contained in the damper could not be determined by visual examination; however, no adverse effects were observed which would have resulted from engine vibration.

Careful inspection of the various bolted connections recommended by Electro-Motive for periodic tightness inspection did not reveal damage or wear.

The thermostatic elements in the temperature control valves (TCVs) were replaced. Inspection of the thermostatic element O-rings in those engines in which the elements and O-rings had not been previously changed revealed obvious wear. This wear is attributed to the normal functioning of the valve, during which the O-ring rolls along the surface of the thermostatic element as the position changes during engine warmup. As such, these O-rings are subject to deterioration from factors other than exposure to engine coolant and temperature. Loss of sealing function from these O-rings would result in slightly longer engine warmup from standby conditions since leakage of the coolant around the thermostatic element would occur. It is evident from the absence of engine high temperature alarms during past testing that the TCVs had functioned properly with the thermostatic element O-rings in the as-found condition.

Cooling system pressure cap seals were found to be somewhat hardened and deteriorated.

Engine top deck cover seals were found to be in good condition.

The manufacturer's recommendation identified as most significant in the technical evaluation was the replacement of the cylinder head to liner seals (grommets). Visual examination of these seals revealed no indication of deterioration and examination of the cylinder liner interior revealed no evidence of any water leakage into the cylinders.

The cylinder head water outlet elbow seals were found to have indications of dryness or aging on the upper half of the O-ring, which is exposed to air. The cylinder liner water inlet seals were in good condition.

Inspections of the cylinder liner lower seals, which seal the pressurized air box from the engine crankcase, indicated that in some cylinders the lower of the two seals retained areas of permanent flatness after their removal from the engine. Although leakage at these seals would have been noted by actuation of the crankcase pressure detector, the areas of permanent set do indicate that replacement of the seals was warranted.

All 160 fuel injectors were removed and tested. Of these, six failed due to minor leakage, three failed due to binding of the injector rack, and one failed due to excessive leak-down during the pressure holding examination. The condition of these injectors, while not harmful to the engine, could have resulted in cylinder misfire or poor fuel economy.

All gear backlash and thrust dimensions observed during engine maintenance were within Electro-Motive's allowable values. No indications of operation with incorrect exhaust valve time were noted.

Cooling system flexible seals removed from the engines were somewhat hardened, but functional, with no indications of leakage.

Inspection of the accessible portions of the engine jacket water flow path revealed some evidence of corrosion. Pitting was discovered on all cylinder head water outlet elbow bores. The cylinder liner jumper lines and the jacket water discharging piping also had varying indications of corrosion and scale. These conditions were caused by depletion of the corrosion inhibitor additive due to in-leakage of raw water into the engine cooling system from tube leaks in the heat exchangers. The leaks were discovered in 1981, and an inspection program to repair and periodically inspect the heat exchangers was developed and implemented. Rust inhibitor adequacy is checked monthly with inhibitor being added when required. These indications are not considered to be detrimental to engine operation.

During the performance of the inspection and maintenance program, an excellent opportunity exists for assessment of the overall engine condition. Several deficiencies not related to the vendor's program were discovered and remedied during the course of the inspection. For example, the accessory drive housing of engine 3C was found to have hairline cracks at several of the pump mounting flanges. Also, a lube oil pressure switch which provides a redundant signal to prevent reengagement of the right bank air start motors was found to be improperly connected. These items illustrate additional benefits resulting from indepth periodic inspections.

The goal of Electro-Motive's scheduled maintenance program is to inspect and/or replace components on either a calendar-time or run-time basis before failure can occur. The mechanical components inspected during maintenance were found to be in good condition, typical of an engine with little run-time. It is recognized that frequent fast starts required for nuclear standby service are detrimental to gear trains and top deck components. BFN's routine operating procedure of making idle starts and allowing the engine to become fully warmed up and lubricated before performance of any tests requiring fast starts has prevented problems in these areas. Engines in other nuclear installations which are routinely fast started for all tests have encountered a variety of problems due to inadequate lubrication, none of which were evident on the BFN diesel generator installations.