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BRUNSWICK STEAM ELECTRIC PLANT
TECHNICAL SUPPORT MEMORANDUM

FORM 3

TSM 91-0856
File No. 5095

TO: John Moyer ATTENTION: Shift Supervisor

PROGRAM or COMPONENT ID: Diesel Generator #3

WR/JO No. or Ref. Document: NA

KEYWORD: Diesel Generator

SUBJECT: Long Term Operability of EDG #3

After the EDG #3 valve setting problems of 10/15/91, the following concerns were raised by the NRC:

- 1) Did the high temperature damage the intake valves?
- 2) Was any of the EDG equipment damaged by the high temperature?
- 3) What parameters did the vender inspect during the run?
- 4) Is Tech Support satisfied with the current engine data?

1) No. The material of construction of intake and exhaust valves are identical except that the exhaust valves are stellite faced. Pull cards were taken on the PMTR run on 10/16/91. The pull cards measure both the compression and ignition pressures of the cylinders during actual running conditions. The compression pressures were approximately 775 psi and were within 40 psi of each other. These values were within the normal range and in close agreement with the last set of pull card readings. This indicates good cylinder compression, and therefore, no valve or valve seat damage. Additionally, besides no degradation of the valves, this analysis shows that the engine is performing well. (Reference Attachment 1)

Subsequent discussions with Knut Stang (Nordberg vender expert) did not reveal any potential damage to the valves would have occurred. Furthermore, he stated that the cooling effect of the turbocharger injecting air into the cylinder would cool the intake valves even if held off seat.

2) No. No physical damage to the exhaust piping was observed upon inspection. The turbocharger design maximum temperature, is 670 °C (1238 °F). The indicator read 1200 °F at the inlet and 940 °F at the discharge. Based on the downstream temperature, no damage to that portion of the turbocharger piping would have occurred. Damage to the turbocharger, according to the vender, would first be to the oil seals which would be evidenced as loss of oil level in the turbocharger. Oil level was monitored during the runs with no noted difference. No turbocharger vibration was noted.

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A	211
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Ray Drew	
Bill Stackhouse	
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PREPARED: Dimit L. Mangis / W.J. Stackhouse DATE: 10/16/91

APPROVED: Scott Winters DATE: 10/16/91
Manager/Supervisor
Certified Engineer

(Route to Tech Support Component Engineering clerk for processing)

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and the intake manifold pressure (a direct measure of turbocharger performance) taken during the operability run, slightly improved compared to the values taken prior to the diesel outage. This indicates no degradation in turbocharger performance and possibly, an enhancement of turbocharger performance.

Per Knut Stang, short term runs at high turbocharger inlet temperature would not have degraded the turbocharger. Even slight damage would have been evident by poor performance, inconsistent turbocharger data and high vibration levels.

3) Chuck Reynolds, Hatch & Kirk, observed all engine parameters and was the individual who noted the high exhaust temperatures. Chuck was specifically questioned as to the current condition of EDG #3, and he repeatedly answered that the diesel engine was not permanently damaged by the long no-load runs or the subsequent test runs which included the turbocharger surging, and that cleaning the injectors and adjusting the valve lash settings would return the EDG to good operating status.

Additionally, surging through the turbocharger is addressed in the vendor's manual as follows: "Turbocharger(s) are built to handle a small amount of surging; however, operation in sustained surge will result in damage to the turbocharger, bearings, or the compressor wheel." On only one of the five runs during which the surging occurred (approximately 17 total surges) was the condition allowed to continue for more than a few seconds before power was immediately reduced to eliminate the problem. On that one run, approximately 10 surges occurred in 3 to 5 minutes while testing was being conducted.

Per Stang, since the diesel ran for 5 hours after valve adjustment on 10/16/91 at up to 110% load, there is no concern with the diesel meeting its design requirement of continuous operation for 30 days.

4) Yes. The data taken during the PMTR and operability runs on EDG #3 was nearly identical to the two runs which occurred on 3/20/91 and 5/13/91. During these runs, the fuel oil consumption rate for the EDG #3 was determined. Considerable fuel rack position data was taken at those times, and the three sets of data were compared (see Attachment 2). The fuel rack readings versus engine loads were nearly identical to the SP 90-C48 data, and the linkshaft advance readings (see Attachment 2) are actually closer to the original factory data than the data taken on 10/1/91 just prior to the EDG #3 outage. The other engine parameters compared very well between the data taken on 10/1/91 and 10/16/91 (see Attachment 3 and Attachment 4). The close correlation of data, taken before and after the outage, indicates that no damage occurred to the engine.

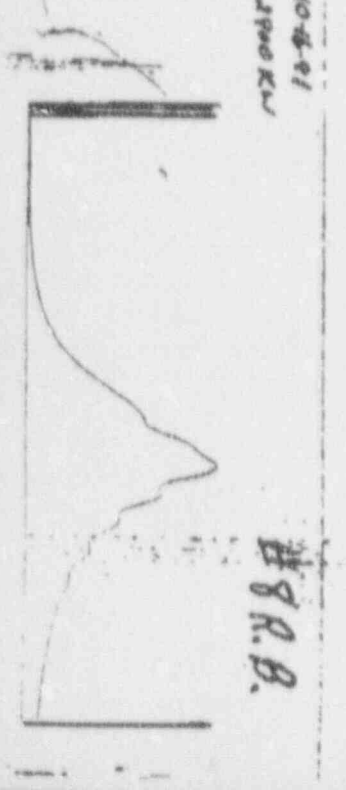
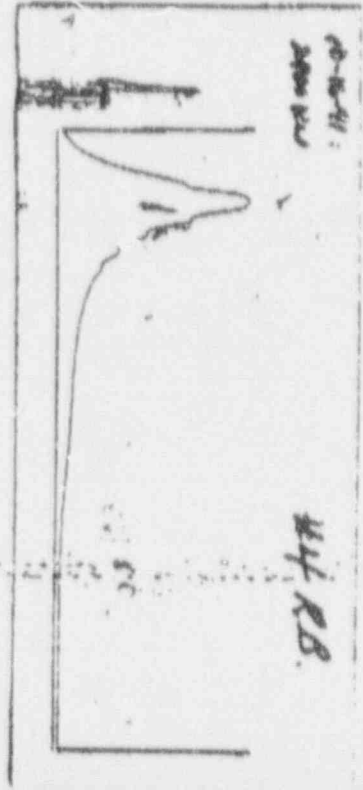
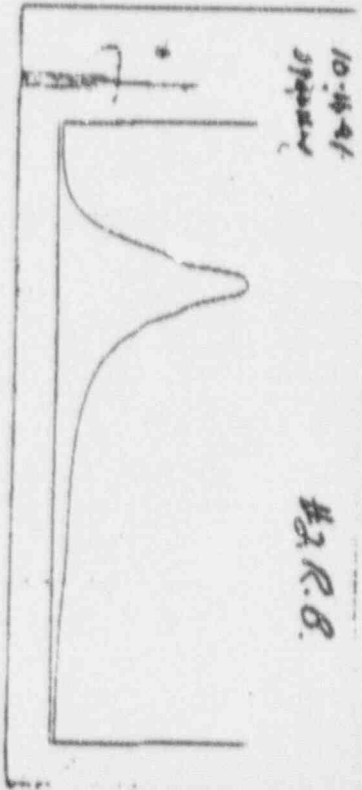
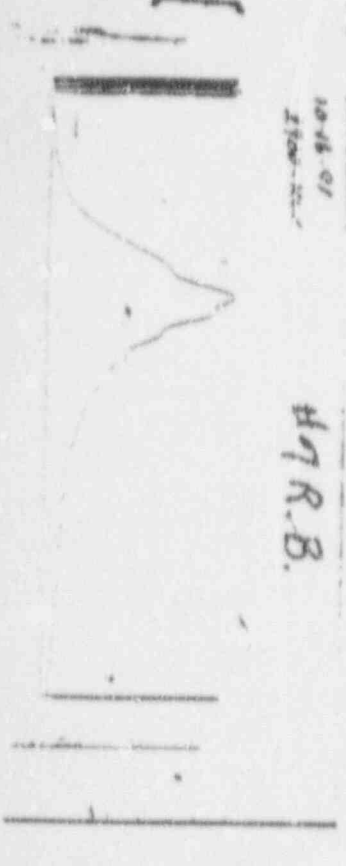
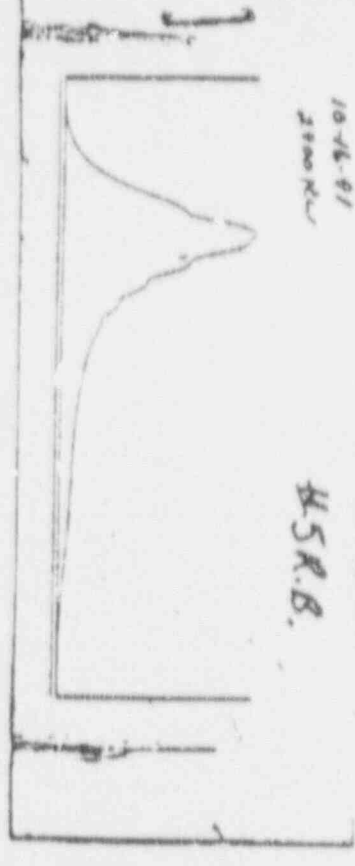
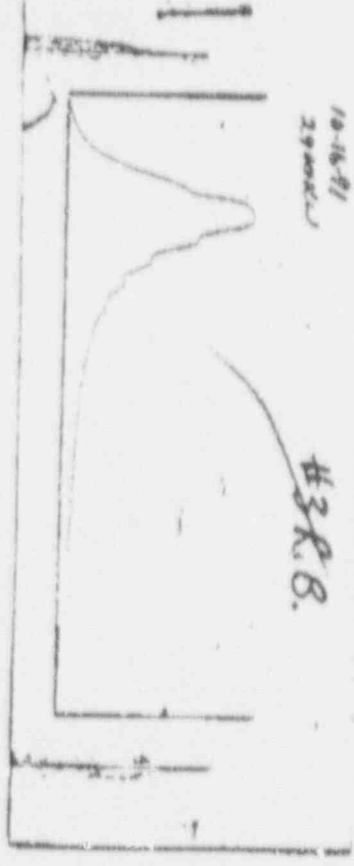
Per Knut Stang, running the diesel unloaded for several hours, does not damage the engine, but does create a nuisance exhaust emission when burning off the oil accumulated in the exhaust manifold.

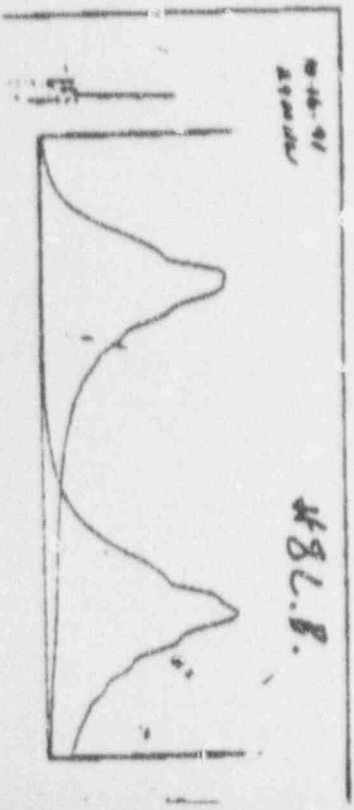
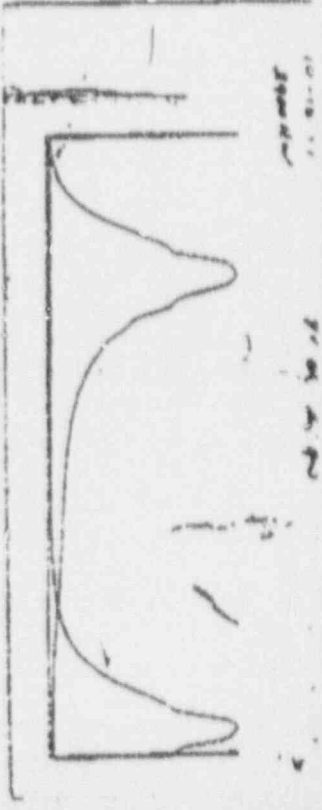
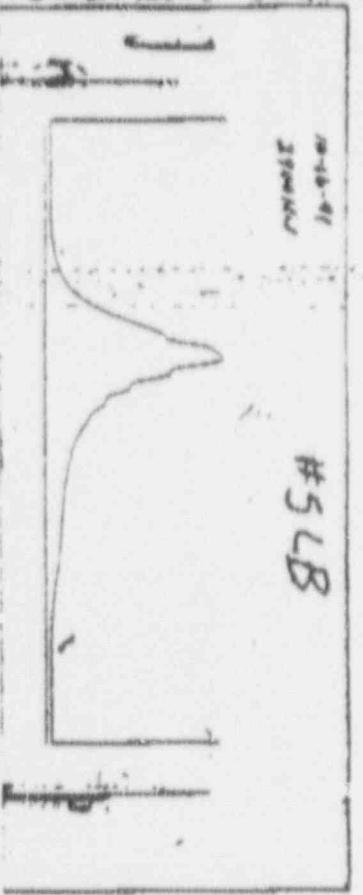
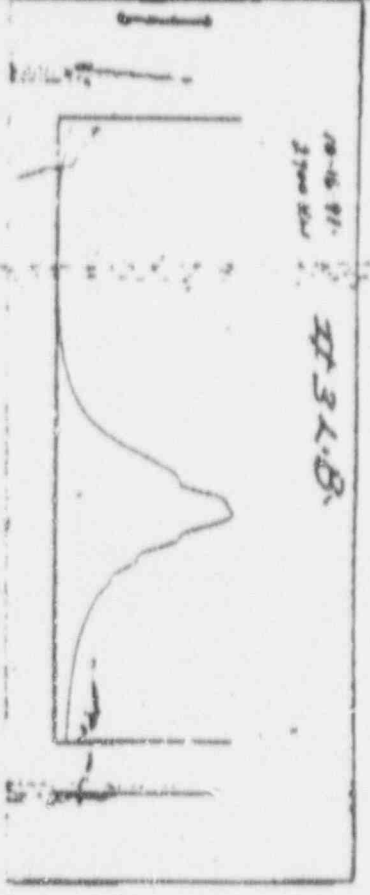
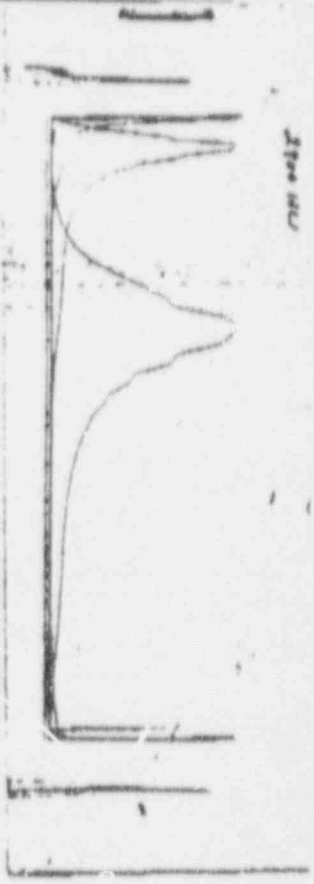
Summary:

Based on the above discussion, and the evaluations performed by two Nordberg diesel experts (Knut Stang - 48 years experience with Nordbergs and Chuck Reynolds - 20 years experience with Nordbergs), Technical Support has concluded that EDG #3 sustained no damage as the result of outage activities and improper valve settings. Therefore, Technical Support considers EDG #3 fully operable and capable of performing its intended design function.

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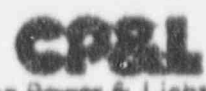
Attachment 1





Attachment 2

FORM NO. 2001
7/81



Carolina Power & Light Company

DATE 10/26/91
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PURPOSE	USER:	FILE NO.	CS NO.
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<input type="checkbox"/> CALCULATION	<input type="checkbox"/> CNSE	WR & A NO.	PT/MI NO.
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ORIGINATOR Dave Mengis

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