TECHNICAL BULLETIN

No. **115-97**

FTC RAILROAD TESTING
AMERICAN ASSOCIATION OF RAILROADS RP503 TEST PROCEDURE

Of the many procedures by which fuel additives are tested, that set by the specifications of the Association of American Railroads (AAR) is the most stringent. The AAR RP503 procedure involves a three phase test sequence by which treated fuel specifications are exactly analysed then combustion products and engine wear effects are carefully examined and finally fuel consumption changes are precisely measured in an "*as new*" EMD 645E3B diesel engine.

This test procedure has been conducted at the Southwest Research Institute, San Antonio, Texas, using diesel fuel treated with the FTC Combustion Catalyst. The findings of the test program reported in the SwRI final report were:

1. A carefully measured 1.74% reduction in fuel consumption as a result of treating fuel with the FTC Catalyst. (That effect under controlled laboratory conditions translates to a 3-4% improvement under normal operating conditions as confirmed by Australian and US experience).

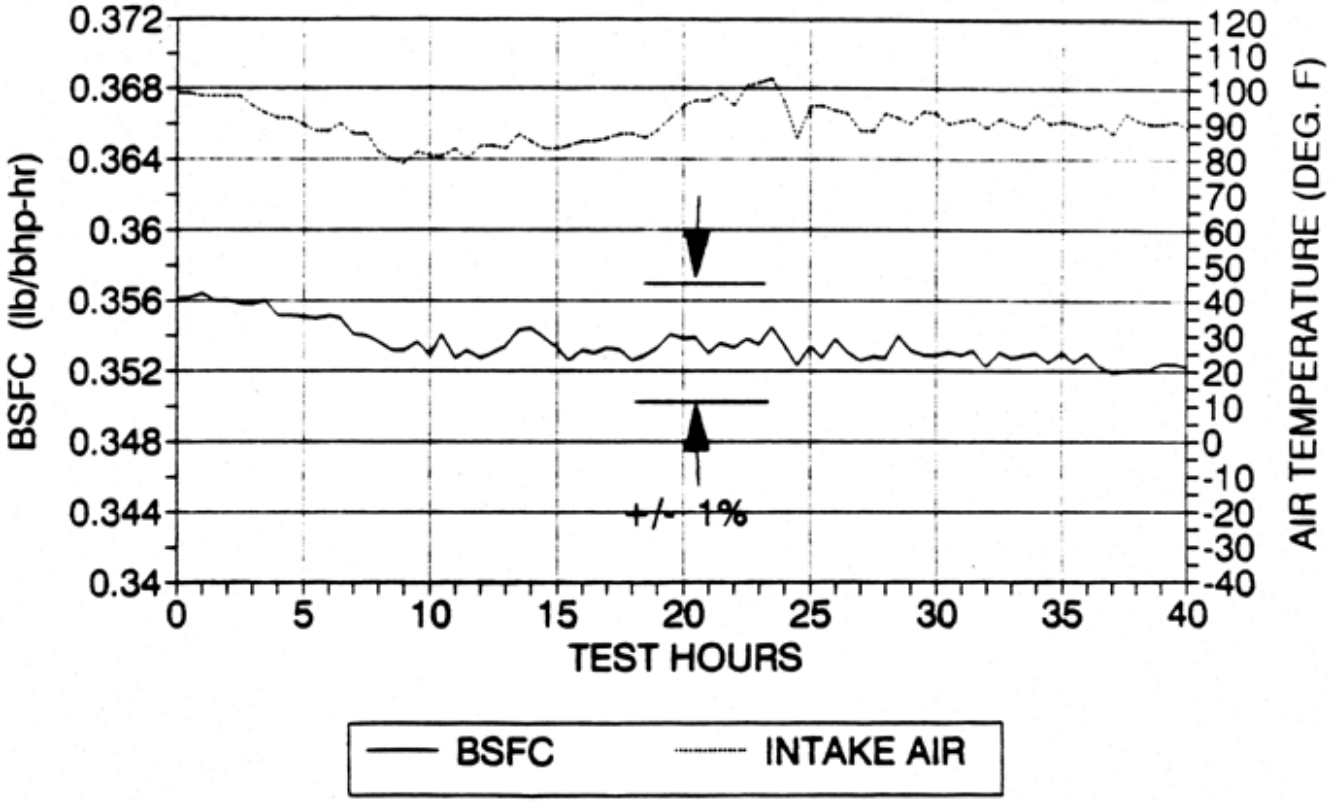
2. No detectable adverse wear or deposits on engine components (Cat 1G II test).

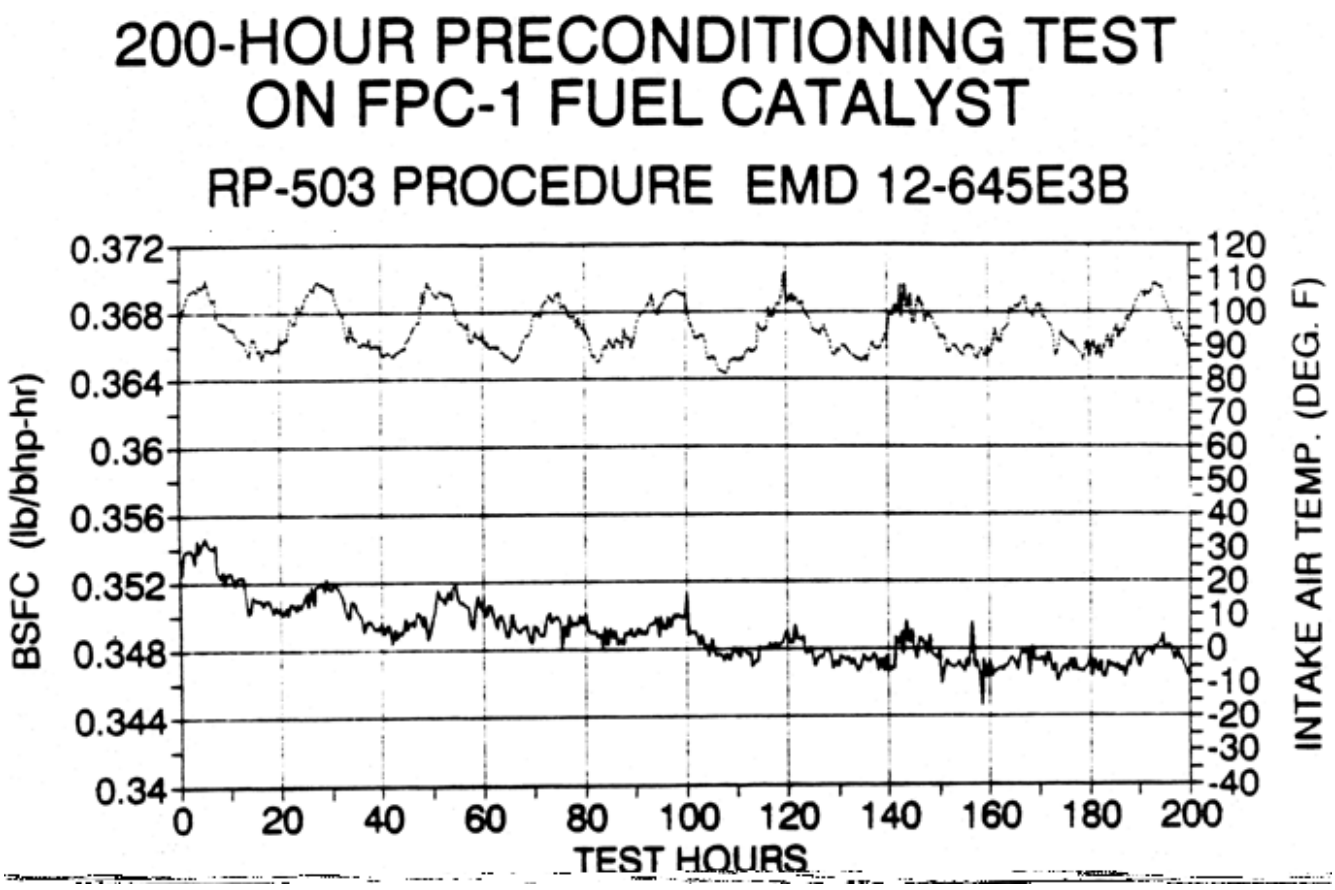
3. No measured increase in undesirable emissions.

4. No alteration to fuel specifications.

5. A transition or conditioning period of 130 hours from the start of fuel treatment to the point at which the new level of engine performance was established.

40-HOUR BASELINE TEST
RP-503 PROCEDURE EMD 12-645E3B





Six US railroads have now run controlled tests with this fuel catalyst and the results are summarised:

Willamette & Pacific Railroads

Operate a fleet of EMD-GP39-2 locomotives in West Central Oregon. These locomotives are powered by 12 cylinder 645 series EMD engines.

Willamette & Pacific determined to evaluate the effect of FTC upon fuel economy and smoke emissions by testing six identical 39-2 locomotives. The test fleet was divided into two groups with three locomotives comprising the control (untreated) group and the other three making up the treated group.

All locomotives were baseline tested at multiple throttle notch settings idle, 2, 4, 6 and 8 while loaded to 80%. The locomotives ran in normal service for one month then returned for a further series of tests under the same operating conditions.

The average improvement shown by the three FTC treated locomotives compared with the control group was **4.3%**. Smoke output reduced **15%**.

Alaska Railroad Corporation (ARR)

ARR undertook to measure the effect of the FTC catalyst upon fuel economy in seven EMD GP40-2 locomotives. This State owned short line railroad operates 51 locomotives in Alaska. The fleet comprises primarily GP40-2 locomotives powered by 16 cylinder EMD 645 series engines. Three locomotives comprised the control group and four made up the treated test group. Again, the tests were run at 80% load at notch settings 2, 4, 6 and 8; a six week conditioning period was run prior to re-testing all seven locomotives.

The average improvement of the test locomotives was **7.7%** (average of notch settings 2, 4, 6 and 8). Smoke density reduction at idle **44%**.

Kyle Railroad Company Inc.

Kyle Railroad Company Inc agreed to evaluate FTC in a fleet of five U-30C-2 locomotives. Kyle Railroad is a short line railroad operation in Kansas and operates a fleet of U30B and U30C locomotives powered by 16 cylinder General Electric engines.

The test locomotives were tested at multiple notch settings 2, 4 and 6 while loaded to 100% during baseline and again after six weeks conditioning with treated fuel.

FTC fuel treated tests showed a **5.4%** fuel efficiency gain and a **21%** reduction in smoke output.

Wisconsin Central Transportation

Two methods were employed for measuring fuel consumption while the engines were load box tested. Initially four naturally aspirated (roots blown) locomotives were tested before and after FTC treatment.

The two SW 1500 Switchers and two GP35's (modified to natural aspiration) were first tested with base fuel, treated with FTC and tested again after a two month engine pre-conditioning period. Fuel economy was improved **6.5%** measured by the indirect method (Carbon Balance).

The tests were conducted at multiple throttle notch settings 2, 4 and 6. A second method was also used employing a weigh scale. This test showed a **5%** average fuel economy at throttle notch setting 6 only.

Wisconsin Central staff observed and commented on reduced exhaust smoking, cleaner spark arresters, carbon plugs, inductor tubes and airboxes. Exhaust sparking was visibly reduced. Reduced carbon build-up on piston crowns and ring belt area was also noted.

Following these tests Wisconsin Central conducted a third test using the weigh scale procedure and an EMD SD45 locomotive powered by a 3600 BHP EMD645 Series engine.

This test conducted at throttle notch setting 8 showed a **4.5%** reduction in BSFC.

Washington Central Railroad Company/Montana Rail Link (WC/MRL)

Montana Rail Link and Washington Central operate co-operatively. Montana Rail Link operate 140 locomotives over two thousand track miles and Washington Central operate 7 locomotives.

A loadbox trial was completed in December 1996 employing four EMD-SD-9 special duty, six axle drive locomotives powered by EMD 16 v 567C engines rated at 1750 bhp.

The four engines were tested at throttle settings 2, 4 and 6 for fuel economy and idle 2, 4, 6 and 8 for smoke density. The average calculated reduction in fuel consumption of the four test locomotives was **7.71%**. Average reduction in smoke density **26.9%**.

Indiana Harbour Belt RR

Loadbox tests were conducted on three Indiana Harbour Belt (IHB) locomotive engines to prove increased engine efficiency and reduced smoke.

The three locomotives were EMD powered and comprised an SW1500, a GP38-2 and an SD40. The test fleet was first tested under load at throttle notch positions 1, 3 and 5 using untreated fuel.

The test fleet was then treated with FPC-2 and operated under normal duty cycle for approximately 600 hours. The locomotives were then returned to the loadbox and re-tested with FPC-2 treated fuel while reproducing all engine and power output conditions.

A summary of test results are:-

1. Fuel consumption reduced 7% to 9% depending upon throttle setting. Overall reduction in consumption was **7.7%** following FPC-2 treatment.

2. Exhaust smoke density was reduced 10% to 60% averaging **21.7%** for the entire fleet at all throttle settings.

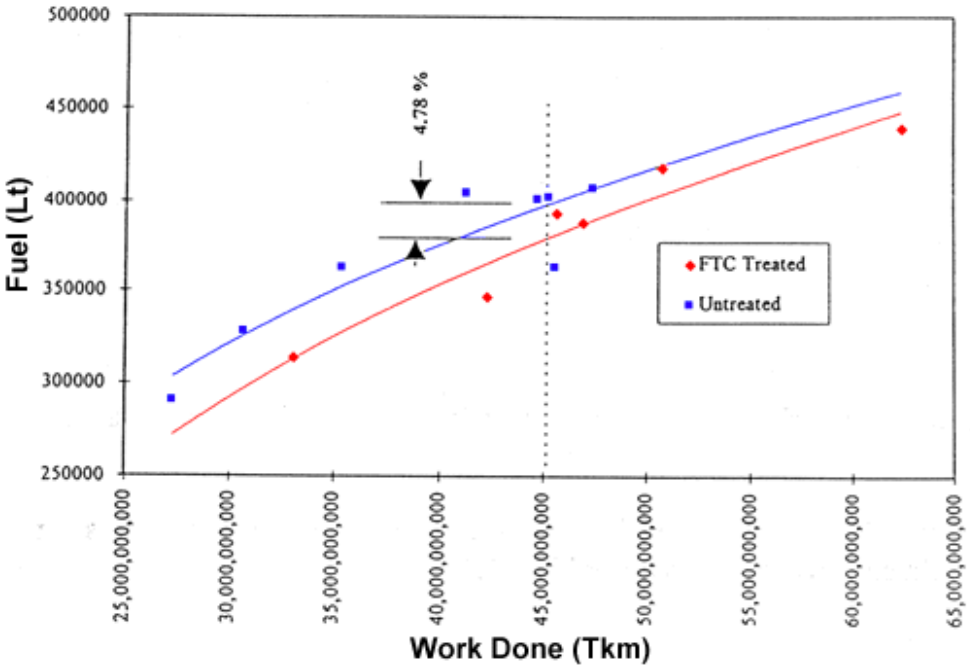
Australian Railroad Experience

Goldsworthy Mining Limited (GML) commenced treating railroad fuel with the FTC Catalyst following extensive testing in their power generation plant during 1981. The railroad used FTC treated fuel until the Company was sold in 1991.

GML operated a fleet of 10 locomotives comprising English Electric 6CSRKT and 12CSVT and a Clyde EMD JT42C.

A statistical study was conducted at the time of treatment cessation, which provided evidence of a **4.8%** increase in fuel consumption following withdrawal of FTC Catalyst from the fuel.

The graph below illustrates these changing consumption patterns.



CONCLUSION

These six US field tests with EMD and GE motive power units together with our Australian experience confirm the significant fuel efficiency potential of FTC and that under normal commercial operating conditions the fuel economies achieved are higher than that measured under a controlled laboratory condition with an engine in "*as new*" condition, operating under an optimum environment not encountered in normal commercial operations.

Fuel Technology Pty. Ltd. ACN 100 293 490
2 Tipping Road, Kewdale, Western Australia, 6105
Telephone (08) 9353; 1016 Facsimile (08) 9353 1013; Email fueltech@iinet.net.au
60 Formation Street, Wacol, Queensland, 4076. Telephone (07) 3271 4138 Facsimile (07) 3271 5739