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PLACER DOME
Paddington/Red Hill Operations

Evaluation of FTC Combustion Catalyst as a means of reducing diesel fuel costs in mobile mining equipment

May, 2005

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C O N T E N T S

Appendix

EXECUTIVE SUMMARY

The FTC/FPC Combustion Catalysts manufactured and marketed by Fuel Technology Pty Ltd have proven in laboratory and field trials to significantly reduce fuel consumption under comparable load conditions and to also substantially reduce carbon emissions.

Following meeting with Jim Lavery and Colin Brand it was agreed that a fuel efficiency study should be conducted on haul trucks at the Red Hill site employing two International Engineering test procedures, namely "Specific Fuel Consumption" (SFC) and "Carbon Mass Balance" (CMB). It was also agreed that selected Doug Gould prime movers at Paddington be tested using the CMB test procedure as SFC circuit could not be established. This trial commenced on 21st March, 2005 and was completed on 11th May, 2005.

Due to flow meter malfunction during SFC testing at Red Hill all data collated using this test method is unusable. However, the AS2007-1982 test procedure undertaken at both Red Hill and Paddington provides accurate fuel consumption figures.

The net average efficiency gain (reduction in fuel consumption) measured at Red Hill and Paddington by the CMB test method was **7.2%**. Smoke emissions were reduced by an average of **33.5%** following FTC-3 treatment of fuel.

BACKGROUND

The FTC Combustion Catalyst is the only fuel chemical yet proven by the world's leading testing authority, Southwest Research Institute (Texas) to improve fuel efficiency in an as new 2500HP diesel engine operating at its most efficient state. SwRI also determined that FTC does not alter the physical or chemical properties of diesel fuel.

SwRI also determined, using the Caterpillar 1G2 Test (ASTM 509A) that there are no detrimental effects that could cause increased wear or deposit problems following catalyst treatment of fuel.

These findings have been verified by countless field studies in diverse applications, which have confirmed efficiency benefits for mine mobile equipment. Maintenance benefits documented include reduced wear metal profiles in lubricating oil and reduced soot. Combustion and exhaust spaces become essentially free of any hard carbon with continuous catalyst use.

FTC's action in producing fuel efficiency gains is to promote a faster fuel burn which releases the fuel's energy more efficiently. That is, a larger portion of the fuel burn occurs when the piston is closer to top dead centre.

INTRODUCTION

Equipment provided for this fuel efficiency evaluation comprised four Caterpillar 777D haul trucks, Nos 59, 60, 109 and 110. Additionally, four Doug Gould prime movers, Midabean, KNL, Knard and Lakanooky were also provided for the fuel efficiency test.

Fuel Technology Pty Ltd supplied, *on loan*, FTC Catalyst metering systems at Red Hill and at Doug Gould's fuel farm. These systems were calibrated allowing fuel to be FTC treated at time of each test truck refuelling.

TEST METHOD

The Carbon Mass Balance (CMB) is a procedure whereby the mass of carbon in the exhaust is calculated as a measure of the fuel being burned. The elements measured in this test include the exhaust gas composition, (HC,CO,CO_2 and O_2) temperature and the gas flow rate calculated from the differential pressure and exhaust stack cross sectional area. This is an engineering standard test (AS2077-1982) and has been used by the US EPA since 1974 as the "Standard Federal Test Procedure" for fuel economy and emission testing. (Horiba four gas analyser photograph No. 1).

Each test truck at Red Hill was driven to the service bay while Doug Gould trucks were halted prior to entering weighbridge at Paddington. At this time CMB probe was positioned in the exhausts independently. With the assistance of on-site personnel the test truck engine was run at high idle while emissions were recorded. Exhaust smoke samples via "Bosch Smoke" testing equipment were also recorded at this time.

TEST RESULTS

A summary of the CMB fuel efficiency results achieved in this test program is provided in the following tables.

Carbon Balance Fuel Consumption Test Results
TABLE 1
RED HILL

Unit No.	Untreated 21/3/05 Carbon flow g/s	Treated 9/5/05 Carbon flow g/s	Variation
59	11.928	10.881	- 8.8%
60	11.159	10.276	- 7.9%
109	11.553	10.827	- 6.3%
110	9.697	9.122	- 5.9%
AVERAGE	**11.084**	**10.276**	**- 7.3%**

TABLE 2
DOUG GOULD PADDINGTON

Unit No.	Untreated 21/3/05 Carbon flow g/s	Treated 9/5/05 Carbon flow g/s	Variation
MIDBEAN			
Left Exhaust	0.493	0.458	
Right Exhaust	0.592	0.551	
TOTAL g/s	**1.085**	**1.009**	**- 7%**
KNL			
Left Exhaust	0.793	0.739	
Right Exhaust	1.043	0.969	
TOTAL g/s	**1.836**	**1.708**	**- 7%**
KNARD			
Left Exhaust	0.567	0.530	
Right Exhaust	0.618	0.566	
TOTAL g/s	**1.185**	**1.096**	**- 7.5%**
LAKANOOKY			
Left Exhaust	0.611	0.569	
Right Exhaust	0.798	0.743	
TOTAL g/s	**1.409**	**1.312**	**- 6.9%**
AVERAGE	**1.379**	**1.281**	**- 7.1%**

The CMB test procedure provides confirmation that addition of the Catalyst to the fuel supply has resulted in a reduction in carbon flow (fuel consumption) of 7.3% at Red Hill and 7.1% at the Doug Gould fuel farm. Combining the two sites results in a total reduction in fuel consumption of **7.2%.**

BOSCH SMOKE MEASUREMENTS

A Bosch smoke test is also undertaken during conduct of the CMB test and the results are shown in the following table.

Carbon impregnation on filter is then measured via Bosch infra red meter with a scale of "0" (*perfectly white*) to "10" (*black*) readings. Smoke patches in *Appendix*.

TABLE 3
Bosch Smoke Results
RED HILL

Unit No.	Untreated 21/3/05	Treated 9/5/05	Variation
59	1.3	0.9	- 31%
60	1.3	1.2	- 8%
109	1.5	1.2	- 20%
110	1.2	1.0	- 17%
AVERAGE	**5.3**	**4.3**	**- 19%**

TABLE 4
Bosch Smoke Results
DOUG GOULD PADDINGTON

Unit No.	Untreated 21/3/05	Treated 9/5/05	Variation
MIDABEAN			
Left Exhaust	0.5	0.4	
Right Exhaust	0.6	0.4	
AVERAGE	**1.1**	**0.8**	**- 27%**
KNL			
Left Exhaust	0.4	0.1	
Right Exhaust	0.4	0.2	
AVERAGE	**0.8**	**0.3**	**- 62%**
KNARD			
Left Exhaust	0.5	0.1	
Right Exhaust	0.6	0.6	
AVERAGE	**1.1**	**0.7**	**- 36%**
LAKANOOKY			
Left Exhaust	0.2	0.1	
Right Exhaust	0.1	0.1	
AVERAGE	**0.3**	**0.2**	**- 33%**
TOTAL AVERAGE	**3.3**	**1.7**	**- 48%**

GREENHOUSE GAS REDUCTION

A gross reduction of **7.2%** of the current estimated annual fuel consumption of 15,000 KL translates to **2,906 tonnes per annum** reduction in CO_2 emissions, based on the formula outlined in Worksheet 1 of the "Electricity Supply Business Greenhouse Change Workbook". Our estimate is based on the following calculations:-

(15,000 KL x 38.6 x 69.7) ÷ 1000 = 40,356 tonnes CO_2 per annum

- 7.2% (13,920 KL x 38.6 x 69.7) ÷ 1000 = 37,450 tonnes CO_2 per annum

CO_2 reduction by application FTC Catalyst
40,356 tonnes – 37,450 = 2,906 tonnes

CONCLUSION

These carefully controlled international engineering standard test procedures conducted at Red Hill and Paddington provides clear evidence of average reduced fuel consumption of **7.2%.**

A fuel efficiency gain of **7.2%** as measured by the Australian Standards (AS2007) CMB test method if applied to the estimated fuel currently consumed by these two operations of approximately 15 ML per annum at a cost of $0.56/L will result in a net saving in excess of **$500,000** per annum.

Additional to the fuel economy benefits measured, is a reduction in greenhouse gas emissions of 2,906 tonnes per annum due to more complete combustion of the fuel. Further, the more complete combustion will translate to significant reduction over time in engine maintenance costs. FTC/FPC also acts as an effective biocide.

Appendix "B"

Carbon Balance Printouts

Carbon Balance Results

Paddington