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BHP/BILLITON
Mt WHALEBACK NEWMAN

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

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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 meetings with Business Improvement Coach, David Hales, it was agreed that a fuel efficiency study should be conducted on two 789 Caterpillar dump trucks employing the engineering standard test namely "Specific Fuel Consumption Procedure". This trial commenced on 18th December 2001 and was completed on the 31st January 2002.

The net average efficiency gain (reduction in fuel consumption) measured by the SFC test method was **5.3%**.

BACKGROUND

The FTC/FPC 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/FPC's action in producing fuel efficiency gains is to promote a more complete and 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 of two 789 Caterpillar dump trucks operating in the Mt Whaleback pit at BHP/Billiton Newman operations. Trucks DT137 and DT140 were both tested on untreated fuel. Due to fuel meter failure when conducting treated tests on DT140 this test was aborted.

Fuel Technology Pty Ltd supplied, on loan, an air operated FTC/FPC catalyst metering system that was calibrated allowing fuel to be treated at time of refuelling of the two test trucks.

TEST METHOD

The Specific Fuel Consumption (SFC) test procedure requires measurement of the mass of fuel consumed related to the work performed in hauling a measured load of ore over a defined distance.

A start point was selected on a reproducible section of the ramp haul and the windrow marked. A point at the north waste dump was defined as the end point of the haul route. The distance between these points was measured at 2.6km.

MacNaught Model M5 flow transducers complete with thermocouple probes were connected to the truck's fuel tank outlet and return fuel pipelines (*Photograph No. 1*).

These transducers, which have been calibrated to ± 0.25% by a NATA certified laboratory, are connected to a KEP Minitrol Totaliser mounted in the truck cab. The thermocouple probes are connected to a duel reading digital thermometer, also mounted in the cab workstation (*Photograph No. 2*).

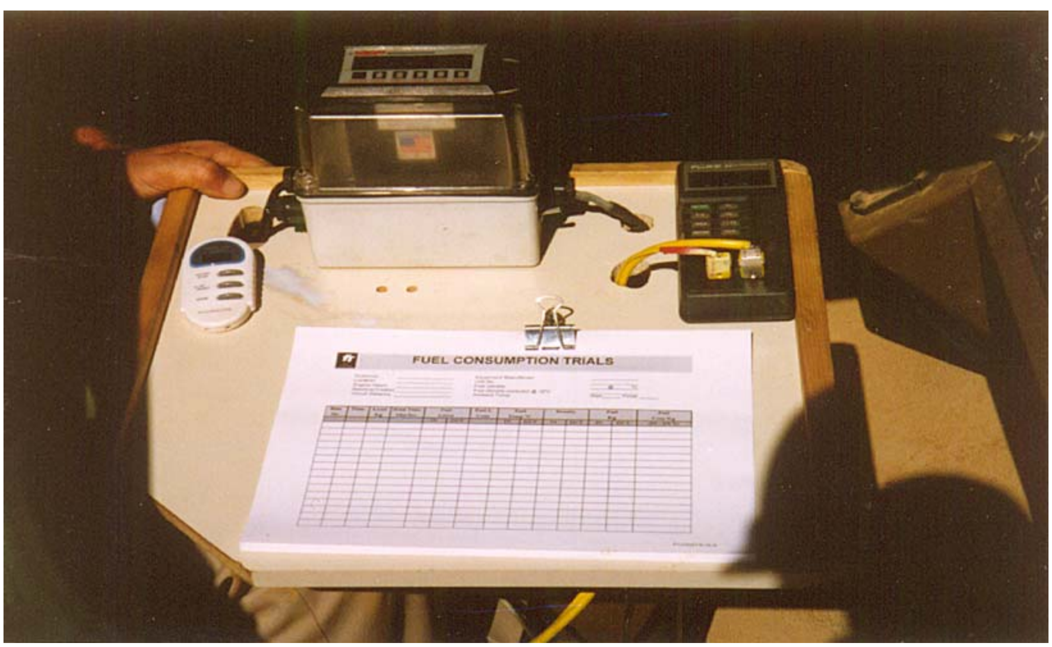
As the temperature of the fuel can vary relative to ambient temperature changes as well as increase significantly during a working shift, constant temperature monitoring is required to enable calculation of the mass of fuel consumed for each haul.

Prior to the test commencing a fuel sample is drawn and the density measured at the observed temperature and then corrected to the industry standard of 15°C by use of the Institute of Petroleum Density Correction Table, Volume VIII, Table 53B.

Following loading of the truck at each cycle, allowing the load monitor to register, the load in Tonnes is recorded and the truck driven to the pit ramp marker and stopped. The Minitrol totaliser and stopwatch are zeroed. At the signal "*GO*" the driver accelerates and the test engineer activates the totaliser and stopwatch. The truck is driven at full throttle to avoid driver variables over the haul route. Fuel temperatures are recorded at the mid haul point. Upon arrival at the end marker the stopwatch and Minitrol totaliser readings are recorded.

TEST EQUIPMENT

Photograph No. 1



Photograph No. 2

TEST RESULTS

SPECIFIC FUEL CONSUMPTION TRUCK TRIAL

Customer:	BHP Newman	Engine Hrs	33312
Date:	18/12/01	Amb; Temp; Start deg; C	30
Truck No;	137	Amb; Temp; Finish deg; C	38
Make/Model	Cat 789	Circuit Distance Km	2.6
		Unit Tare weight	131

Fuel Sample	Density	Temp Deg C
	0.816	61.2
Corrected	0.849	15

UNTREATED

Run No	Time	Load Tonnes	Haul Time		Haul Time	Fuel (Lt)		Fuel (Lt)	Fuel Temp		Density		Fuel (kg)		Fuel (kg)	Fuel (kg)	**Tonne/km**
			Mins	Secs	Mins	In	Out	Consumed	In	Out	In	Out	In	Out	Consumed	Per Tonne	**Per kg Fuel**
1	6.50	178	10	56	10.93	168.16	115.26	52.90	41.5	64.9	0.830	0.813	139.56	93.74	45.82	0.1483	**17.5357**
2	7.26	160	10	31	10.52	161.32	111.86	49.46	43.8	66.8	0.828	0.812	133.62	90.83	42.79	0.1470	**17.6813**
3	7.56	153	10	25	10.42	159.95	111.30	48.65	45.7	68.1	0.827	0.811	132.26	90.28	41.99	0.1478	**17.5863**
4	8.27	155	10	26	10.43	152.36	103.91	48.45	47.6	69.1	0.826	0.810	125.79	84.21	41.58	0.1454	**17.8837**
5	8.56	176	10	51	10.85	165.92	113.48	52.44	49.3	71.1	0.824	0.809	136.78	91.81	44.98	0.1465	**17.7460**
6	9.30	167	10	36	10.60	162.85	112.39	50.46	51.3	72.0	0.823	0.808	134.03	90.84	43.18	0.1449	**17.9432**
7	10.03	170	10	42	10.70	163.57	111.84	51.73	53.0	73.4	0.822	0.807	134.42	90.29	44.13	0.1466	**17.7326**
8	10.37	151	10	28	10.47	154.94	105.47	49.47	54.6	73.7	0.821	0.807	127.14	85.12	42.02	0.1490	**17.4493**
9	11.08	154	10	35	10.58	160.70	110.97	49.73	56.1	76.1	0.820	0.805	131.71	89.38	42.33	0.1485	**17.5035**
10	12.43	174	10	54	10.90	165.64	112.13	53.51	57.7	75.9	0.818	0.806	135.56	90.33	45.23	0.1483	**17.5334**
11	13.43	163	10	53	10.88	164.72	113.47	51.25	60.4	79.0	0.817	0.803	134.49	91.16	43.33	0.1474	**17.6405**
12	14.15	182	11	02	11.03	165.54	111.87	53.67	61.3	79.3	0.816	0.803	135.06	89.85	45.21	0.1444	**18.0004**
13	14.50	177	11	00	11.00	164.98	111.34	53.64	62.7	79.7	0.815	0.803	134.44	89.39	45.05	0.1463	**17.7769**
14	15.20	185	11	15	11.25	168.67	114.25	54.42	63.9	81.1	0.814	0.802	137.31	91.62	45.70	0.1446	**17.9792**
Mean		168			10.75			51.41							43.810	0.147	**17.714**
Std Dev		11.55422001			0.2595			2.0499							1.5165	0.0015	**0.1841**
C.V		6.9%			2.4%			4.0%							3.5%	1.0%	**1.0%**

SPECIFIC FUEL CONSUMPTION TRUCK TRIAL

Truck No:	137	Engine Hrs	33970
Date:	30/01/02	Amb; Temp; Start deg; C	36
		Amb; Temp; Finish deg; C	38

Fuel Sample	Density	Temp Deg C
	0.822	50.1
Corrected	0.847	15

TREATED

Run No	Time	Load Tonnes	Haul Time		Haul Time	Fuel (Lt)		Fuel (Lt)	Fuel Temp		Density		Fuel (kg)		Fuel (kg)	Fuel (kg)	**Tonne/km**
			Mins	Secs	Mins	In	Out	Consumed	In	Out	In	Out	In	Out	Consumed	Per Tonne	**Per kg Fuel**
1	10.45	164	10	50	10.83	161.09	112.26	48.83	55.3	74.4	0.818	0.805	131.82	90.35	41.47	0.1406	**18.4939**
2	11.55	184	11	07	11.12	164.45	112.19	52.26	56.0	74.9	0.818	0.805	134.49	90.26	44.23	0.1404	**18.5167**
3	12.23	173	10	43	10.72	162.67	112.62	50.05	57.4	77.4	0.817	0.803	132.87	90.40	42.47	0.1397	**18.6113**
4	12.50	192	11	06	11.10	166.05	113.46	52.59	58.9	78.8	0.816	0.802	135.46	90.96	44.50	0.1378	**18.8708**
5	1.30	141	10	28	10.47	151.06	105.46	45.60	60.8	77.8	0.814	0.802	123.02	84.62	38.40	0.1412	**18.4156**
6	2.03	179	11	00	11.00	162.29	112.35	49.94	62.1	79.1	0.814	0.802	132.02	90.05	41.97	0.1354	**19.2022**
7	2.34	176	10	51	10.85	162.61	112.70	49.91	63.3	79.6	0.813	0.801	132.15	90.28	41.87	0.1364	**19.0641**
8	3.03	177	10	53	10.88	162.71	112.41	50.30	64.6	81.2	0.812	0.800	132.09	89.93	42.16	0.1369	**18.9943**
9	3.34	168	10	50	10.83	162.26	110.24	52.02	65.5	81.2	0.811	0.800	131.61	88.19	43.42	0.1452	**17.9054**
10	4.02	163	10	50	10.83	162.03	112.99	49.04	66.5	83.9	0.810	0.798	131.31	90.18	41.13	0.1399	**18.5842**
11	4.29	177	10	53	10.88	162.66	111.90	50.76	67.8	83.2	0.810	0.799	131.67	89.36	42.31	0.1374	**18.9270**
12	5.03	157	10	40	10.67	162.09	112.64	49.45	68.8	81.3	0.809	0.800	131.10	90.10	41.00	0.1424	**18.2645**
Mean		171			10.85			50.06							42.078	0.139	**18.654**
Std Dev		13.46009816			0.1803			1.8704							1.6100	0.0028	**0.3725**
C.V		7.9%			1.7%			3.7%							3.8%	2.0%	**2.0%**

% CHANGE: Treated-Baseline	Load Tonnes			Haul Time Mins		Fuel (Lt) Consumed		Fuel (kg) Consumed	Fuel (kg) Per Tonne	**Tonne/km Per kg Fuel**
Baseline	2.04%			0.87%		-2.63%		-3.95%	**-5.0%**	**5.3%**

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

TABLE 1
Specific Fuel Consumption Test Results
(kg fuel per Tonne of Ore)

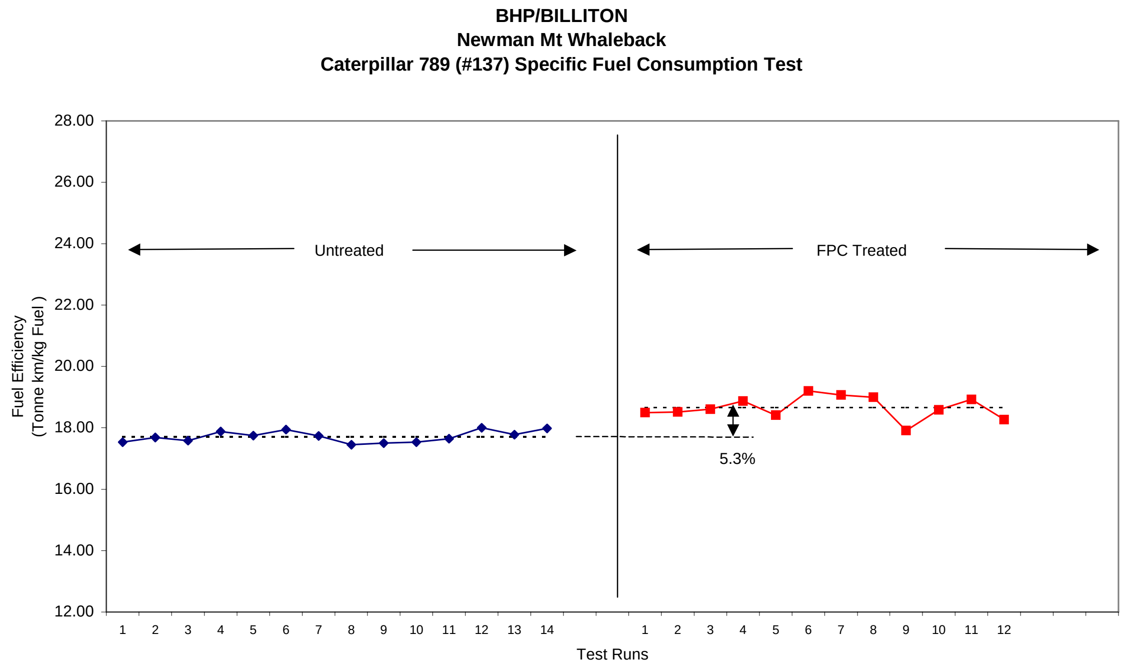
Unit No.	Untreated 18/12/01 Fuel kg per tonne	Treated 31/1/02 Fuel kg per tonne	Variation
137	0.147	0.139	-5%

As outlined in SAE paper "Specific Fuel Consumption Measurements" to accurately calculate fuel consumption, the distance travelled must be used in the calculation to determine Tonne km per kg fuel.

TABLE 2
Specific Fuel Consumption Test Results
(Tonne km per kg fuel)

Unit No.	Untreated 18/12/01 Tonne km per kg fuel	Treated 31/1/02 Tonne km per kg fuel	Variation
137	17.714	18.654	5.3 %

GRAPHICAL REPRESENTATION OF TEST RESULTS



The SFC test procedure provides confirmation that addition of the Catalyst to the fuel supply has resulted in an average efficiency gain of **5.3%.** The raw data sheets are contained in the *Appendix*.

GREENHOUSE GAS REDUCTION

A gross reduction of **5.3%** of the current estimated annual fuel consumption of 30,000 KL translates to a **4,597 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:-

(30,000 KL x 38.6 x 74.9) ÷ 1000 = 86,734 tonnes CO_2 per annum

- 5.3% (28,440 KL x 38.6 x 74.9) ÷ 1000 = 82,137 tonnes CO_2 per annum

CO_2 reduction by application FPC Catalyst
86,734 – 82,137 = **4,597 tonnes**

CONCLUSION

These carefully controlled engineering standard test procedures conducted on DT137 at Mt Whaleback's operations provide clear evidence of reduced fuel consumption of **5.3%**.

A fuel efficiency gain of **5.3%** as measured by the International Engineering Test Procedure SFC, if applied to the total fuel currently consumed at this operation, will result in a **net** saving of in excess of **$515,000 per annum.**

Additional to the fuel economy benefits measured is a reduction in greenhouse gas emissions in excess of 4,500 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 "A"

Raw Data Sheets