KALGOORLIE CONSOLIDATED GOLD MINES
SUPER PIT SITE

Evaluation of FTC Combustion Catalyst as a means of reducing Geenhouse Gas Emissions and diesel fuel costs in mobile mining equipment.

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EXECUTIVE SUMMARY

The FTC/FPC Combustion Catalysts manufactured and marketed by Fuel Technology 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 Kalgoorlie Consolidated Gold Mines Maintenance Superintendent Open Pits, Mr Lou Fornaro, it was agreed that a fuel efficiency study should be conducted on selected haul trucks at the Super Pit site employing an International Engineering test procedure namely "Specific Fuel Consumption" (SFC). This trial commenced on 19th July 2003 and was completed on 14th August 2003.

The net average efficiency gain (reduction in fuel consumption) measured by the SFC test method following FTC Combustion Catalyst treatment of test trucks fuel was **5.6%.**

BACKGROUND

The FTC Combustion Catalyst is the only fuel chemical yet proven by the world's leading testing authority, Southwest Research Institute (SwRI) San Antonio, 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 and a significant reduction in visible exhaust smoke of up to 30% is often achieved 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 of three Caterpillar 793 series trucks, No's 202, 206 and 225. A 1.9 km test circuit was surveyed up "W" and "Y" haul ramps commencing approximately fifty mitres from the base of "W" ramp or the 260 level. This circuit was selected due to the opinion of site personnel that it was a more repeatable circuit that could be used for untreated and treated tests where no changes to the profile would occur over the three week test period.

Fuel Technology Pty Ltd organised for an independent contractor to manually treat each test trucks fuel with FTC Combustion Catalyst at time of refuelling over the three-week test period.

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 windrow markers marked. A point near the summit of the pit was defined as the end point of the haul route. The distance between these points was surveyed at 1.9km.

MacNaught Model M10 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 dual reading digital thermometer, also mounted in the cab workstation (*Photograph No. 2*).

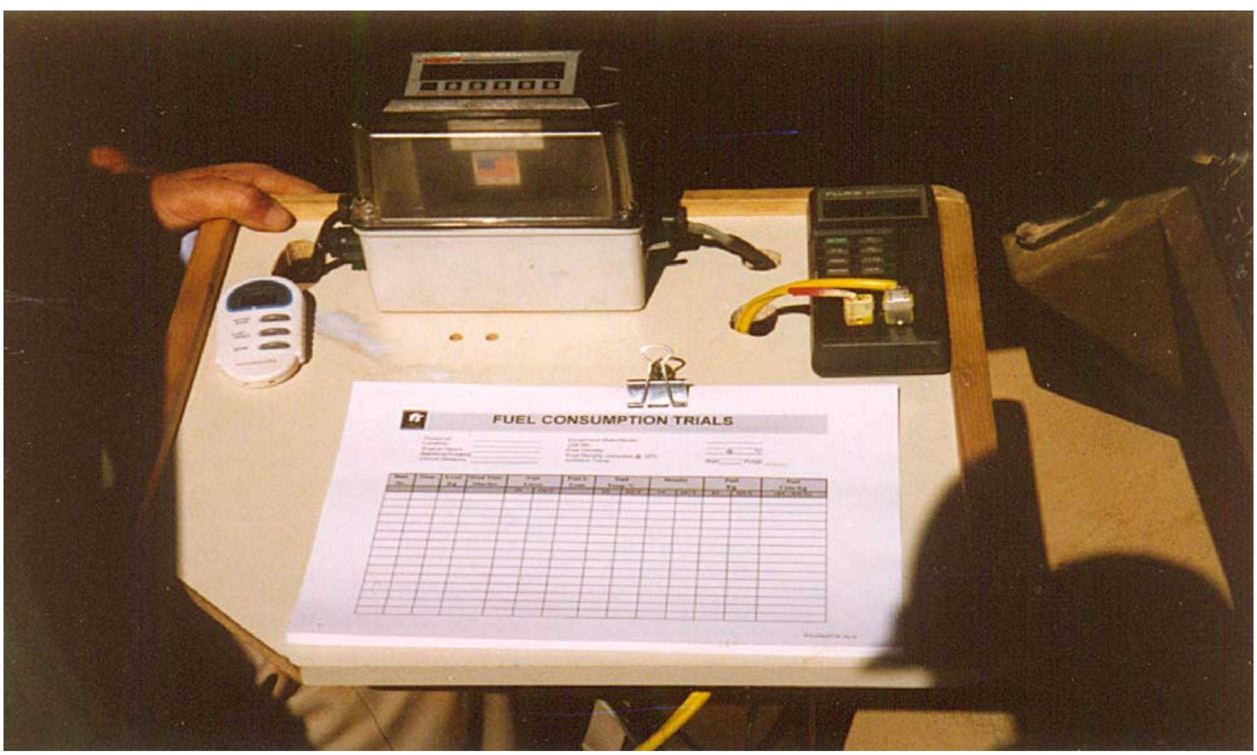
As the temperature of the fuel can vary relative to ambient temperature changes as well as increase significantly during a working shift, constant temperature monitoring is required to enable calculation of the mass of fuel consumed for each haul.

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. Fuel samples tested for untreated tests were within the normal density measured for diesel fuel of 0.840 @ 15°C. Fuel samples tested at time of treated tests indicated a substantially lower density and for this reason fuel samples were submitted to an independent Laboratory, which confirmed a lower density to untreated tests. (*Laboratory report in Appendix*)

Following loading of the truck at each cycle, the truck is driven as per normal locked in second gear up the surveyed test circuit. The Minitrol totaliser and stopwatch are zeroed and as the truck passes the test circuit start point, 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 tests conducted on trucks 202, 206 and 225 in a working environment provided fuel efficiency gains of **4.6%, 6.6%** and **5.6%** respectively averaging **5.6%** when SAE recommended formula of Tonne/km per kg of fuel is applied. Computer printouts follow in tables 1, 2 and 3. Graphical representation is graphs 1, 2 and 3. (*Work sheets in Appendix*.)

Table 1

SPECIFIC FUEL CONSUMPTION TRUCK TRIAL

Customer:	KCGM SUPERPIT	Engine Hrs		
Date:	16/07/2003	Amb; Temp; Start deg; C		
Truck No;	202	Amb; Temp; Finish deg; C		
Make/Model	Cat 793B	Circuit Distance Km	1.9	
		Unit Tare Weight Tonne	172	

Fuel Sample	Density	Temp Deg C
	0.827	33.6
Corrected	0.840	15

UNTREATED

Run No	Time	Load Tonne	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	12.15	187	8	00	8.00	125.33	69.45	55.88	23.8	48.1	0.834	0.817	104.51	56.72	47.79	0.1183	**14.2720**
2	1.50	212	8	08	8.13	127.83	70.71	57.12	25.7	50.5	0.833	0.815	106.42	57.63	48.79	0.1137	**14.9539**
3	2.15	216	8	17	8.28	130.22	72.52	57.70	27.1	50.6	0.832	0.815	108.29	59.10	49.19	0.1136	**14.9854**
4	2.50	214	8	10	8.17	128.55	71.42	57.13	28.2	52.2	0.831	0.814	106.80	58.12	48.68	0.1129	**15.0664**
5	3.15	231	8	35	8.58	134.11	74.72	59.39	29.7	53.1	0.830	0.813	111.27	60.76	50.51	0.1127	**15.1597**
6	4.15	208	8	15	8.25	130.38	72.63	57.75	33.1	54.3	0.827	0.812	107.86	59.00	48.87	0.1150	**14.7751**
7	4.50	218	8	18	8.30	131.22	73.13	58.09	33.6	54.7	0.827	0.812	108.52	59.38	49.14	0.1130	**15.0802**
8	10.10	207	8	12	8.20	127.94	70.10	57.84	21.5	45.7	0.836	0.818	106.89	57.37	49.52	0.1168	**14.5404**
9	10.40	216	8	17	8.28	129.33	71.70	57.63	23.7	50.8	0.834	0.815	107.86	58.42	49.44	0.1142	**14.9110**
10	11.05	229	8	26	8.43	131.94	73.40	58.54	25.5	51.5	0.833	0.814	109.87	59.77	50.10	0.1123	**15.2086**
11	11.35	219	8	14	8.23	129.38	71.75	57.63	26.8	52.4	0.832	0.814	107.62	58.38	49.24	0.1129	**15.0888**
12	12.05	229	8	32	8.53	133.88	74.45	59.43	28.4	53.2	0.831	0.813	111.20	60.54	50.67	0.1136	**15.0379**
Mean		216			8.28			57.84							49.327	0.114	**14.923**
Std Dev		11.98104564			0.1658			0.9753							0.8074	0.0018	**0.2731**
C.V		5.6%			2.0%			1.7%							1.6%	1.6%	**1.8%**

SPECIFIC FUEL CONSUMPTION TRUCK TRIAL

Truck No:	202	Engine Hrs	28343
Date:	12/08/2003	Amb; Temp; Start deg; C	11.9
		Amb; Temp; Finish deg; C	

Fuel Sample	Density	Temp Deg C
	0.832	14.5
Corrected	0.832	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		222	8	11	8.18	129.49	73.03	56.46	19.0	46.0	0.829	0.810	107.32	59.13	48.19	0.1098	**15.5347**
2		201	8	03	8.05	125.27	69.99	55.28	25.0	50.2	0.825	0.807	103.30	56.47	46.83	0.1120	**15.1336**
3		203	8	04	8.07	127.05	71.60	55.45	27.8	52.1	0.823	0.805	104.51	57.67	46.84	0.1115	**15.2098**
4		224	8	11	8.18	128.99	72.97	56.02	29.4	53.0	0.822	0.805	105.97	58.73	47.24	0.1071	**15.9275**
5		223	8	11	8.18	130.22	73.85	56.37	31.3	54.9	0.820	0.803	106.79	59.33	47.46	0.1079	**15.8125**
6		243	8	25	8.42	134.83	75.89	58.94	33.2	55.2	0.819	0.803	110.40	60.95	49.44	0.1075	**15.9473**
7		228	8	16	8.27	132.16	74.51	57.65	35.0	56.1	0.818	0.803	108.04	59.80	48.24	0.1084	**15.7549**
8		215	8	06	8.10	129.33	71.98	57.35	38.4	56.7	0.815	0.802	105.42	57.74	47.67	0.1104	**15.4233**
9		222	8	12	8.20	129.77	72.64	57.13	39.5	58.9	0.814	0.801	105.67	58.16	47.52	0.1082	**15.7547**
Mean		220			8.18			56.74							47.715	0.1092	**15.6109**
Std Dev		12.75190618			0.1118			1.1577							0.8186	0.0018	**0.3011**
C.V		5.8%			1.4%			2.0%							1.7%	1.6%	**1.9%**

% CHANGE: Treated-Baseline	Load Tonnes			Haul Time Mins		Fuel (Lt) Consumed		Fuel (kg) Consumed	Fuel (kg) Per Tonne	**Tonne.km Per kg Fuel**
Baseline	2.14%			-1.21%		-1.91%		-3.27%	-4.3%	**4.6%**

Table 2

SPECIFIC FUEL CONSUMPTION TRUCK TRIAL

Customer:	KCGM SUPERPIT	Engine Hrs	27374
Date:	17/07/2003	Amb; Temp; Start deg; C	
Truck No;	206	Amb; Temp; Finish deg; C	
Make/Model	793B	Circuit Distance Km	1.9
		Unit Tare Weight Tonne	172

Fuel Sample	Density	Temp Deg C
	0.829	29.8
Corrected	0.839	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	2.50	220	8	38	8.63	128.83	71.92	56.91	33.1	54.9	0.827	0.811	106.50	58.35	48.16	0.1238	**15.4667**
2	3.25	223	8	41	8.68	128.83	71.70	57.13	34.9	56.5	0.825	0.810	106.34	58.09	48.24	0.1231	**15.5560**
3	3.55	235	8	49	8.82	129.27	71.86	57.41	36.1	57.2	0.825	0.810	106.60	58.19	48.41	0.1198	**15.9736**
4	4.25	238	8	60	9.00	131.11	72.47	58.64	37.1	57.8	0.824	0.809	108.02	58.64	49.38	0.1213	**15.7760**
5	5.55	233	8	51	8.85	129.94	71.97	57.97	38.0	58.2	0.823	0.809	106.97	58.22	48.75	0.1213	**15.7846**
6	10.50	224	8	40	8.67	129.22	71.37	57.85	24.4	47.3	0.833	0.817	107.63	58.29	49.34	0.1255	**15.2495**
7	11.20	227	8	46	8.77	129.72	72.25	57.47	26.3	51.5	0.832	0.814	107.86	58.79	49.07	0.1239	**15.4486**
8	12.50	209	8	26	8.43	126.33	70.60	55.73	32.0	55.3	0.828	0.811	104.54	57.26	47.28	0.1251	**15.3104**
9	2.15	233	8	45	8.75	129.55	72.03	57.52	33.7	56.2	0.826	0.810	107.05	58.37	48.67	0.1211	**15.8092**
10	2.50	209	8	20	8.33	125.77	70.49	55.28	35.4	57.0	0.825	0.810	103.77	57.08	46.69	0.1235	**15.5044**
11	4.20	216	8	39	8.65	128.33	71.48	56.85	39.9	59.8	0.822	0.808	105.47	57.74	47.73	0.1240	**15.4443**
Mean		224			8.69			57.16							48.339	0.123	**15.575**
Std Dev		10.09049958			0.1859			0.9669							0.8458	0.0018	**0.2290**
C.V		4.5%			2.1%			1.7%							1.7%	1.5%	**1.5%**

SPECIFIC FUEL CONSUMPTION TRUCK TRIAL

Truck No:	206	Engine Hrs	27859
Date:	13/08/2003	Amb; Temp; Start deg; C	9.8
		Amb; Temp; Finish deg; C	

Fuel Sample	Density	Temp Deg C
	0.8292	15
Corrected	0.829	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		208	8	27	8.45	127.66	74.30	53.36	28.9	52.6	0.819	0.803	104.59	59.63	44.96	0.1193	**16.0592**
2		212	8	29	8.48	127.66	74.19	53.47	33.9	55.7	0.816	0.800	104.15	59.38	44.76	0.1175	**16.2990**
3		247	9	07	9.12	132.49	76.84	55.65	34.7	56.8	0.815	0.800	108.01	61.44	46.56	0.1119	**17.0967**
4		251	9	20	9.33	136.88	79.41	57.47	35.8	57.7	0.815	0.799	111.49	63.45	48.04	0.1144	**16.7297**
5		227	8	54	8.90	134.33	78.37	55.96	36.7	57.5	0.814	0.799	109.32	62.63	46.69	0.1179	**16.2361**
6		229	8	55	8.92	133.83	78.20	55.63	37.8	59.1	0.813	0.798	108.80	62.40	46.40	0.1166	**16.4202**
7		244	8	59	8.98	131.77	75.79	55.98	38.9	59.7	0.812	0.798	107.04	60.44	46.59	0.1128	**16.9635**
8		230	8	45	8.75	129.72	75.80	53.92	39.7	59.8	0.812	0.798	105.29	60.45	44.84	0.1124	**17.0327**
Mean		231			8.87			55.18							46.107	0.1153	**16.6046**
Std Dev		15.74801575			0.3004			1.4511							1.1547	0.0028	**0.4019**
C.V		6.8%			3.4%			2.6%							2.5%	2.4%	**2.4%**

% CHANGE:	Load Tonnes			Haul Time		Fuel (Lt)		Fuel (kg)	Fuel (kg)	**Tonne/km**
Treated-Baseline				Mins		Consumed		Consumed	Per Tonne	**Per kg Fuel**
Baseline	3.00%			2.04%		-3.46%		-4.62%	**-6.2%**	**6.6%**

Table 3

SPECIFIC FUEL CONSUMPTION TRUCK TRIAL

Customer:	KCGM SUPERPIT		Engine Hrs	5877
Date:	19/07/2003		Amb; Temp; Start deg; C	
Truck No;	225		Amb; Temp; Finish deg; C	
Make/Model	793B		Circuit Distance Km	1.9
			Unit Tare Weight Tonne	167

Fuel Sample	Density	Temp Deg C
	0.824	38.1
Corrected	0.840	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	9.40	224	8	26	8.43	137.11	80.05	57.06	24.9		0.833	0.851	114.25	68.11	46.14	0.1174	**16.1013**
2	10.10	207	8	18	8.30	135.77	80.32	55.45	26.9		0.832	0.851	112.95	68.34	44.60	0.1186	**15.9317**
3	10.35	212	8	19	8.32	136.05	80.43	55.62	29.0		0.830	0.851	112.98	68.44	44.54	0.1169	**16.1682**
4	11.05	214	8	45	8.75	139.55	83.35	56.20	31.2		0.829	0.851	115.67	70.92	44.75	0.1168	**16.1764**
5	11.35	238	8	55	8.92	141.72	82.52	59.20	33.3		0.827	0.851	117.26	70.22	47.04	0.1156	**16.3574**
6	12.10	210	8	23	8.38	137.05	80.93	56.12	35.2		0.826	0.851	113.20	68.86	44.34	0.1170	**16.1547**
7	12.55	227	8	37	8.62	138.83	81.37	57.46	34.5		0.827	0.851	114.74	69.24	45.51	0.1149	**16.4508**
8	1.25	216	8	39	8.65	139.44	81.92	57.52	36.6		0.825	0.851	115.04	69.71	45.33	0.1177	**16.0526**
9	2.40	216	8	25	8.42	137.11	80.82	56.29	38.3		0.824	0.851	112.95	68.77	44.18	0.1148	**16.4707**
10	3.25	237	8	58	8.97	141.88	82.14	59.74	39.9		0.823	0.851	116.72	69.89	46.83	0.1153	**16.3906**
11	3.55	226	8	37	8.62	139.22	81.70	57.52	41.2		0.822	0.851	114.41	69.52	44.89	0.1137	**16.6331**
12	4.20	232	8	47	8.78	140.66	81.97	58.69	42.4		0.821	0.851	115.47	69.75	45.72	0.1140	**16.5815**
Mean		222			8.60			57.24							45.323	0.116	**16.289**
Std Dev		10.56975387			0.2281			1.3980							0.9539	0.0016	**0.2220**
C.V		4.8%			2.7%			2.4%							2.1%	1.4%	**1.4%**

SPECIFIC FUEL CONSUMPTION TRUCK TRIAL

Truck No:	225		Engine Hrs	6375
Date:	14/08/2003		Amb; Temp; Start deg; C	
			Amb; Temp; Finish deg; C	

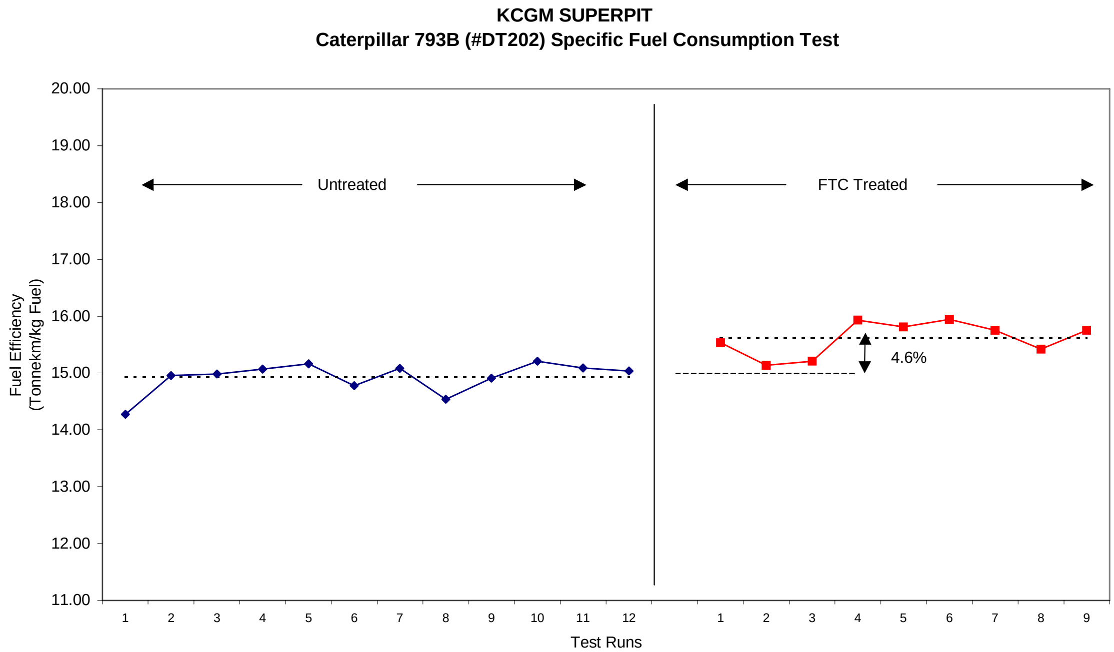
Fuel Sample	Density	Temp Deg C
	0.827	15
Corrected	0.827	15

TREATED

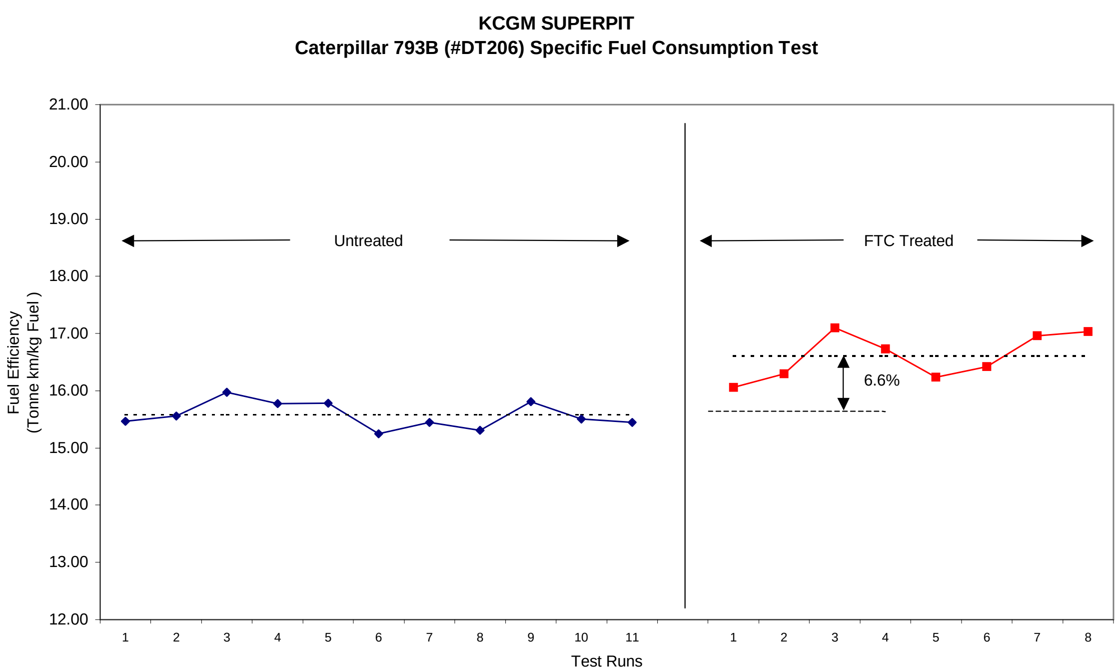
Run No	Time	Load Tonnes	Haul Time		Haul Time	Fuel (Lt)		Fuel (Lt)	Fuel Temp		Density		Fuel (kg)		Fuel (kg)	Fuel (kg)	**Tonne/km**
			Mins	Secs	Mins	In	Out	Consumed	In	Out	In	Out	In	Out	Consumed	Per Tonne	**Per kg Fuel**
1		241	8	47	8.78	139.16	83.98	55.18	38.0	51.2	0.811	0.801	112.82	67.29	45.52	0.1110	**17.0284**
2		227	8	43	8.72	137.94	84.76	53.18	38.9	52.2	0.810	0.801	111.73	67.86	43.87	0.1108	**17.0631**
3		238	8	45	8.75	139.94	84.93	55.01	39.3	53.0	0.810	0.800	113.32	67.95	45.37	0.1115	**16.9602**
6		246	8	58	8.97	139.94	85.27	54.67	39.7	53.2	0.810	0.800	113.28	68.21	45.07	0.1086	**17.4092**
7		234	8	49	8.82	138.38	85.48	52.90	41.1	53.9	0.809	0.799	111.88	68.33	43.55	0.1081	**17.4958**
8		228	8	48	8.80	137.38	85.25	52.13	42.1	54.3	0.808	0.799	110.98	68.13	42.84	0.1079	**17.5171**
9		218	8	32	8.53	137.94	85.98	51.96	43.5	55.0	0.807	0.799	111.29	68.67	42.62	0.1101	**17.1642**
10		221	8	38	8.63	138.55	85.59	52.96	44.6	55.4	0.806	0.798	111.67	68.34	43.34	0.1111	**17.0112**
11		212	8	30	8.50	137.77	86.53	51.24	45.6	56.2	0.805	0.798	110.95	69.03	41.91	0.1100	**17.1810**
Mean		229			8.72			53.25							43.789	0.1099	**17.2034**
Std Dev		11.27066004			0.1467			1.4146							1.2855	0.0014	**0.2164**
C.V		4.9%			1.7%			2.7%							2.9%	1.2%	**1.3%**

% CHANGE: Treated-Baseline	Load Tonnes			Haul Time Mins		Fuel (Lt) Consumed		Fuel (kg) Consumed	Fuel (kg) Per Tonne	**Tonne/km Per kg Fuel**
Baseline	3.55%			1.47%		-6.97%		-3.39%	**-5.3%**	**5.6%**

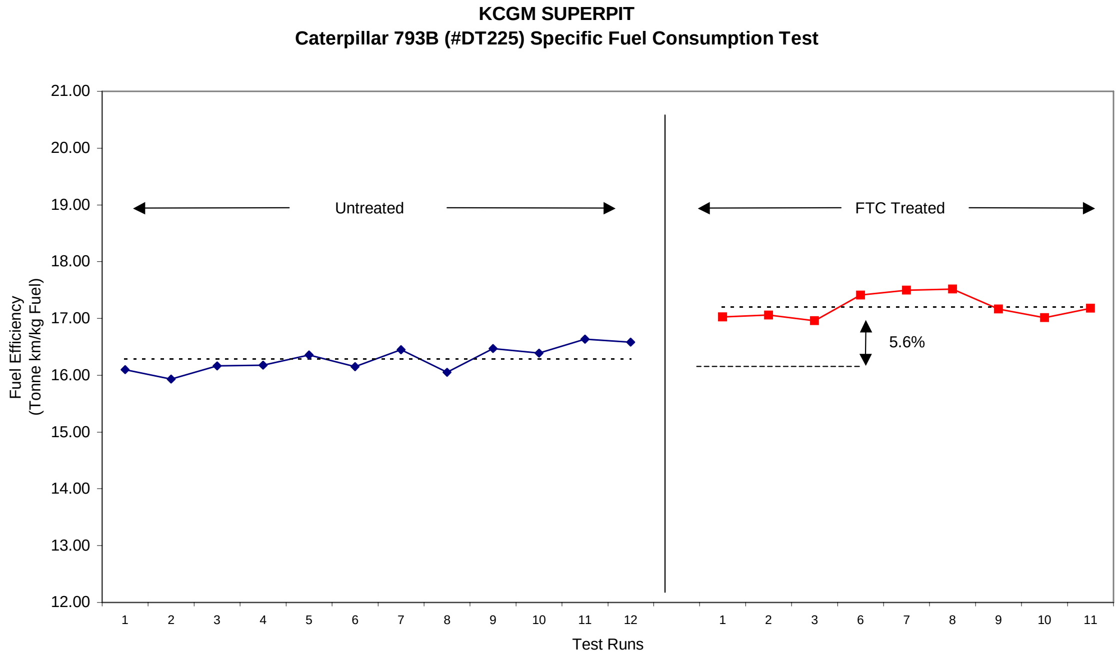
Graph 1



Graph 2



Graph 3



GREENHOUSE GAS REDUCTION

A gross reduction of **5.6%** of the current estimated annual fuel consumption of 80,000 kL translates to a **12,952 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:-

(80,000 kL x 38.6 x 74.9) ÷ 1000 = 231,291 tonnes CO_2 per annum

- 5.6% (75,520 kL x 38.6 x 74.9) ÷ 1000 = 218,339 tonnes CO_2 per annum

CO_2 reduction by application FPC Catalyst
231,291 – 218,339 = 12,952 tonnes

CONCLUSION

This carefully controlled engineering standard test procedure conducted on a selection of Kalgoorlie Consolidated Gold Mine's fleet provides clear evidence of average reduced fuel consumption of **5.6%**.

A fuel efficiency gain of **5.6%,** as measured by the SAE Specific Fuel Consumption test method, if applied to the total fuel currently consumed by KCGM mobile equipment of approximately 80ML p.a. at a cost of $0.40/L, will result in a <u>**net**</u> saving in excess of <u>**$1,400,000 per annum**</u>**.**

Additional to the fuel economy benefits measured is a reduction in greenhouse gas emissions of <u>12,952 tonnes per annum</u> **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”

Laboratory Density Results