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CATERPILLAR 785B (DT48)
FUEL EFFICIENCY EVALUATION
NEWCREST MINING
TELFER OPEN PIT MINING OPERATIONS

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TELFERREP

C O N T E N T S

Appendix

EXECUTIVE SUMMARY

This report details the results of the fuel efficiency study which covers the operations of DT48 hauling from a range of pits over three defined and measured haul routes.

The evaluation has been designed to monitor changes in fuel consumption hauling up the ramp plus extensions to leach pad 2, waste dump 4 and to ROM.

Baseline tests were completed during the week commencing 16th November, 1998 and treated tests during week commencing 30th November, 1998.

The trial procedures enables fuel consumption measurements to be made with the truck operating under normal mine working conditions monitoring haul times, net fuel consumed, fuel temperature, payload carried and distance travelled.

The results achieved in this evaluation and detailed in this report confirm that:-

1. The trial data has uniformity and reproducibility providing confidence in the measuring technique and test protocol.

2. Measuring the change in mean fuel efficiency baseline to FTC-3 treated which averaged **5.5%** over the three test routes.

INTRODUCTION

Newcrest open pit mine management agreed to evaluate the FTC-3 Combustion Catalyst at the Telfer open pit mining operations employing a Caterpillar 785B (DT48) dump truck in an effort to quantify the economic benefit of reduced fuel consumption under actual mine haulage operations.

The trial was structured to measure the baseline (untreated) fuel consumption then treating the truck's fuel with FTC-3 catalyst for a 200 hour conditioning period and measuring the treated fuel consumption.

The evaluation was designed to measure fuel consumption over the most rigorous and high fuel consuming section of the open pit operation, namely the climb out of the pit.

TEST PROCEDURE

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. Points adjacent to waste dump 4 lease pad 2 and ROM donut were defined as the end points of the three haul routes. The distance between these points were measured as 1100, 2000 and 1400 meters respectively.

MacNaught Model M5 flow transducers complete the 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 $\pm$ 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 RESULTS

The individual results achieved for each of the three test sectors are shown in Table 1 below.

The volumetric results, which are subject to temperature and density changes, are corrected to the more accurate mass measurement and reported as fuel consumed in kilograms/tonne (kg/t).

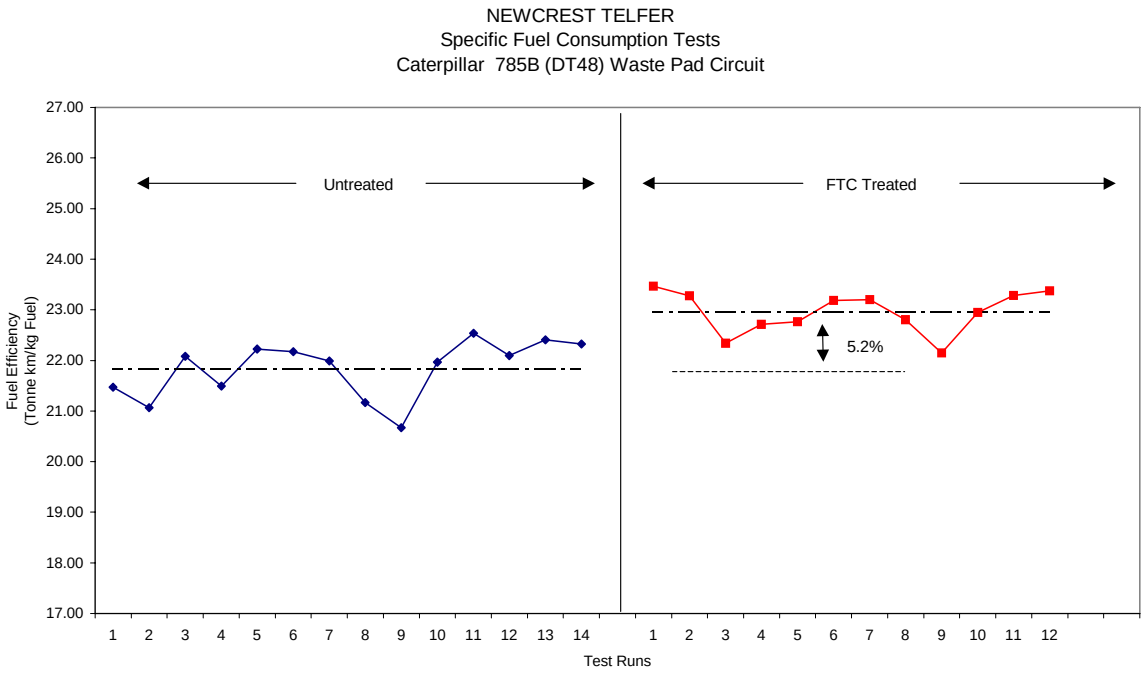
We have also calculated the efficiency on the basis of fuel consumed for a given amount of work performed and reported as tonne-kilometres/kilogram (tkm/kg). *(Reference Koehler DE & Daglio JA, SAE Technical Paper 872146).*

TABLE 1

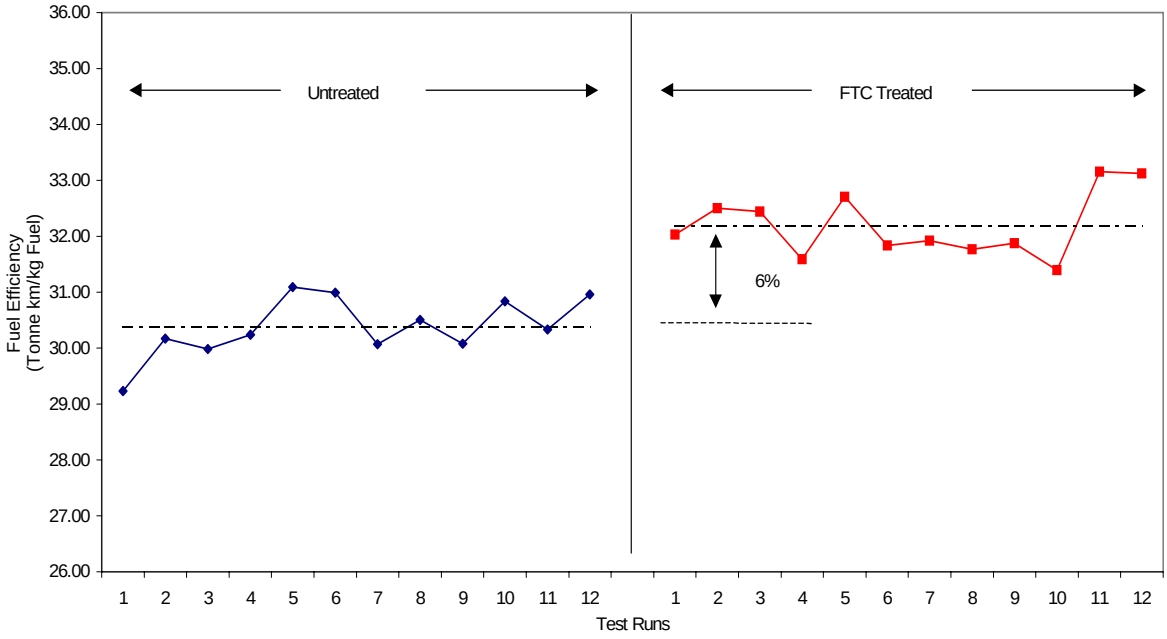
Caterpillar 785B (Truck DT48)

Test Sector	Baseline tkm/kg 16/17 Nov '98	Treated tkm/kg 30 Nov/1 Dec '98	Variation
Waste Dump 4	21.833	22.958	+ 5.2%
Leach Pad 2	30.375	32.195	+ 6.0%
ROM (Donut)	26.567	27.994	+ 5.4%
AVERAGE	**26.258**	**27.716**	**+ 5.5%**

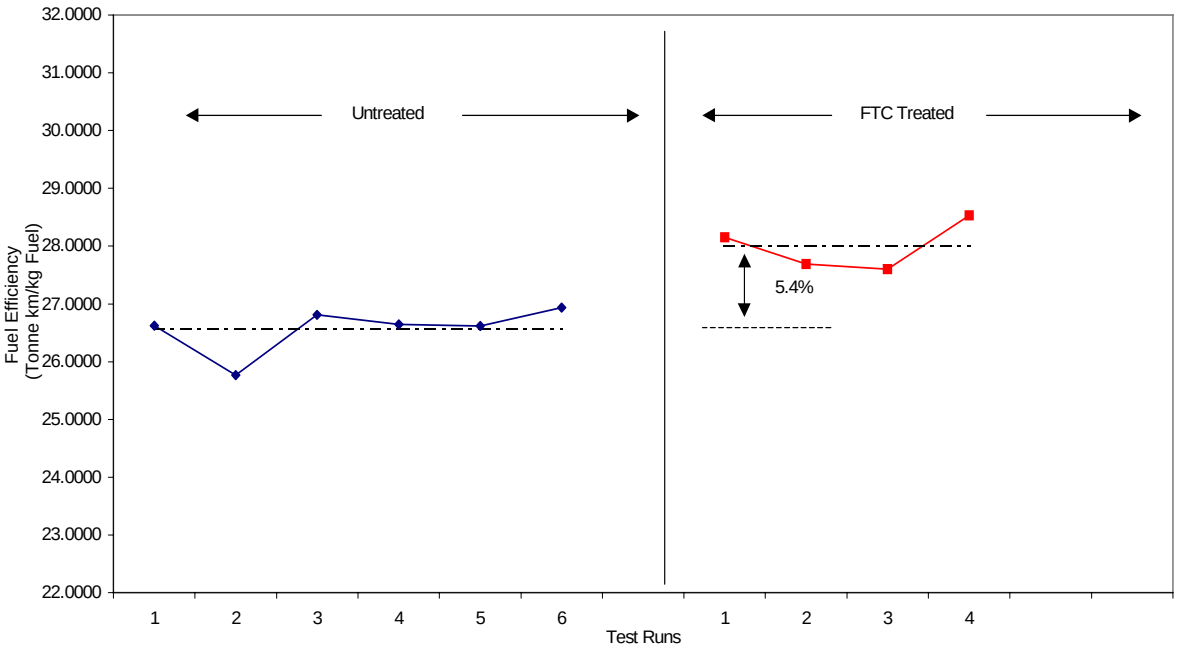
Details of all data extracted during the evaluation program for each of the three test sectors are shown in the following computer printouts together with graphical representations of the results.



NEWCREST TELFER
Specific Fuel Consumption Tests
Caterpillar 785B (DT48)
Leach Pad Circuit



NEWCREST TELFER
Specific Fuel Consumption Tests
Caterpillar 785B (DT48)
ROM Circuit



SPECIFIC FUEL CONSUMPTION TRUCK TRIAL

Customer: Telfer
Date: 16/11/1998
Truck No; DT48
Make/Model Cat 785
Cicuit Waste pad 4

Engine Hrs 21379
Circuit Distance Metres 1100
Tare weight Tonne 110

Fuel Sample	Density	Temp Deg C
	0.838	35.7
Corrected	0.853	15

UNTREATED

Run No	Time	Load kg	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	1453	129000	3	41	3.68	49.91	35.68	14.23	43.5	59.3	0.833	0.821	41.55	29.30	12.25	0.0512	21.4681
2	1515	122000	3	39	3.65	49.47	35.40	14.07	44.1	60.3	0.832	0.821	41.16	29.05	12.11	0.0522	21.0652
3	1535	138000	3	42	3.70	49.82	35.40	14.42	45.4	60.1	0.831	0.821	41.41	29.06	12.35	0.0498	22.0818
4	1600	125000	3	39	3.65	49.57	35.48	14.09	47.0	60.4	0.830	0.821	41.14	29.11	12.03	0.0512	21.4911
5	1615	145000	3	41	3.68	49.43	34.64	14.79	48.6	63.4	0.829	0.818	40.97	28.35	12.62	0.0495	22.2211
6	1635	135000	3	43	3.72	50.23	35.91	14.32	50.3	62.2	0.828	0.819	41.58	29.42	12.15	0.0496	22.1732
7	1705	141000	3	48	3.80	50.62	35.71	14.91	51.4	60.5	0.827	0.821	41.86	29.30	12.56	0.0500	21.9866
8	1730	131000	3	51	3.85	50.75	35.94	14.81	52.2	63.4	0.826	0.818	41.94	29.41	12.53	0.0520	21.1631
9	740	117000	3	37	3.62	48.66	34.59	14.07	37.1	49.5	0.837	0.828	40.73	28.65	12.08	0.0532	20.6748
10	800	132000	3	47	3.78	49.86	35.83	14.03	38.5	53.9	0.836	0.825	41.68	29.56	12.12	0.0501	21.9644
11	815	143000	3	43	3.72	49.41	35.09	14.32	40.1	56.0	0.835	0.824	41.25	28.90	12.35	0.0488	22.5366
12	830	143000	3	48	3.80	49.64	35.02	14.62	41.4	57.7	0.834	0.823	41.40	28.80	12.60	0.0498	22.0946
13	845	140000	3	42	3.70	49.41	35.14	14.27	43.0	58.5	0.833	0.822	41.15	28.88	12.27	0.0491	22.4087
14	900	139000	3	43	3.72	49.54	35.27	14.27	44.2	60.1	0.832	0.821	41.22	28.95	12.27	0.0493	22.3270
Mean		134286			3.72			14.37							12.306	0.050	21.833
Std Dev		8597.213962			0.0666			0.2968							0.2020	0.0013	0.5642
C.V		6.4%			1.8%			2.1%							1.6%	2.6%	2.6%

SPECIFIC FUEL CONSUMPTION TRUCK TRIAL

Truck No: DT48
Date: 30/11/1998

Engine Hrs 21643

Fuel Sample	Density	Temp Deg C
	0.8355	41.3
Corrected	0.854	15

TREATED

Run No	Time	Load kg	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	1025	122000	3	39	3.65	46.62	33.94	12.68	45.2	58.4	0.833	0.823	38.82	27.95	10.87	0.0469	23.4682
2	1045	118000	3	30	3.50	46.22	33.68	12.54	46.4	60.8	0.832	0.822	38.45	27.67	10.78	0.0473	23.2749
3	1100	129000	3	27	3.45	45.90	32.14	13.76	47.8	62.7	0.831	0.820	38.14	26.37	11.77	0.0492	22.3353
4	1120	152000	3	51	3.85	49.76	34.89	14.87	49.1	63.2	0.830	0.820	41.30	28.61	12.69	0.0484	22.7090
5	1140	132000	3	29	3.48	46.32	32.61	13.71	50.4	64.6	0.829	0.819	38.40	26.71	11.69	0.0483	22.7683
6	1200	146000	3	32	3.53	46.75	32.44	14.31	51.7	64.6	0.828	0.819	38.71	26.57	12.15	0.0474	23.1859
7	1220	147000	3	34	3.57	47.04	32.69	14.35	52.7	66.1	0.827	0.818	38.92	26.74	12.18	0.0474	23.2030
8	1130	133000	3	32	3.53	46.80	32.89	13.91	53.9	63.5	0.827	0.820	38.68	26.96	11.72	0.0482	22.8039
9	1150	123000	3	32	3.53	46.76	33.02	13.74	55.2	65.0	0.826	0.819	38.61	27.03	11.57	0.0497	22.1491
10	1210	131000	3	32	3.53	46.73	32.99	13.74	56.3	65.5	0.825	0.818	38.55	27.00	11.55	0.0479	22.9487
11	1410	132000	3	32	3.53	46.02	32.35	13.67	59.7	68.0	0.823	0.817	37.85	26.42	11.43	0.0472	23.2805
12	1440	138000	3	36	3.60	47.46	33.50	13.96	59.8	67.8	0.822	0.817	39.03	27.36	11.67	0.0471	23.3729
Mean		133583			3.56			13.77							11.674	0.0479	22.9583
Std Dev		10509.37532			0.1039			0.6474							0.5272	0.0009	0.4170
C.V		7.9%			2.9%			4.7%							4.5%	1.8%	1.8%

% CHANGE: Treated-Baseline	Load kg			Haul Time Mins		Fuel (Lt) Consumed		Fuel (kg) Consumed	Fuel (kg) Per Tonne	Tonne/km Per kg Fuel
Baseline	-0.52%			-4.17%		-4.20%		-5.14%	**-4.9%**	**5.2%**

SPECIFIC FUEL CONSUMPTION TRUCK TRIAL

Customer: Telfer
Date: 16/11/1998
Truck No; DT48
Make/Model Cat 785
Circuit Leach Pad

Engine Hrs 21379
Circuit Distance Metres 2000
Tare weight Tonne 110

Fuel Sample	Density	Temp Deg C
	0.838	35.7
Corrected	0.853	15

UNTREATED

Run No	Time	Load kg	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	1430	139000	5	03	5.05	67.80	48.18	19.62	37.7	56.0	0.837	0.824	56.72	39.69	17.04	0.0684	29.2329
2	915	148000	5	12	5.20	68.80	48.77	20.03	46.0	59.5	0.831	0.821	57.15	40.05	17.10	0.0663	30.1715
3	945	138000	5	03	5.05	67.33	47.95	19.38	47.7	61.5	0.830	0.820	55.85	39.31	16.54	0.0667	29.9864
4	1015	145000	5	09	5.15	68.25	48.38	19.87	49.9	61.9	0.828	0.820	56.51	39.65	16.86	0.0661	30.2427
5	1030	145000	5	01	5.02	67.06	47.74	19.32	51.5	64.3	0.827	0.818	55.45	39.04	16.40	0.0643	31.0910
6	1100	149000	5	07	5.12	68.20	48.40	19.80	53.4	64.2	0.826	0.818	56.30	39.59	16.71	0.0645	30.9943
7	1125	136000	5	01	5.02	67.14	47.83	19.31	55.0	66.1	0.824	0.817	55.35	39.05	16.30	0.0665	30.0668
8	1150	140000	5	02	5.03	67.43	47.90	19.53	56.5	65.7	0.823	0.817	55.52	39.12	16.39	0.0666	30.5057
9	1215	135000	5	01	5.02	64.72	45.32	19.40	57.9	68.5	0.822	0.815	53.22	36.93	16.29	0.0665	30.0752
10	1240	146000	5	09	5.15	68.25	48.45	19.80	59.0	69.0	0.822	0.815	56.07	39.46	16.60	0.0649	30.8344
11	1300	137000	5	02	5.03	65.28	45.83	19.45	60.0	70.0	0.821	0.814	53.58	37.30	16.29	0.0659	30.3340
12	1330	141000	5	03	5.05	67.42	48.03	19.39	61.0	70.2	0.820	0.814	55.29	39.08	16.21	0.0646	30.9610
Mean		141500			5.07			19.58							16.562	0.066	30.375
Std Dev		4945.15373			0.0633			0.2437							0.3066	0.0012	0.5367
CV		3.5%			1.2%			1.2%							1.8%	1.8%	1.8%

SPECIFIC FUEL CONSUMPTION TRUCK TRIAL

Truck No: DT48
Date: 30/11/1998

Engine Hrs 21643

Fuel Sample	Density	Temp Deg C
	0.8355	41.3
Corrected	0.854	15

TREATED

Run No	Time	Load kg	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	1455	138000	4	46	4.77	63.26	44.92	18.34	57.5	69.3	0.824	0.816	52.13	36.64	15.48	0.0624	32.0810
2	1515	146000	5	01	5.02	65.84	47.15	18.69	58.7	69.7	0.823	0.815	54.20	38.45	15.75	0.0615	32.5010
3	1545	133000	4	53	4.88	64.67	46.86	17.81	59.7	69.6	0.823	0.815	53.19	38.21	14.98	0.0617	32.4402
4	1615	135000	4	57	4.95	65.36	46.84	18.52	60.5	69.3	0.822	0.816	53.72	38.21	15.51	0.0633	31.5885
5	1640	144000	4	56	4.93	65.55	47.01	18.54	61.1	70.1	0.822	0.815	53.85	38.32	15.53	0.0611	32.7078
6	1700	142000	4	59	4.98	65.19	46.27	18.92	61.9	71.1	0.821	0.814	53.51	37.66	15.83	0.0628	31.8339
7	910	126000	4	57	4.95	65.15	47.87	17.28	44.9	56.5	0.833	0.825	54.26	39.48	14.79	0.0626	31.9241
8	935	125000	4	56	4.93	64.82	47.57	17.25	46.9	60.4	0.832	0.822	53.90	39.10	14.80	0.0630	31.7668
9	1015	127000	5	01	5.02	65.09	47.58	17.51	49.1	59.0	0.830	0.823	54.02	39.15	14.87	0.0627	31.8739
10	1040	112000	4	52	4.87	64.23	47.60	16.63	50.8	61.6	0.829	0.821	53.23	39.08	14.14	0.0637	31.3985
11	1235	154000	5	01	5.02	65.74	46.82	18.92	57.6	67.8	0.824	0.817	54.16	38.24	15.93	0.0603	33.1548
12	1340	152000	5	09	5.15	66.96	48.18	18.78	59.1	69.8	0.823	0.815	55.10	39.28	15.82	0.0604	33.1221
Mean		136167			4.96			18.10							15.286	0.0621	32.1948
Std Dev		12327.599			0.0952			0.7729							0.5580	0.0011	0.5819
CV		9.1%			1.9%			4.3%							3.7%	1.8%	1.8%

%CHANGE: Treated/Baseline	Load kg			Haul Time Mins		Fuel (Lt) Consumed			Fuel (kg) Consumed	Fuel (kg) Per Tonne	Tonne/km Per kg Fuel
Baseline	-3.77%			-2.33%		-7.54%			-7.70%	**-5.7%**	**6.0%**

SPECIFIC FUEL CONSUMPTION TRUCK TRIAL

Customer:	Telfer	Engine Hrs	21379
Date:	16/11/1998	Circuit Distance Metres	1400
Truck No;	DT48	Tare weight Tonne	110
Make/Model	Cat 785		
Circuit	ROM		

Fuel Sample	Density	Temp Deg C
	0.838	35.7
Corrected	0.853	15

UNTREATED

Run No	Time	Load kg	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	1345	145000	4	15	4.25	56.13	40.06	16.07	62.0	70.5	0.819	0.813	45.99	32.58	13.41	0.0526	26.6257
2	1430	131000	4	05	4.08	54.98	39.10	15.88	62.3	66.9	0.819	0.816	45.00	31.91	13.09	0.0543	25.7694
3	1455	136000	4	03	4.05	54.52	39.19	15.33	62.8	71.3	0.819	0.813	44.66	31.85	12.79	0.0522	26.8120
4	1510	146000	4	14	4.23	56.34	40.22	16.12	63.5	72.5	0.818	0.812	46.11	32.66	13.45	0.0525	26.6468
5	1530	138000	4	08	4.13	55.14	39.50	15.64	64.0	73.1	0.818	0.812	45.10	32.06	13.05	0.0526	26.6129
6	1545	143000	4	11	4.18	55.37	39.57	15.80	64.3	72.5	0.818	0.812	45.28	32.13	13.15	0.0520	26.9338
Mean		139667			4.16			15.80							13.157	0.053	26.567
Std Dev		5988.87858			0.0807			0.2908							0.2441	0.0008	0.4105
C.V		4.3%			1.9%			1.8%							1.9%	1.6%	1.5%

SPECIFIC FUEL CONSUMPTION TRUCK TRIAL

Truck No:	DT48	Engine Hrs	21666
Date:	30/11/1998		

Fuel Sample	Density	Temp Deg C
	0.8355	41.3
Corrected	0.854	15

TREATED

Run No	Time	Load kg	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	1332	142000	4	05	4.08	54.49	39.64	14.85	53.5	62.6	0.827	0.820	45.05	32.52	12.53	0.0497	28.1527
2	1110	130000	4	00	4.00	52.72	38.35	14.37	53.4	62.7	0.827	0.820	43.59	31.46	12.14	0.0506	27.6870
3	1505	134000	3	55	3.92	51.83	37.02	14.81	60.0	67.7	0.822	0.817	42.61	30.24	12.38	0.0507	27.6003
4	1535	147000	4	07	4.12	53.60	38.57	15.03	60.8	70.2	0.822	0.815	44.04	31.43	12.61	0.0491	28.5361
Mean		138250			4.03			14.77							12.413	0.0500	27.9940
Std Dev		7675.71929			0.0886			0.2802							0.2086	0.0008	0.4353
C.V		5.6%			2.2%			1.9%							1.7%	1.5%	1.6%

%CHANGE: Treated-Baseline	Load kg			Haul Time Mins		Fuel (Lt) Consumed		Fuel (kg) Consumed	Fuel (kg) Per Tonne	Tonne/km Per kg Fuel
Baseline	-1.01%			-3.04%		-6.54%		-5.65%	**-5.1%**	**5.4%**

To prove the statistical significance of the difference in the means between baseline and treated test data a Student t-Test was performed. All three sectors for both phases of the evaluation show the difference between FTC treated and each sector of untreated tests, the means are significant at a 99% level of confidence.

CONCLUSION

The results of this extensive and rigorous test program evaluating the performance of FTC-3 at Newcrest Mining's Telfer open pit mining operation provides accurate and conclusive evidence of economic fuel consumption reductions.

The mean of the three test sectors is **5.5%**. The range of benefit is from a low of **5.2%** being the short predominantly high fuel consumption ramp haul to **6.0%** being the longer run to leach pad 2.

It is interesting to note the reduction in haul times following introduction of the catalyst to the fuel ranging from **2.33%** to **4.17%**.

Additional to the net economic benefit of reduced fuel consumption longer-term use of the catalyst will also provide meaningful maintenance benefits as a result of more complete and cleaner combustion. This also impacts positively on a reduction of greenhouse gas emissions.

Appendix "B"

RAW DATA