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BHP GOONYELLA-RIVERSIDE MINE

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

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EXECUTIVE SUMMARY

The FTC Combustion Catalyst is the only fuel chemical yet proven by the world's leading independent testing authority, Southwest Research Institute (Texas), to produce a fuel efficiency benefit in an as new 2500HP diesel engine, operating at its most efficient state.

Under the control of Goonyella-Riverside project engineer, Mr Scott Degenhardt, a tightly controlled series of fuel consumption measurements determined fuel efficiency improvements of 5.7-6.1%. The method used measured specific fuel consumption and conforms to an engineering standard. It was performed during normal mining operations.

The results have determined that implementation of this product at Goonyella-Riverside operations will result in a cost reduction in excess of **$900,000 pa**, with a payback of any capital equipment cost in under two weeks (based on annual fuel consumption of 38 million litres and a fuel cost of 50cents/litre).

In addition, reduction of greenhouse gases is calculated at **6480 Tonnes** CO2 pa.

BACKGROUND

The FTC Combustion Catalyst is the only fuel chemical yet proven by the world's leading testing authority, Southwest Research Authority (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.

These findings have been verified by countless field studies in diverse applications, which have confirmed efficiency benefits of 5-8% for mine mobile equipment. Maintenance benefits documented include reduced oil wear metal profiles and reduced oil 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 cause 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.

BHP Goonyella-Riverside management chose two trucks to determine fuel efficiency changes initiated by the FTC Combustion Catalyst…..1 x Caterpillar 784B coal hauler, and 1 x Caterpillar 793B rear dump pre-strip truck. BHP's Mr Scott Degenhardt was appointed project supervisor, and in conjunction with Fuel Technology Pty Ltd's Brid Walker, planned and conducted this trial.

The evaluation was designed to measure fuel consumption during normal mining operations. To eliminate the effects of driver variability, it was agreed that a portion of the haul cycle be marked out that required full throttle application. Also to ensure that the method used was both reliable and repeatable, a minimum 12 replicate runs were to be made for each test component.

PROCEDURES

The procedure adopted by Fuel Technology Pty Ltd and approved by Goonyella-Riverside, is an engineering standard that is adapted from the SAE Type II Truck Test. This method measures the mass of fuel consumed to haul a set payload over a marked route.

Flowscan fuel flow meters were fitted to the engine supply and return fuel lines at the fuel tank. Thermocouple probes are fitted to these meters. The flowmeters, which have been calibrated to +/- 0.25% by a NATA certified laboratory, were connected to a KEP Minitrol totalizer mounted in the truck cabin. The thermocouple probes were connected to a dual readout Fluke digital thermometer. A stopwatch was used to time each cycle performed.

At both baseline and treated measurements, a fuel sample was drawn for density determination.

Fuel volume, temperature and density provide the information to determine fuel mass (Kg) consumed, for each replicate run. A minimum 12 replicates provides statistical significance to the results.

An interval of 200 hours is required between baseline and treated measurements for catalyst action to take effect.

Coal hauler, CH33 was measured over a 2.7km section of haul road between Riverside service bay and ROM 1. This section is slightly downhill on the loaded run, and uphill on the empty return. CH33 approaches the start of the each test leg at full governed speed, so measurements commence from a flying start. CH33's payload monitor was inoperable. Accurate and reliable data could only be obtained on the empty return leg.

Pre-strip rear dump, RD34 was monitored over a 400m section of steep ramp from Shovel 31. RD 34 was brought to a stop prior to commencement of measurements. With a shorter test distance, 16 replicate runs were performed to enhance statistical significance. Empty return runs were not possible as driver variation was considerable and resulted in very poor repeatability.

RESULTS

Table 1 displays the average fuel efficiency, in Tonne.km/kg fuel, for each truck and test route. Complete data including original measurements and calculations are shown in the Appendix.

Table 1
Truck Fuel Efficiency (Tonne.km/kg Fuel)

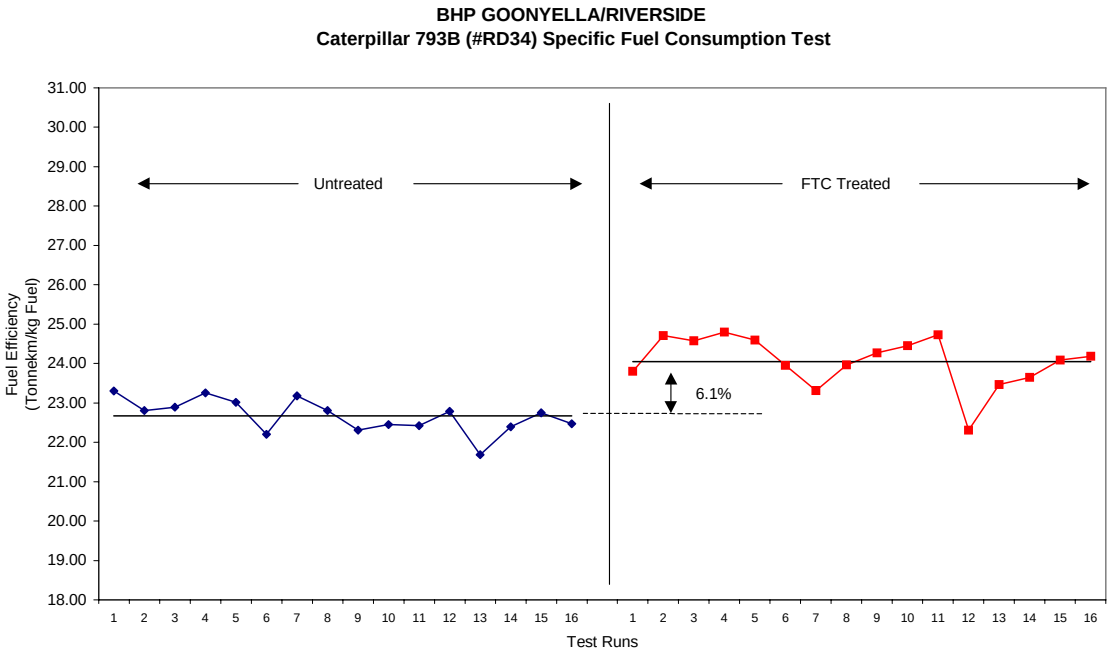
Test Unit	Baseline	Treated	% Change	Engine Duty Cycle
RD34 Loaded Up Ramp	**22.67**	**24.05**	**+6.1%**	**100%**
CH33 Empty Uphill Run	**51.51**	**54.44**	**+5.7%**	**85%**
CH33 Loaded Downhill	**154.30**	**178.15**	**+15.5% ***	**60-65%**

** Note CH33 payload monitor inoperable. Heavier payloads are suspected for baseline (untreated) measurements.*

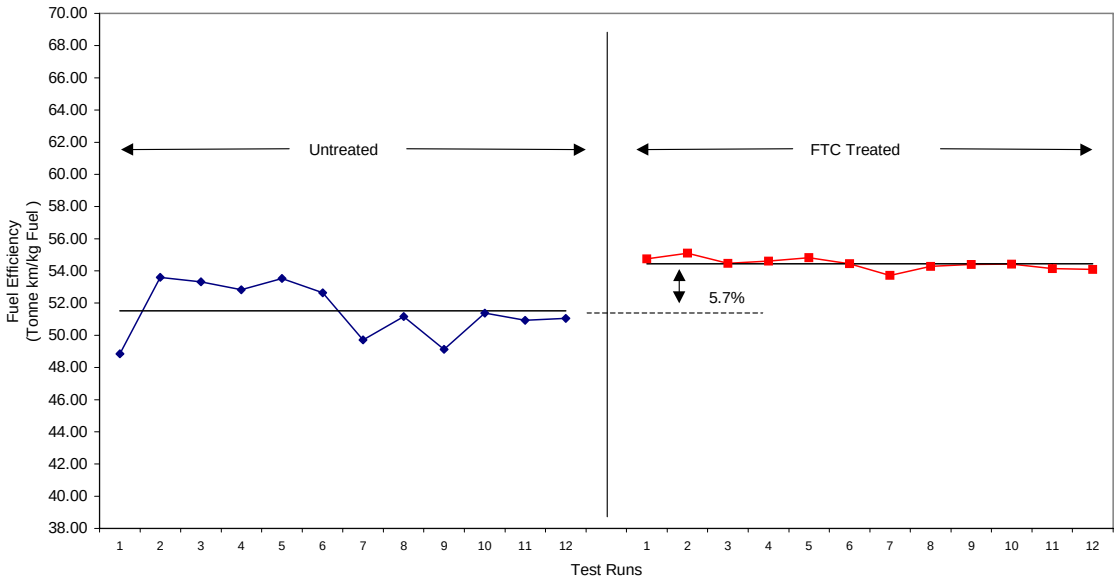
Graphical presentation of the data follows:

GRAPH 1

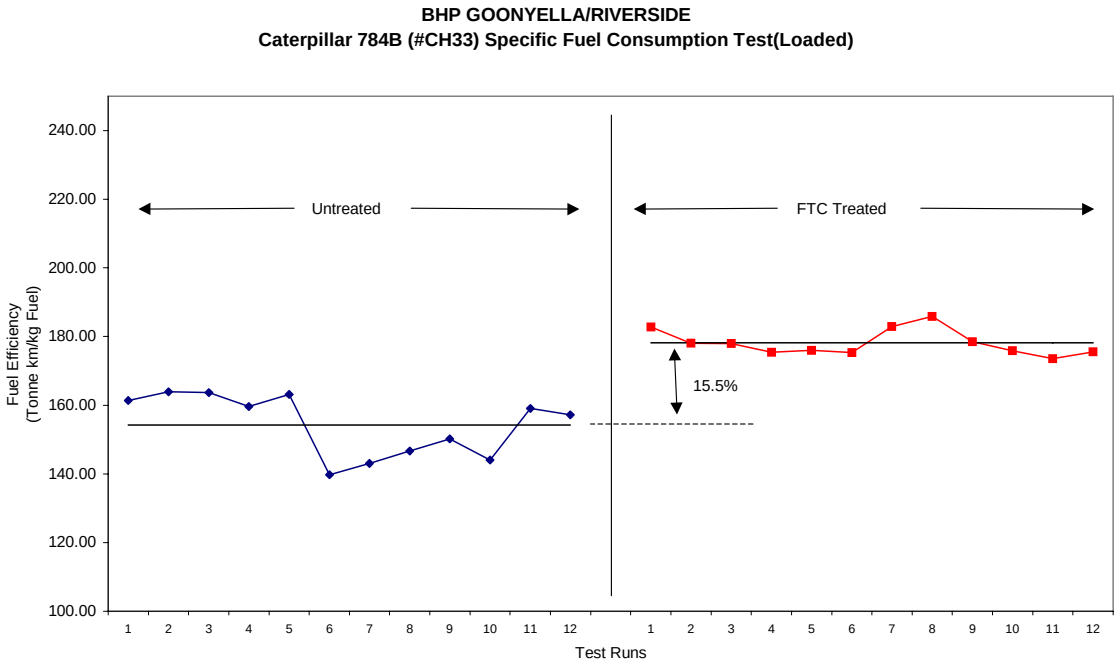
(RD34 Loaded)



GRAPH 2
(CH33 Empty)



GRAPH 3
(CH33 Loaded)



DISCUSSION

The measurements for CH33 (empty return) and RD34 were tightly controlled and accurately performed. The measurements confirm a fuel efficiency improvement of 5.7 to 6.1%, and this is within our expectations (5-8%) for this type of equipment and operating conditions. Based on a maximum fuel consumption of approximately 260L/hr for a Cat 784B and 370L/hr for a Cat 793B, the engine duty cycles were about 85% and 100% respectively under test. This reflects the important components of normal operating conditions for the Goonyella-Riverside fleet.

Use of the FTC-3 Combustion Catalyst is economic above a fuel cost of 9.9 cents/L, and would provide an annual (net) return of over $900,000, (or $2465/day) based on current estimations of fuel cost and consumption. This is equivalent to a fuel discount of approximately 2.3cents/L. (FTC-3 @ $18/L for a 1:3200 mix strength).

There are two options for treating fuel at Goonyella-Riverside…

1. Automatic metering systems can be installed at each of the 5 fueling points. Capital cost would be approximately $20,000-25,000. This would be recovered in less than 2 weeks.
2. The second alternative is to request BHP's fuel supplier to assist, by dosing at the terminal, before delivery to site. Currently, Peak Downs mine is very keen to pursue this option, and Goonyella-Riverside would strengthen the case.

NOTE:

Without operating payload monitors, no significance can be placed of the results for CH33 on the loaded run. A 16% reduction in fuel usage cannot be attributable to FTC catalyst use. It is strongly suspected that the major portion of this change is due to heavier payloads carried during baseline measurements, which were recorded after a period of heavy rain a few days before. Operating downhill, this was at a lower duty cycle (60-65%). Catalyst benefit is often higher at lower duty cycles, however it is unlikely that anything in excess of 8% could be attributed to catalyst effect.

C O N T E N T S

Appendix

Appendix "A"

Computer Printout Data