CLEAN AIR TESTING SOLUTIONS

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To: Inkomati Mine 26/09/2011

ATT: HOD Engineering

RE: Letter of recommendation for use of Centron diesel additive.

Letšeng Diamond Mine – Lesotho:

Testing on three diesel fuel additives was conducted between March 2009 and March 2010, according to the standardised EPA protocol for cumulative effect fuel additive testing for diesel fuels, using an EPA compliant Autologic Gas analyser, and the standard methodology for snap acceleration testing, performed with the Autologic Opacity meter, SAE J1667, according to manufacturer's specifications. Consumption testing was performed by making use of the calibrated electronic fuel management system (Petroman Pacs running on a SQL database).

The fuel consumption baseline for all the earth moving equipment was based on the electronic data collected from the onsite fuel management system. This data was supported with manual documentation for two weeks prior to starting the project. This data was used as the standard for comparison for collected data after addition of the diesel fuel additives were initiated. Exhaust emissions were monitored onsite before initiation of the diesel fuel additives. This was repeated three times prior to addition of the products. These values were standardised as the baseline and were used as a comparison for data collected after initiation of the product.

The Autologic gas analyser was used to monitor the emissions on all the earth moving equipment. The Autologic gas analyser and the Autologic heavy-duty opacity meter were used on the fixed-head dump trucks at Letšeng Diamond Mine, present at the time of running the project. All earth moving equipment was dosed onsite, during morning and evening refuelling. Dosing with all the diesel fuel additives were on a ratio specified by the suppliers. Product A & B had a dosing ratio of 4 ml of product per 1 litre of diesel, while Product C had a dosing ratio of 3.2 ml of product per 1 litre of diesel. The earth moving equipment was dosed before refuelling based on the amount of time they worked. By making use of the current average consumption in litres per hour of the individual vehicles, product volumes were estimated and added to the vehicles. The vehicles were refuelled and any difference in calculated litres and actual litres put in was accounted for by topping up with more product. Product was added to the fuel tank before refuelling, to enhance mixing. All fuel for the excavators and dozers was dispensed out of an accurately calibrated diesel bowser unit number 2, while the fixed-head dump trucks were refuelled at pump 3 of the calibrated diesel fuel depot. The electronic meter on the bowser and pump 3 was used to obtain diesel volumes put into the vehicle fleets. Fuel

filters were changed after 7 days of product initiation, as guided by the standardised EPA fuel testing protocol.

Table 1 details the consumption results of product A. The measurements were performed over a period of a week. The reduction in amount of fuel used, known as “consumption improvement” was 2 - 3% over the range of the Caterpillar articulated dump trucks.

Fuel consumption and exhaust emission results are not available for product B as the product failed on mechanical issues. The tests started in the same manner as for product A and C, according to EPA protocol. On pouring the product into the fuel system, it was very thick and glue-like. This product did not mix with the fuel and within an hour of adding the product B to the system, there was severe injector failure. Due to this premature failure, the product could not be tested and brought about very severe doubts about this type of product being tested. The mine subsequently discontinued use of the product without further discussions.

Tables 2, 3 and 4 are the results of product C. The results were very encouraging early on in the study. The mine decided to proceed with further detailed testing in order to see the true long-term effects of this product on various vehicle fleets as the short- term results corresponded with the manufacturer’s claim. As per manufacturer’s statement, the first ten days of the product being introduced into the fuel system was classified as the “clean-up” phase

Table 1: Summary table from phase 1 of the fuel enhancement evaluation at Letšeng Diamond Mine, showing the fuel economy figures in litres per hour of the caterpillar articulated dump trucks before and after initiation of Product A.

	Baseline	**Results**			**% change to baseline**
Unit	**LPH**	**Hours**	**Litres**	**LPH**	
1010010	**25.28**	120.3	2980.8	**24.77**	**-2**
1010011	**28.31**	73.4	2265.9	**30.89**	**+8**
1010012	**28.20**	79.3	2463.3	**31.07**	**+9**
AVERAGE	**27.26**	273.0	7710.0	**28.91**	**+6**

This was based on the detergent and algaecide properties of the product cleaning out the fuel tank and fuel lines,dissolving and pushing all contaminants into the fuel filter. The fuel filter was changed after ten days on each of the vehicles, to allow uninhibited fuel flow. Once the filters were changed, the results phase was established. The results of the last ten days of the study were most significant and reflective of the manufacturer’s claims. Tables 2, 3 and 4 display the remarkable improvements in consumption and exhaust emissions.

Table 2. Summary table from phase 1 of the fuel enhancement evaluation at

Letšeng Diamond Mine, showing the fuel economy figures in litres per hour of the caterpillar excavators before and after initiation of Product C.

	Baseline	First 10 Days			Last 10 Days			% Change to baseline	% Change to first 10 days
Unit	**LPH**	**Hours**	**Litres**	**LPH**	**Hours**	**Litres**	**LPH**		
365/01	**37.7**	239	9258	**38.7**	219	7614	**34.8**	**-7.7%**	**-10.2%**
365/02	**39.7**	170	6713	**39.4**	226	8477	**37.5**	**-5.5%**	**-4.8%**
385/01	**58.0**	232	13309	**57.3**	192	9626	**50.3**	**-13.3%**	**-12.2%**
385/03	**54.2**	220	12921	**58.9**	220	12724	**57.8**	**6.6%**	**-1.8%**
AVERAGE	**48.6**			**49.0**			**44.9**	**-5.0%**	**-8.4%**

Table 3: A summary table from phase 3 of the fuel enhancement evaluation at Letšeng Diamond Mine, showing the fuel economy figures in litres per hour of the caterpillar fixed-head dump trucks before and after initiation of Product C.

	Baseline	First 10 Days			Last 10 Days			% Change
Unit	**LPH**	**Hours**	**Liters**	**LPH**	**Hours**	**Liters**	**LPH**	**to Baseline**
773 - R01	**48.0**	198	8089	**40.9**	180	7454	**41.3**	**-13.5%**
773 - R02	**43.4**	199	8248	**41.4**	182	7230	**39.7**	**-8.6%**
773 – R03	**n/a**	n/	n/a	**n/a**	n/a	n/a	**n/a**	**n/a**
FLEET AVERAGE	**45.7**			**41.2**			**40.5**	**-11.4%**

Note 1: Since the baseline fuel consumption information of the electronic system and the manual recording system had a large variance, the results of the final stage of phase 1 were compared to the first 10 days of testing, as opposed to the baseline, as this recording of consumption data was reliable and valid. The comparison to the baseline is represented for interest but is not used in the report.

Note 2: 385/03 is a new vehicle just 2-3 months in operation at the time of the evaluation so considered still to be in a “breaking in” phase.

Table 4: A summary table from phase 3 of the fuel enhancement evaluation at Letšeng Diamond Mine, showing the improvement in smoke figures in percentage of the caterpillar fixed-head dump trucks before and after initiation of Product C.

EQUIPMENT	BASELINE	FINAL	% Change
773-R01	19.8	12.7	**-35.80%**
773-R02	23.9	16.9	**-29.40%**
FLEET AVERAGE	**21.9**	**14.8**	**-32.30%**

Product C is in fact Centron.

The phase 2 full-rollout trial programme that involved treating the entire fuel supply at Letseng with Centron for a period of 6 months has just been completed with similar results and we await confirmation to implement on a permanent basis.

The very same testwork was performed at a Diamond mine in Botswana with similar results. This information is proprietary and is not currently available for the public eye but I ran that project and can confirm very similar results. We are currently ¾ of the way through phase 2 with very promising results so far.

None of the projects I have worked on with Centron have had negative mechanical effects. In my projects, I make use of engine oil samples, oil filter samples, fuel filter samples and if possible, visuals of injector heads to look at all mechanical aspects. We have not experienced any negative impacts of Centron on ANY mechanical aspect of any of the vehicles that participated in the projects. Most of the vehicles were CAT engines but not only. Please see below a visual of the fuel filters, each after the standard 500 hr service interval, before and after the use of Centron.

Yours Faithfully

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Paola Trevisan
Clean Air Testing Solutions
Member