Test Summary Report

Imperial logistics

Centron Diesel Fuel Additive was tested on (1) International 9800i freightliner truck between June 8th and July 6th, 2010. The result of this evaluation was extremely positive as it clearly demonstrated that the use of Centron reduces emissions & improves fuel economy performance. Overall the fuel economy on the International 9800i freightliner truck improved by 10.5 %, while the opacity improved by 51%

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Fuel Enhancement Project
PRELIMINARY REPORT

Privileged, private and confidential

Exhaust Emissions and Fuel Consumption Results
Centron Diesel Fuel Additive Performance Evaluation
Imperial Logistics, South Africa

Prepared for

Francois Ehlers

Of

The Imperial Group

Compiled & Verified by

Miss Paola Trevisan
Clean Air Testing Solutions

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Disclaimer:

This report and all the information herein is accurate, valid and all measurements were performed according to approved methods and regulations. All the information within this report is private, privileged and confidential.

It is hereby declared that the results contained in this report are a true reflection of the conditions prevailed on site during the period of conducting this survey. The information and recommendations offered in this report are made in good faith with professional integrity.

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Executive Summary:

Pollutant regulations are not a matter of concern only for engine manufacturers but they also require policy implementation, commitment and important effort by all of industry in order to provide environmentally friendly working procedures and conditions. Use of fuel enhancers will help to achieve reduced emissions and improve the performance of new engines as well as older engine types and thus also reducing fuel usage among the old and new engine types. The aim of the present work is to perform a study of the effect of a fuel enhancing additive (Centron) added to 500 ppm diesel, on the combustion emissions, fuel savings, and related savings on maintenance and engine life, of the freightliners and knock-on effects on all other vehicles at the Imperial Group.

The components that make up diesel exhaust emissions are hydrocarbons (HC), carbon monoxide (CO), carbon dioxide (CO_2), oxygen (O_2), nitric oxides (NO_x) and sulphur oxides, namely sulphur dioxide and sulphur tri-oxide (SO_2 and SO_3) respectively. Reportable greenhouse gases are all those mentioned above besides the sulphur oxides. Sulphur dioxide is always present and this is dependant on the quality of the fuel being used, in this case, diesel with a sulphur content of 500 ppm. Emissions of sulphur di and trioxide depend upon the fuel sulphur content, which is legally restricted within maximum values.

Diesel exhaust emission gases are influenced by environmental conditions, operating conditions, parasitic loads, engine temperature, and altitude. Unless the test conditions can be tightly controlled a high degree of variability can occur making it difficult to obtain reliable results for comparative purposes.

Different emissions mean different things and it is not always possible to reduce all emissions at the same time. Emissions formation and combustion in diesel engine processes are controlled by: piston bowl shape, swirl intensity, injection profile, number of holes, diameter of holes and directions of spray nozzles, interaction of sprays with cylinder walls and of wall surface flows formed by the sprays.

To determine possible carbon emission improvements & fuel savings benefits independent testing was performed with Centron Diesel Fuel Additive on one International 9800i truck operating out of the Alrode and Durban fuel depots of Imperial logistics.

Methodology:

Testing on Centron Diesel Fuel Additive was conducted between June 8th 2010 and July 6th 2010, according to the standardised EPA protocol for cumulative effect fuel additive testing for diesel fuels, using an EPA compliant Autologic Gas analyser and Opacity Meter using the standard methodology for snap acceleration testing performed with the Autologic Opacity meter, SAE J1667.

Data from the last 2 weeks of the driver's fuel log were used to establish baseline fuel economy measured in KM/L. Additional baseline fuel data based on historical consumption is forthcoming from Imperial's fuel management department. Fuel consumption data is based on the electronic motherboard of the vehicles as well as manually recorded data. This data collected from the driver's recordings was used as the standard for comparison for collected data after initiation of Centron. Exhaust emissions were monitored onsite at the Alrode depot before initiation of Centron. This was performed twice prior to addition of the product, when the driver returned from DBN. 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 environmental emissions on the International 9800i, and the gas analyzer as well as the Autologic Opacity meter. The International 9800i was dosed onsite at the Alrode and DBN depots, during refuelling. Dosing with Centron was on a ratio of 3.2 millilitres of Centron per litre of diesel. The International 9800i was dosed before refuelling based on the distance travelled either to the coast or back up to JHB using the current average consumption of the International 9800i to estimate the volume of Centron to be added. The International 9800i was refuelled and any difference in calculated litres and actual litres put in was accounted for by topping up with more Centron. All fuel for the International 9800i was dispensed from the same fuel depots in DBN as well as Alrode. The DBN fuel depot used Engen Diesel while the Alrode Depot used Total fuel. The electronic meter was used to obtain diesel volumes put into the International 9800i. The fuel filter was changed after 2862 kms of Centron use, as guided by the standardised fuel testing protocol.

Results:

Table 1: A summary table from phase 1 of the evaluation at Imperial Logistics, showing the fuel economy improvement on the 9800i freightliner, after the initiation of Centron:

		Baseline	Last 10 Days			% Change to baseline
Unit	**Route**	**KM/L**	**KMs**	**Litres**	**KM/L**	
H9013	To DBN	**2.08**	4209	1840	**2.30**	**-10.5%**
H9013	To JHB	**1.57**	3186	2100	**1.63**	**-3.8%**

Note 1: The results of the last 10 days of phase 1 were compared to the last 2 weeks of baseline as calculated from the driver's logbook.

Table 2: A summary table from phase 1 of the evaluation at Imperial Logistics, showing the Opacity improvement on the 9800i freightliner after the initiation of Centron:

Opacity (Black Smoke) Performance Results

EQUIPMENT NUMBER	Baseline Opacity (%)	Final Opacity (%)	% Change
H9013	15.7%	7.7%	**-51%**

Note 1: *Gas emission results are not displayed as final results are not available as the test vehicle was pulled off the project before the final gas tests could be performed. Phase 2 is recommended to confirm reductions in exhaust gas emissions.*

Discussion:

The elimination of the black smoke clearly demonstrates that the use of Centron resulted in cleaner, more efficient fuel combustion, thus less overall harmful emissions and improved fuel economy performance. The driver also noted a marked improvement in the operability of the engine. This is due to Centron causing fuel to burn cleaner, enhanced combustion and lubrication of vital engine parts. These added benefits will lead to reduced maintenance costs and longer lasting equipment. This will add to the Residual Value of these assets.

Fuel economy results in particular on the route from JHB to DBN, namely 10.5% are consistent with the fuel savings claims of Centron. Fuel economy performance is likely to continue to improve on a gradual basis until its maximum performance level is achieved, which could take up to 8 weeks.

Overall, the fuel savings achieved by the 9800i freightliner truck on the route from JHB to DBN was 10.5 %, while the fuel savings on the route from DBN to JHB was 3.8%. Fuel economy is affected by many factors including route and load. The difference in fuel savings between the two routes is likely due to the elevated incline travelling on the return route from DBN to JHB. Of significance is Centron clearly had a positive impact on fuel economy performance during this shortened test. Therefore it is reasonable to conclude the fuel economy results will be equal to or better test when evaluating a larger sampling of vehicles treated with Centron on a continuous basis over a full test cycle of 90 days. This expanded evaluation or phase 2 will allow for a broader collection of fuel consumption and emission data verifying the results achieved during the single vehicle test plus precisely quantify the economic and environmental benefits Imperial can expect by implementing Centron.

Conclusion:

In summary, Centron produced an average 10.5% improvement in fuel economy en route to DBN and 3.8% en route to JHB, along with significant reductions in exhaust black smoke and soot, namely 51%. The Imperial Group will also benefit from decreased maintenance costs, fewer fuel related issues, improved equipment performance & extended equipment life through the continued use of Centron,

Recommendations:

Based on the positive performance on the very short time period, it is my recommendation that the Imperial Group perform Phase 2 of the Fuel enhancement project dosing both the Alrode and DBN depots. Please note that the following are merely recommendations for Imperial Group to consider regarding strategies to reduce fuel costs and improve air quality.

Three strategies have been identified for reducing emissions on equipment currently in use:

1. Engine modifications
2. Exhaust gas treatment
3. Fuel composition modifications

Engine modifications and exhaust gas treatment are considered costly alternatives to achieve reduced exhaust emissions plus these strategies are proven to have little or no positive impact on fuel economy performance.

Based on the results of the Centron evaluation it is clear that Centron favourably modifies the composition of diesel fuel resulting in reduced exhaust emissions and improved fuel economy performance. Further, the cost of implementing Centron is more than offset by fuel cost savings resulting in net positive cash flow and enhanced bottom line profit for the Imperial Group. Again, it is therefore recommended that the Imperial Group pursue phase 2 testing.

The results of the Centron evaluation confirms the manufacturer's claims of reduced emissions and improved fuel economy performance. Therefore I am confident that the potential for additional maintenance and financial benefits exist for the Imperial Group by treating its fuel supply with Centron. These benefits as listed by the manufacturer are noted in Addendum A1.

Addendum A1 – Benefits of using Centron:

Centron Cleans and removes deposits from fuel tanks, lines, injectors, valves, and piston rings and keeps them clean with continuous use bringing engine back to "like new" performance.

- Improved sealing of valves and piston rings reduces blow-by and improves performance and fuel economy,
- Improves injector spray pattern to facilitate improved atomization,
- Reduces operating and maintenance costs: A cleaner engine lasts longer and runs better, and
- Eliminates exhaust gas recirculation valve fouling and reduces diesel particulate filter (DPF) regenerations saving time, money, and increases DPF life.

Centron Improves Combustion by reducing fuel surface tension and introducing additional oxygen to the combustion process.

- Reduced surface tension allows better atomization so more of the fuel molecule to exposed to oxygen during the combustion process,
- Oxygenates enable a more complete fuel burn providing better fuel economy, more power, reduced black smoke and soot, and
- The improved combustion reduces hazardous emissions and particulate matter (PM) through a more efficient yet lower temperature combustion process.

Centron Lubricates pumps, valves, injectors, and piston rings.

- Replaces lost lubrication of ULSD and improves the performance and extends the life of pumps and injectors, reducing maintenance costs.
- Increased lubrication to the upper cylinder area, valves and top rings and reduces blow-by thus improving efficiency and reducing oil contamination and dilution.

Centron Conditions the fuel by removing water by emulsifying it and carrying it through the combustion process.

- Resolves algae and sludge issues, making Centron one of the best algae and sludge solutions on the market today.

- Emulsifies water and suspends it allowing it to exit the fuel system through combustion instead of accumulating.
- Keeps fuel tanks and lines from rusting out.
- Eliminates fuel line freeze during cold weather.
- Protects and conditions bulk tank storage.

Centron Stabilizes fuel allowing it to stay fresh over an off season, protecting against corrosion, water issues and wax and varnish deposits,

- Promotes molecular balance in the fuel and makes it shelf and tank stable, thus enhancing the oxidation stability of straight diesel, biodiesel blends, gasoline and gasoline ethanol blends,
- Controls water accumulation during storage, and
- Facilitates easier starting after storage

Should the Imperial Group elect to implement Centron at its Alrode and DBN depots it is further recommended that:

- The accuracy and validity of the electronic fuel recording system is maintained.
- The methodology of dosing and monitoring results is maintained and upheld at all times.
- The integrity and accuracy in manual data recording on site is maintained during refuelling and equipment dosing.

Addendum A2 – Calibration certificate for 5 gas analyzer:

N56 W24701 N. Corporate Circle, Unit 2

Sussex, WI 53089

Tel: 262-820-9672

Fax: 262-820-9674

Certificate of Calibration – Gas Analyzer

Serial Number: 3814

Model Number: 310-0111

Customer Name: Centron Energy

Date Tested: 10/09/2009

Technician: L. Rohde

Calibration Conducted: The gas analyzer is calibrated using certified blended Calibration gas. This gas is blended by PraxAir Inc. PraxAir Inc is a gas blender certified by the state of California, Bureau of Automotive Repair. The Bureau of automotive repair is the premier authority on gas blending for automotive analyzers in the United States. The calibration gas is blended to +- 1% accuracy per the Bureau's standard.

Test Conducted: After calibration, the analyzer is subjected to an audit procedure to verify the accuracy of the readings. This procedure is a 3 point audit verifying the accuracy of the analyzer across its range. The first step into the audit is to introduce a certified blend of audit gas into the analyzer under test. Each individual gas is then checked to verify the analyzer conforms to the required accuracy limits. The readings and results of this test are attached. Analyzers outside of the required limits are rejected. Some 4 gas analyzers will display 0 for NOx on the attached pages. This is normal as the NOx sensor is not present on these models.

Addendum A3 – Calibration certificate for opacity meter:

N56 W24701 N. Corporate Circle, Unit 2

Sussex, WI 53089

Tel: 262-820-9672

Fax: 262-820-9674

Certificate of Calibration – Smoke Meter

Serial number: 4076

Model Number: 310-0331

Customer Name: Centron Africa Impt and Expt

Date Tested: 2/12/2010

Technician: K. Singer

Calibration Conducted: The Smoke bench is calibrated using a factory certified calibration filter. This filter is used to verify accuracy to within 1% of the filter value. The meter, by software design is calibrated in a linear range where the absence of light is 100% opacity and the presence of unfiltered light is 0% opacity.

Test Conducted: During the calibration process, the analyzer is subjected to an audit procedure to verify the accuracy of the readings. This audit procedure verifies that the smoke reading of the calibration filter is within 1% of reading.

Document Revision 1.1

Addendum A4:

Paola's Credentials

PAOLA NICOLE TREVISAN

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PROFILE

- **ID Number:** 840404 0221 083
- **Date of Birth:** 1984-04-04
- **Nationality:** South African
- **Home Language:** English
- **Second Language:** Afrikaans
- **Drivers Licence:** Code B (own car)
- **Marital Status:** Single
- **Health:** Excellent

QUALIFICATIONS

BSc Natural and Agricultural Sciences – Human Physiology, University of Pretoria, 2007

- Currently enrolled for a Masters in public health at the University of Pretoria - completing 2010
- Registered SAIOH occupational hygiene assistant

Monitoring & Evaluation, UP, 2009

- Certificate

EDUCATION

Matriculation, St Andrew's School for Girls, 2002

- Subjects (HG): English, Afrikaans, Maths, Biology, Science, Speech & Drama
- Passed with Exemption

- Excelled in Rowing
- Leadership roles: Monitor, Captaincy

KEY STRENGTHS

- Work well under pressure
- Perseverance
- Integrity
- Self-disciplined
- Caring
- Assertive
- Public speaking / presentations

WORK EXPERIENCE

Trevi Sales cc, South Africa; 2003 - Present

- Lab manager, Sales representative
- Reference: Loraine Trevisan – +2711 979 2124

Makrosafe (PTY) LTD, South Africa; February - May 2008

- Part time – Health and hygiene assistant
- Reference: Leon Van Der Walt - +2782 553 8438

SANSAT International Trading cc, South Africa; July 2009 – May 2010

- Full time - Fuel and environmental specialist managing and running a fuel enhancement and environmental project at Letseng Diamond Mine, Lesotho since March 2009 until May 2010
- Reference: Jannie Pretorius - +2782 561 6444

Clean Air Testing Solutions cc, South Africa; May 2010 – Present

- Company owner – Fuel and environmental specialists providing services to all mining, logistics, industrial and automotive applications, since May 2010