Vehicle Emission Monitoring Survey

For

Clean Fuel Technology (Pty) Ltd – (Fuel Fix)

By

VR Environmental Consultants

Report Date: 30/08/2022
Test Date: 19/08/2022

Survey Reference No: VREC 2022-181
Vehicle Emission Survey Conducted on behalf of Clean Fuel Technology (Pty) Ltd – (Fuel Fix) for Internal Auditing Requirements.

sanas Testing Laboratory

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- Report Number **VREC 2022-181** and all sections herein constitute a complete report issued on the date listed herein.
- The results reported herein are a representation of the vehicle, plant and process conditions that prevailed on the date and time of the testing and represent only samples taken on this date.
- VREC management and staff are responsible for all the information provided in the report, except where information was provided by the customer.
- Where VREC staff are not responsible for the sampling stage, (e.g. the sample has been provided by the customer), VREC will state that the results apply to the sample as received.

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Date	**30th August 2022**

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Executive Summary

Clean Fuel Technology (Pty) Ltd – Fuel Fix engaged VR Environmental Consultants to conduct their Vehicle Emissions test at our facility based in Edenvale, Sebenza.

The diesel vehicle exhaust emission sampling was required for internal and regulatory compliances. The objective of the test series were the following;

- To quantify opacity emissions from **(1)** diesel vehicle to compare the results to the National Environmental Management: Air Quality Act of 2004 (Act 39 of 2004).
- To quantify opacity emissions from **(1)** diesel vehicle and to compare the results to the National Environmental Management: Air Quality Act of 2004 (Act 39 of 2004) were possible.

The emission testing was conducted using the following:

- *The emission sampling was also performed using the Free Acceleration Smoke test method for opacity sampling. The summary of the results indicated that the sampled vehicles complied with the legal requirements.*

- *"The emission testing was conducted using the sample methodologies and equipment for emission testing as per the US EPA Methods as in part 2, Section (5), (6), (7), GN 893 of 22 November 2013 of the NEMA:AQA Section 21 Listed Activities. Annexure A – "Methods for Sampling and Analysis".*

- *The Sampling System for O_2, CO_2, CO, SO_2 and NO_X are the testo 350, and Optima 7 – MRU Portable gas analysers.*

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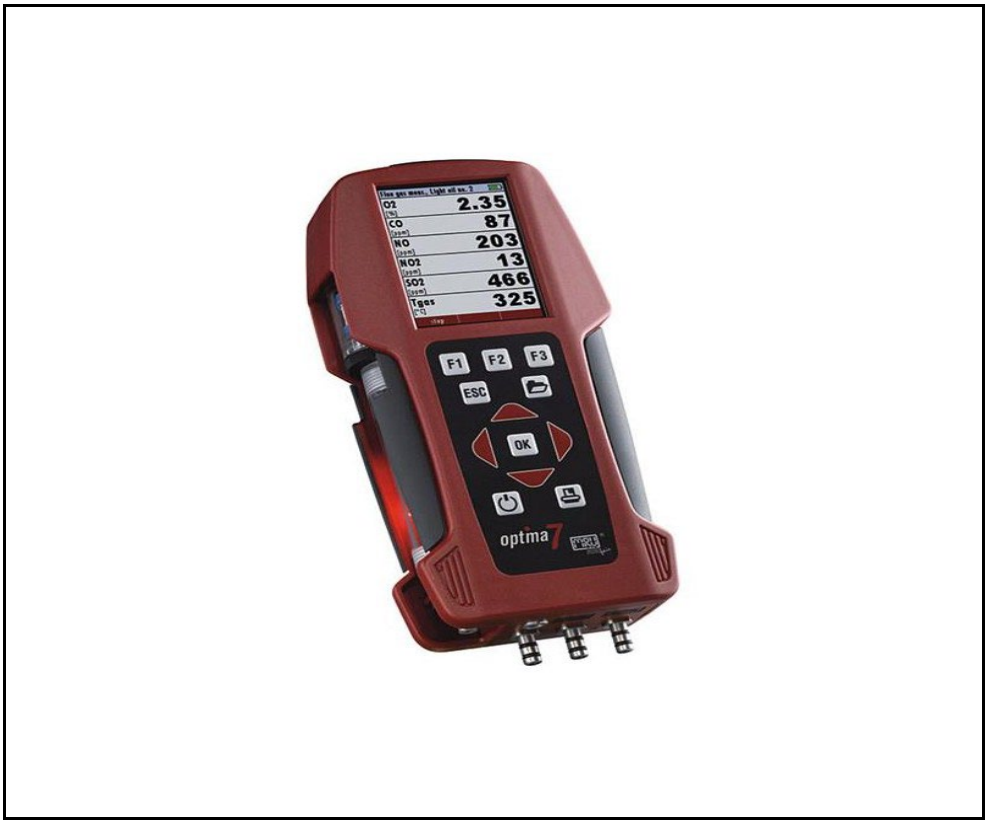
Optima 7 – MRU Portable Gas Analyzer – Serial Number: 331848



The testing was conducted on the 19th of August 2022**.** One (1) vehicle was tested using the following US EPA Methods as listed below:

Parameter	Symbol	Method
Oxygen	O_2	US EPA Method 3
Carbon Dioxide	CO_2	US EPA Method 3
Sulphur Dioxide	SO_2	US EPA Method 6C
Oxides of Nitrogen	NO_x Expressed as NO_2	US EPA Method 7E
Carbon Monoxide	CO	US EPA Method 10
Diesel Smoke (Opacity)	HSU (%)	TEXA SPA – OPABOX Autopower
VREC Sampling Plan	N/A	Procedure 5(I)

All the relevant stack gas parameters were also measured, i.e. Gas Composition, Velocity, Flowrate, Pressure and Temperature. Ambient conditions were also recorded.

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LIST OF DEFINITIONS AND ABBREVIATIONS

ABBREVIATIONS	DEFINITIONS
US EPA	United States Environmental Protection Agency
Point source	A single identifiable source and fixed location of atmospheric emission, and includes stacks and residential chimneys
Design capacity	Means capacity as installed
NO_x	The sum of nitrogen oxide (NO) and nitrogen dioxide (NO_2) expressed as nitrogen dioxide (NO_2)
SO_2	Sulphur Dioxide
CO_2	Carbon dioxide
CO	Carbon Monoxide
New Plant Standards	Existing plants to comply with minimum emission standards for new plants by 01 April 2020.
Normal operating condition	Means any condition that constitutes operation as designed.
mg/dscm	***milligrams per dry standard cubic metre*** at the following conditions: 0ºC (273K),101.3 kPa, Stack O_2 & 0% Moisture.
mg/Nm	***milligrams per normal cubic metre*** at the following conditions of: 0ºC (273K), 101.3 kPa, & 0% Moisture.
Reference O_2	"NEM:AQA" Section 21 – Listed Activities have requirements for monitoring and reporting for PM, NO, NO_2, CO, and SO_2 gases. It is required that the concentration of these gases be corrected for the diluting effects of excess air. The amount of excess air is determined from the O_2 concentration measured in the flue Gas. The measured O_2 concentration, together with the O_2 reference value is used" … "to obtain the corrected gas concentration." (*Combustion Analysis Basics*, TSI Inc. 2004)
SANAS	South African National Accreditation System
ISO / IEC 17025:2017	ISO Standard for Emission Testing & Analysis
NEM:AQA	National Environmental Management – Air Quality Act (Act No. 39 of 2004)

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Diesel Vehicle Emission Sampling – Glossary of Terms

Term	Definition
Air Pollution	Any change in the composition of the air caused by smoke, soot, dust, cinders, solid particles of any kind, gases, fumes, aerosols and odorous substances
APPA	The Atmospheric Pollution Prevention Act, 45 of 1965
Air Quality Act	The National Environment Management: Air Quality Act, 2004
Compressed Ignition Powered Vehicle	A vehicle powered by an internal combustion
Control Measure	A technique, practice or procedure used to prevent or minimize the generation, emission, suspension or airborne transport of fugitive dust, pesticide or sandblasting activities
Dark Smoke	**a.** Smoke which has a density of 60 Hartridge smoke units or more (coastal areas), or in relation to emissions from a turbo-charged compressed ignition powered engine means a density of 66 Hartridge smoke units or more (inland areas); or **b.** Smoke which has a light absorption co-efficient of more than 2.125 m-1 or more, or in relation to emissions from a turbo-charged compressed ignition powered engines mean a light absorption co-efficient of more than 2.51 m-1
Diesel Smoke	Particles, including aerosols, suspended in the exhaust stream of a diesel engine which absorb, reflect, or refract light.
FAS	Free Acceleration Smoke is a test method used to determine diesel exhaust opacity, where the engine is accelerated against its own inertia.
Opacity	The percentage (**%**) of light transmitted from a source which is prevented from reaching a light detector
HSU	Hartridge Smoke Units represents the degree of opacity as a percentage where 0% is transparent and 100% is opaque.
Public Road	A public road as defined in section 1 of the National Road Traffic Act, 1996 (Act 6 No. 93 of 1996), as amended
VOSA	Vehicle & Operator Services Agency compiled a Specification for Diesel Smoke Meters and covered smoke meters to be used for statutory testing in the HGV, PSV, MOT and SVA schemes, including those to be used for Reduced Pollution Certification, Roadside Enforcement and by Vehicle & Operator Services Agency Testing Division (MOT/05/01/01 Including MOT/08/19/01 Issued October 2001- first Revision: April 2002 2nd Revision May 2003.) The DX260 Diesel Smoke Meter is approved by VOSA.

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Summary of Results

Table 1: O_2, CO_2, CO, SO_2 and NO_X – Monitoring Results

Registration Number	O_2 %	CO_2 %	CO ppm	NO_X ppm	SO_2 ppm
MAZDA BT50 – DV 75 MS GP – (Fuel Fix Treated)	8.86	8.83	1 376.25	47.17	0.42

Table 2: Diesel Vehicle Exhaust Opacity Monitoring Results

No.	Registration Number	Make	Model	Results (Opacity)	Opacity Limit	Result in K(m^{-1})	Limits in K(m^{-1})	Pass / Fail
1	DV 75 MS GP – (Fuel Fix Treated)	MAZDA	BT50	26%	66%	0.79 k(m^{-1})	2.50 k(m^{-1})	PASS

Conclusion**

O_2, CO_2, CO, SO_2 and NO_X Testing

The emission testing conducted on the vehicle was carried out as part of Clean Fuel Technology (PTY) Ltd – (Fuel Fix) company internal monitoring and reporting policy. The aim of the testing was to determine if the emissions emitted from the Diesel fired vehicle treated with fuel fix, causes any harm to the environment and will not in our opinion cause detrimental harm to the receiving environment.

Diesel Smoke Testing

The vehicle emission test conducted on the vehicle treated with fuel fix, concluded that the vehicle was compliant the opacity limit.

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1. Client Information

Project Details	Vehicle Emission Testing
Enterprise Name	Clean Fuel Technology (Pty) Ltd
Contact Person	Eugene De Haast
Registered Address	8 Christiaan De Wet Rooihuiskraal C, Pretoria, Pretoria
Postal Address:	P.O Box 58 Rooihuiskraal, Pretoria
Telephone Number (General)	+27 76 019 4298
Fax Number (General)	n/a
Cell Phone Number	+27 76 019 4298
Industry Type/Nature of Trade	Fuel Contamination Solution
E-mail Address	eugened.dehaast@gmail.com
Land Use Zoning as per Town Planning Scheme	Industrial

2. Introduction

2.1 Subject of this report

Clean Fuel Technology (PTY) Ltd – (Fuel Fix) appointed VR Environmental Consultants to conduct their Vehicle Emissions Test. The aim was to quantitatively determine the opacity and noxious gases emitted from this vehicle treated with Fuel fix. This report details the findings from the results conducted on the vehicle and is compared to the environmental limits set out by the Department of Environmental Affairs to determine compliance (For Diesel Vehicles Only).

2.2 Background to investigation

Environmental air quality management in South Africa is governed in terms of the National Environmental Management: Air Quality Act (39 of 2004), and its attendant regulations (hereafter referred to as the "NEM:AQA"). The NEM:AQA takes a holistic approach to the management of air quality. It addresses the regulation of both sources of air pollutants, as well as ambient air. This enables ambient air quality issues in particular areas to be identified, with information pertaining to the pertinent emitters available to authorities for focused intervention.

2.3 Aims and objectives

The objectives of this report are to:

- Quantify the opacity from one specific diesel vehicle.
- Compare the measured limits to the National Environmental Management: Air Quality Act (39 of 2004) to evaluate compliance.

2.4 Limitations and scope of investigation

The results obtained are indicative of the conditions that prevailed at the time of the test and should not be accepted as evidence of their condition at any other time. Modifications to the engine mechanics could cause variations in measured results. Opacity sampling of exhaust emissions were performed in accordance with the Free Acceleration Smoke (FAS) test.

3. Regulations

The National Environmental Management: Air Quality Act (2004) requires that national standards be established for municipalities to monitor point, non-point and mobile source emissions. This is brought to effect in the National Framework for Air Quality Management in the Republic of South Africa (2007).

There has been a lot of misunderstanding regarding the Diesel Vehicle Exhaust Emission monitoring and limits. That is why the South African government introduced a by-law-model for adoption by the different municipalities in South Africa as an easy guide.

Law Model outlining the relevant Municipality.

Relevant Municipal Area	Inland/Coastal
Tshwane	Inland

Opacity Limits for Non-Turbo and Turbo Engines in all Vehicles.

Opacity Limits	
Turbo Engines	**Non-Turbo Engines**
60%	66%

The relevant acceptable limits are clearly outlined below:

Limits (Units)	**Variation of Limits**
Reduced Pollution Certificate (RPC)	Fast Pass= Vehicle passes the test first time with readings below **1.50(m^{-1})**
Limits in **K(m^{-1})** – All regardless of vehicle class or type. Non-Turbo=**2.50**, Turbo=**3.00**	
RPC 1	0.20 K(m^{-1})
RPC 2	0.40 K(m^{-1})
RPC 3	0.80 K(m^{-1})
RPC 4	1.00 K(m^{-1})
Short Conversion Table (Units)	
1.00 K(m^{-1})	35.0%
1.50 K(m^{-1})	47.5%
2.50 K(m^{-1})	**66.6%**
3.00 K(m^{-1})	72.5%

K(m^{-1})= coefficient of light absorption **m^{-1}** (world standard), (HSU= Hartridge Smoke Units in **%**) **(SA Standard-old).**

Row highlighted in YELLOW indicates the limit for South Africa.

4. METHODOLOGY

- The vehicle to be tested is allowed to reach normal operating temperature before testing.

- Once the vehicle has reach normal operating temperatures, the accelerator is pressed fully, twice. This is performed to remove any particulates that have settled in the exhaust system during the idling period to reach normal operating temperatures.

- The probe is then inserted and secured in the exhaust pipe exit. The Diesel Smoke Meter samples the exhaust emissions through periods of idling and full, free acceleration. The sample is drawn through a chamber, within which a beam of high intensity light is passed.

- The amount of light which is scattered and/or absorbed is proportional to the amount of Particulate matter (opacity) entrained in the exhaust emissions.

- The results are recorded and compared to a standard for assessment.

5. Equipment Specifications

VREC uses an OPABOX Auto power which is a partial flow opacity meter for diesel engines. It incorporates a latest generation exhaust gas analysis chamber developed to conform to international standards.

OPABOX Autopower is designed to be practical and versatile and meets the full range of requirements of mechanics in the field of exhaust gas analysis. The analysis chamber is incorporated in a practical trolley mounted on wheels with ball bearings. The analyzer can therefore be moved effortlessly to the vehicle waiting to be tested.

OPABOX AUTOPOWER

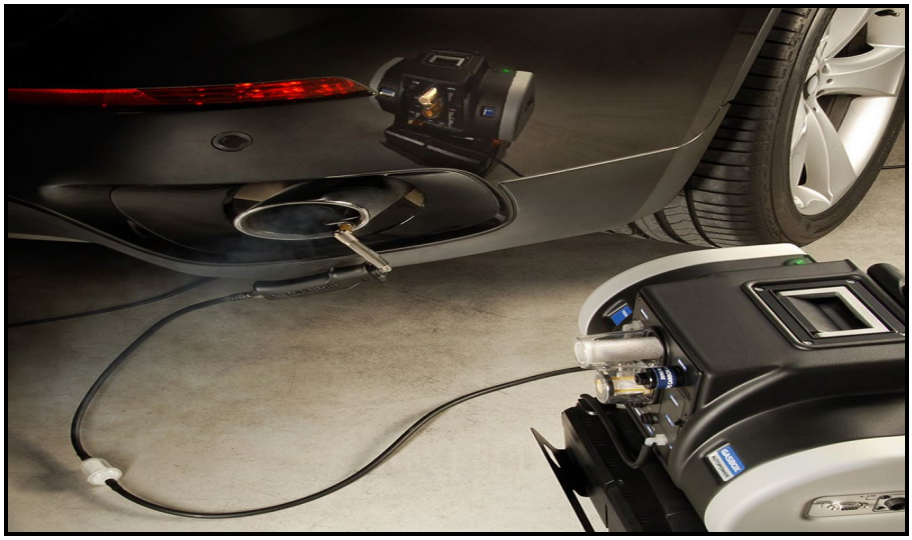

Figure 1: TEXA SPA – OPABOX Autopower

Manufacturer: TEXA SPA

Model: OPABOX Autopower

Serial Number: GOBLT004337

6. Maximum and Minimum Emissions – O2, CO2, CO, SO2 and NOX – Monitoring Results

Registration Number	Emissions	O_2 %	CO_2 %	CO ppm	NO_X ppm	SO_2 ppm
MAZDA BT50 – DV 75 MS GP – (Fuel Fix Treated)	**Maximum**	12.20	13.00	2 574.00	110.00	4.00
	Minimum	3.20	6.50	348.00	21.00	1.00

Conclusion**

O_2, CO_2, CO, SO_2 and NO_X Testing

The emission testing conducted on the vehicle was carried out as part of Clean Fuel Technology (PTY) Ltd – (Fuel Fix) company internal monitoring and reporting policy. The aim of the testing was to determine if the emissions emitted from the Diesel fired vehicle treated with fuel fix, causes any harm to the environment and will not in our opinion cause detrimental harm to the receiving environment.

7. Diesel Vehicle Exhaust Opacity Monitoring Results

No.	Registration Number	Make	Model	Results (Opacity)	Opacity Limit	Result in K(m^{-1})	Limits in K(m^{-1})	Pass / Fail
1	DV 75 MS GP – (Fuel Fix Treated)	MAZDA	BT50	26%	66%	0.79 k(m^{-1})	2.50 k(m^{-1})	PASS

Conclusion**

Diesel Smoke Testing

The vehicle emission test conducted on the vehicle treated with fuel fix, concluded that the vehicle was compliant and did meet the opacity limit.

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8. Vehicle Emission Reports

Please find the attached Vehicle Emission Report below,

Customer copy

Diesel Emission Test Result

Test Date 19/08/2022

Test Time 09:54

Test Station	
Test station number	

Vehicle details	
Plate	DV 75 MS GP
VIN	AFBPXXMJ2PFC45757
Manufacturer	MAZDA
Model	BT-50
Registration date	31/08/2022
Class	Turbo Diesel

Limits	min.	max.
Engine temperature	60	
k (1/m)		3.00
Opa range < 2,5 (k)		0.50
Opa range >= 2,5 (k)		0.70
rpm min. limit	400	1200
rpm max limit	1650	7000

Measurement Result					
Preconditioning	Measured value	Unit	min.	max.	Result
Engine oil temperature	#60	°C	60		PASSED
Reference acceleration / Idle Speed	#1000	rpm			
Reference acceleration / Max speed	#6000	rpm			

Smoke Acceleration					
Acceleration number	Absorbtion coeff. (1/m)	Idle Speed (rpm)	Max speed (rpm)	Acceleration time (s)	Notes
1	0.73	#1000	#6000	-	
2	0.90	#1000	#6000	-	
3	0.73	#1000	#6000	-	

Overall result	min.	max.	Mean value	Result
Absorbtion coefficient / MOT Test (1/m)		3.00	0.79	PASSED
Total result				PASSED
Notes				

= Manual input

Manufacturer	Model:	Serial number	Approval certification number	Scheduled check expiration	Notes
TEXA SPA	OPABOX Autopower	GOBLT004337	OM00372EST001b/NET2	03/07/2023	

Tested by	Signature
DAVID MAKALU	

VR ENVIRONMENTAL CONSULTANTS CC
SANAS APPROVED FOR EMISSION
TESTING
Unit 1, 13 Imvubu St,
Sebenza, Johannesburg

9. OPABOX Autopower Texa Machine – Calibration Certificate.

PROFESSIONAL AUTOMOTIVE EQUIPMENT

DC DIAGNOSTICS Pty Ltd, Reg : 2014/149838/07, Vat : 4960266957, Imp / Exp : 21467739
Tel : +2772 505 3859, Email : sales@dcdiagnostics.co.za, www.dcdiagnostics.co.za
Address : 41 Elgin Rd, Vandia Grove 2194, Johannesburg, South Africa

CALIBRATION CERTIFICATE

OPACITY CALIBRATION
Diesel Smoke Meter

Manufacturer	TEXA SPA
OPACIMETER MODEL:	OPABOX Autopower
Approval certification number	OM00372EST001b/NET2
Serial number	GOBLT004337
Last calibration date	04/07/2022 14:06
Next calibration	03/07/2023

#	FILTER	Threshold	Correction
K1	18.80	18.19	0.61
K2	29.00	29.18	-0.18
K3	40.07	40.17	-0.10

CERTIFYING CO.	
Company Name	DC Diagnostics (Pty) Ltd
Office	Technical
Town	Johannesburg
Phone	+27725053859

Test start TIME	14:05
Test end TIME && DATE	04/07/2022 14:06
Engineer:	Colin
Signature	

Periodic Check
Diesel Smoke Meter

Manufacturer	TEXA SPA
OPACIMETER MODEL:	OPABOX Autopower
Approval certification number	OM00372EST001b/NET2
Registration number	GOBLT004337
Scheduled check expiration	03/07/2023

#	Nominal	Measured	Difference	Result
K1	1.04	1.04	0.00	Passed
K2	1.71	1.72	-0.01	Passed
K3	2.56	2.56	0.00	Passed

CERTIFYING CO.	
Company Name	DC Diagnostics Pty Ltd
Office	Technical
Town	Johannesburg
Phone	+27725053859

Test start TIME	14:08
Test end TIME && DATE	04/07/2022 14:09
Engineer:	Colin
Signature	

Director : D G Colley

Official Distributors for

TEXA G-SCAN POWER PROBE turbo ARMEC Intitek CARMAN ZENITH GYS

ADDENDUM: Amendment Record

Proposed By:	Section	Change
Vischal Rambridge	N/A	None

End of Report