



**EMISSION SURVEY
FINAL REPORT**

**Geelhoutsvlei Timbers (Pty) Ltd
Karatara, Western Cape
Report No. GHV-062**

BY

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LAQS

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EXECUTIVE SUMMARY

Lethabo Air Quality Specialists CC (LAQS) conducted an emission survey on the stack serving Geelhoutsvlei (GHV) in Karatara, Western Cape.

The objective of the measurement program was to quantify the emission of pollutants and record operating parameters in the stack in accordance with Government Notice 893 on 22 November 2013 (GN893). The following table provides a summary of pollutants measured for the stack and indicates compliance vs non-compliance:

Pollutant	Boiler
Particulate matter	✘
Oxides of nitrogen	✓

In addition to quantification of the pollutants mentioned above, the following parameters were measured as part of the emissions survey, where applicable:

- Combustion gases inclusive of GHG
- Gas velocity
- Gas volumetric flow rate
- Gas temperature as well as absolute and static pressure
- Water vapour content of the stack gas

1. INTRODUCTION

GHV operations include the cutting and drying of timber at their premises in Karatara, Western Cape.

The process used by GHV includes the drying of wood that is heated by hot water produced in a boiler which is fuelled by solid wood waste produced at GHV. The wood drying process is included in the "*List of Activities Which Result in Atmospheric Emissions*" as published in Government Notice 893 on 22 November 2013 (GN893). Sub-category 9.5, "*Wood burning, drying and the production of manufactured wood products*" is applicable.

GHV was issued with an atmospheric emission license (AEL), No. WCED002. The emission limits imposed by the AEL are:

Application	Boiler		
Common name	Chemical symbol	Plant status	mg/Nm ³ under normal conditions of 10% O ₂ , 273 Kelvin and 101.3 kPa
Particulate matter	N/A	New	150
		Existing	200
Oxides of nitrogen	NO _x expressed as NO ₂	New	500
		Existing	700

This report details the methodology applied by LAQS and the results obtained, as well as the results obtained from the emissions survey.

2. METHOD OF MEASUREMENTS

All isokinetic and anisokinetic sampling activities were carried out according to internationally accepted test methods which are included in Appendix A of the List of Activities That Result in Atmospheric Emissions as published in Government Notice 893 of 22 November 2013 (GN893).

For legislative compliance purposes a minimum of three (3) tests were conducted per pollutant per stack as described in GN893.

A calibrated automated isokinetic sampling system was used to carry out all of the isokinetic measurements described below.

A calibrated Ecom Model J2KN-Pro portable emissions analyser was used to measure the concentrations of O₂, NO, NO₂, NO_x, CO, SO₂, CO₂, CH₄ present in the stack gas streams on a volume/volume basis. The analyser complies with the requirements of EN 50379-2:2004, "Specification for Portable Electrical Apparatus Designed to Measure Combustion Gas Parameters".

The following methods apply to the work done by LAQS:

Pollutant	Method type	Method reference
Stack gas velocity		USEPA Method 1: "Sample and Velocity Traverses for Stationary Sources". USEPA Method 2: "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type-S Pitot Tube)". Gas velocities were calculated from data obtained from 12 point velocity pressure measurements. Velocity pressure measurements were taken by means of an S-type pitot tube. Volumetric flow rates were calculated from the individual point velocities and internal dimensions of the stack.
Stack gas temperature		The gas temperatures were measured by means of a Type-K thermocouple connected to a digital thermometer.
Total particulate matter	Isokinetic	USEPA Method 17: "Determination of Particulate Matter Emissions from Stationary Sources" This entails in-stack filtration, with the filter at stack conditions of temperature and pressure. High-purity borosilicate glass microfiber thimbles are used for all isokinetic sampling applications. The thimbles are completely free of binders or additives and can be used at temperatures up to 500°C or when using solvents incompatible with cellulose thimbles. These thimbles have a 0.8 µm nominal particle retention capability.

3. RESULTS

All raw data collected during the test period are available at LAQS's offices and will be made available to interested parties on written authorisation by Geelhoutvlei Timbers.

All of the international isokinetic methods referred to in Section 2 above state that isokinetic results will be acceptable if the isokinetic sampling deviation is less than 10%.

Results obtained are reported at the following conditions:

Normal temperature and pressure (NTP): This condition is also referred to as NTP and refer to conditions at 0°C (273.15 K) and 101.325 kPa.

Where concentrations are reported at NTP or mg/Nm³ it refers to the conversion of concentrations to NTP conditions. As these conditions imply a reduction in the sampled gas volume due to the effect of reduced temperature and increased pressure, the resulting calculated concentration is higher than at actual stack gas conditions.

NTP, dry: Current emission limits imposed by the Department of Environmental Affairs, and published in GN893, require results to be reported at NTP on a dry basis, i.e. based on the gas volume with water vapour removed. The removal of the water vapour content from the stack gas implies a further reduction in gas volume, resulting in even higher calculated concentrations.

The following results were obtained:



3.1 Boiler

DESCRIPTION	UNIT	Test 1	Test 2	Test 3	Ave
Date	-	21/09/17			
Time of Day	-	10h30	11h40	13h00	
Test Duration	min	60			
Barometric Pressure	kPa	98.09	98.20	98.06	98.1
Duct Static Pressure	kPa	0.052	-0.08	-0.049	-0.026
Gas Temperature (Average)	°C	127.1	119.8	137.0	128.0
Gas Velocity	m/s	5.2	4.6	6.0	5.3
Volumetric Flow Rate (Actual)	m ³ /h	11978	10605	13657	12080
Volumetric Flow Rate (NTP, wet)	Nm ³ /h	7918	7140	8791	7950
Volumetric Flow Rate (NTP, dry)	Nm ³ /h	7443	6712	8263	7470
Total Particulate Concentration					
Actual	mg/m ³	516.3	475.4	252.9	414.9
NTP, wet	mg/Nm ³	781.4	705.6	392.4	626.5
NTP, dry	mg/Nm ³	900.2	822.4	431.7	718.1
NTP, dry, 10% O ₂	mg/Nm ³	1523.3	1350.3	477.2	1117.0
Emission limit, dry	Mg/Nm³	New: 150 , Existing: 200			
Total Particulate Emission Rate	Kg/h	6.184	5.042	3.454	4.893
Water Concentration	% (V/V)	13.2	14.2	9.1	12.2
Isokinetic Efficiency	%	-1.4	-1.3	-1.4	
Leak Check	l/min	0.00			

Table 1a: Bolier Stack; Stack Conditions and Particulate Emissions

LAQS

Gas	Unit	Test 1	Test 2	Test 3	Average	Limit
O ₂	%	14.5	14.3	11.1	13.3	
CO	mg/Nm ³ , 10% O ₂ , dry	869.0	481.7	1405.7	918.8	
NO		73.0	77.4	77.0	75.8	
NO ₂		12.5	8.4	0.2	7.1	
NO _x (as NO ₂)		124.4	127.1	118.3	123.3	700
SO ₂		0.0	0.0	4.9	1.6	
CO ₂	g/Nm ³ , 10% O ₂ , dry	21.3	22.7	20.1	22.1	
CH ₄	mg/Nm ³ , 10% O ₂ , dry	0.045	0.024	0.024	0.032	

Table 1b: Boiler Stack; Summary of Combustion Gas Components per Test

4. DISCUSSION

4.1. Sample Port Location

The stack conformed to the sample port location as detailed in the methods referred to in Section 2 above.

4.2. Isokinetic Sampling Efficiency

The parameter which must be controlled to establish isokinetic sampling is the gas velocity as it enters the nozzle of the sample probe. This velocity must be equal to the actual gas velocity at the specific sample point in the duct/stack.

An isokinetic deviation outside the prescribed specification of $\pm 10\%$ can lead to either over or under sampling of particles of a certain size.

The isokinetic sampling efficiencies were calculated to be within the specified limit of the prescribed method for all isokinetic measurements conducted on the stack, the largest deviation being -1.4%.

4.3. Representativeness of Sampling Results

It is LAQS's opinion that the emissions reported are representative of the operating conditions that prevailed in the stack and the drier at the time that the samples were taken.

The results may vary should plant operating conditions change due to, e.g. fuel feed rate, raw material feed rate, composition changes, etc., as well as upset process conditions.

4.4. Compliance with Emission Standards

4.4.1. Total Particulate Matter

The measured concentrations for the total particulate matter (TPM) were well above the emission limit of 200 mg/Nm^3 , dry conditions for the boiler. As can be seen from Table 1a, the measured concentration varied from 477.2 mg/Nm^3 to 1523.3 mg/Nm^3 , with an average concentration of 1117.0 mg/Nm^3 for the test period.

4.4.2. Oxides of Nitrogen

The measured NO_x concentration was well below the emission limit of 700 mg/Nm^3 , dry conditions. As can be seen from Table 1b the measured average concentration varied from 118.3 mg/Nm^3 to 124.4 mg/Nm^3 , with an average concentration of 123.3 mg/Nm^3 , for the test period.



5. QUALITY CONTROL AND QUALITY ASSURANCE

The Tecora and ECOM emissions measuring equipment described in Section 3 above are both calibrated and within the validity period of the calibration.

The 4-decimal figure chemical balance used for gravimetric analysis is also new and its calibration is also regarded as valid.

Please see Appendix B for copies of the factory calibration certificates.

6. NAEIS AND GREENHOUSE GAS DATA

GHV's maximum production capacity is 9 100 tons of saw dust and wood shavings used as energy source per annum (tpa).

Using the maximum production capacity of 9100 tpa, LAQS estimates that GHV's operations can be expected to have the following annual emissions:

Boiler Stack:

Compound	kg/annum	Emission factor kg/ton
TSP	52064.19	5.72E+00
PM10 filterable (*)	34778.88	3.82E+00
PM2.5 (#)	25667.65	2.82E+00
SO ₂	76.1	8.36E-03
NO	3532.1	3.88E-01
NO ₂	329.30	3.62E-02
NO _x	5747.4	6.32E-01
CO	42826.9	4.71E+00
CO ₂	1029200.2	1.13E+02
CH ₄	1.50	1.65E-04
N ₂ O	IPCC code	IPCC code

(*): AP-42 Section 12.13: Open-hearth exhaust: PM10 = 66.8%

(#): AP-42 Section 12.13: Open-hearth exhaust: PM2.5 = 49.3%

7. COMPARISON YEAR ON YEAR

DESCRIPTION	UNIT	2016	2017
Date	-	08/08/16	21/09/17
Barometric Pressure	KPa	100.17	98.1
Duct Static Pressure	KPa	-0.0373	-0.026
Gas Temperature (Average)	°C	132	128.0
Gas Velocity	m/s	5.9	5.3
Volumetric Flow Rate (Actual)	m ³ /h	13300	12080
Volumetric Flow Rate (NTP, wet)	Nm ³ /h	8850	7950
Volumetric Flow Rate (NTP, dry)	Nm ³ /h	7940	7470
Total Particulate Concentration			
Actual	mg/m ³	62.6	414.9
NTP, wet	mg/Nm ³	94.1	626.5
NTP, dry	mg/Nm ³	105	718.1
NTP, dry, 10% O ₂	mg/Nm ³	162	1117.0
Total Particulate Emission Rate	Kg/h	0.833	4.893
Water Concentration	% (V/V)	10.3	12.2

8. CONCLUSIONS

It is LAQS's opinion that the emissions reported are representative of the actual emissions that occurred at the time of the tests and the operating conditions that prevailed at that time period.

The results may become non-representative of the true emissions if deviations from process operating conditions, raw material feed rate and/or composition changes as well as upset conditions occur.

APPENDIX A | DECLARATION

DECLARATION

I, CHARL SPARKS, hereby declare that the emission measurements conducted by Lethabo Air Quality Specialists CC were carried out under the operating conditions given below. I also declare that the process/es were operating normally during the time of the measurements.

Date	Process	Percentage of maximum capacity
21/09/2017	9.5. Wood Burning, Drying and the production of laminated and compressed wood products	100%

Atmospheric Emissions License No: WCED002

Signature [Handwritten Signature]
MANAGER

Date 21/09/2017

Designation GREENHOUSES TENDERS

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