OCCUPATIONAL HYGIENE & ENVIRONMENTAL SERVICES

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PERFORMED THIS

STACK EMISSION MEASUREMENT SURVEY
INTERIM REPORT

FOR

PRIMA INDUSTRIAL HOLDINGS, BENONI

Date: 23 September 2013
Reference No: GIJ 17988 HM

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STATEMENT

I, C. Brodie, performed this Stack Emission Measurement Survey on behalf of Gijima Occupational Hygiene & Environmental Services at Prima Industrial Holdings, Benoni.

I declare that the results given in this report are a true reflection of conditions encountered during the survey period. The results and observations, while only applying to the conditions that existed at the time of the survey, are as representative of typical plant operation activities, environmental conditions and variations in plant operation as specific constraints allowed for.

Recommendations made in this report are made in good faith and every effort was made to ensure the professional integrity there-of. The final responsibility however still lies with the client to ensure the suitability and correctness there-of, prior to implementation. Gijima Occupational Hygiene & Environmental Services shall in no way be liable for any losses suffered by the client as a result of the implementation of any of these recommendations.

This report is subject to our Quality Management System and is peer reviewed and verified by a Quality Controller.

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DATE: 23 SEPTEMBER 2013

1.0. EXECUTIVE SUMMARY AND CONCLUSION

STACK EMISSION MEASUREMENT SURVEY
PRIMA INDUSTRIAL HOLDINGS, BENONI
31 JULY TO 15 AUGUST 2013

1.1. SYNOPSIS

This Stack Emission Measurement Survey (SEMS) was conducted on 31 July to 15 August 2013 at Prima Industrial Holdings, Benoni. The main purpose of this SEMS was to quantify the particulate and gaseous emissions from selected point sources located within the Prima Industrial Holdings works, to determine legal compliance and to provide recommendations for mitigation measures where applicable.

Particulate and Gaseous results:
The furnaces located at the Prima Industrial Holdings, Benoni are small (less than 5 ton capacity), and therefore the results reflected in this report fall below the limits stipulated by NEM:AQA.

Particulate and Gaseous emissions from the Furnace 1 Stack conform to all permissible limits for particulate and gaseous emissions stipulated by NEM:AQA.

1.2. RESULTS SUMMARY

The results for the measured pollutants of concern from all stacks are summarized and tabulated below. The results are evaluated against the gaseous and particulate limits stipulated by NEM: AQA.

Table 1.2.1.: Average Measured Emissions – Furnace 1 Stack

Stack Name	Oxides of Sulphur (SO_2)			Oxides of Nitrogen (NO_2)			Particulate Matter (PM)			Comments
	Average Emission Rate (mg/Nm^3)	Existing Permissible Emission Rate (mg/Nm^3)	Future Permissible Emission Rate (mg/Nm^3)	Average Emission Rate (mg/Nm^3)	Existing Permissible Emission Rate (mg/Nm^3)	Future Permissible Emission Rate (mg/Nm^3)	Average Emission Rate (mg/Nm^3)	Existing Permissible Emission Rate (mg/Nm^3)	Future Permissible Emission Rate (mg/Nm^3)	
Furnace A1	45.68	400	400	53.66	1200	400	<0.01*	100	30	Conforms to the NEM:AQA requirements
Furnace A2	18.12	400	400	53.65	1200	400	<0.01*	100	30	Conforms to the NEM:AQA requirements
10 Ton Furnace	33.16	400	400	75.03	1200	400	0.48	100	30	Conforms to the NEM:AQA requirements

Legend:

* - Below detection limit

mg/Nm^3 - Milligrams per normal cubic metre

NEM:AQA - National Environmental Management Air Quality Act (No 39 of 2004)

2.0. PURPOSE AND METHODOLOGY

2.1. INTRODUCTION

This Stack Emissions Measurement Survey was performed on 31 July to 15 August 2013 at Prima Industrial Holdings, Benoni.
The survey was initiated at the request of:

Kobus Jacobs
Prima Industrial Holdings
26 Lincoln Road
Benoni
1501
Gauteng

TEL: **+2711 421 6911**
FAX: **+2711 845 3809**
EMAIL: **k.jacobs@primaindustrial.co.za**

2.2. PURPOSE AND SAMPLING LOCATIONS

2.2.1. PURPOSE

The purpose of the survey was to determine Total Oxides of Sulphur (**SO_2**), Oxides of Nitrogen (**NO_2**) and Particulate Matter emissions from the stacks of concern at the Furnace Section of the Prima Industrial Holdings Works.

2.2.2. SAMPLING LOCATIONS

- **Furnace A1 Outlet Stack**
  The sampling position was located on the vertical round stack approximately twelve meters above ground level. At this position two 100 mm sampling ports were installed. The sampling position was not in accordance with ISO 9096:2003 in that the position was not a minimum of eight hydraulic diameters downstream from any obstructions, but was a minimum of two hydraulic diameters upstream of the stack exit. The sampling position was however in accordance with ISO 9096:2003 in that no negative flows were measured on any of the sampling lines. The sampling position was deemed to be the most practical position to perform measurements within the requirements of ISO 9096:2003 and the limitations of the plant design.

- **Furnace A2 Outlet Stack**
  The sampling position was located on the vertical round stack approximately twelve meters above ground level. At this position two 100 mm sampling ports were installed. The sampling position was not in accordance with ISO 9096:2003 in that the position was not a minimum of eight hydraulic diameters downstream from any obstructions, but was a minimum of two hydraulic diameters upstream of the stack exit. The sampling position was however in accordance with ISO 9096:2003 in that no negative flows were measured on any of the sampling lines. The sampling position was deemed to be the most practical position to perform measurements within the requirements of ISO 9096:2003 and the limitations of the plant design.

- **10 Ton Furnace Outlet Duct**
  The sampling position was located on the diagonal round stack approximately two meters above ground level. At this position two 100 mm sampling ports were installed. The sampling position was not in accordance with ISO 9096:2003 in that the position was not a minimum of eight hydraulic diameters downstream from any obstructions and not a minimum of two hydraulic diameters upstream from any obstructions. The sampling position was however in accordance with ISO 9096:2003 in that no negative flows were measured on any of the sampling lines. The sampling position was deemed to be the most practical position to perform measurements within the requirements of ISO 9096:2003 and the limitations of the plant design.

2.3. STATUTORY REQUIREMENTS

This Stack Emissions Measurement Survey was conducted in accordance with the requirements of the National Environment Management: Air Quality Act, 2004 (NEM:AQA) (Act No. 39 of 2004).

2.4. SEMS STANDARDS & STRATEGIES

Measured results were evaluated against the Listed Activities and Associated Minimum Emission Standards identified in terms of section 21 of NEM:AQA (Act No. 39 of 2004).

2.4.1. VELOCITIES, VOLUMES, TEMPERATURES AND PRESSURES

Preliminary measurements were performed making use of **ISO 9096:2003** – "Stationary Source Emissions – Manual determination of mass concentrations of particulate matter, as a guideline".

2.4.2. TOTAL PARTICULATE MATTER

All measurements performed were based on **ISO 9096:2003** – "Stationary Source Emissions – Manual determination of mass concentrations of particulate matter, as a guideline". A minimum of two particulate measurements were performed on the stack of concern.

2.4.3. OXIDES OF SULPHUR

All oxides of sulphur (**SO_2**) measurements were performed using **EPA Conditional Test Method CTM-034** - Determination of gaseous concentrations from stationary sources, using a portable flue gas analyser, as a guideline.
Measurements are taken using a calibrated portable flue gas analyser.

2.4.4. OXIDES OF NITROGEN

All oxides of nitrogen (**NO_2**) measurements were performed using **EPA Conditional Test Method CTM-034** - Determination of gaseous concentrations from stationary sources, using a portable flue gas analyser, as a guideline.
Measurements are taken using a calibrated portable flue gas analyser.

2.4.5. GAS MEASUREMENTS

All oxygen (**O_2**) and carbon dioxide (**CO_2**) measurements were performed using **EPA Conditional Test Method CTM-034** - Determination of gaseous concentrations from stationary sources using a portable flue gas analyser, as a guideline.
Measurements are taken using a calibrated portable flue gas analyser.

2.5. SURVEY METHODOLOGY & INSTRUMENTATION

2.5.1. SAMPLING EQUIPMENT

- **Particulate Matter, Velocities, Temperatures and Pressure**
  Measurements were performed using an Environmental Supply Company C-5000 Isokinetic Source Sampler with calibrated dry gas meter. *A valid calibration certificate is available on request*.

- **Oxides of Nitrogen, Oxides of Sulphur, Oxygen and Carbon Dioxide**
  Measurements were performed using an Enerac Model 500-10 calibrated portable flue gas analyser. *A valid calibration certificate is available on request.*

2.5.2. SAMPLING MEDIA

- **Total Particulate Matter (TPM)**
  High quality, pre-weighed Whatman glass-fibre 47mm disc filters were used to collect the particulate matter in the flue gas, capable of operating at temperatures of up to 500^{o}C without mass filter losses and a retention of 99.9% of particles < 0.3 µm.

- **Oxides of Sulphur**
  The samples are extracted isokinetically in line with the particulate matter, from the stack of concern, into a 10% hydrogen peroxide solution.

2.5.3. SAMPLE ANALYSIS

- **Total Particulate Matter (TPM)**
  All disc filters used were prepared, pre and post weighed by Modderfontein Laboratories, a SANAS and ISO 9000:2001 accredited laboratory. Gravimetric weighing was performed by means of a calibrated electronic micro balance, which indicates numerical values up to the fifth decimal of a gram. *A valid calibration certificate is available on request.*

- **Oxides of Nitrogen (NO_2), Oxides of Sulphur (SO_2) Oxygen (O_2) and Carbon Dioxide (CO_2)**
  All oxides of nitrogen (**NO_2**), oxygen (**O_2**) and carbon dioxide (**CO_2**) measurements were performed using a calibrated portable flue gas analyser (Enerac Model 500-10 calibrated flue gas analyser).

3.0. OBSERVATIONS

3.1. GENERAL

All measurements were performed once confirmation was received that the plant and process was running normally.

Due to maintenance and repairs that were carried out on Furnace 2 during the time of testing, only Furnace 1 was tested. The results for Furnace 1 can be used as an indication for the emissions for Furnace 2 as both furnaces are identical.

The Total results for the survey are given in Annexure A. All concentrations have been reported on a dry basis and have been normalised to 0 ^{o}C and 1013.23 mb. “Measured” refers to the actual measured temperature and pressure in the stack at the time of the measurements.

3.2. STACK SPECIFIC

- **Furnace 1 Stack**
  Two measurements are reported on Furnace 1 Stack. Stable plant conditions were maintained and no visible or measured deviations occurred.

4.0. GLOSSARY & REFERENCES

Key/legend of abbreviations and/or symbols used in this report:

Signs / symbols:

µm	-	micrometre
mg/Nm^3	-	milligrams per normal cubic metre
∅	-	diameter
>	-	larger than
<	-	smaller than
%	-	percentage
^oC	-	degrees Celsius
m/s	-	meters per second
mb	-	millibars
mm	-	millimeters

Abbreviations:

A/a

Av.	-	Average

C/c

CO_2	-	Carbon Dioxide

E/e

EPA	-	Environmental Protection Agency

I/i

ISO	-	International Organisation for Standardisation

N/n

NEM:AQA	-	National Environment Management: Air Quality Act, 2004 (Act No. 39 of 2004)
NO_X	-	Oxides of Nitrogen

O/o

O_2	-	Oxygen

P/p

PM	-	Particulate Matter

S/s

SEMS	-	Stack Emissions Measurement Survey
SO_2	-	Oxides of Sulphur

T/t

TPM	-	Total Particulate Matter

U/u

US	-	United States

REFERENCES

- ISO 9096:2003 – Manual determination of mass concentration of particulate matter.
- US EPA Method 5 – Determination of particulate matter emissions from stationary sources.
- US EPA Method 17 – Determination of particulate matter emissions from stationary sources.
- US EPA CTM 034 – Determination of gaseous emissions from stationary sources using a portable flue gas analyser (Conditional Test Method)

ANNEXURE A:
TOTAL PARTICULATE AND GASEOUS RESULTS

Isokinetic Test Results		Prima Industrial Complex			10 Ton Furnace	
			1		2	
Parameter	Date	Start Time	15-Aug-13	22:08	15-Aug-13	0:22
		Stop Time		22:49		23:12
			Measured Result	Calculated Result	Measured Result	Calculated Result
CO_2	%	Kg/Nm^3	0.00	0.00	0.00	0.00
O_2	%	Kg/Nm^3	21.00	0.30	21.00	0.30
Absolute Pressure		mb		846.72		846.72
Moisture Content	%			-0.13		-0.23
Gas Temperature	Deg C	K	22.60	295.75	29.00	302.15
Duct/Stack Diameter	m	m^2	0.87	0.59	0.87	0.59
Velocity Head	mb		0.54		0.54	
Sampling Time	Sec		2400		2400	
Gas Velocity		m/s		10.39		10.57
Gas Volume (Actual)		m^3/s		6.18		6.28
Gas Volume NTP (Wet)		Nm^3/s (wet)		4.77		4.74
Gas Volume (NTP (Dry)		Nm^3/s (dry)		4.77		4.76
Nozzel Diameter	mm	m^2	8.00	0.0000503	8.00	0.0000503
Sampled Volume (Dry)		m^3		1.19		1.31
Sampled Volume NTP (Dry)		Nm^3		0.92		0.99
Dust Collected	mg		0.53		0.37	
Dust Burden (Dry)		mg/m^3		0.44		0.28
Dust Burden NTP (Dry)		mg/Nm^3		0.58		0.37
Sampled Volume (Wet)		m^3		1.19		1.30
Sampled Volume NTP (Wet)		Nm^3		0.92		0.98
Dust Burden (Wet)		mg/m^3		0.44		0.28
Dust Burden NTP (Wet)		mg/Nm^3		0.58		0.38
Dust Emission Rate		mg/s		2.75		1.78
SO_2 Collected	mg		21.30		42.50	
SO_2 Burden (Dry)		mg/m^3		17.84		32.54
SO_2 Burden NTP (Dry)		mg/Nm^3		23.11		43.07
SO_2 Burden (Wet)		mg/m^3		17.86		32.61
SO_2 Burden NTP (Wet)		mg/Nm^3		23.15		43.17
SO_2 Emission Rate		mg/s		110.34		204.81
NO_2 Collected	mg		68.00		75.00	
NO_2 Burden (Dry)		mg/m^3		56.95		57.42
NO_2 Burden NTP (Dry)		mg/Nm^3		73.79		76.00
NO_2 Burden (Wet)		mg/m^3		57.03		57.55
NO_2 Burden NTP (Wet)		mg/Nm^3		73.89		76.18
NO_2 Emission Rate		mg/s		352.25		361.43

Isokinetic Percentage		%		95.13		102.25
DGM Volume Caluclated	m^3	Nm^3	1.25	0.97	1.27	0.96

Isokinetic Test Results			Prima Industrial Complex			Furnace A1 Outlet
			1		2	
Parameter	Date	Start Time	31-Jul-13	14:05	31-Jul-13	15:24
		Stop Time		14:45		16:04
			Measured Result	Calculated Result	Measured Result	Calculated Result
CO_2	%	Kg/Nm^3	0.00	0.00	0.00	0.00
O_2	%	Kg/Nm^3	21.00	0.30	21.00	0.30
Absolute Pressure		mb		864.08		864.08
Moisture Content	%			0.27		-0.36
Gas Temperature	Deg C	K	32.67	305.82	35.89	309.04
Duct/Stack Diameter	m	m^2	0.85	0.57	0.85	0.57
Velocity Head	mb		0.22		0.22	
Sampling Time	Sec		2160		2160	
Gas Velocity		m/s		6.68		6.69
Gas Volume (Actual)		m^3/s		3.79		3.80
Gas Volume NTP (Wet)		Nm^3/s (wet)		2.89		2.86
Gas Volume (NTP (Dry)		Nm^3/s (dry)		2.88		2.87
Nozzel Diameter	mm	m^2	8.00	0.0000503	8.00	0.0000503
Sampled Volume (Dry)		m^3		0.72		0.73
Sampled Volume NTP (Dry)		Nm^3		0.55		0.55
Dust Collected	mg		<0.01		<0.01	
Dust Burden (Dry)		mg/m^3		<0.01		<0.01
Dust Burden NTP (Dry)		mg/Nm^3		<0.01		<0.01
Sampled Volume (Wet)		m^3		0.73		0.73
Sampled Volume NTP (Wet)		Nm^3		0.55		0.55
Dust Burden (Wet)		mg/m^3		<0.01		<0.01
Dust Burden NTP (Wet)		mg/Nm^3		<0.01		<0.01
Dust Emission Rate		mg/s		<0.01		<0.01
SO_2 Collected	mg		10.00		40.10	
SO_2 Burden (Dry)		mg/m^3		13.82		55.03
SO_2 Burden NTP (Dry)		mg/Nm^3		18.14		73.01
SO_2 Burden (Wet)		mg/m^3		13.78		55.23
SO_2 Burden NTP (Wet)		mg/Nm^3		18.09		73.28
SO_2 Emission Rate		mg/s		52.23		209.72
NO_2 Collected	mg		27.00		32.00	
NO_2 Burden (Dry)		mg/m^3		37.30		43.92
NO_2 Burden NTP (Dry)		mg/Nm^3		48.97		58.26
NO_2 Burden (Wet)		mg/m^3		37.20		44.07
NO_2 Burden NTP (Wet)		mg/Nm^3		48.84		58.47
NO_2 Emission Rate		mg/s		141.03		167.35

Isokinetic Percentage		%		100.06		99.93
DGM Volume Caluclated	m^3	Nm^3	0.73	0.55	0.73	0.55

Isokinetic Test Results			Prima Industrial Complex			Furnace A2 Outlet
			1		2	
Parameter	Date	Start Time	31-Jul-13	10:38	31-Jul-13	11:50
		Stop Time		11:18		12:31
			Measured Result	Calculated Result	Measured Result	Calculated Result
CO_2	%	Kg/Nm^3	0.00	0.00	0.00	0.00
O_2	%	Kg/Nm^3	21.00	0.30	21.00	0.30
Absolute Pressure		mb		864.08		863.98
Moisture Content	%			-0.11		0.67
Gas Temperature	Deg C	K	22.33	295.48	25.00	298.15
Duct/Stack Diameter	m	m^2	1.10	0.95	1.10	0.95
Velocity Head	mb		1.07		1.05	
Sampling Time	Sec		2160		2160	
Gas Velocity		m/s		14.55		14.44
Gas Volume (Actual)		m^3/s		13.83		13.73
Gas Volume NTP (Wet)		Nm^3/s (wet)		10.90		10.72
Gas Volume (NTP (Dry)		Nm^3/s (dry)		10.92		10.65
Nozzel Diameter	mm	m^2	6.00	0.0000283	6.00	0.0000283
Sampled Volume (Dry)		m^3		0.89		0.89
Sampled Volume NTP (Dry)		Nm^3		0.70		0.70
Dust Collected	mg		<0.01		<0.01	
Dust Burden (Dry)		mg/m^3		<0.01		<0.01
Dust Burden NTP (Dry)		mg/Nm^3		<0.01		<0.01
Sampled Volume (Wet)		m^3		0.89		0.90
Sampled Volume NTP (Wet)		Nm^3		0.70		0.70
Dust Burden (Wet)		mg/m^3		<0.01		<0.01
Dust Burden NTP (Wet)		mg/Nm^3		<0.01		<0.01
Dust Emission Rate		mg/s		<0.01		<0.01
SO_2 Collected	mg		9.40		15.90	
SO_2 Burden (Dry)		mg/m^3		10.55		17.84
SO_2 Burden NTP (Dry)		mg/Nm^3		13.38		22.83
SO_2 Burden (Wet)		mg/m^3		10.52		17.89
SO_2 Burden NTP (Wet)		mg/Nm^3		13.35		22.90
SO_2 Emission Rate		mg/s		86.97		146.35
NO_2 Collected	mg		36.00		39.00	
NO_2 Burden (Dry)		mg/m^3		40.39		43.75
NO_2 Burden NTP (Dry)		mg/Nm^3		51.24		56.00
NO_2 Burden (Wet)		mg/m^3		40.31		43.88
NO_2 Burden NTP (Wet)		mg/Nm^3		51.13		56.16
NO_2 Emission Rate		mg/s		333.09		358.97

Isokinetic Percentage		%		100.16		101.74
DGM Volume Caluclated	m^3	Nm^3	0.89	0.70	0.88	0.69