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Date:
01 April 2020

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Ref: (12/4/12L-W4/A3)

Dear Mrs Thivhafuni

MATIMBA POWER STATION'S MONTHLY EMISSIONS REPORT FOR THE MONTH OF FEBRUARY 2020

This serves as the monthly report required in terms of Section 7.7.1 in Matimba Power Station's Atmospheric Emission License 12/4/12L-W4/A3.



Matimba Power Station
Management
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Private Bag X 215 LEPHALALE 0555 SA
Tel +27 14 763 8911 Fax +27 14 763 3616 www.eskom.co.za
Eskom Holdings SOC Ltd Reg No 2002/015527/30

Raw Materials and Products

Table 1: Quantity of Raw Materials and Products used/produced for the month.

Raw Materials and Products used	Raw Material Type	Unit	Maximum Permitted Consumption Rate (Quantity)	Consumption Rate
	Coal	Tons/month	1 500 000	1 001 992
	Fuel Oil	Tons/month	1 200	316.743
Production Rates	Product/ By-Product Name	Unit	Maximum Production Capacity Permitted (Quantity)	Production Rate
	Energy	GWh	4 212.6	2 164.848

Abatement Technology

Table 2: Abatement Equipment Control Technology utilise.

Associated Unit	Technology Type	Actual Utilisation (%)
Unit 1	Electrostatic Precipitator	99.937
Unit 2	Electrostatic Precipitator	99.916
Unit 3	Electrostatic Precipitator	99.953
Unit 4	Electrostatic Precipitator	99.824
Unit 5	Electrostatic Precipitator	99.962
Unit 6	Electrostatic Precipitator	99.933

Associated Unit	Technology Type	Actual Utilisation (%)
Unit 1	SO ₃ Plant	90
Unit 2	SO ₃ Plant	93
Unit 3	SO ₃ Plant	100
Unit 4	SO ₃ Plant	93
Unit 5	SO ₃ Plant	100
Unit 6	SO ₃ Plant	90

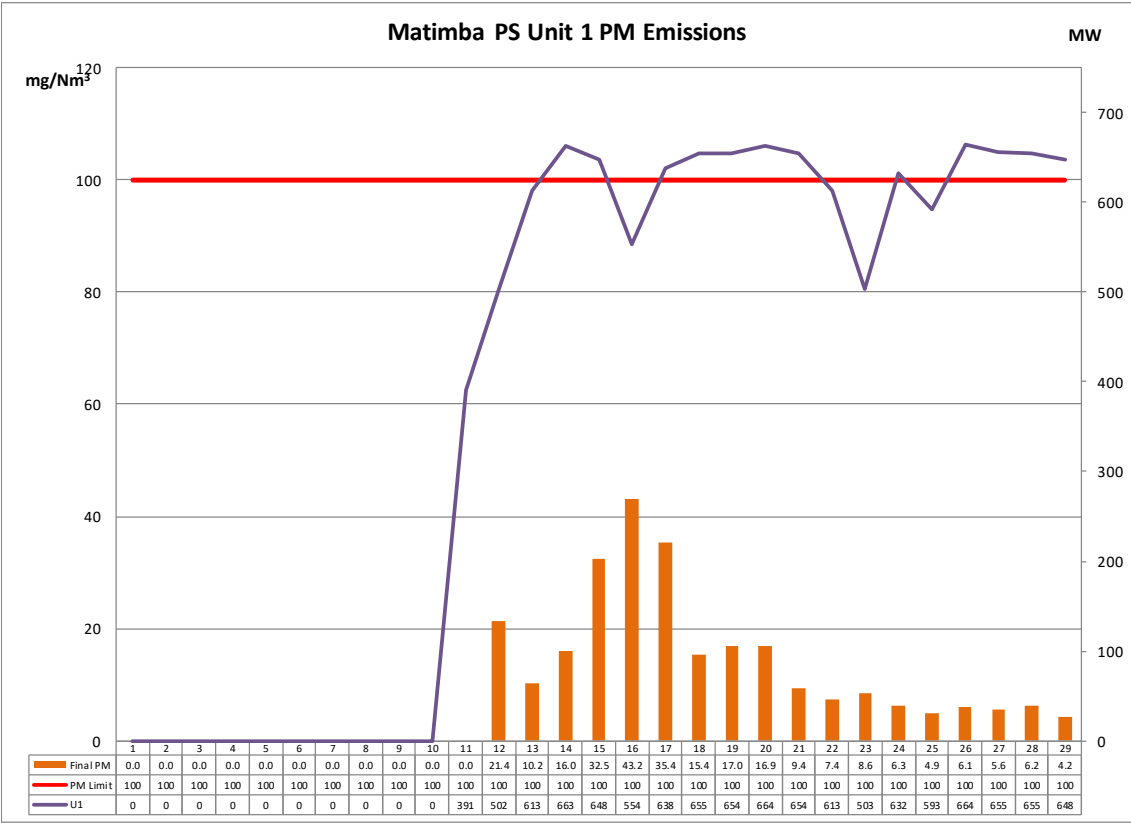
Energy Source Characteristics

Table 3: Energy Source Material Characteristics.

	Characteristic	Stipulated Range (Unit)	Monthly Average Content
Coal burned	Sulphur Content	0.8-1.6%	1.41
	Ash Content	30-40%	31.41

Emissions Reporting

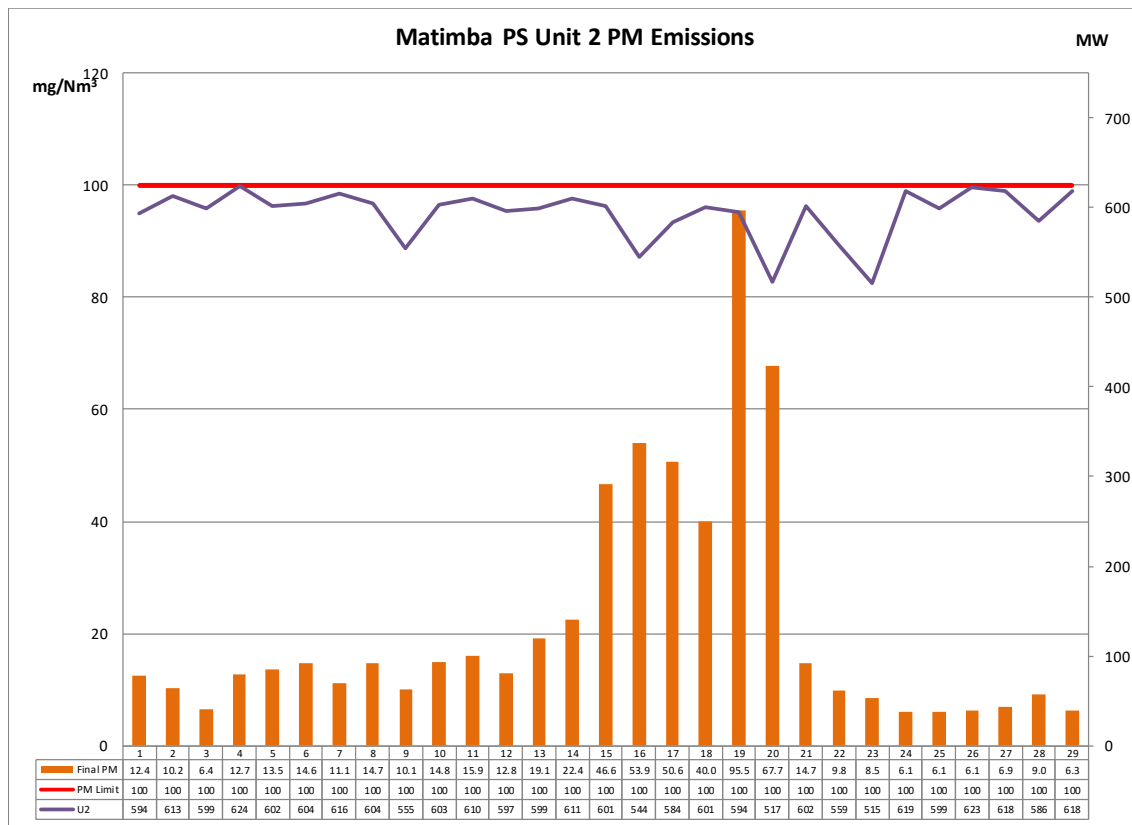
Unit 1 particulate emissions



Graph 1: Particulate matter daily average emissions against emission limit for unit 1 for the month of February 2020

Interpretation:
All daily averages below particulate emission limit of 100 mg/Nm³.

Unit 2 particulate emissions

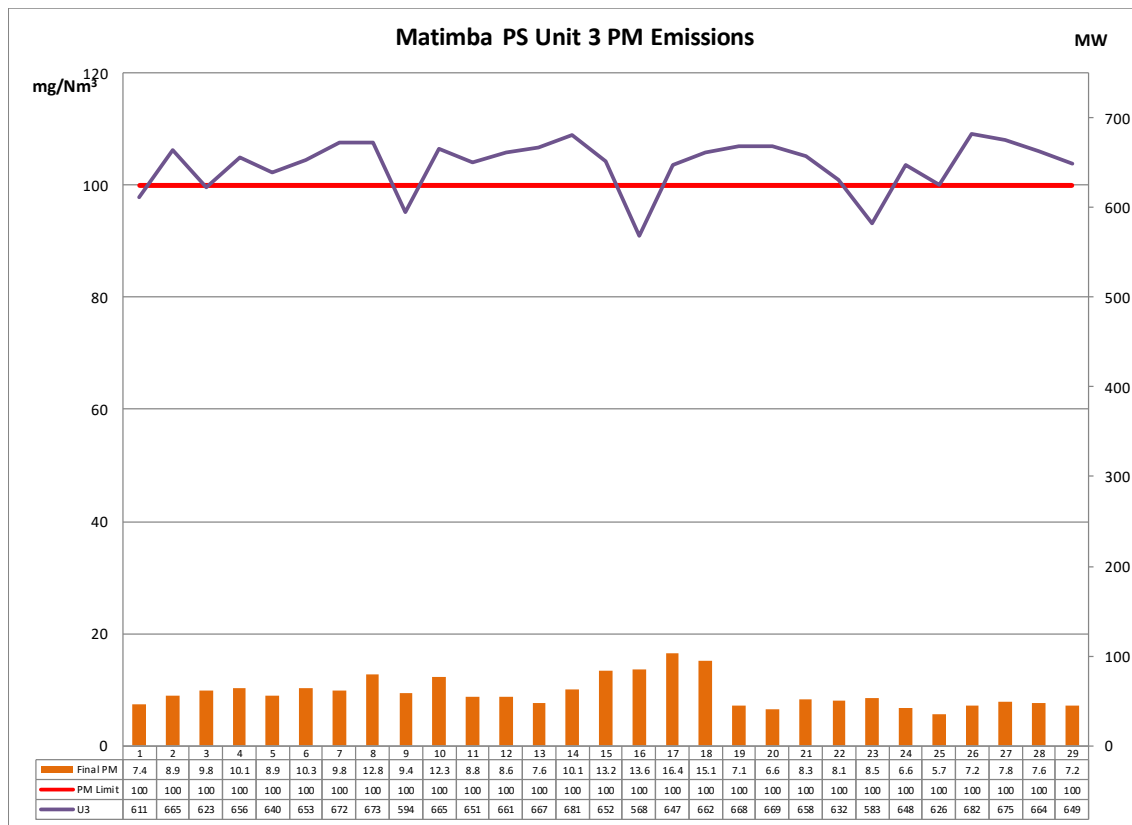


Graph 2: Particulate matter daily average emissions against emission limit for unit 2 for the month of February 2020

Interpretation:

All daily averages below particulate emission limit of 100 mg/Nm³.

Unit 3 particulate emissions

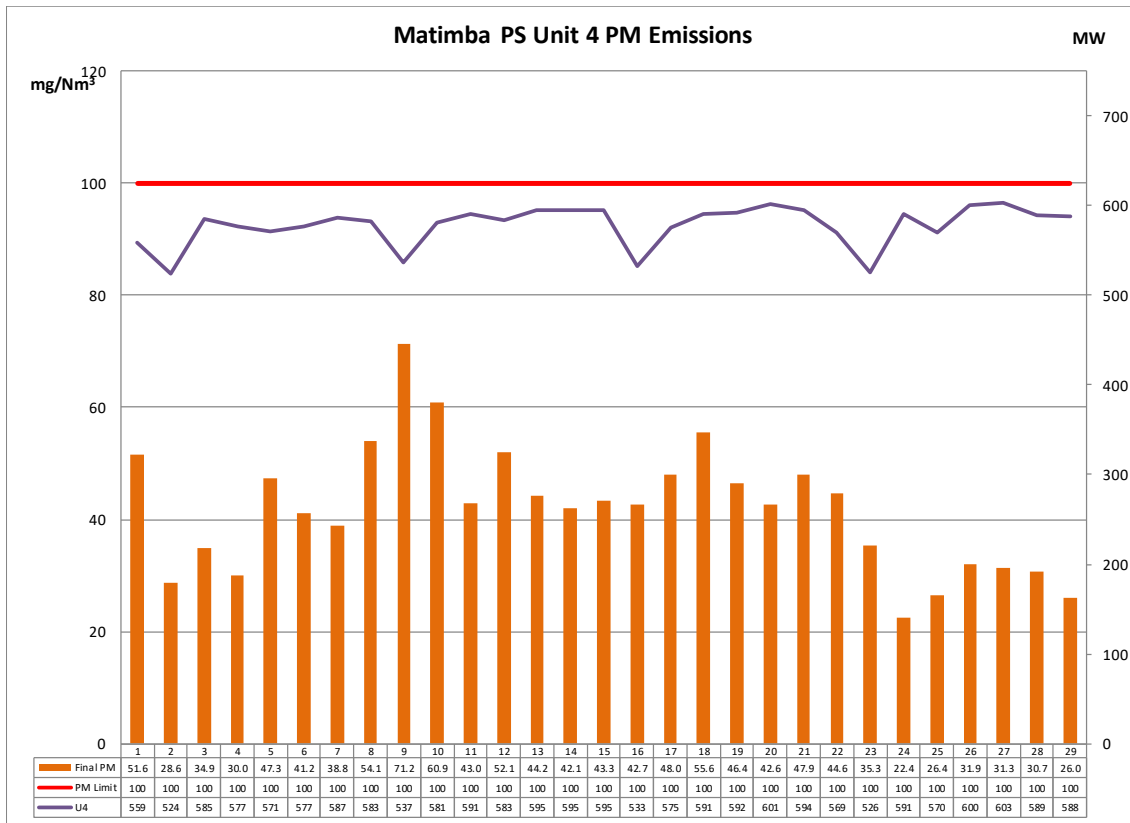


Graph 3: Particulate matter daily average emissions against emission limit for unit 3 for the month of February 2020

Interpretation:

All daily averages below particulate emission limit of 100 mg/Nm³.

Unit 4 particulate emissions

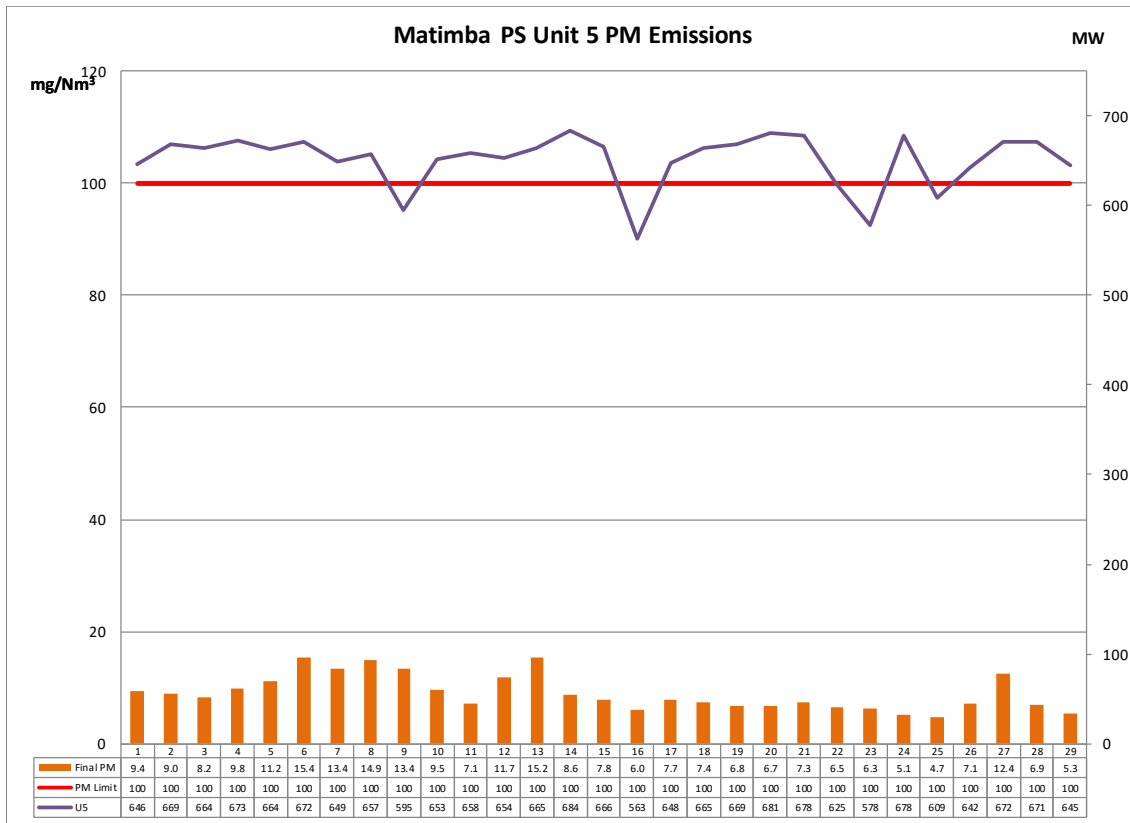


Graph 4: Particulate matter daily average emissions against emission limit for unit 4 for the month of February 2020

Interpretation:

All daily averages below particulate emission limit of 100 mg/Nm³.

Unit 5 particulate emissions

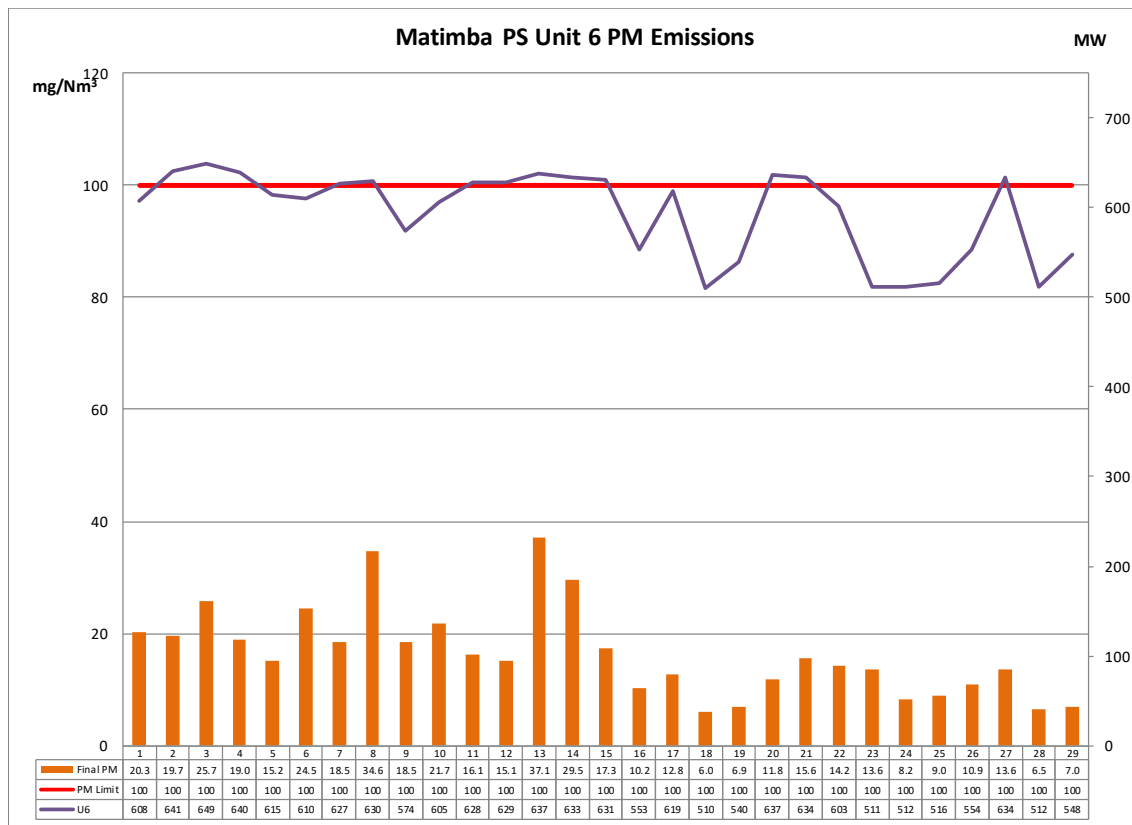


Graph 5: Particulate matter daily average emissions against emission limit for unit 5 for the month of February 2020

Interpretation:

All daily averages below particulate emission limit of 100 mg/Nm³.

Unit 6 particulate emissions

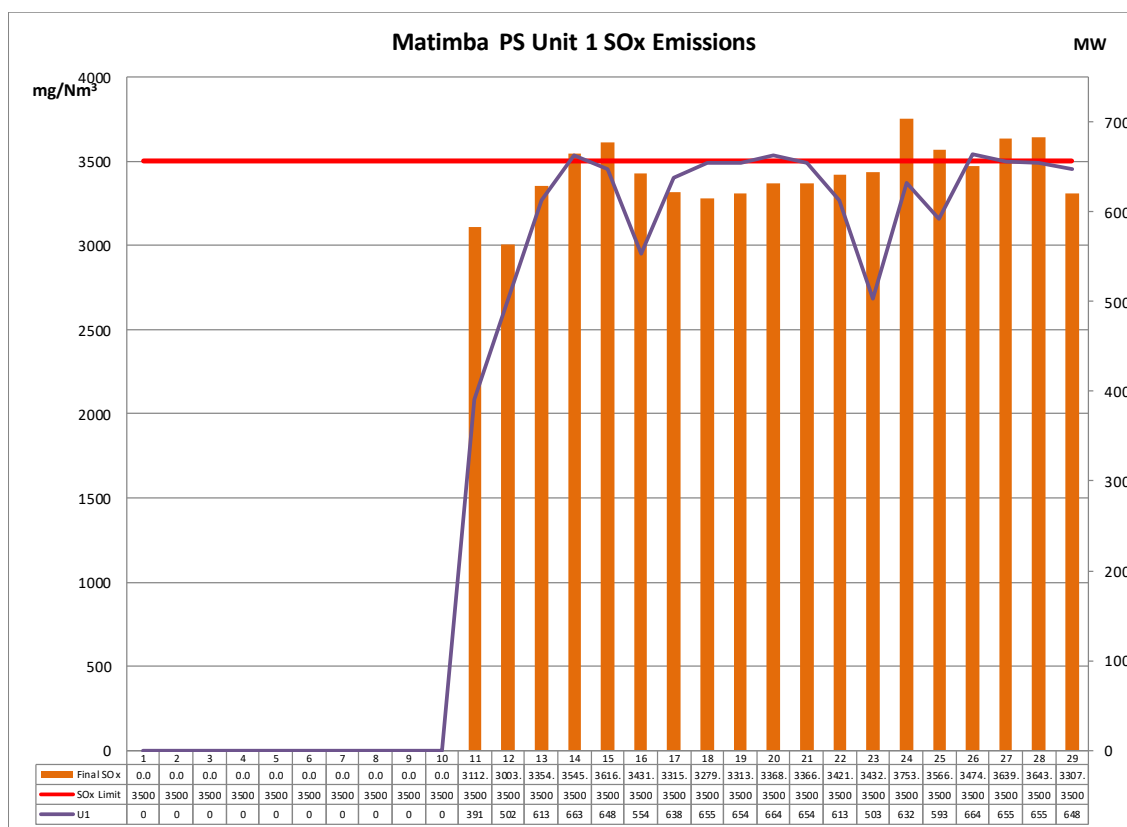


Graph 6: Particulate matter daily average emissions against emission limit for unit 6 for the month of February 2020

Interpretation:

All daily averages below particulate emission limit of 100 mg/Nm³.

Unit 1 SO₂ emissions

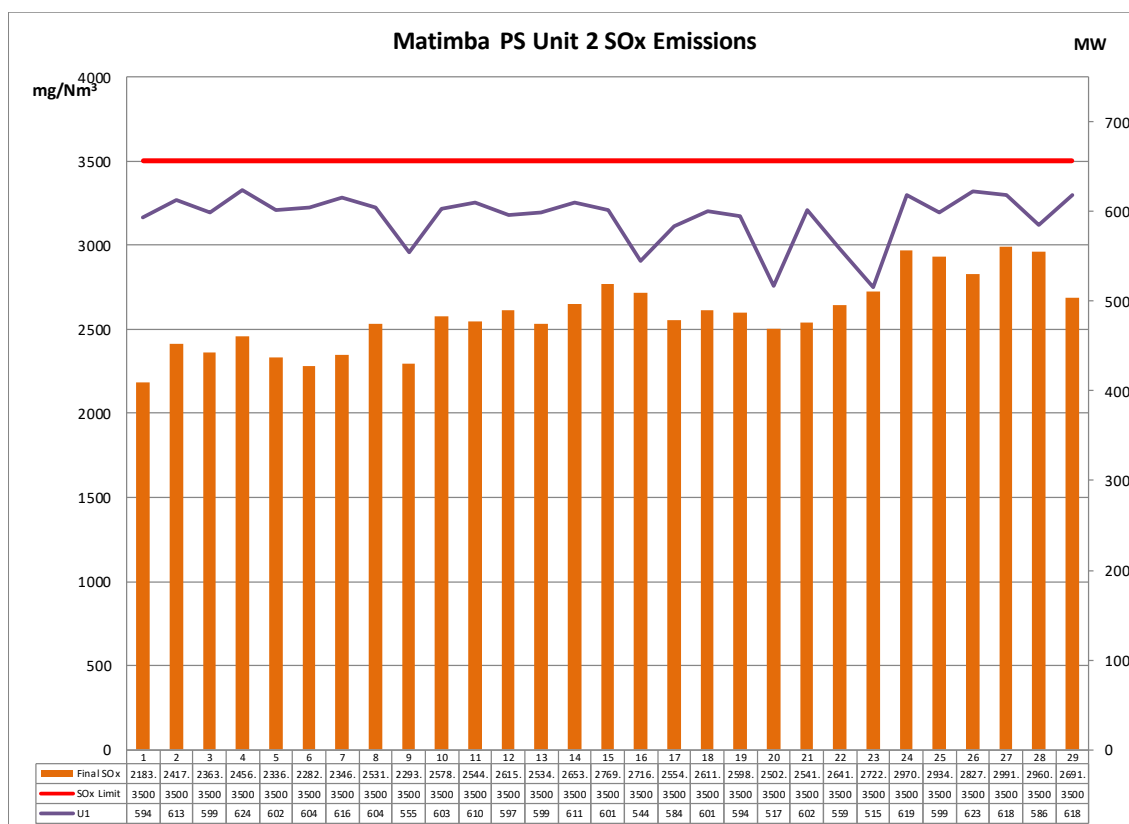


Graph 7: SO₂ daily average emissions against emission limit for unit 1 for the month of February 2020

Interpretation:

The SO₂ daily average of 3500mg/Nm³ was exceeded on the 14th, 15th, 24th, 25th, 27th and 28th of February 2020. It is suspected that the exceedances are due to an increase in the sulphur content of the coal used in the combustion process. The exceedances will be thoroughly investigated to determine the root cause.

Unit 2 SO₂ emissions

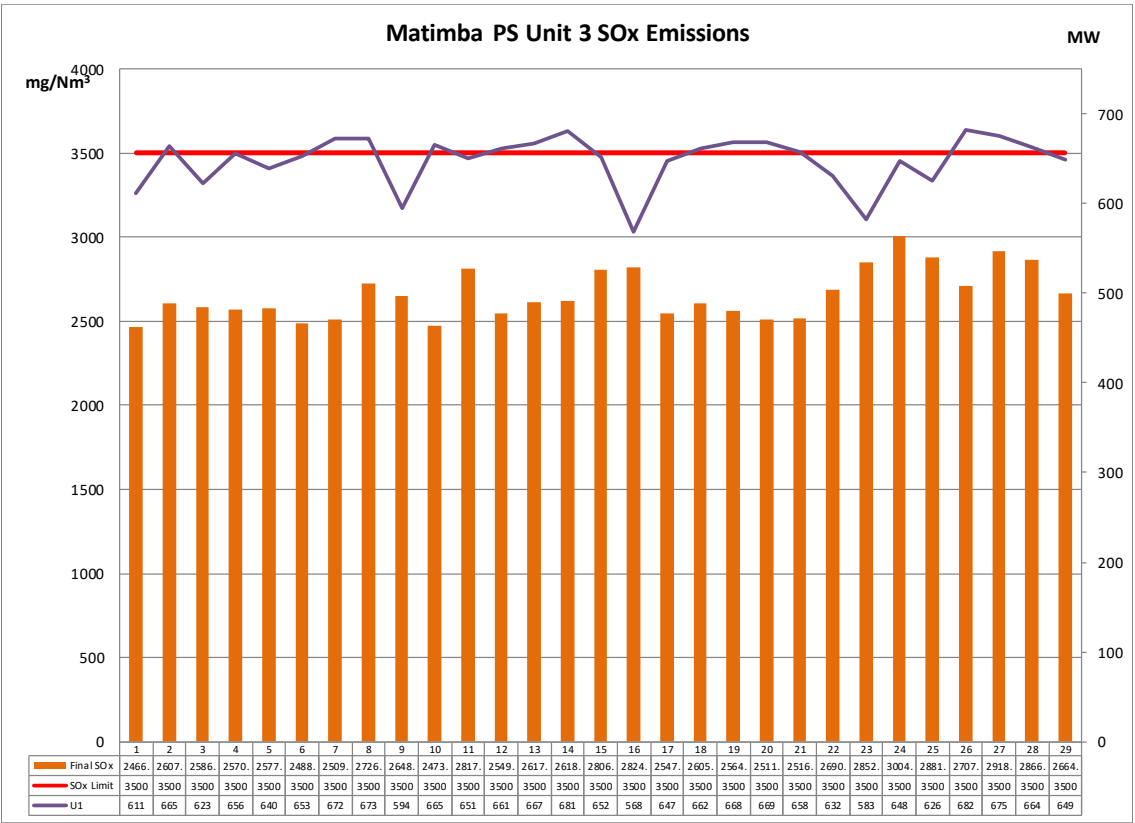


Graph 8: SO₂ daily average emissions against emission limit for unit 2 for the month of February 2020

Interpretation:

All daily averages below SO₂ emission limit of 3500 mg/Nm³.

Unit 3 SO₂ emissions

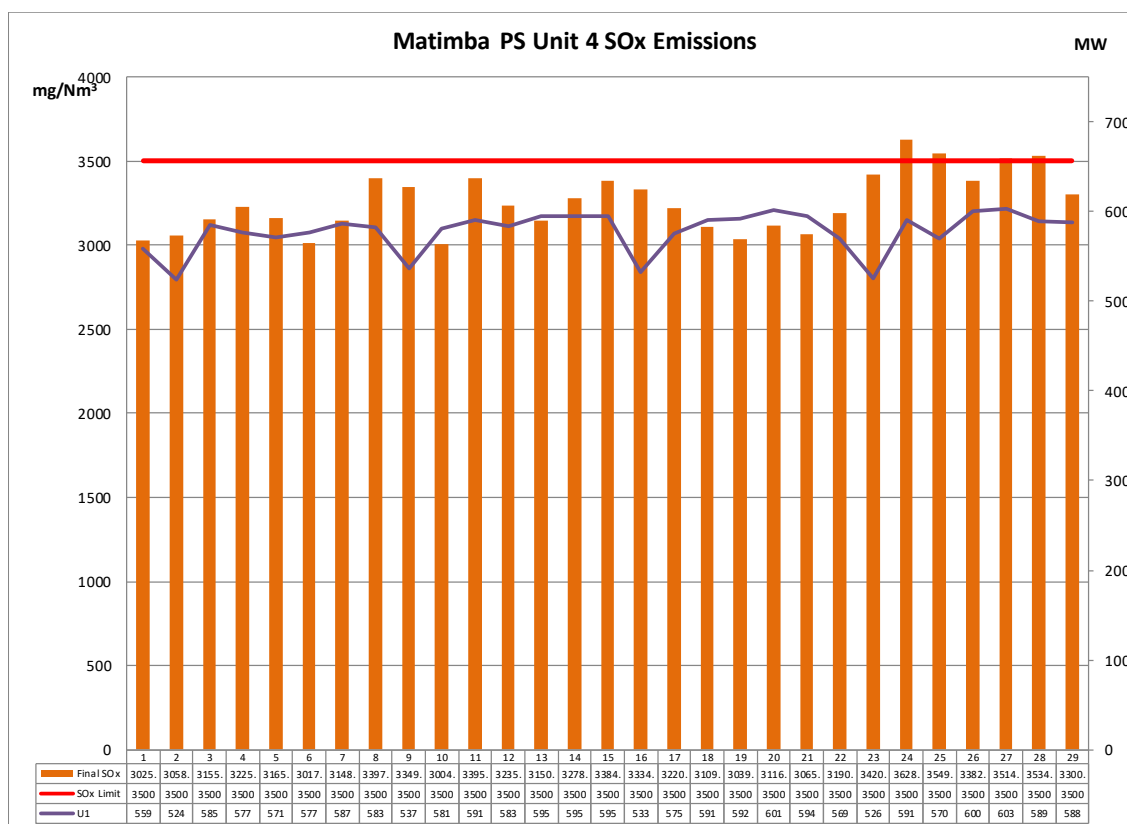


Graph 9: SO₂ daily average emissions against emission limit for unit 3 for the month of February 2020

Interpretation:

All daily averages below SO₂ emission limit of 3500 mg/Nm³.

Unit 4 SO₂ emissions

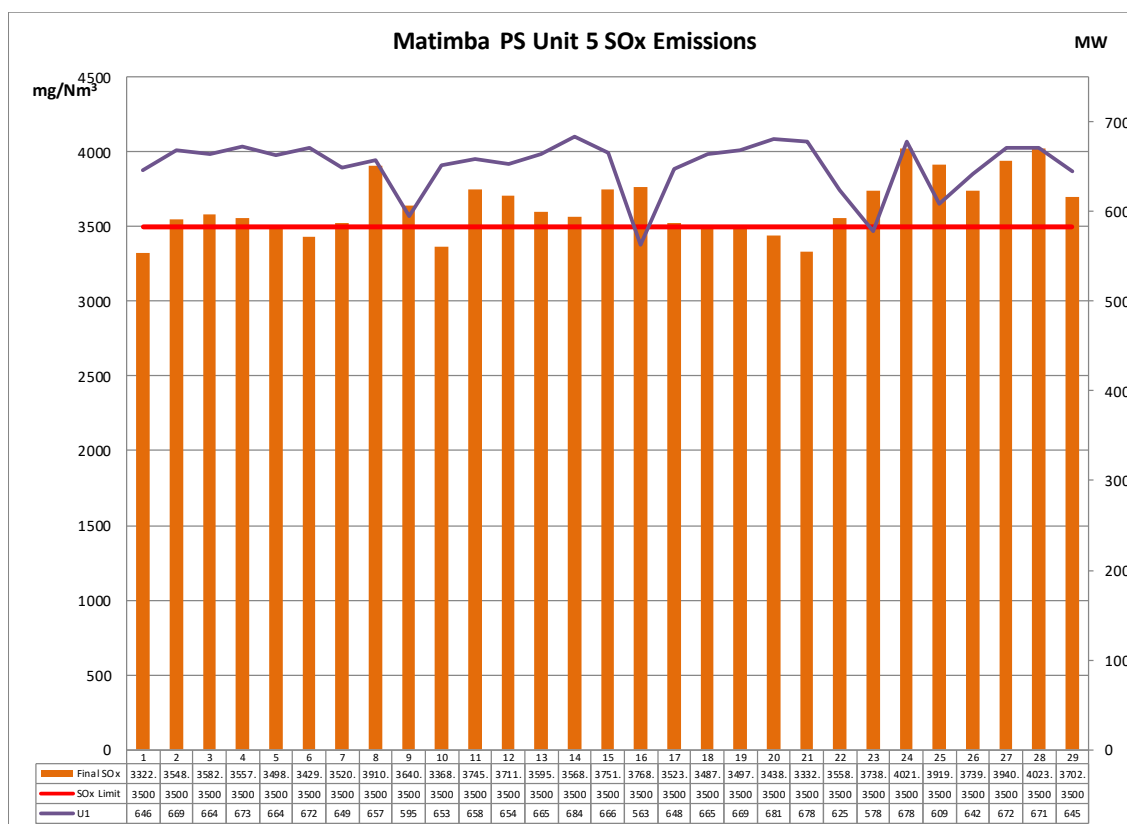


Graph 10: SO₂ daily average emissions against emission limit for unit 4 for the month of February 2020

Interpretation:

The SO₂ daily average of 3500mg/Nm³ was exceeded on the 24th, 25th, 27th and 28th of February 2020. It is suspected that the exceedances are due to an increase in the sulphur content of the coal used in the combustion process. The exceedances will be thoroughly investigated to determine the root cause.

Unit 5 SO₂ emissions



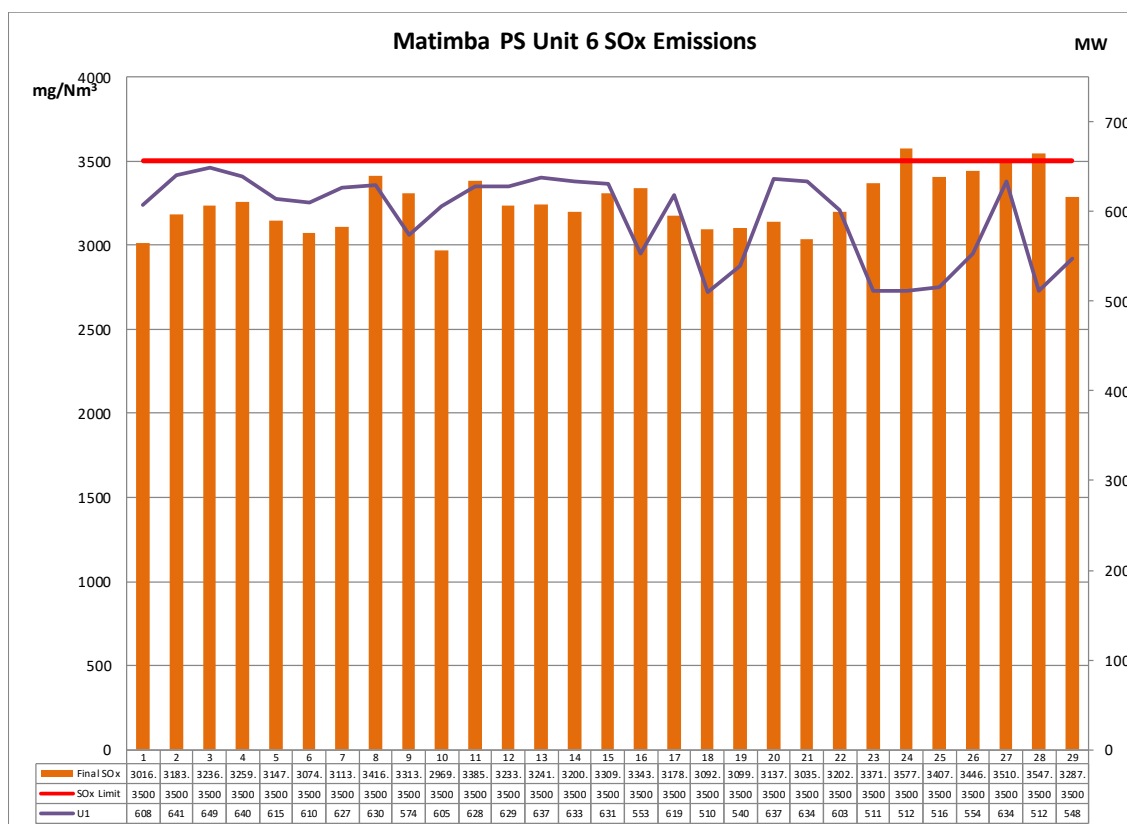
Graph 11: SO₂ daily average emissions against emission limit for unit 5 for the month of February 2020

Interpretation:

The SO₂ daily average of 3500mg/Nm³ was exceeded from the 2nd until the 4th, from the 7th until the 9th, from the 11th until the 17th and from the 22nd until the 29th of February 2020. This lead to a monthly average of 3636mg/Nm³ which exceeds the monthly average limit of 3500mg/Nm³.

It is suspected that the exceedances are due to an increase in the sulphur content of the coal used in the combustion process. The exceedances will be thoroughly investigated to determine the root cause.

Unit 6 SO₂ emissions

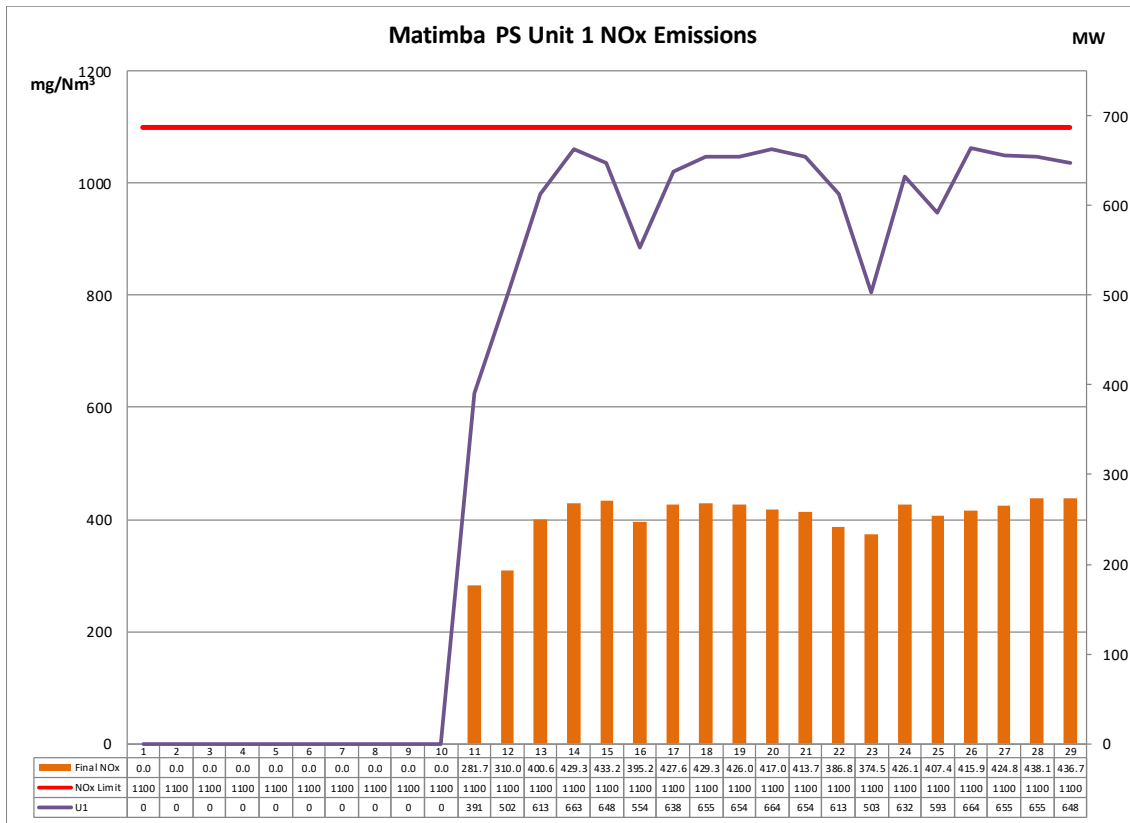


Graph 12: SO₂ daily average emissions against emission limit for unit 6 for the month of February 2020

Interpretation:

The SO₂ daily average of 3500mg/Nm³ was exceeded on the 24th and 28th of February 2020. It is suspected that the exceedances are due to an increase in the sulphur content of the coal used in the combustion process. The exceedances will be thoroughly investigated to determine the root cause.

Unit 1 NO_x emissions

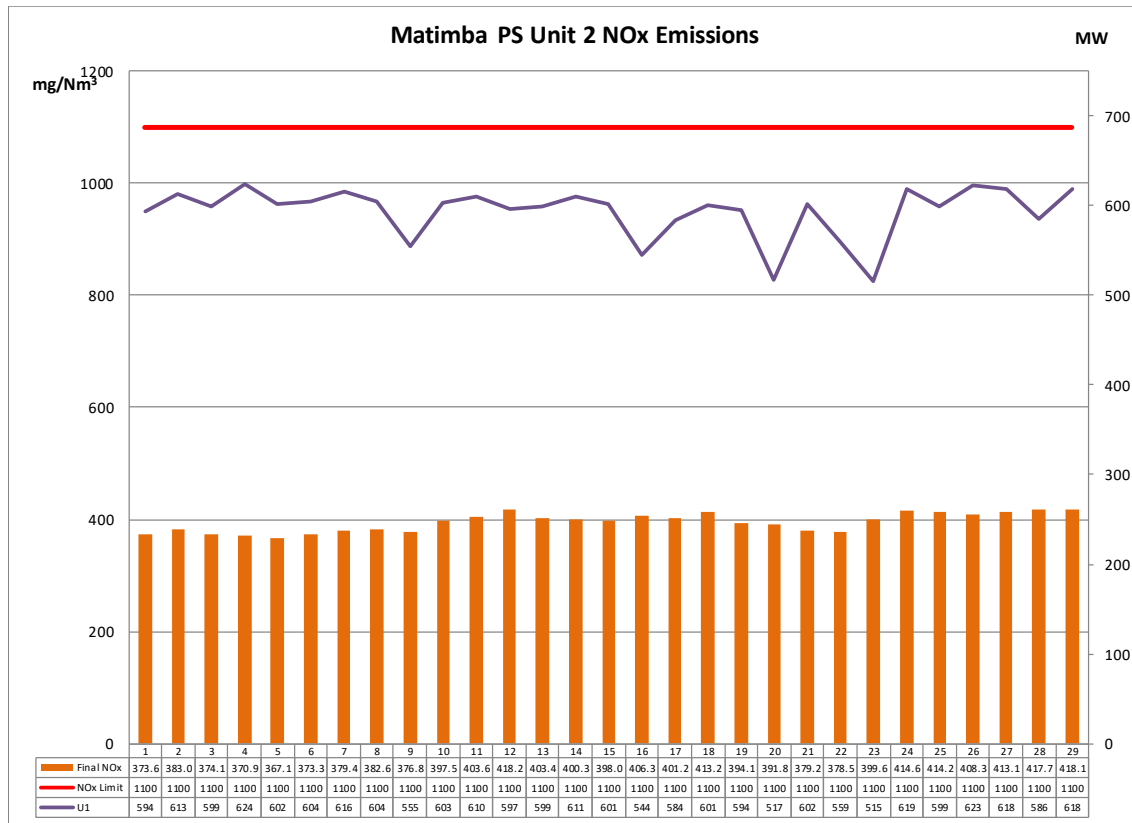


Graph 13: NO_x daily average emissions against emission limit for unit 1 for the month of February 2020

Interpretation:

All daily averages below NO_x emission limit of 1100 mg/Nm³.

Unit 2 NO_x emissions

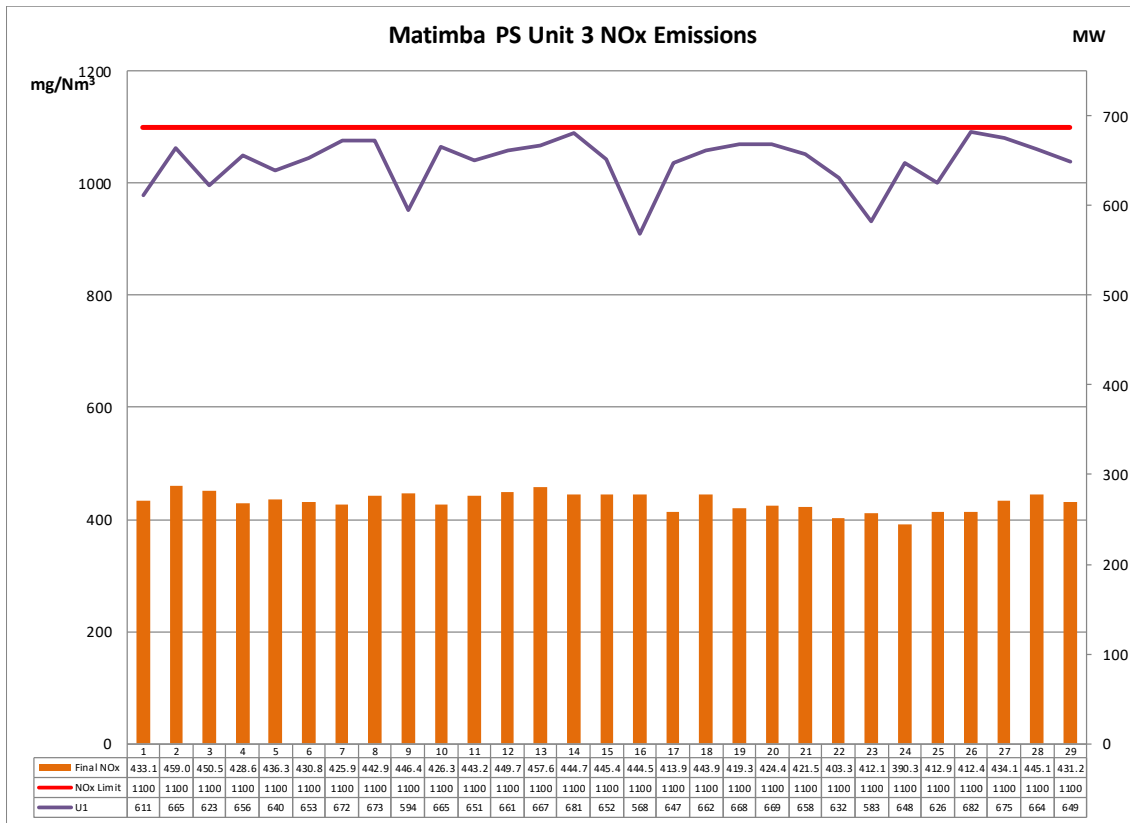


Graph 14: NO_x daily average emissions against emission limit for unit 2 for the month of February 2020

Interpretation:

All daily averages below NO_x emission limit of 1100 mg/Nm³.

Unit 3 NO_x emissions

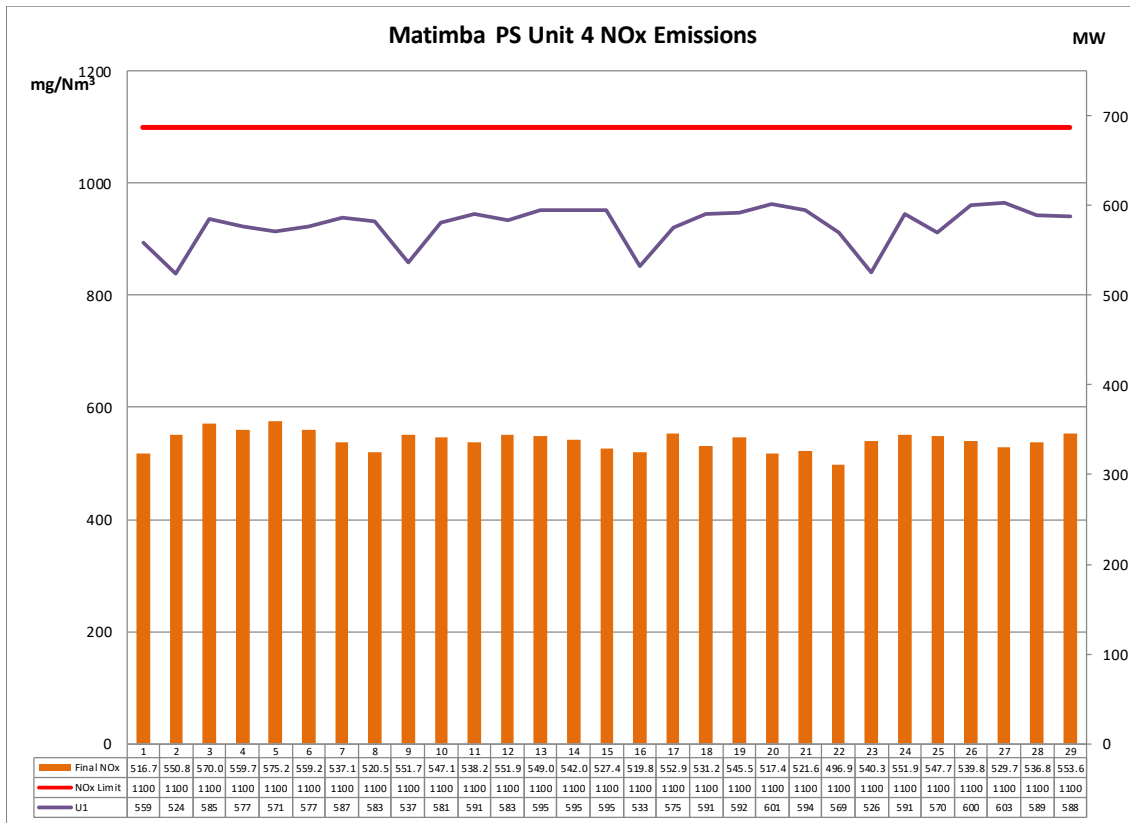


Graph 15: NO_x daily average emissions against emission limit for unit 3 for the month of February 2020

Interpretation:

All daily averages below NO_x emission limit of 1100 mg/Nm³.

Unit 4 NO_x emissions

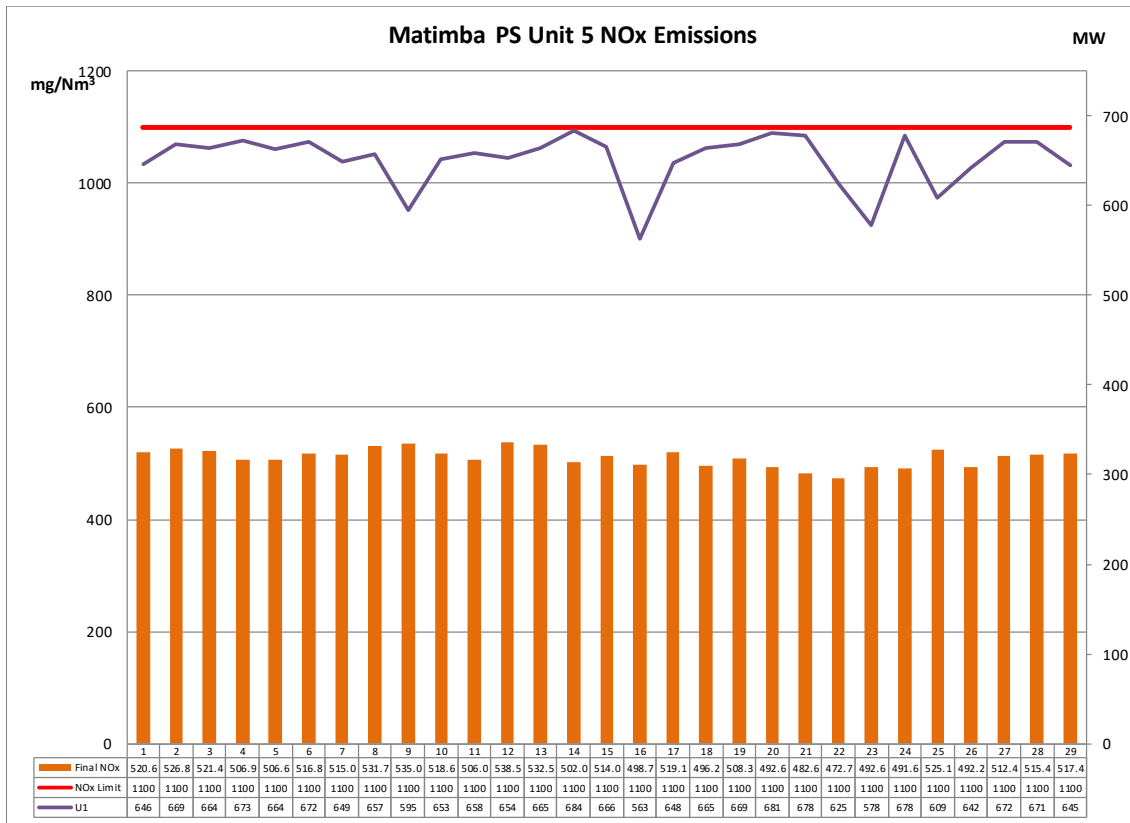


Graph 16: NO_x daily average emissions against emission limit for unit 4 for the month of February 2020

Interpretation:

All daily averages below NO_x emission limit of 1100 mg/Nm³.

Unit 5 NO_x emissions

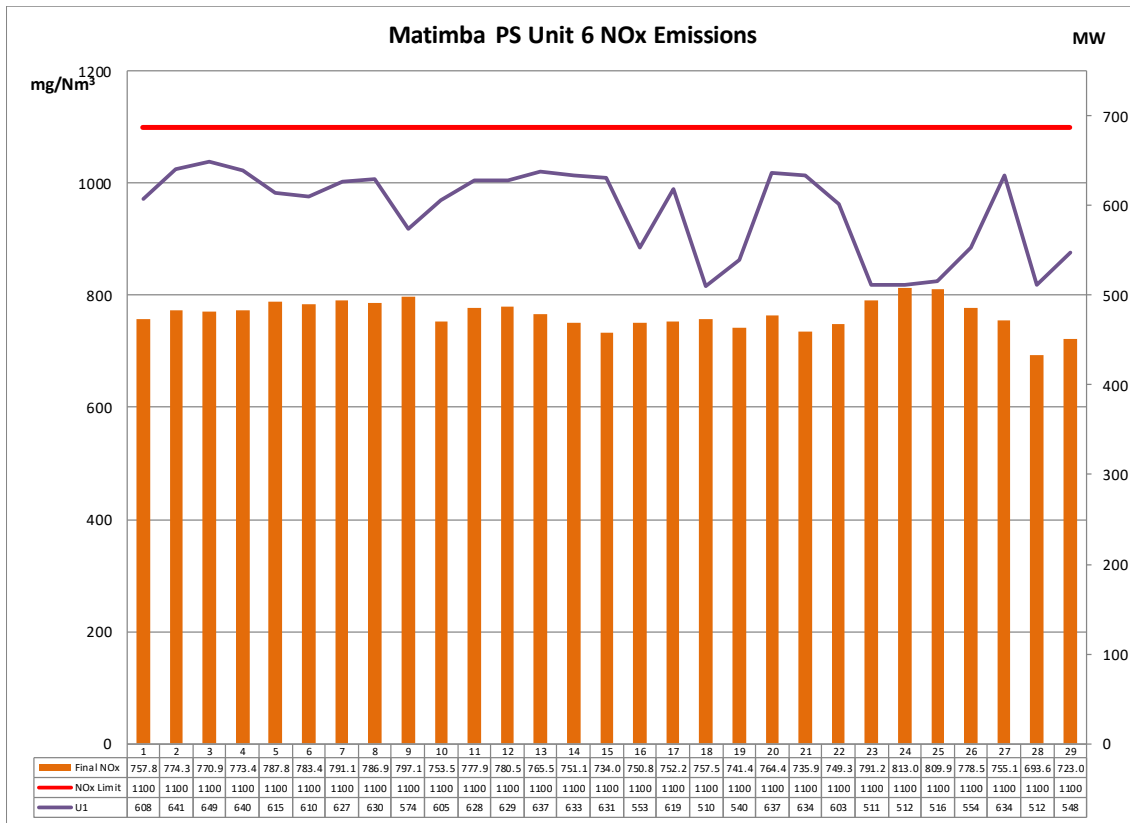


Graph 17: NO_x daily average emissions against emission limit for unit 5 for the month of February 2020

Interpretation:

All daily averages below NO_x emission limit of 1100 mg/Nm³.

Unit 6 NO_x emissions



Graph 18: NO_x daily average emissions against emission limit for unit 6 for the month of February 2020

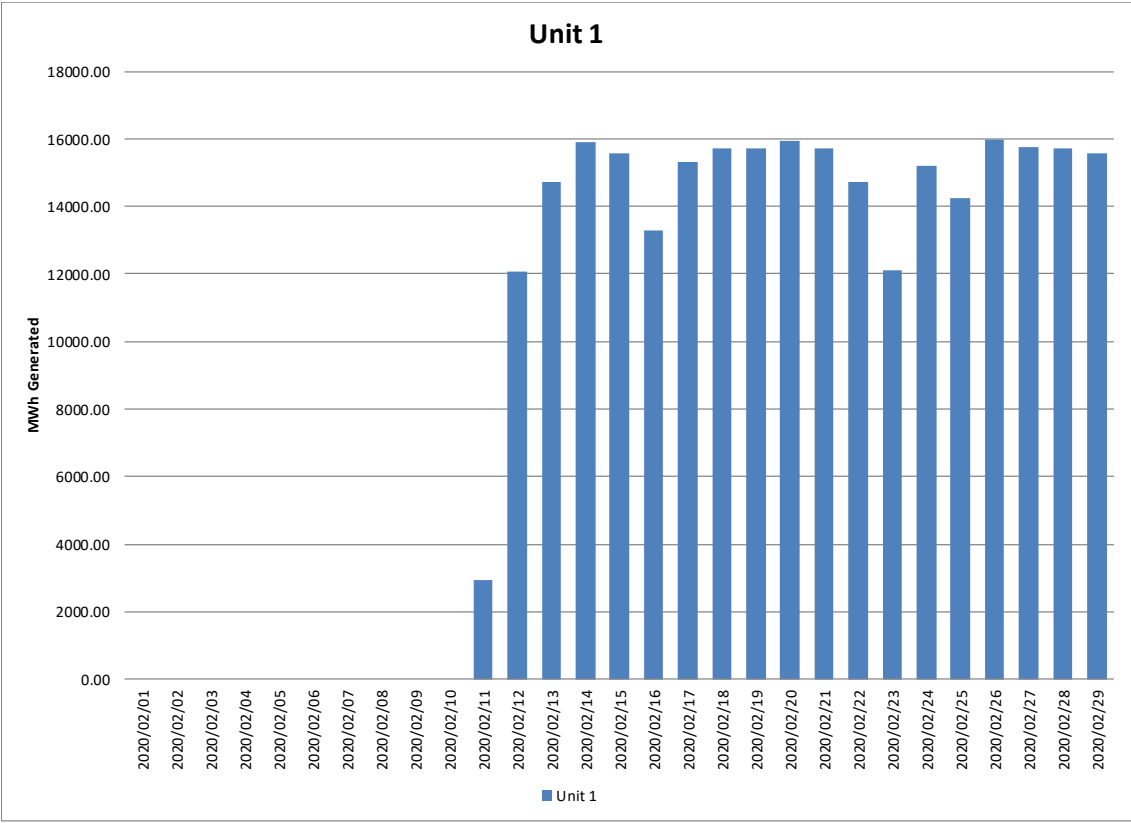
Interpretation:

All daily averages below NO_x emission limit of 1100 mg/Nm³.

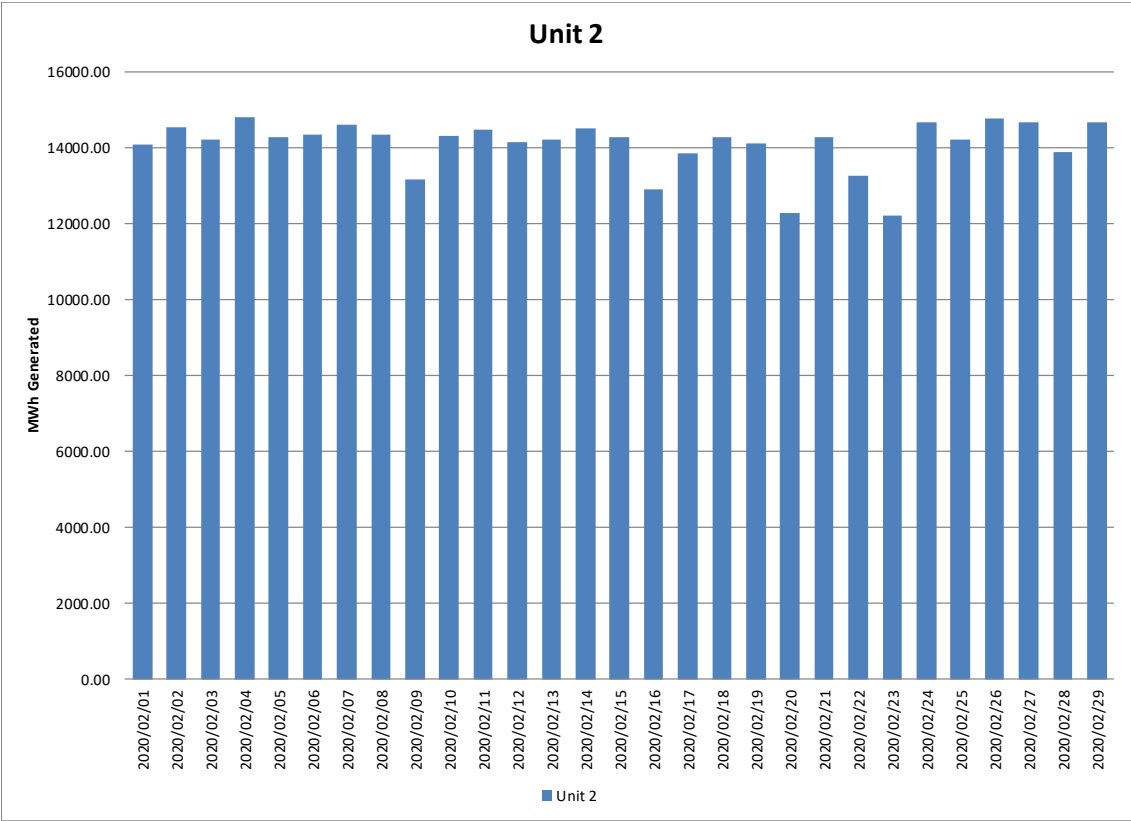
Table 4: Daily power generated per unit in MWh for the month of February 2020

Date	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
2020/02/01	0.00	14059.13	14233.53	13336.27	15365.00	14455.00
2020/02/02	0.00	14528.73	15532.87	9120.73	15918.30	15235.20
2020/02/03	0.00	14208.73	14519.73	13965.47	15812.70	15436.93
2020/02/04	0.00	14801.80	15329.27	13773.93	16018.50	15212.93
2020/02/05	0.00	14265.87	14923.93	13626.40	15788.60	14628.40
2020/02/06	0.00	14318.27	15248.87	13766.73	15988.40	14508.20
2020/02/07	0.00	14603.13	15737.07	14019.13	15455.30	14924.87
2020/02/08	0.00	14323.80	15737.33	13917.67	15633.70	14999.33
2020/02/09	0.00	13146.33	13846.47	12819.40	14163.80	13656.60
2020/02/10	0.00	14295.13	15566.53	13869.73	15528.40	14412.27
2020/02/11	2928.47	14455.40	15252.67	14112.47	15666.50	14956.27
2020/02/12	12057.27	14152.33	15493.47	13923.07	15555.80	14959.67
2020/02/13	14732.07	14191.67	15582.00	14211.20	15823.70	15169.93
2020/02/14	15920.20	14484.20	15924.80	14194.13	16284.20	15074.67
2020/02/15	15573.40	14260.47	15239.73	14198.87	15853.10	15004.80
2020/02/16	13304.80	12899.20	13231.67	12729.20	13409.10	13147.93
2020/02/17	15314.00	13840.53	15157.53	13730.47	15424.10	14716.67
2020/02/18	15737.33	14256.20	15526.80	14098.00	15818.70	12129.80
2020/02/19	15722.73	14095.20	15697.73	14127.20	15917.20	12837.67
2020/02/20	15942.33	12254.20	15706.93	14359.27	16193.50	15155.07
2020/02/21	15719.40	14279.53	15447.13	14187.93	16133.50	15076.00
2020/02/22	14731.73	13267.87	14819.20	13592.73	14865.90	14329.93
2020/02/23	12103.93	12211.87	13633.13	12551.13	13746.40	12177.40
2020/02/24	15189.47	14675.80	15200.00	14103.53	16146.30	12189.60
2020/02/25	14241.93	14198.00	14657.27	13611.60	14484.00	12267.80
2020/02/26	15961.27	14768.80	16005.13	14326.33	15273.60	13164.33
2020/02/27	15746.60	14666.47	15840.20	14388.47	15979.30	15073.13
2020/02/28	15728.47	13888.00	15561.07	14064.67	15975.20	12173.67
2020/02/29	15562.80	14664.13	15213.73	14036.53	15346.40	13020.47

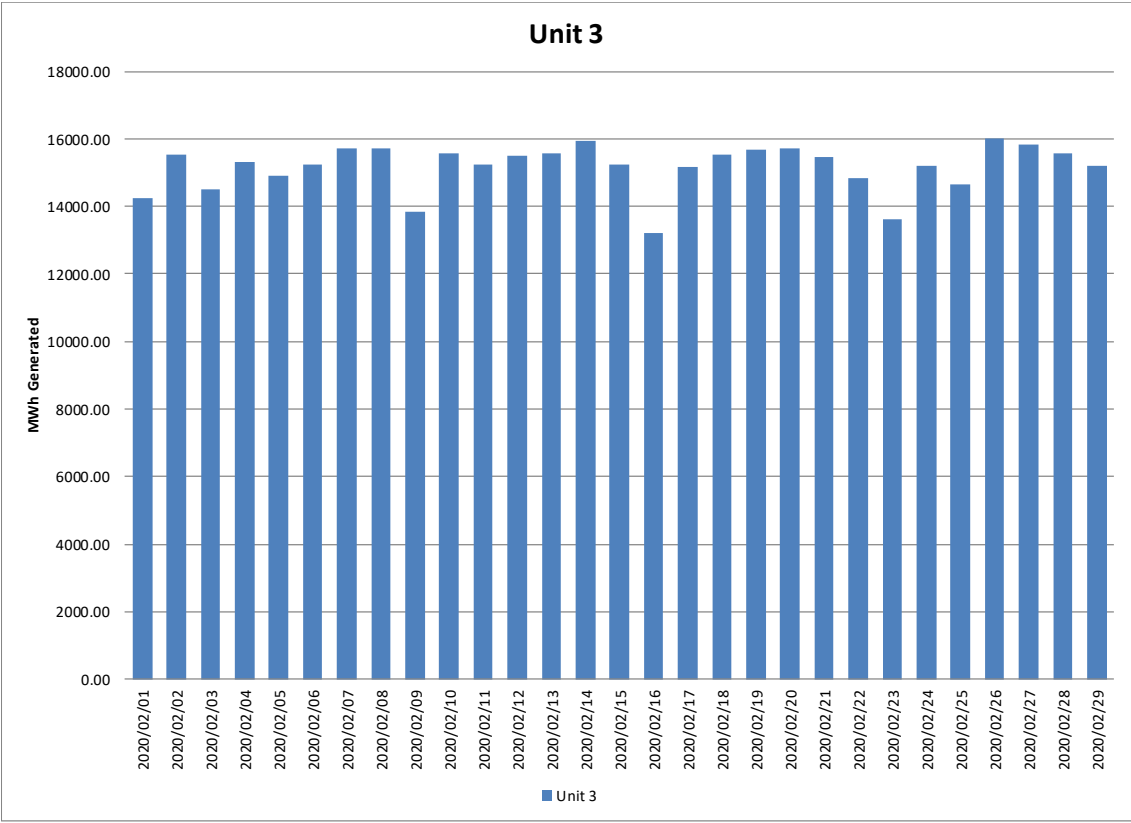
Graph 19: Unit 1 daily generated power in MWh for the month of February 2020



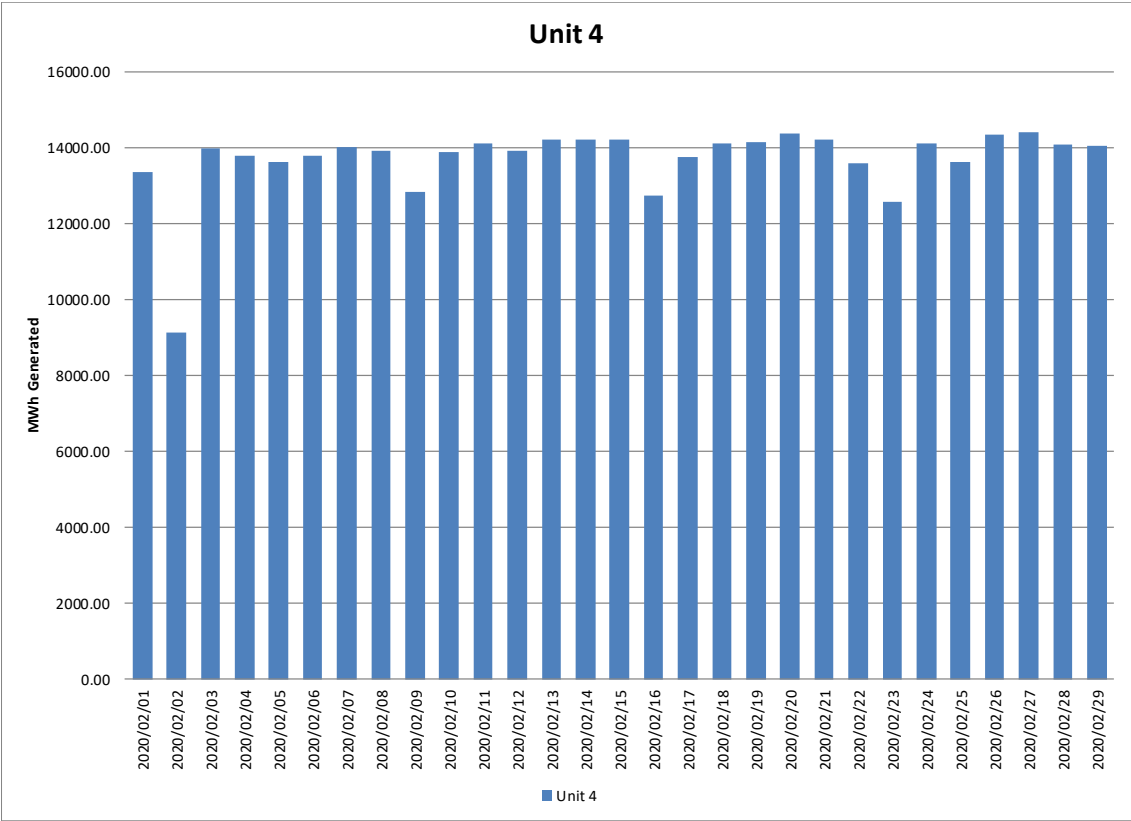
Graph 20: Unit 2 daily generated power in MWh for the month of February 2020



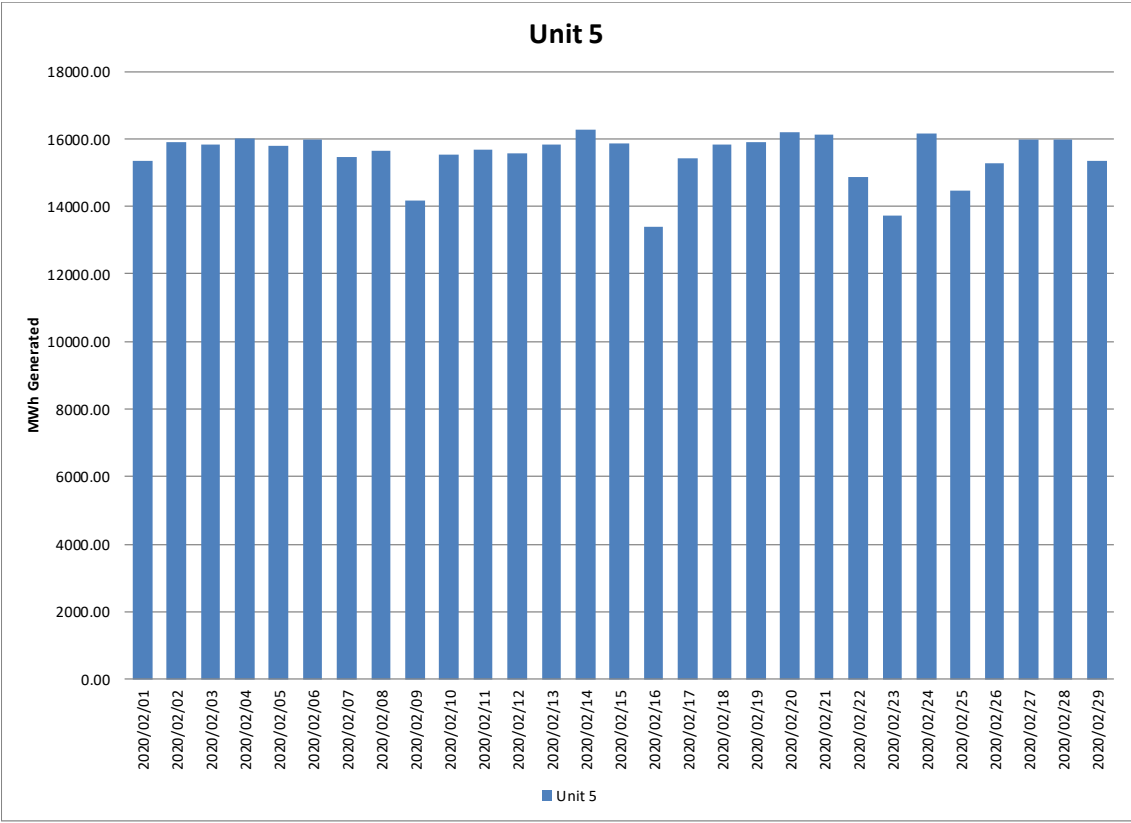
Graph 21: Unit 3 daily generated power in MWh for the month of February 2020



Graph 22: Unit 4 daily generated power in MWh for the month of February 2020



Graph 23: Unit 5 daily generated power in MWh for the month of February 2020



Graph 24: Unit 6 daily generated power in MWh for the month of February 2020

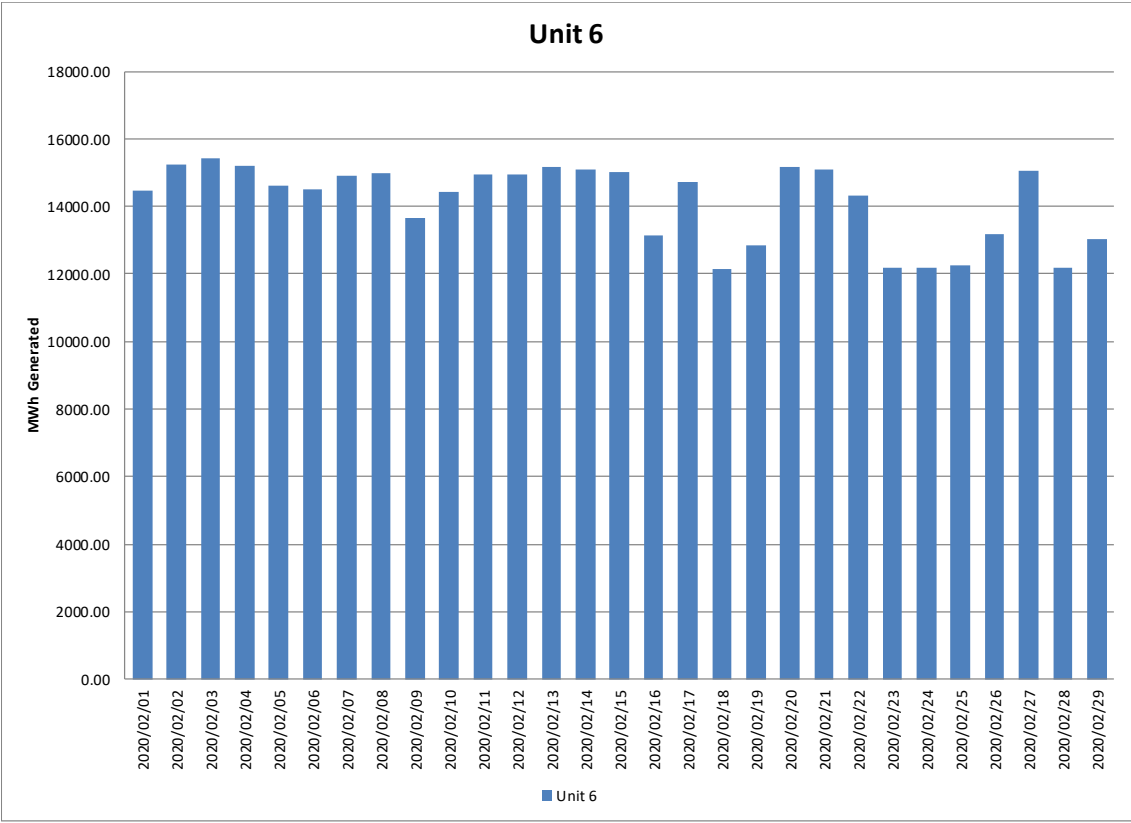


Table 5: Pollutant tonnages for the month of February 2020

Associated Unit/Stack	PM (tons)	SO ₂ (tons)	NO _x (tons)
Unit 1	20.4	4 628.2	553.0
Unit 2	41.1	6 957.5	1 061.2
Unit 3	24.4	5 566.9	904.7
Unit 4	82.1	6 676.2	1 108.9
Unit 5	20.4	8 106.3	1 139.3
Unit 6	33.4	6 743.8	1 589.6
SUM	221.8	38 678.9	6 356.7

Table 6: Reference values for data provided.

Compound / Parameter	Units of Measure	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Oxygen	%	6.12	6.00	6.87	8.50	6.62	8.65
Moisture	%	5.34	4.40	4.34	5.76	4.86	5.26
Velocity	m/s	24.9	30.8	25.8	29.0	27.2	29.5
Temperature	°C	136.7	129.6	135.0	126.5	129.5	126.1
Pressure	mBar	931.0	929.4	932.1	926.5	924.8	921.4

Start-up information.**Table 7:** Start-up information

Unit	4	
Fires in	04H07	2020-02-02
Synchronization with Grid	07H58	2020-02-02
Emissions below limit	07H58	2020-02-02
Fires in to synchronization	3.85	Hours
Synchronization to < Emission limit	0	Hours

Unit	1	
Fires in	12H55	2020-02-11
Synchronization with Grid	16H31	2020-02-11
Emissions below limit	17H04	2020-02-11
Fires in to synchronization	3.6	Hours
Synchronization to < Emission limit	0.55	Hours

Emergency Generation

Table 8: Emergency Generation.

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Emergency Generation hours declared by national Control	308	570	687	639	570	570
Emergency Hours declared including hours after stand down	201	258	570	522	258	258
Days over the Limit during Emergency Generation	0	0	0	0	0	0

Complaints Register

Table 9: Complaints.

Source Code/ Name	Root Cause Analysis	Calculation of Impacts/ emissions associated with the incident	Dispersion modeling of pollutants where applicable	Measures implemented to prevent reoccurrence	Date by which measure will be implemented
None					

Table 10: Total volatile compound estimates.


		
CALCULATION OF EMISSIONS OF TOTAL VOLATILE COMPOUNDS FROM FUEL OIL STORAGE TANKS		
Date:	Wednesday, 01 April 2020	
Station:	Matimba Power Station	
Province:	Limpopo Province	
Tank no.	1-4	
Description:	Outdoor fuel oil storage tank	
Tank Type:	Vertical fixed roof (vented to atmosphere)	
Material stored:	Fuel Oil 150	
<p align="center">MONTHLY INPUT DATA FOR THE STATION</p> <p align="center">Please only insert relevant monthly data inputs into the <u>blue cells</u> below</p> <p align="center">Choose from a dropdown menu in the <u>green cells</u></p> <p align="center">The total VOC emissions for the month are in the <u>red cells</u></p> <p align="center">IMPORTANT: Do not change <u>any</u> other cells without consulting the AQ CoE</p>		
MONTH:	February	
GENERAL INFORMATION:	Data	Unit
Total number of fuel oil tanks:	4	NA
Height of tank:	13.34	m
Diameter of tank:	9.53	m
Net fuel oil throughput for the month:	316.743	tons/month
Molecular weight of the fuel oil:	166.00	Lb/lb-mole
METEROLOGICAL DATA FOR THE MONTH	Data	Unit
Daily average ambient temperature	26.20	°C
Daily maximum ambient temperature	32.94	°C
Daily minimum ambient temperature	20.71	°C
Daily ambient temperature range	12.24	°C
Daily total insolation factor	5.72	kWh/m²/day
Tank paint colour	Grey/medium	NA
Tank paint solar absorbance	0.68	NA
FINAL OUTPUT:	Result	Unit
Breathing losses:	0.57	kg/month
Working losses:	0.01	kg/month
TOTAL LOSSES (Total TVOC Emissions for the month):	0.58	kg/month
<p><small>*Calculations performed on this spreadsheet are taken from the USEPA AP-42- Section 7.1 Organic Liquid Storage Tanks - January 1996. This spreadsheet is derived from materials provided by Jimmy Peress, PE, Tritech Consulting Engineers, 85-93 Chevy Chase Street, Jamaica, NY 11432 USA, Tel - 718-454-3920, Fax - 718-454-6330, e-mail - PeressJ@nyc.rr.com.</small></p>		

Table 11: Average % availability of monitors for the month of February 2020.

Associated Unit/Stack	PM	SO ₂	NO
Unit 1	100.0	99.7	99.7
Unit 2	98.3	100.0	100.0
Unit 3	100.0	100.0	100.0
Unit 4	100.0	100.0	100.0
Unit 5	100.0	100.0	100.0
Unit 6	100.0	100.0	100.0

Ambient Air quality Monitoring

No exceedances were noted at the Marapong monitoring station during February 2020.

Ambient CO, PM_{2.5} and NO₂ concentrations at Marapong monitoring site show influence of emissions from low level sources in the area, ambient PM₁₀ concentrations were influenced by emissions from both low level and tall stack emitters while ambient SO₂ concentrations show influence of emissions from tall stack emitters.

The average data recovery for the period was 57.8% and the station availability was 57.6%.

Detailed results can be found in Attachment 1, "Marapong air quality monthly report for February 2020".

General

Name and reference number of the monitoring method used:

1. Particulate and gas monitoring according to standards
 - a. BS EN 14181:2004 - Quality Assurance of Automated Measuring Systems
 - b. ESKOM internal standard 240-56242363 Emissions Monitoring and Reporting Standard

Sampling locations:

1. Stack one
 - a. Particulates:
 - i. S23° 40' 2.8" E027° 36' 34.8" 175m from ground level and 75m from the top.
 - b. Gas:
 - i. S23° 40' 2.8" E027° 36' 34.8" 100m from ground level and 150m from the top.
 - c. Stack height
 - i. 250 meter consist of 3 flues
2. Stack two
 - a. Particulates:
 - i. S23° 40' 14.8" E027° 36' 47.5" 175m from ground level and 75m from the top.
 - b. Gas:
 - i. S23° 40' 14.8" E027° 36' 47.5" 100m from ground level and 150m from the top.
 - c. Stack height
 - i. 250 meter consist of 3 flues

Unit 1

1. Zero out of 32 precipitator fields is out of service.
1. No abnormalities on the SO₃ plant. Preventative maintenance done during the month.

Unit 2

1. Four out of 32 precipitator fields is out of service. Repairs will be done during the next opportunity outage.
2. No abnormalities on the SO₃ plant. Preventative maintenance done during the month.

Unit 3

1. Two out of 32 precipitator fields is out of service. Repairs will be done during the next opportunity outage.
2. No abnormalities on the SO₃ plant. Preventative maintenance done during the month.

Unit 4

1. Five precipitator fields out of service. Repairs will be done during the next opportunity outage.
2. No abnormalities on the SO₃ plant. Preventative maintenance done during the month.

Unit 5

1. All precipitator fields in service.
2. No abnormalities on the SO₃ plant.

Unit 6

1. Three out of 32 precipitator fields is out of service. Repairs will be done during the next opportunity outage.
2. No abnormalities on the SO₃ plant. Preventative maintenance done during the month.

SO₃ common plant

1. No abnormalities on the sulphur storage plant.

CEMs

1. No adjustments done on the CEMs. Calibration is done every second week.

Particulate monitors

2. No downtime or repairs done on the particulate monitors.

Air quality improvements

1. None

Social responsibility conducted

No campaigns conducted in February 2020

Sampling dates and times

1. Continuous

Attachments

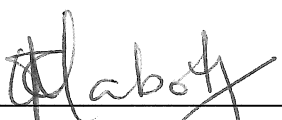
1. Marapong air quality monthly report for February 2020

The rest of the information demonstrating compliance with the emission license conditions is supplied in the annual emission report sent to your office.

Hoping the above will meet your satisfaction.

I hereby declare that the information in this report is correct.

Yours sincerely



O. Mabotja 2020/04/30

GENERAL MANAGER: MATIMBA POWER STATION

RESEARCH, TESTING AND DEVELOPMENT

SUSTAINABILITY DEPARTMENT

MARAPONG AIR QUALITY MONTHLY REPORT

FEBRUARY 2020

EXECUTIVE SUMMARY

This monthly report covers the ambient air quality data as monitored at Marapong monitoring site in February 2020.

There were no exceedances of the national ambient air quality limits of all the parameters monitored at the monitoring station during the period under review.

Ambient CO, PM_{2.5} and NO₂ concentrations at Marapong monitoring site show influence of emissions from low level sources in the area, ambient PM₁₀ concentrations were influenced by emissions from both low level and tall stack emitters while ambient SO₂ concentrations show influence of emissions from tall stack emitters.

The average data recovery for the period was 57.8% and the station availability was 57.6%.

DISCLAIMER

It is certified that the data presented is, to the best of our knowledge, a true copy of the specified record and for the times and places indicated thereon, as held on file at Research, Testing and Development (RT&D). The user assumes the entire risk related to the use of this data. In no event will RT&D be liable to the user or to any third party for any direct, indirect, incidental, consequential, special or exemplary damages or profit resulting from any use or misuse of this data.

1. INTRODUCTION

At the request of Eskom Environmental Management, Research, Testing and Development Department (RT&D) commissioned an ambient air quality monitoring site at Marapong Township to assess impacts from Matimba Power Station and other pollution source emissions in the area.

The Marapong site is equipped for continuous monitoring of ambient concentrations of sulphur dioxide (SO₂), nitrogen dioxide (NO₂), ozone (O₃), mercury (Hg) and fine particulate matter (FPM) of particulate sizes <10µm and <2.5µm in diameter (PM₁₀ and PM_{2.5}). In addition, meteorological parameters of wind velocity (WVL), wind direction (WDR) and ambient temperature (TMP) were also recorded.

Standard Specifications, Equipment/Techniques used for the measurement of SO₂, O₃ and NO_x conform to US-EPA equivalent method No EQSA-0486-060, EQOA-0880-047 and RFNA-1289-074 respectively.

This report has been compiled and submitted in accordance with the Conditional Authorisation issued in respect of The Construction of the Proposed Eskom Holdings Limited: Generation Division 4800MW Medupi Coal-Fired Power Station and Associated Infrastructure near Lephalale (Ref:12/12/20/695), especially in respect of condition 3.2.1 Air Quality Management. The results presented are compared to the National Air Quality Standards, as published in DEA discussion document, Ref: AQM&CC/24/10/07/4. In addition, this monitoring is undertaken as part of Eskom's Environmental Management Plan and to further validate the CALPUFF dispersion model that was utilized in the original EIA, but was consistently over predicting. The results of the study will be tested

for compliance against the national ambient air quality standards. The monitoring site is accredited by the South African National Accreditation System (SANAS).

2. SITE LOCATION

The monitoring site is located in Marapong at co-ordinates: S23° 39' 21.8" E27° 37' 41.3" and was commissioned in September 2006 (Figure 1).

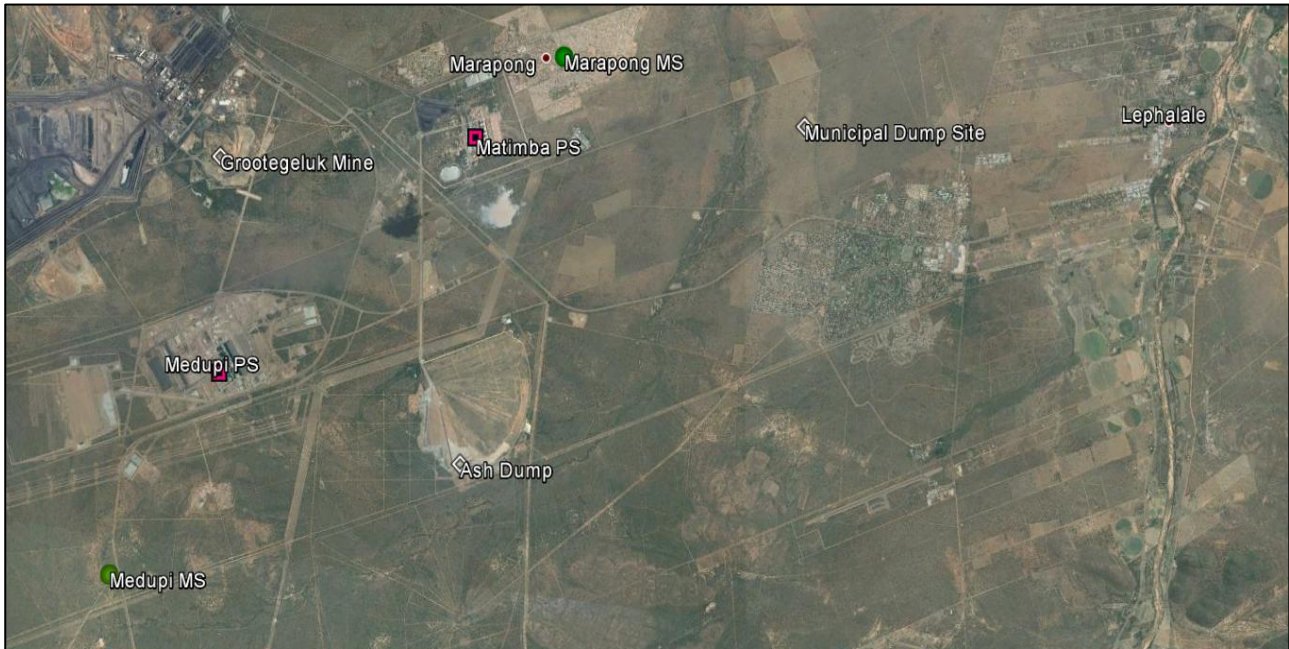


Figure 1: Marapong air quality monitoring site in relation to Matimba Power Station and other pollution sources.

3. DATA RECOVERY

The SANAS guideline figure of 90% per parameter monitored is used as a standard for representative data capture. This describes the required completeness of data set for the reporting of averages and is based on standard arithmetic calculations. The completeness calculations for data sets exclude zero and span data and times where service and/or maintenance is being conducted on the instruments in question.

Availability is a management definition related to system reliability. The availability target is not set in terms of data quality criteria and has no associated quality objectives. A target of 100% availability has been set for performance evaluation. Availability is reported as a measure of the percentage of time that electrical power was available to the monitoring station.

Table 1: Percentage Data Recovery for February 2020

Month	NO ₁	NO ₂	NO _x	O ₃	SGT	SO ₂	TMP	WDR	WSP	WVL	PM _{2.5}	PM ₁₀	CO	HG	HUM	Data Rec	Station Avail.
Feb	37.6	37.6	37.6	54.8	76.2	46.9	76.2	76.2	76.2	76.2	38.1	38.4	56.8	8.2	76.2	57.8	57.6

The average data recovery for the period was 57.8% and the station availability was 57.6%. The low data capture was as a result of frequent power cuts due to load shedding and the burnt fuses of the power cable that connects power from the water tanks to the monitoring site.

4. SUMMARY OF RESULTS FOR REPORTED PERIOD

Table 2 presents the National Ambient Air Quality Standards and Table 3 is a summary report presenting the highest mean concentrations and the number of exceedances above the respective national air quality standards for each measured parameter.

Table 2: National Ambient Air Quality Standards

Pollutant	Unit	Period	Limit	Number of annual exceedances allowed	Source
Carbon Monoxide	ppm	1hr	26	88	DEA
Carbon Monoxide	ppm	8hr	8.7	11	DEA
PM ₁₀	µg/m ³	24hr	75	4	DEA
PM ₁₀	µg/m ³	1year	40	0	DEA
PM _{2.5}	µg/m ³	24hr	40	4	DEA
PM _{2.5}	µg/m ³	1year	20	0	DEA
Nitrogen dioxide	ppb	1year	21	0	DEA
Nitrogen dioxide	ppb	1hr	106	88	DEA
Ozone	ppb	8hr	61	11.	DEA
Sulphur dioxide	ppb	1hr	134	88	DEA
Sulphur dioxide	ppb	10min	191	526	DEA
Sulphur dioxide	ppb	24hr	48	4	DEA
Sulphur dioxide	ppb	1year	19	0	DEA

Table 3: Summary report of parameters at Marapong monitoring site for February 2020

Pollutant	Highest Hourly Mean	No of Hourly National Limit Exceedances	Highest Daily Mean	No of Daily National Limit Exceedances	No of 8hr Moving Average Limit	Highest 10min Mean	No of 10min National Limit Exceedances
FPM (PM–2.5) by Beta gauge [ug/m ³]	81.3		35.7	0		138.7	
FPM (PM–10) by Beta gauge [ug/m ³]	164.8		37.1	0		164.8	
Nitric oxide [ppb]	28.8		11.7			80.	
Nitrogen dioxide [ppb]	18.5	0	13.6			25.9	
Nitrogen oxide [ppb]	33.2		15.1			89.4	
Ozone [ppb]	49.9		34.5		0	50.7	
Sigma theta [deg]	46.4		25.4			75.6	
Sulphur dioxide [ppb]	69.7	0	17.1	0		103.8	0
Ambient temperature [deg C]	36.7		29.5			37.1	
Wind speed [m/s]	3.7		2.3			5.7	
Wind velocity [m/s]	3.5		2.2			5.6	

There were no exceedances of the national ambient air quality limits of all the parameters monitored at the monitoring station during the period under review.

Figure 2 shows the daytime and night-time wind roses for the reporting period. The centre of the wind rose depicts the position of the air quality monitoring station. The positions of the spokes in the polar diagram represent directions from which the wind was blowing. The length of the segment indicates the percentage of the time the wind blew from that direction and the speed in the various categories are denoted by colours and width.

The dominant wind directions during the daytime were north-east, east-north-east, east and north-north-east. During the night, the most frequent directions were east-north-east, east and north-east.

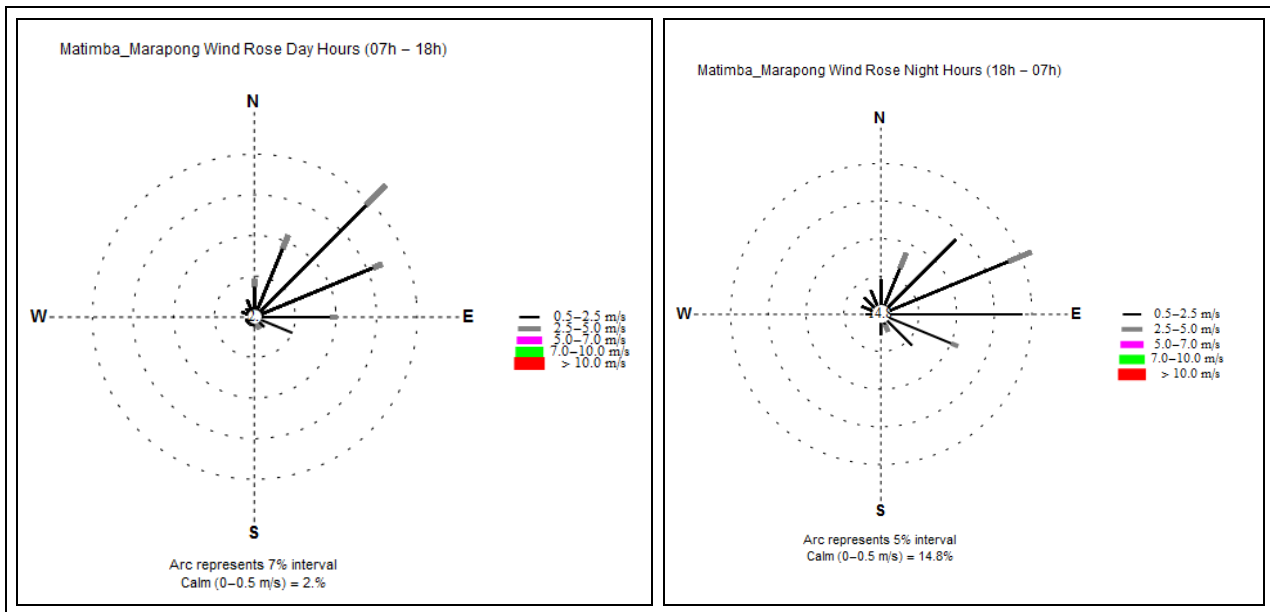


Figure 2: Wind roses at Marapong monitoring site during day and night hours

6. DISCUSSION OF POLLUTANTS

Emissions of primary pollutants such as PM_{10} , $PM_{2.5}$, SO_2 and NO_x from low level sources such as domestic combustion, motor vehicles and smouldering dumps are expected to impact at ground level more significantly during the evening and early morning hours as a result of temperature inversion. Emissions of such pollutants from tall stacks (power stations and other industries), are expected to have more significant impact at ground level during the day, due to atmospheric turbulence influences. O_3 and other oxidants are formed in polluted atmospheres as a result of a rather wide variety of photochemical reactions. A gradual increase of O_3 throughout the day is expected, peaking at mid-afternoon and then decaying once more during the night.

6.1. FINE PARTICULATE MATTER (PM_{10})

6.1.1 Source identification by PM_{10} diurnal variations

Figure 3 shows the PM_{10} hourly mean diurnal variation. Impact of emissions from low level sources such as evening motor vehicle emissions are shown with a peak observed at 21:00 in the evening. Minor concentration peaks observed during the day at 12:00 and 17:00 in the afternoon could be associated with emissions from activities taking place during the day, such as coal mining activities. Impact from low level sources such as morning vehicle emissions is once again shown in the morning with a peak at 08:00.

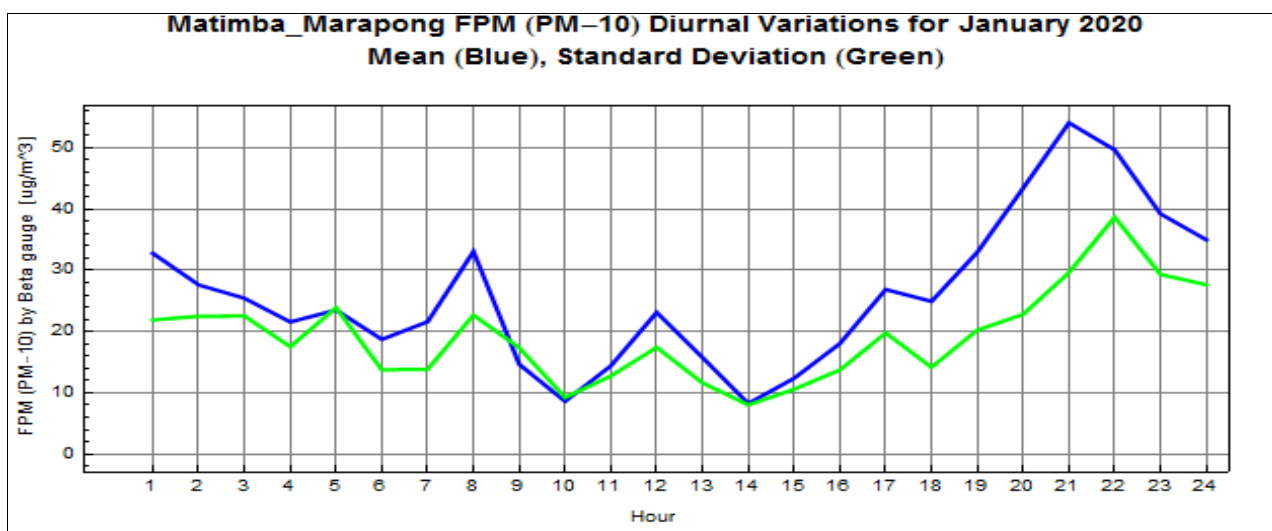


Figure 3: Diurnal variation by PM₁₀ (Mean concentrations = Blue line, Standard Deviation = Green line)

6.1.2. PM₁₀ hourly mean event roses and tables.

As there is no national hourly PM₁₀ limit, the 98th percentile daytime and night-time event rose is presented in Figure 4 to identify the wind sectors from which the highest concentrations are derived.

The most dominant hourly mean concentrations above 50.14 µg/m³ (98th percentile value) at Marapong monitoring site during the daytime period were recorded from north and west-north-west sectors. Exxaro Grootegeeluk coal mine is located in the west-south-west to north-west of the monitoring site. The dominant hourly mean concentrations above 84.60 µg/m³ (98th percentile value) at Marapong monitoring site during the night-time period were recorded from north-east and east sectors. Traffic and domestic combustion emissions in and around Marapong could also be impacting on the ambient PM₁₀ concentrations at the monitoring site.

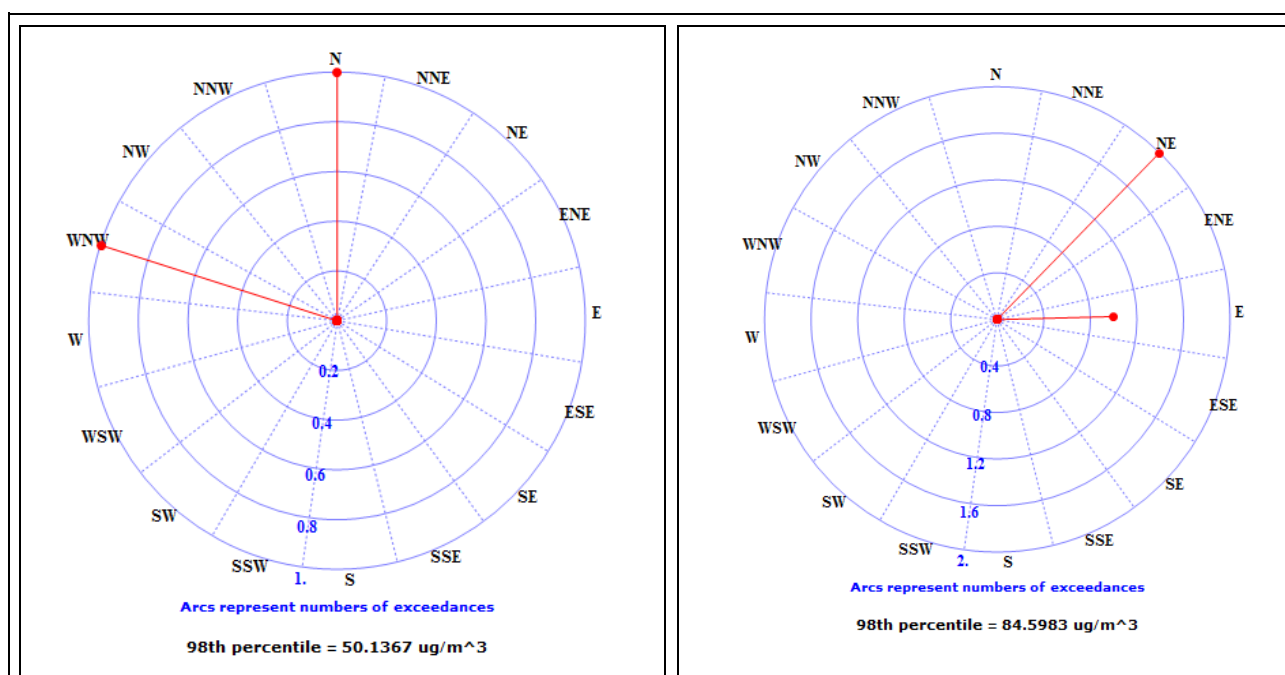


Figure 4: PM₁₀ hourly mean 98th percentile event roses. Left - daytime (06:00-18:00) and right - night time (18:01-05:59)

Table 5: PM₁₀ daytime hourly mean 98th percentile event table

Dir.	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Eve.	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
%	50	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0

Table 6: PM₁₀ night-time hourly mean 98th percentile event table

Dir.	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Eve.	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0
%	0	0	66.67	0	33.33	0	0	0	0	0	0	0	0	0	0	0

6.2. FINE PARTICULATE MATTER (PM_{2.5})

6.2.1 Source identification by PM_{2.5} diurnal variations

Figure 5 shows the PM_{2.5} hourly mean diurnal variation. PM_{2.5} levels are shown to be lower during the day and rise sharply in the afternoon peaking at 22:00 in the evening. This suggests that there is a low-level source of PM_{2.5} or PM_{2.5} formation in the evening. Impact from low level sources such as morning vehicle emissions is once again shown in the morning with a peak at 08:00.

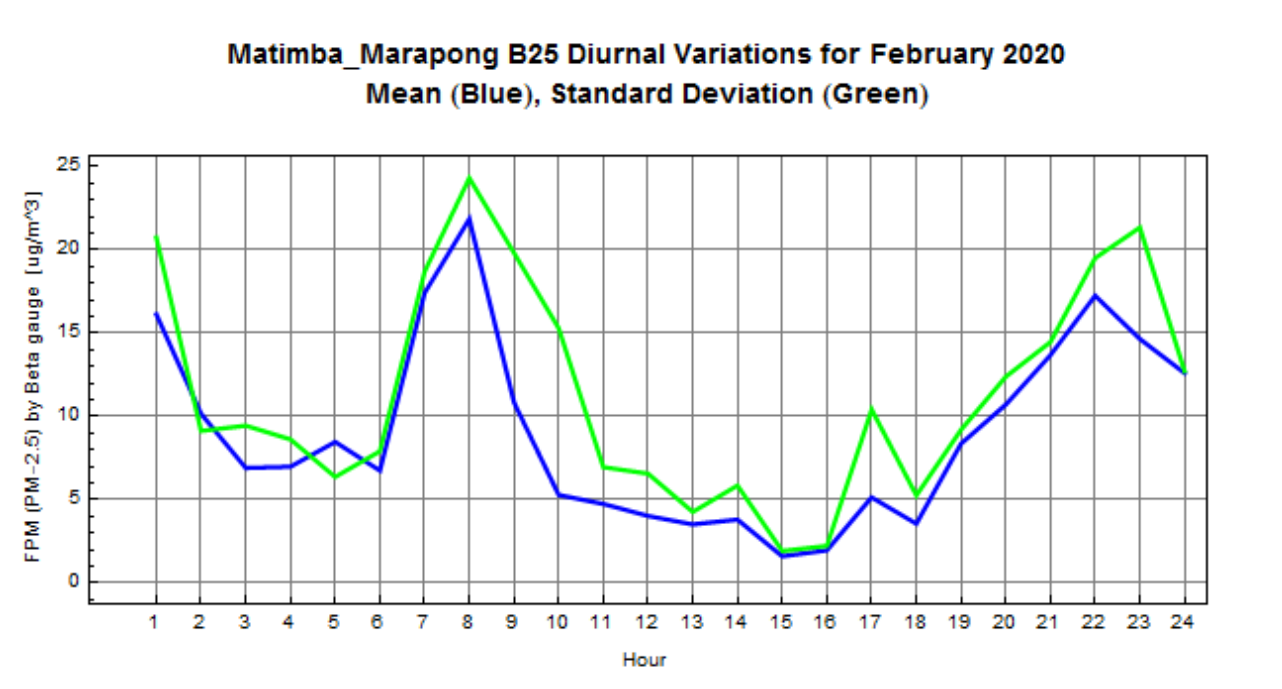


Figure 5: Diurnal variation by PM_{2.5} (Mean concentrations = Blue line, Standard Deviation = Green line)

6.2.2. PM_{2.5} hourly mean event roses and tables.

As there is no national hourly PM_{2.5} limit, the 98th percentile daytime and night-time event roses are presented in Figure 6 to identify the wind sectors from which the highest concentrations are derived.

The most dominant hourly mean concentrations above 51.44µg/m³ (98th percentile value) at Marapong monitoring site during the daytime period were recorded from east-south-east sector. The most dominant hourly mean concentrations above 58.76µg/m³ (98th percentile value) at Marapong monitoring site during the night-time period were recorded from east sector.

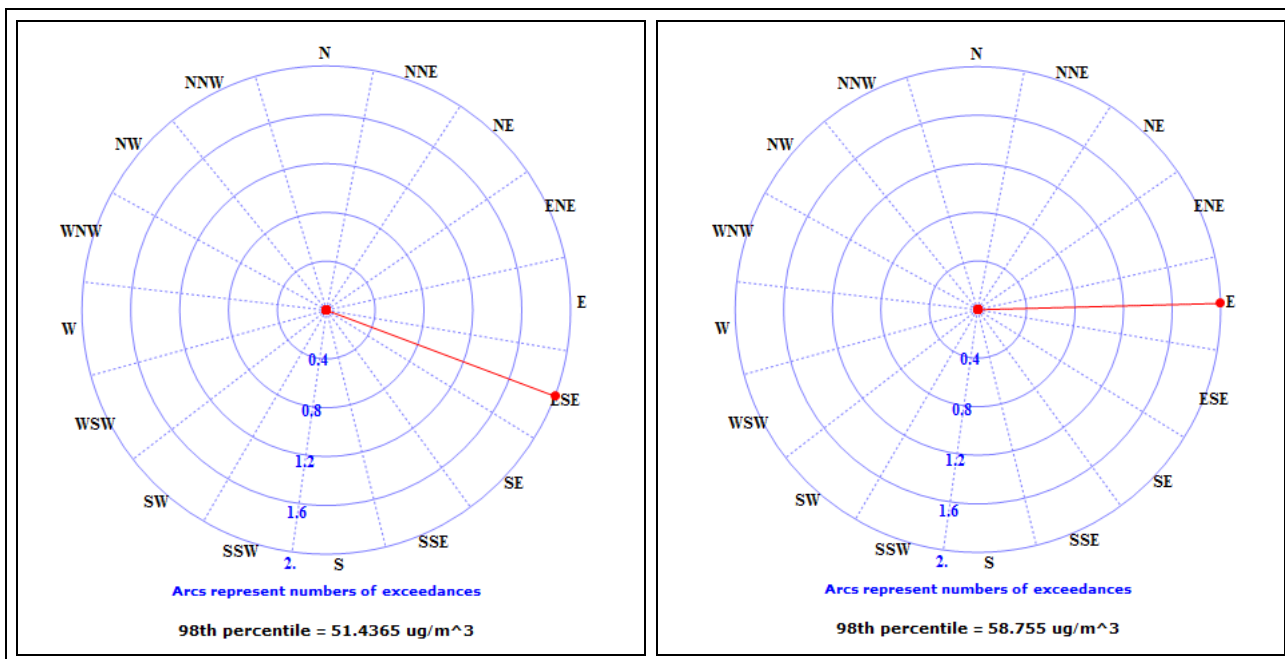


Figure 6: PM_{2.5} hourly mean 98th percentile event roses. Left - daytime (06:00-18:00) and right - night time (18:01-05:59)

Table 7: PM_{2.5} daytime hourly mean 98th percentile event table

Dir.	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Eve.	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
%	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0

Table 8: PM_{2.5} night-time hourly mean 98th percentile event table

Dir.	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Eve.	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
%	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0

6.3 CARBON MONOXIDE (CO)

6.3.1 Source identification by CO diurnal variations

Figure 7 shows the CO hourly mean diurnal variation. CO levels are generally low during the day and are elevated at night peaking at 21:00. Elevation in CO levels is also noticeable with a peak at 08:00 in the morning. Both elevations could be attributed to low level source emissions such as domestic combustion from coal stoves and motor vehicles during morning and evening commuting of workers to/from work.

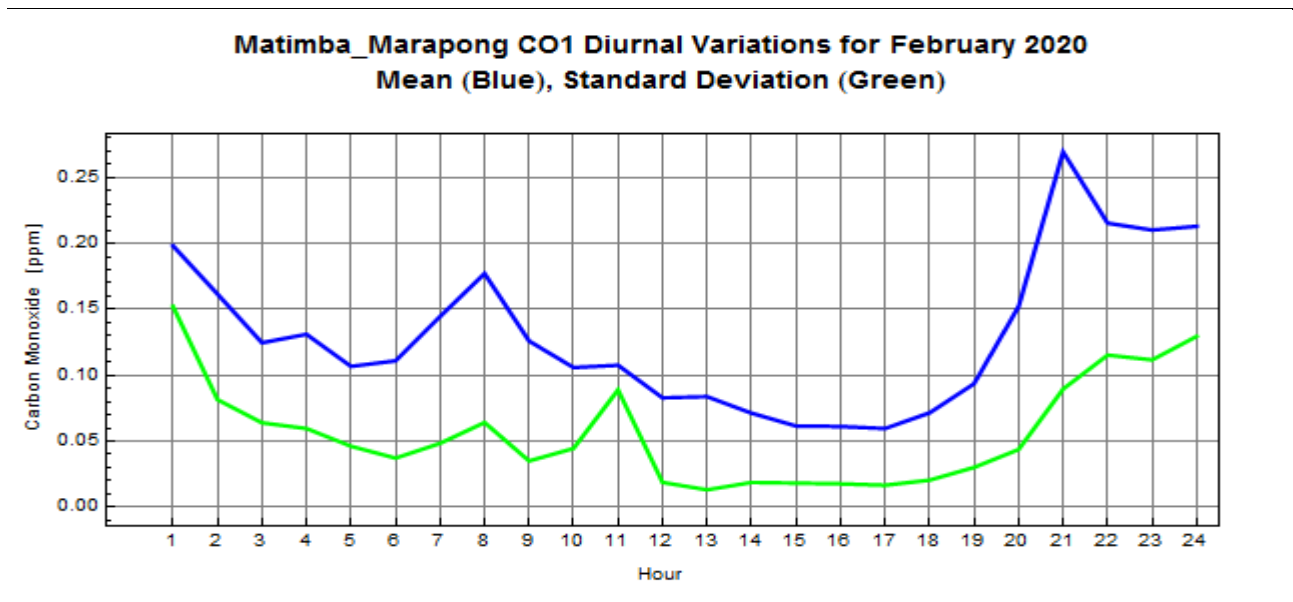


Figure 7: Diurnal variation by CO (Mean concentrations = Blue line, Standard Deviation = Green line)

The national ambient air quality hourly mean CO limit of 26 ppm was not exceeded during the period under review as shown in Figure 8 below.

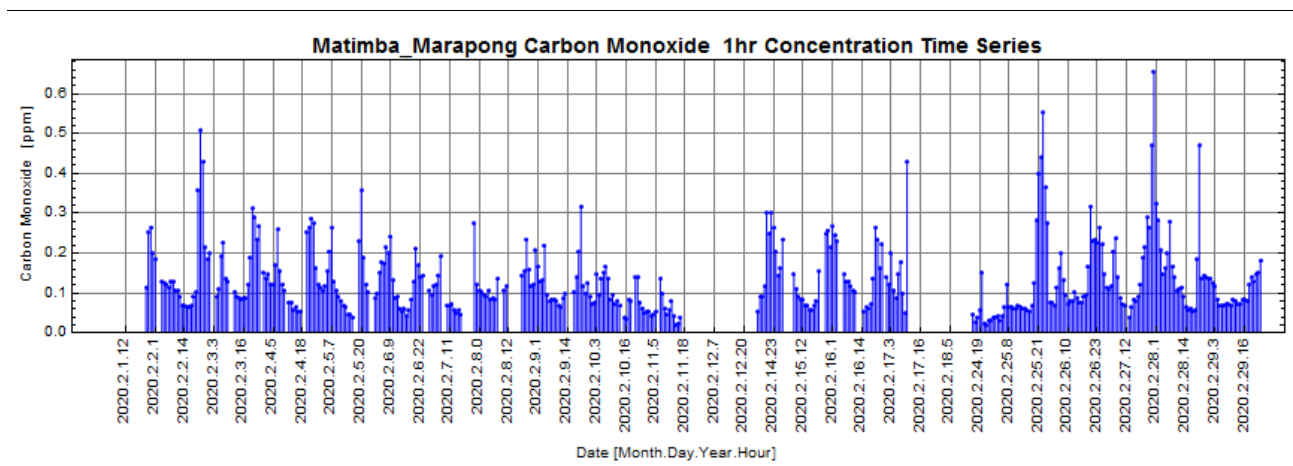


Figure 8: CO hourly Concentrations Time Series

6.3.2 CO hourly mean event roses and tables.

The daytime and night-time event roses are presented in Figure 9 to indicate the wind directions from which the highest concentrations are derived.

The most dominant hourly mean concentrations above 0.26 ppm at Marapong monitoring site during the daytime period were recorded from north-north-east, east-south-east and south-east sectors. The most dominant night-time concentrations above 0.47 ppm (98th percentile value) were recorded from north-east, east-north-east, south-east and south-south-east sectors. CO emissions measured at the monitoring station could be from different sources such as veld fires, back-up power generators, lawn mowers, leaf blowers, undiluted car exhausts without catalytic converters, combustion of fossil fuels. Other sources of CO could be from combustion of fuels such as natural gas, fuel oils from local industries and coal, wood, charcoal burning and also waste burning from Marapong Township.

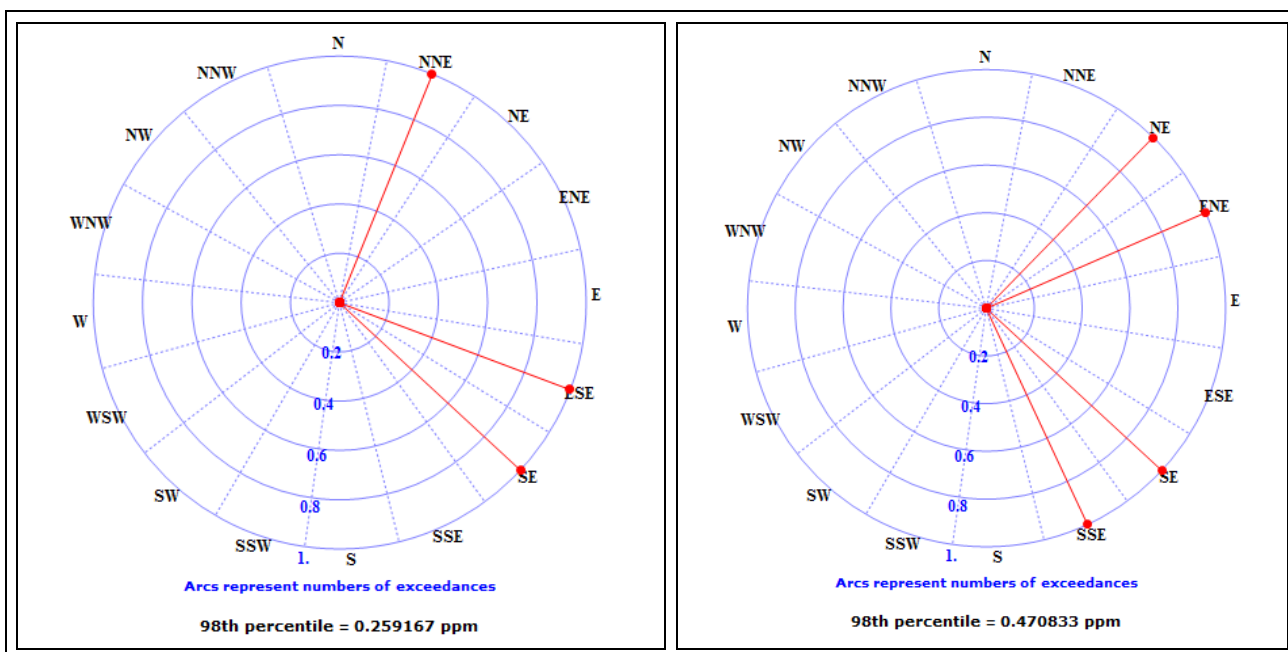


Figure 9: CO hourly mean 98th percentile event roses. Left - daytime (06:00-18:00) and right - night time (18:01-05:59)

Table 9: CO daytime hourly mean 98th percentile event table

Dir.	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Eve.	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0
%	0	33.33	0	0	0	33.33	33.33	0	0	0	0	0	0	0	0	0

Table 10: CO night-time hourly mean 98th percentile event table

Dir.	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Eve.	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0
%	0	0	25	25	0	0	25	25	0	0	0	0	0	0	0	0

6.4. SULPHUR DIOXIDE (SO₂)

6.4.1 Source identification by SO₂ diurnal variations

Figure 10 shows the SO₂ hourly mean diurnal variation. The graph shows that SO₂ levels are low in the morning and in the evening and higher during the day, with the peak recorded between 12:00 and 13:00 in the afternoon. This is a typical signature of a tall stack source and industrial activities during the day.

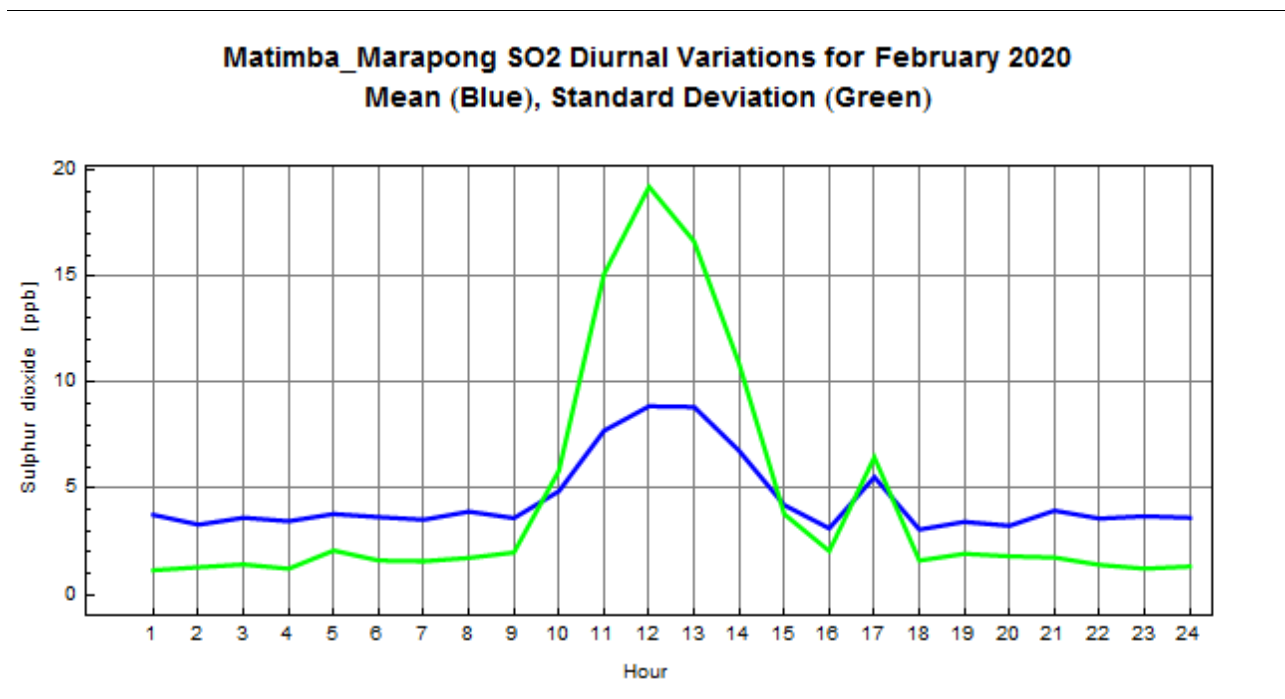


Figure 10: SO₂ diurnal variations (Mean concentrations = Blue line, Standard Deviation = Green line).

6.4.2 SO₂ daytime exceedance and night-time event roses and tables

The daytime and night-time event roses are presented in Figure 11 to indicate the wind directions from which the highest concentrations are derived.

The most dominant daytime concentrations above 58.76 ppb (98th percentile value) were from west-south-west and west-north-west sectors. The most dominant night-time concentrations above 6.72 ppb (98th percentile value) were recorded from north-north-east, north-east and south sectors.

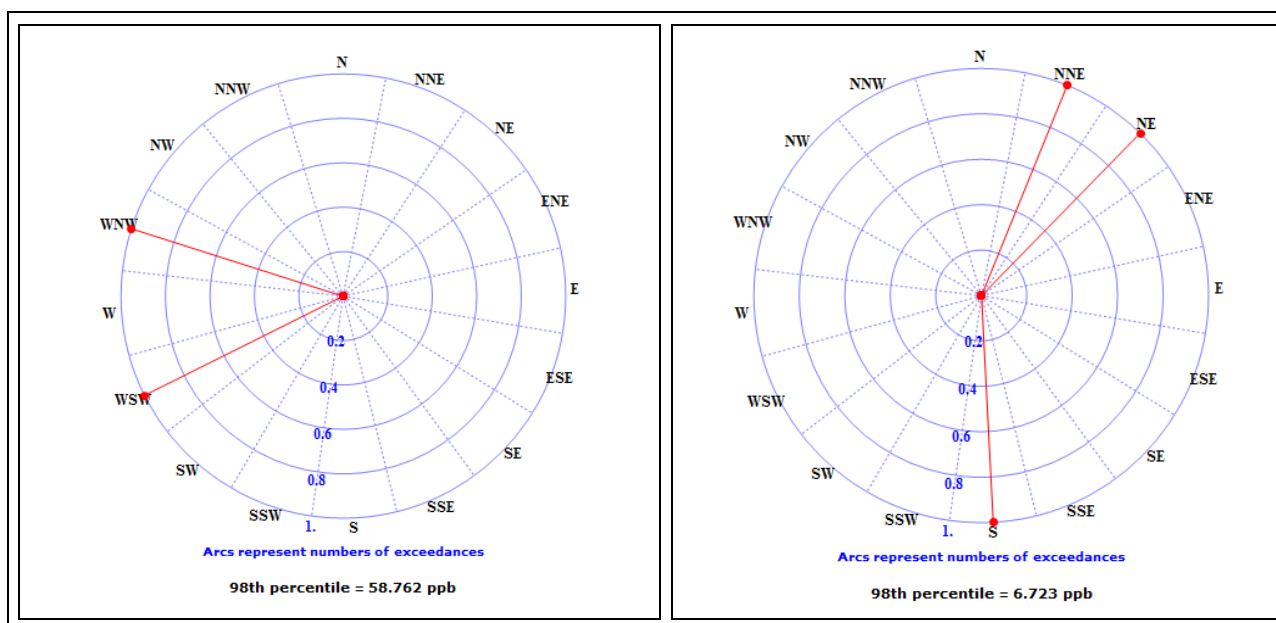


Figure 11: SO₂ hourly mean 98th percentile event roses. Left - daytime (06:00-18:00) and right - night time (18:01-05:59)

Table 11: SO₂ daytime hourly mean 98th percentile event table

Dir.	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Exc.	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
%	0	0	0	0	0	0	0	0	0	0	0	50	0	50	0	0

Table 12: SO₂ night-time hourly mean 98th percentile event table

Dir.	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Eve.	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0
%	0	33.33	33.33	0	0	0	0	0	33.33	0	0	0	0	0	0	0

6.5. NITROGEN DIOXIDE (NO₂)

6.5.1 Source identification by NO₂ diurnal variations

Figure 12 below shows the NO₂ hourly mean diurnal variation. The graph shows a peak at 08:00 in the morning and 21:00 in the evening which are indicative of low level source emissions on ambient NO₂ concentrations, such as early morning and evening emissions from vehicles transporting workers from/to Marapong Township to/from Medupi, Matimba power stations, Grooteveld coal mine and other industries in the area. The NO₂ concentrations are low during midday and throughout the afternoon as a result of absence or minimal number of vehicles in the township at those times.

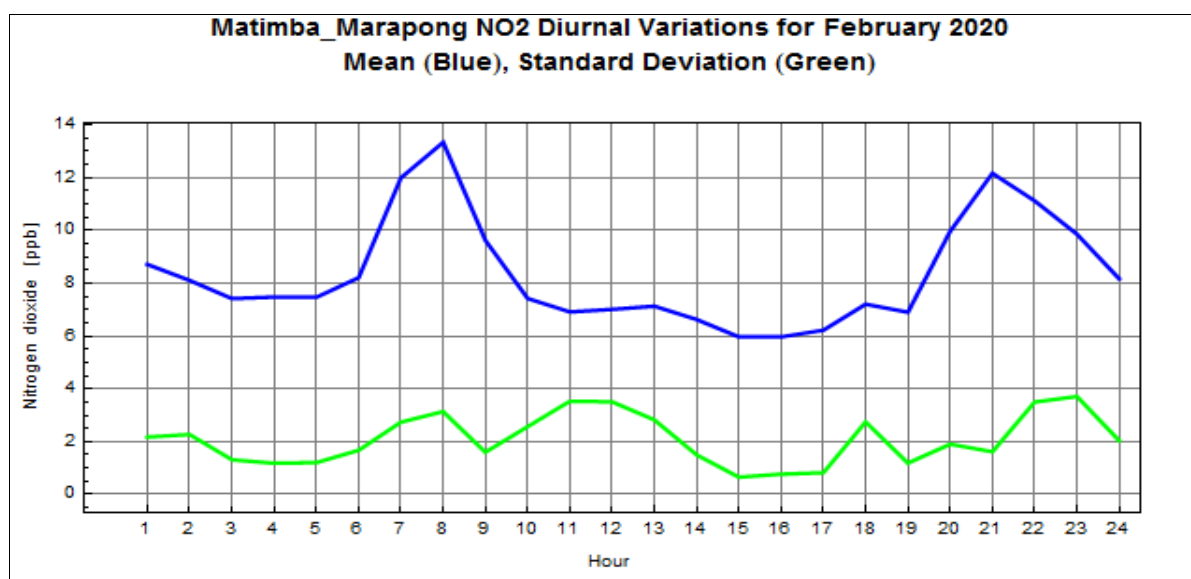


Figure 12: NO₂ diurnal variations (Mean concentrations = Blue line, Standard Deviation = Green line).

6.5.2. NO₂ hourly mean event roses and tables.

The daytime and night-time event roses are presented in Figure 13 to indicate the wind directions from which the highest concentrations are derived. The most dominant daytime concentrations above 16.87 ppb (98th percentile value) were from south-east and west-north-west sectors. The most dominant night-time concentrations above 16.18 ppb (98th percentile value) were recorded from south-east, west and west-north-west sectors. Traffic from Onverwacht and Marapong Township and trucks travelling to the municipal dump might have an influence in the NO₂ readings. There is a taxi rank and it is at a very close proximity to the monitoring site and Lowveld Bus Service just less than a kilometre to the east of the monitoring site. This could have an influence on the NO₂ readings.

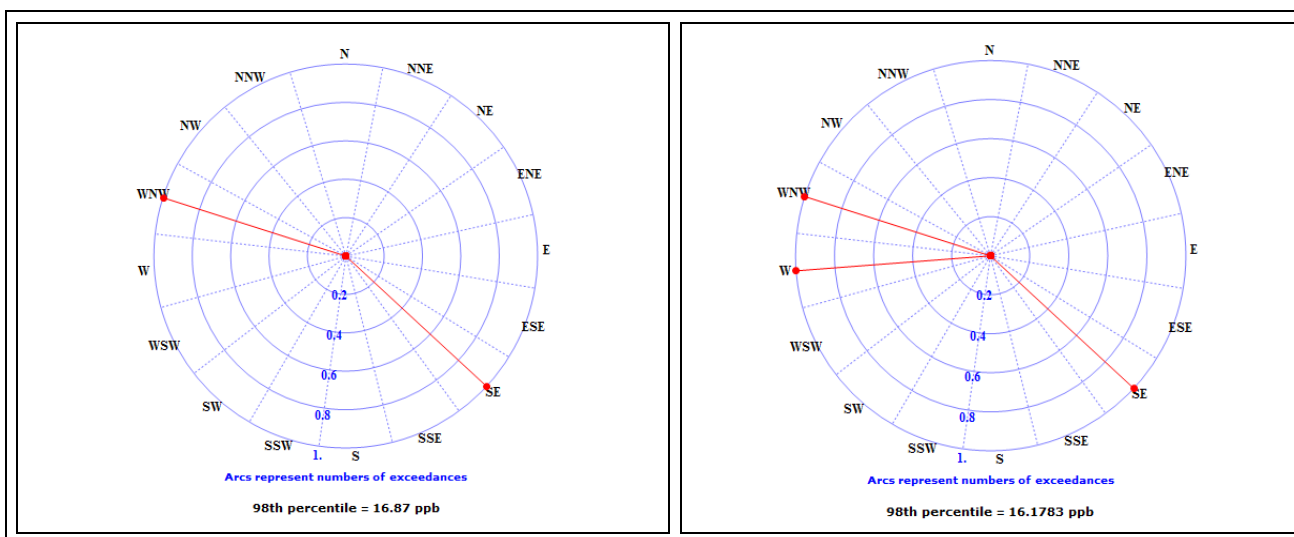


Figure 13: NO₂ hourly mean 98th percentile event roses. Left - daytime (06:00-18:00) and right - night time (18:01-05:59)

Table 13: NO₂ day-time hourly mean 98th percentile event table

Dir.	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Eve.	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0
%	0	0	0	0	0	0	50	0	0	0	0	0	0	50	0	0

Table 14: NO₂ night-time hourly mean 98th percentile event table

Dir.	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Eve.	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0
%	0	0	0	0	0	0	33.33	0	0	0	0	0	33.33	33.33	0	0

6.7 MERCURY (Hg)

There was only 8.1% data recorded for mercury because the Argon gas was finished. The new gas cylinder was installed on 27 February 2020.

7. HISTORICAL CONCENTRATIONS

7.1. RECENT TRENDS

Time series graphs (Figures 17 – 22) for each pollutant with respect to the National Ambient Air Quality Standards are represented from the beginning of the previous year until the end of the current reporting period or since inception of the monitors. The resultant period may vary for each analyser, depending on when it was installed.

Ambient CO and NO₂ concentrations at the monitoring site are well within their national ambient limits with no exceedances from January 2018 until February 2020. The trends show higher concentrations during winter than summer. Ambient PM₁₀ and PM_{2.5} concentrations have exceeded their daily limits on several occasions during the period under review and show increase in winter and decrease in summer. The ambient SO₂ hourly limit has been exceeded several times during the period under review and there is no clear trends shown. There were no exceedances of the national SO₂ daily limit during the period under review. Ambient O₃ concentrations are higher in spring to summer months and lower in winter months. Gaps in the trend analysis are as a result of the instrument being out for service.

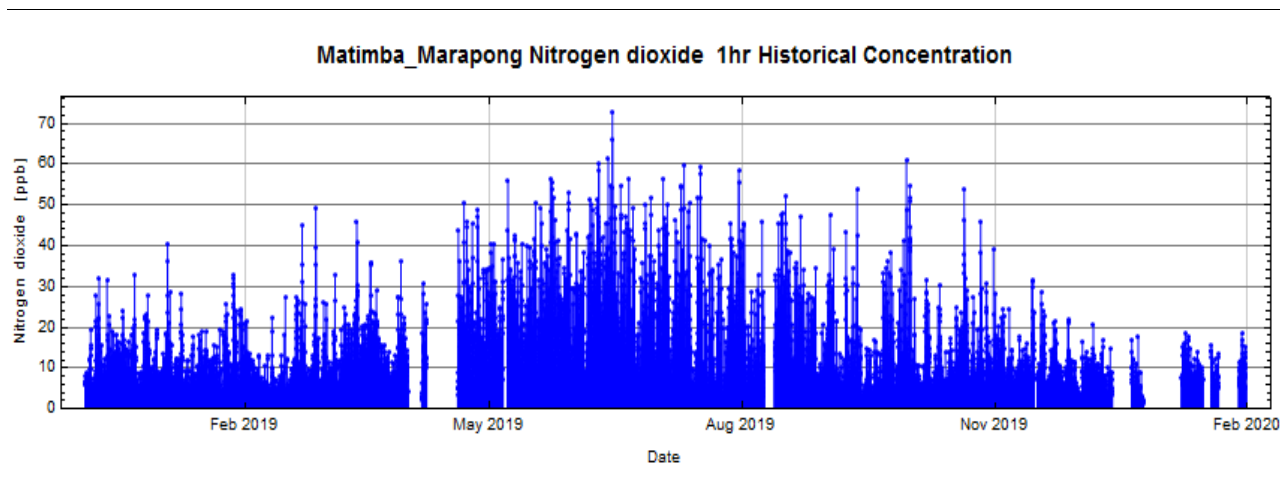


Figure 17: NO₂ Hourly Means

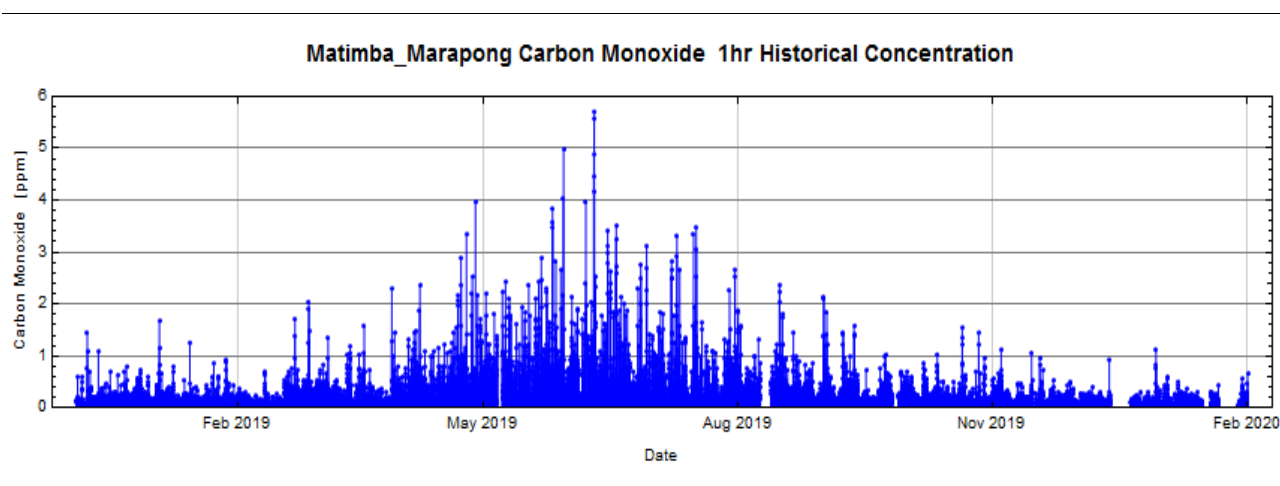


Figure 18: CO Hourly Means

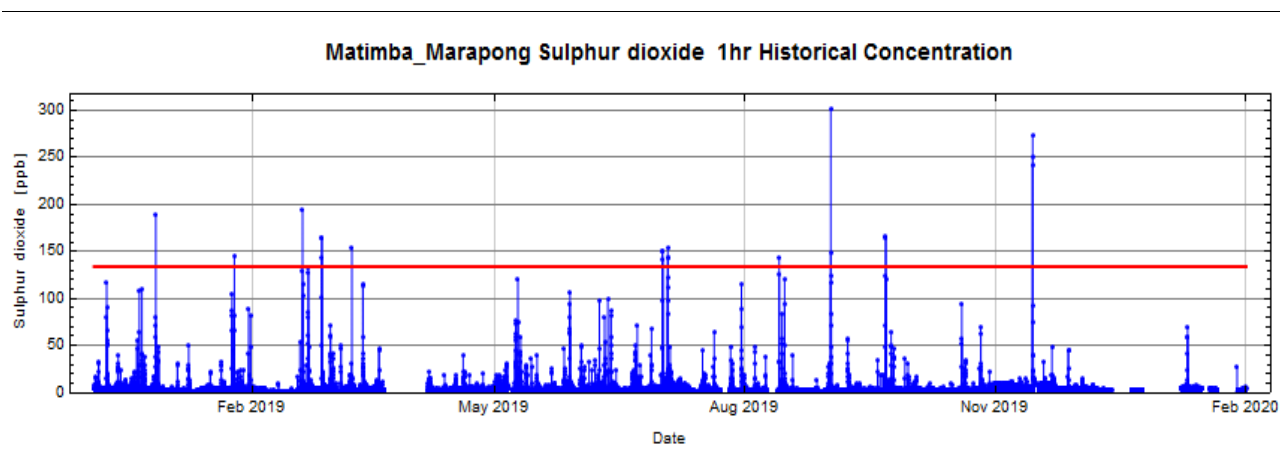


Figure 19: SO₂ Hourly Means

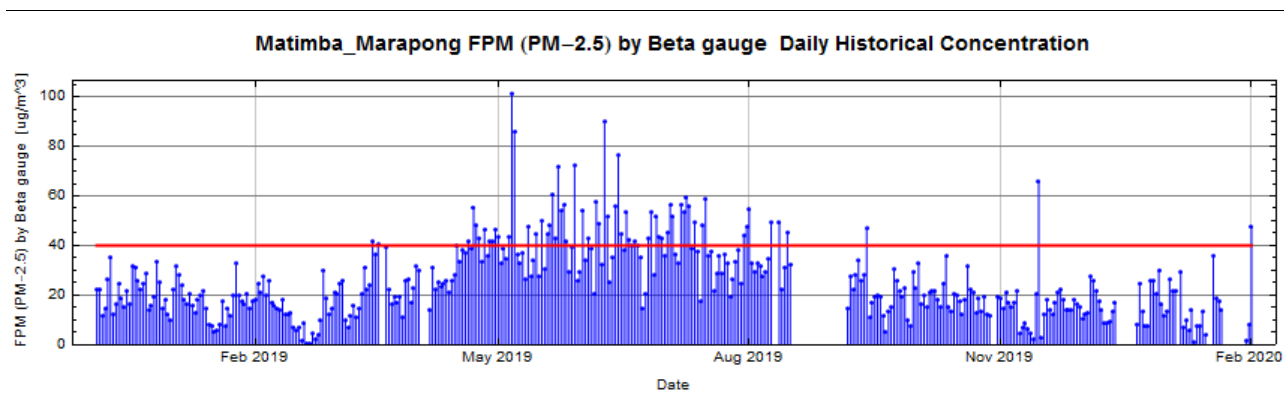


Figure 20: PM_{2.5} Daily Means

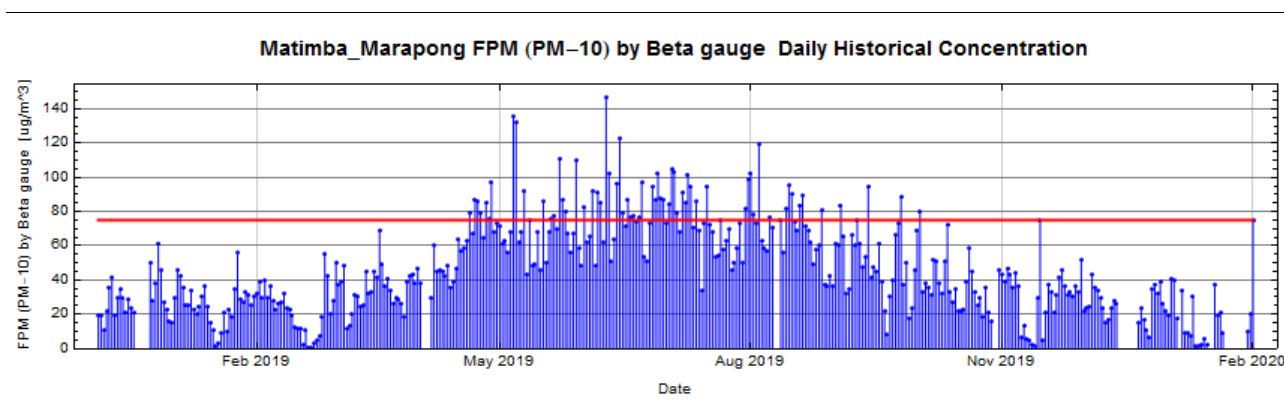


Figure 21: PM₁₀ Daily Means

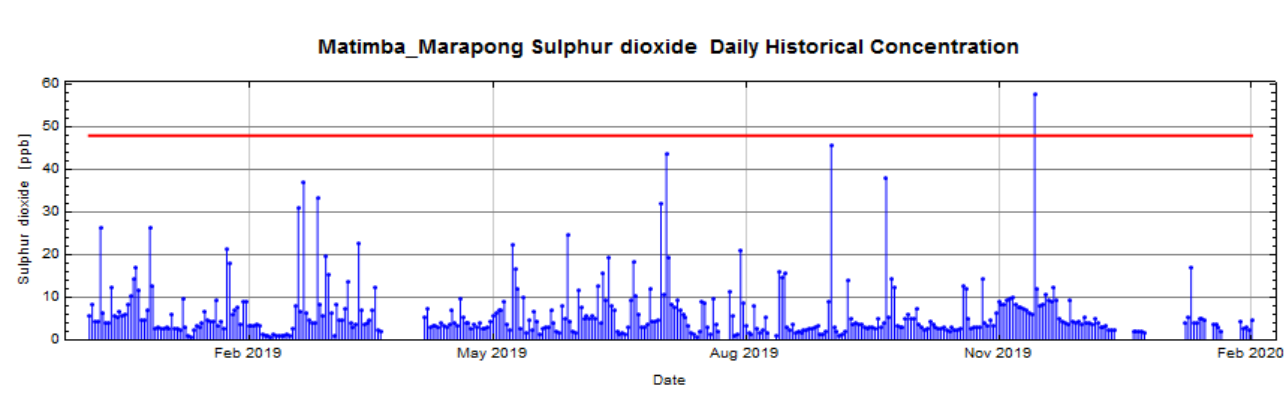


Figure 22: SO₂ Daily Means

7.2. MONTHLY MEANS FOR THE CURRENT CALENDAR YEAR 2020

Table 19: Monthly Means for current year 2020

Parameter measured	Jan	Feb
PM_{2.5} (µg/m ³)	17.2	9.4
PM₁₀ (µg/m ³)	25.9	12.8
NO₂ (ppb)	5.6	8.4
CO (ppb)	0.1	0.1
O₃ (ppb)	27.6	24.2
SO₂ (ppb)	3	4.4

ND = No Data

The above table shows the monthly mean concentrations of pollutants until February 2020.

Table 20: Number of exceedances of the National Ambient Air Quality Limits

	SO ₂ hourly	SO ₂ daily	NO ₂ hourly	PM ₁₀ daily	PM _{2.5} daily	O ₃ 8-hourly	CO hourly	SO ₂ 10 minute
Jan 2020	0	0	0	0	0	0	0	0
Feb 2020	0	0	0	0	0	0	0	0
Total No. of Exceedances	0	0	0	0	0	0	0	0
Allowed no of exceedances	88	4	88	4	4	11	88	526

The numbers of exceedances of all national air quality limits are well below their respective allowed number of exceedances per year.

8. CONCLUSIONS

There were no exceedances of all the parameters monitored at the monitoring station during the period under review.

Ambient CO, PM_{2.5} and NO₂ concentrations at Marapong monitoring site show influence of emissions from low level sources in the area, ambient PM₁₀ concentrations an influence from both tall stack emitters and low level sources, while ambient SO₂ concentrations show influence of tall stack emitters.

Report Compiled by:
Abram Segopa

Reviewed and Authorised by:

Date of Issue: 12 Mar 2020



Bontle Moiloa
Air Quality, Climate Change & Ecosystem Management CoE
Research, Testing and Development (RT&D)

9. ABBREVIATIONS

DEA	Department of Environmental Affairs
FPM	Fine particulate matter
HG	Mercury
HUM	Humidity
NO ₁	Nitric oxide
NO ₂	Nitrogen dioxide
NO _x	Oxides of nitrogen
OZN / O ₃	Ozone
CO	Carbon monoxide
SGT	Sigma theta
TMP	Ambient temperature
WDR	Wind direction from true North
WSP	Wind speed
WVL	Wind velocity
N	North
NNE	North-north-east
NE	North-east
ENE	East-north-east
E	East
ESE	East-south-east
SE	South-east
SSE	South-south-east
S	South
SSW	South-south-west
SW	South-west
WSW	West-south-west
W	West
WNW	West-north-west
NW	North-west
NNW	North-north-west
deg	Degree
deg C	Degree Celsius
ug/m ³	Microgram per cubic meter
m/s	Meters per second
PM _{2.5}	Particulate matter < 2.5 microns in diameter
PM ₁₀	Particulate matter < 10 microns in diameter
ppb	Parts per billion
ppm	Parts per million
MWP	Megawatt Park
RT&D	Research Testing and Development

10. DISTRIBUTION LIST

Eskom Environmental Management
Attention: Emile Marell

Medupi Power Station

Eskom Environmental Management
Eskom Environmental Management
Attention: Chris Mamabolo
Medupi Power Station
Attention: Rosetta Rammutla

Matimba Power Station

Eskom Environmental Management
Attention: Elmien Mocke

Matimba Power Station

CORPORATE SPECIALIST: ENVIRONMENTAL
Attention: Dave Lucas
Corporate Specialist

MWP

MANAGER: ENVIRONMENTAL MANAGEMENT
Attention: Bryan McCourt
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