Eskom

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

Dear Mrs Thivhafuni

MATIMBA POWER STATION'S MONTHLY EMISSIONS REPORT FOR THE MONTH OF JUNE 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.

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	1 034 320
	Fuel Oil	Tons/month	1 200	542.017
Production Rates	**Product/ By-Product Name**	**Unit**	**Maximum Production Capacity Permitted (Quantity)**	**Production Rate**
	Energy	GWh	4 212.6	2 249.976

Abatement Technology

Table 2: Abatement Equipment Control Technology utilise.

Associated Unit	Technology Type	Actual Utilisation (%)
Unit 1	Electrostatic Precipitator	99.928
Unit 2	Electrostatic Precipitator	99.921
Unit 3	Electrostatic Precipitator	99.934
Unit 4	Electrostatic Precipitator	99.935
Unit 5	Electrostatic Precipitator	99.968
Unit 6	Electrostatic Precipitator	99.895

Associated Unit	Technology Type	Actual Utilisation (%)
Unit 1	SO_3 Plant	67.8
Unit 2	SO_3 Plant	73.3
Unit 3	SO_3 Plant	93.3
Unit 4	SO_3 Plant	93.3
Unit 5	SO_3 Plant	93.3
Unit 6	SO_3 Plant	93.3

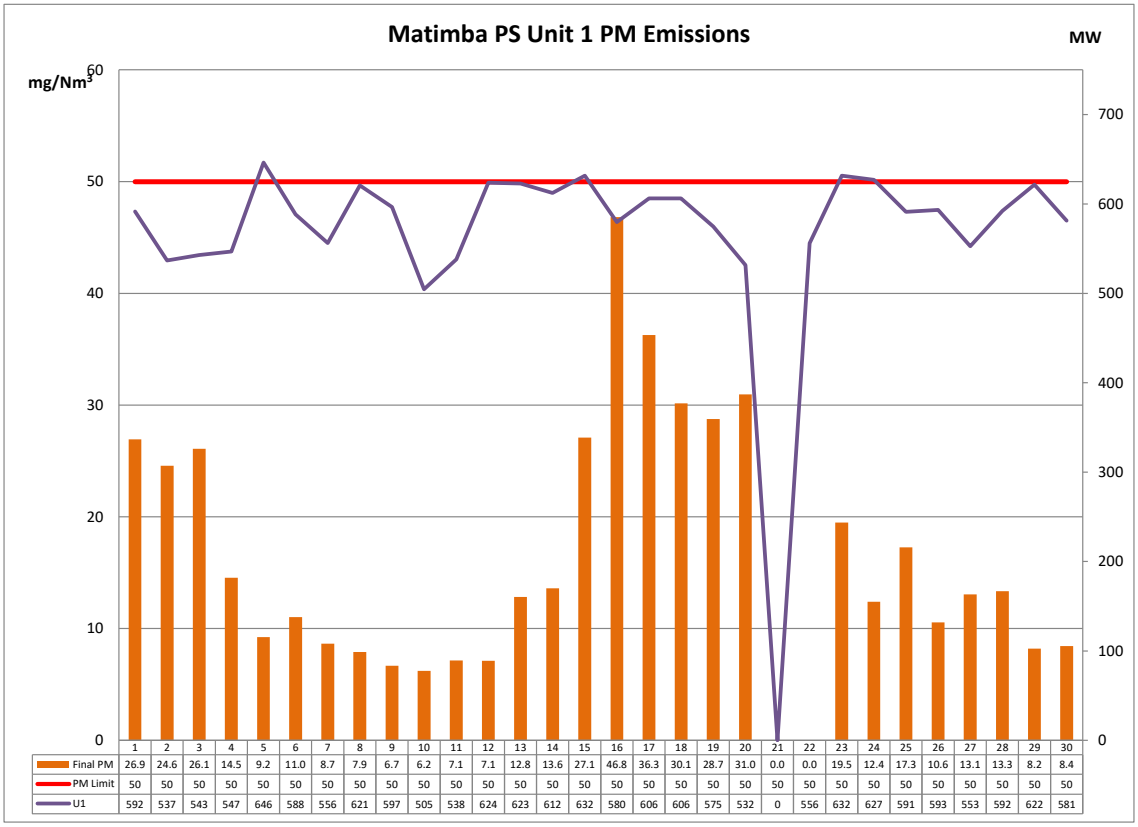
Energy Source Characteristics

Table 3: Energy Source Material Characteristics.

	Characteristic	Stipulated Range (Unit)	Monthly Average Content
Coal burned	**Sulphur Content**	0.8-1.6%	1.226
	Ash Content	30-40%	32.659

Emissions Reporting

Unit 1 particulate emissions

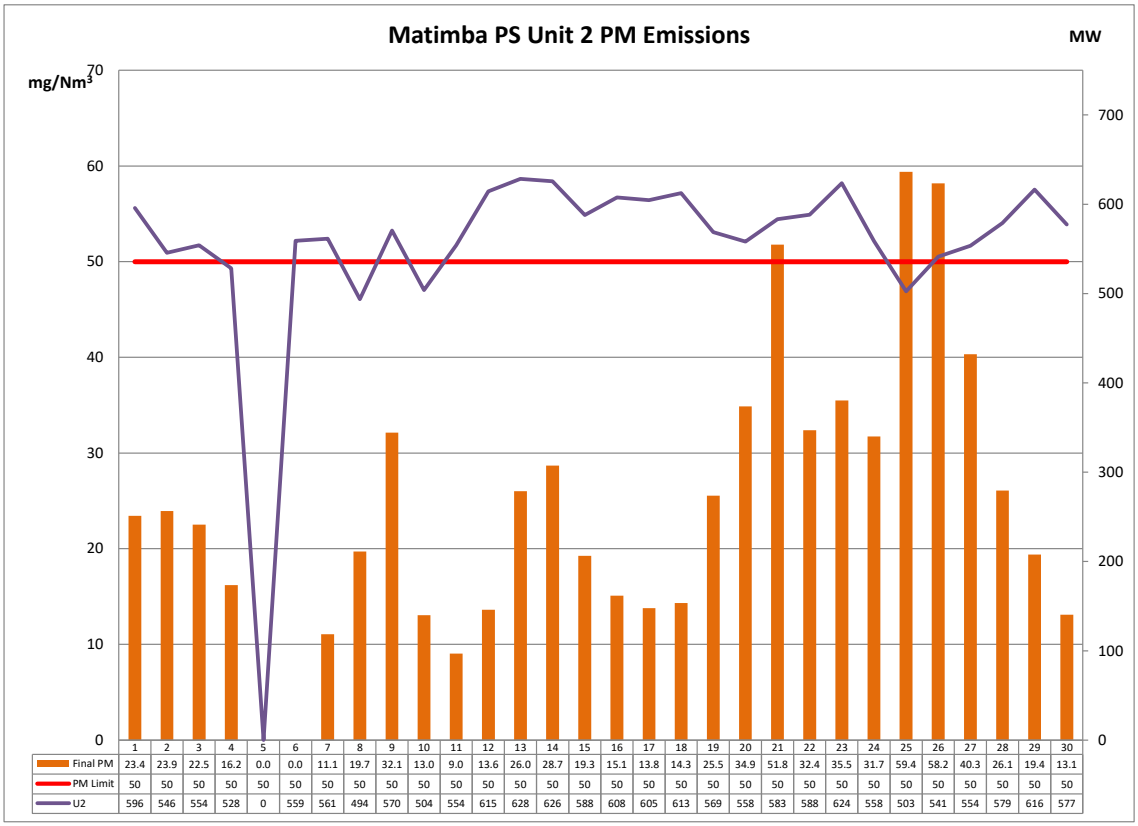


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final PM	26.9	24.6	26.1	14.5	9.2	11.0	8.7	7.9	6.7	6.2	7.1	7.1	12.8	13.6	27.1	46.8	36.3	30.1	28.7	31.0	0.0	0.0	19.5	12.4	17.3	10.6	13.1	13.3	8.2	8.4
PM Limit	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
U1	592	537	543	547	646	588	556	621	597	505	538	624	623	612	632	580	606	606	575	532	0	556	632	627	591	593	553	592	622	581

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

Interpretation:
All daily averages below particulate emission limit of 50 mg/Nm^3.

Unit 2 particulate emissions

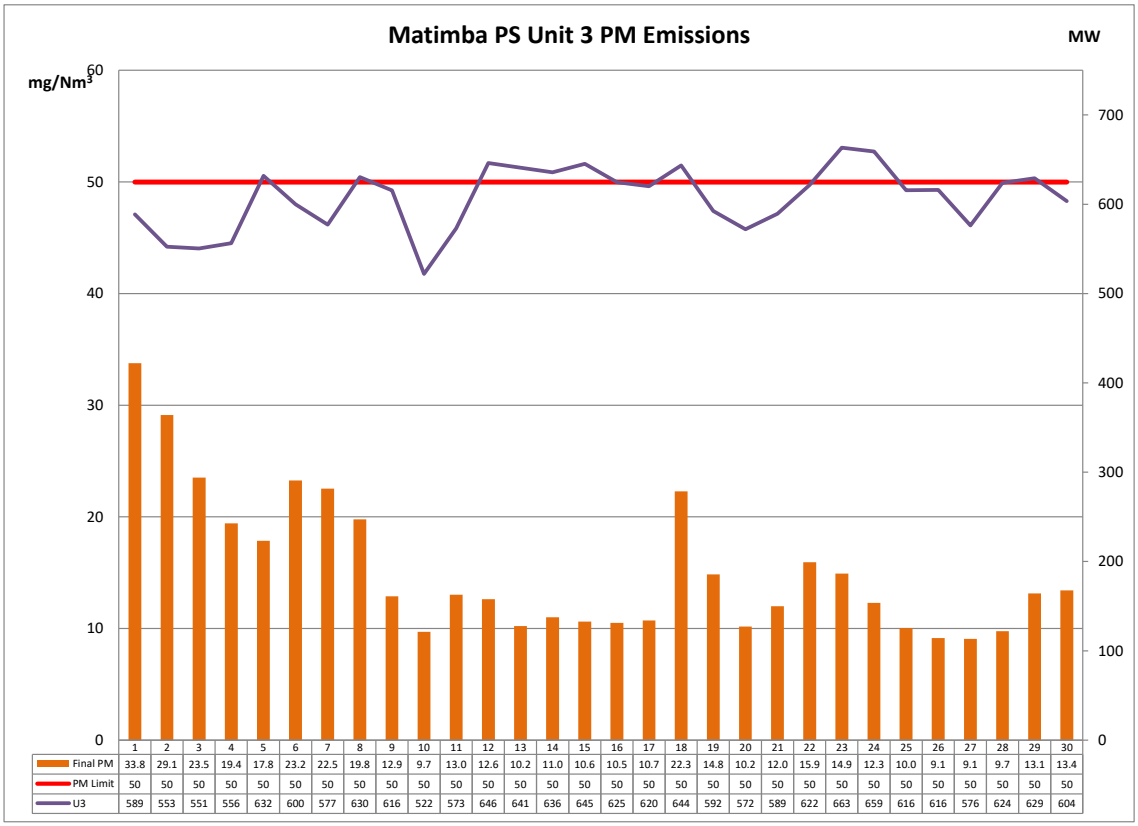


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final PM	23.4	23.9	22.5	16.2	0.0	0.0	11.1	19.7	32.1	13.0	9.0	13.6	26.0	28.7	19.3	15.1	13.8	14.3	25.5	34.9	51.8	32.4	35.5	31.7	59.4	58.2	40.3	26.1	19.4	13.1
PM Limit	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
U2	596	546	554	528	0	559	561	494	570	504	554	615	628	626	588	608	605	613	569	558	583	588	624	558	503	541	554	579	616	577

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

Interpretation:
Unit 2 exceeded the daily limit of 50mg/Nm^3 on the 21st of June 2020, 25th of June 2020 and on the 26th of June 2020. The exceedances were due to unexpected breakdowns on the Sulphur plant and did not exceed the 48hour grace period. The root cause was identified and addressed and no further exceedances were noted for the rest of the month.

Unit 3 particulate emissions

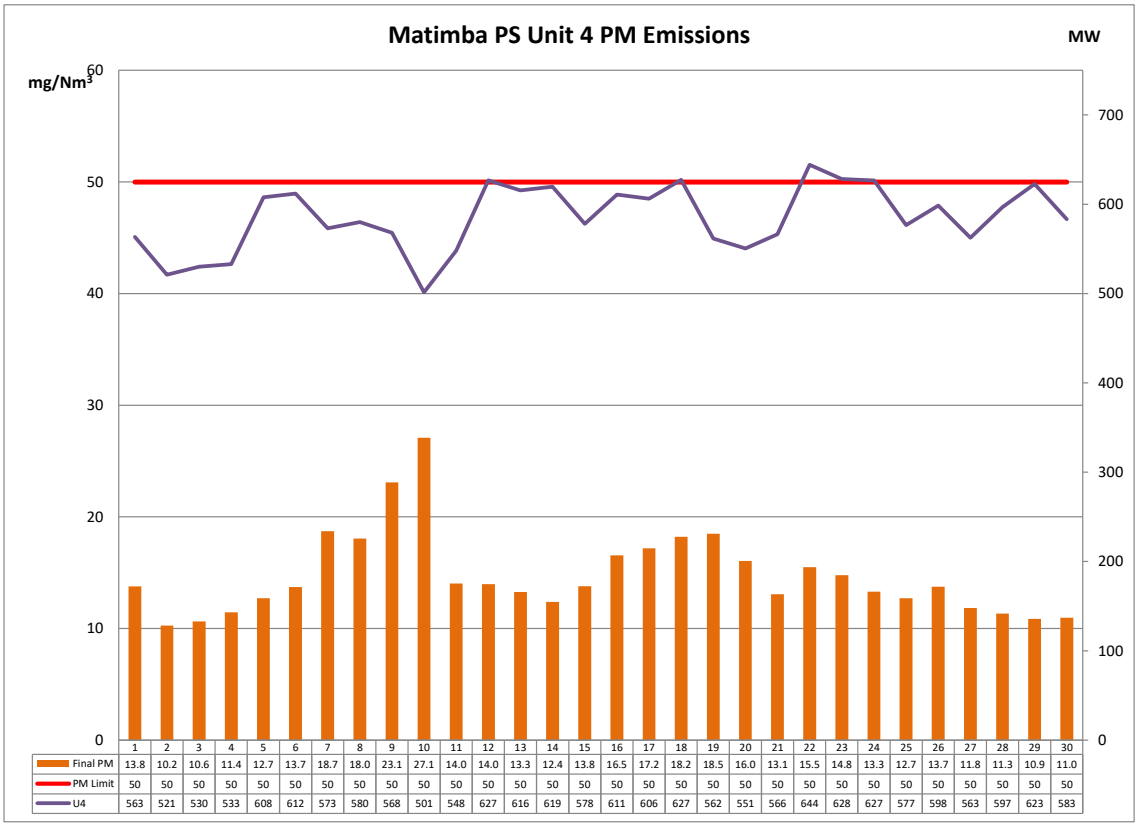


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final PM	33.8	29.1	23.5	19.4	17.8	23.2	22.5	19.8	12.9	9.7	13.0	12.6	10.2	11.0	10.6	10.5	10.7	22.3	14.8	10.2	12.0	15.9	14.9	12.3	10.0	9.1	9.1	9.7	13.1	13.4
PM Limit	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
U3	589	553	551	556	632	600	577	630	616	522	573	646	641	636	645	625	620	644	592	572	589	622	663	659	616	616	576	624	629	604

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

Interpretation:
All daily averages below particulate emission limit of 50 mg/Nm^3.

Unit 4 particulate emissions

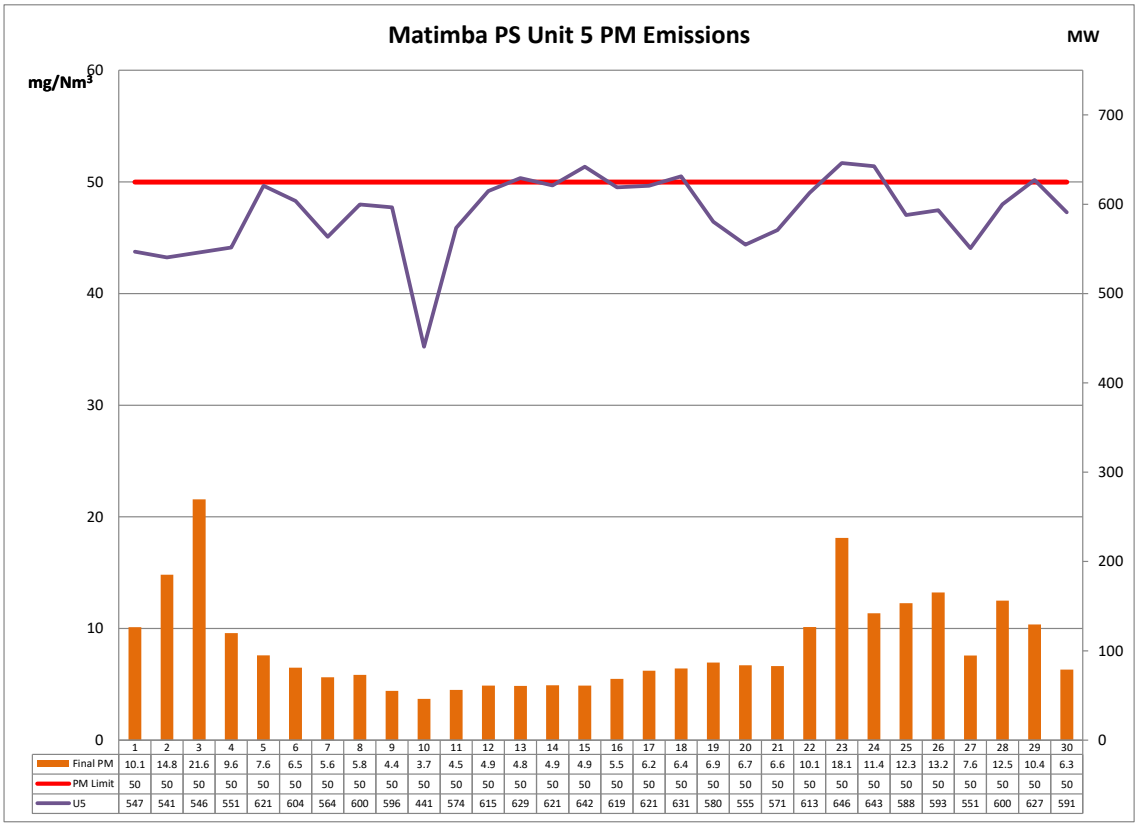


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final PM	13.8	10.2	10.6	11.4	12.7	13.7	18.7	18.0	23.1	27.1	14.0	14.0	13.3	12.4	13.8	16.5	17.2	18.2	18.5	16.0	13.1	15.5	14.8	13.3	12.7	13.7	11.8	11.3	10.9	11.0
PM Limit	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
U4	563	521	530	533	608	612	573	580	568	501	548	627	616	619	578	611	606	627	562	551	566	644	628	627	577	598	563	597	623	583

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

Interpretation:
All daily averages below particulate emission limit of 50 mg/Nm^3.

Unit 5 particulate emissions

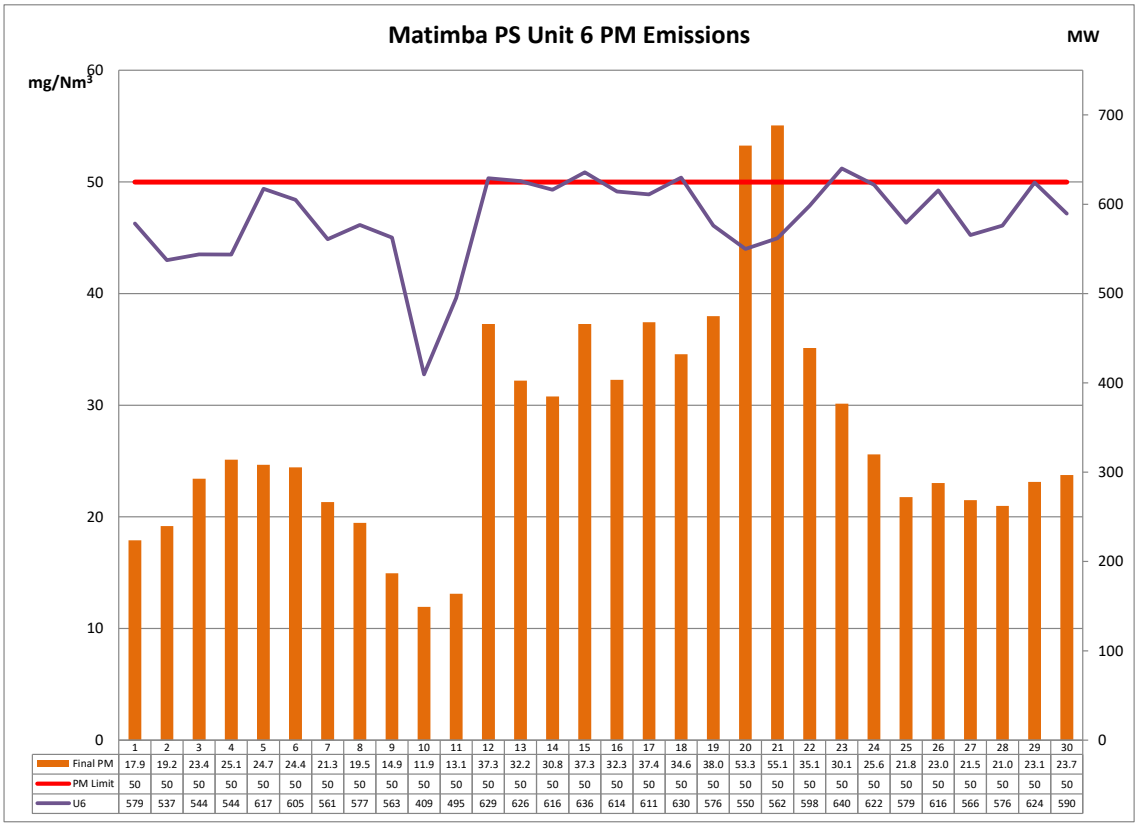


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final PM	10.1	14.8	21.6	9.6	7.6	6.5	5.6	5.8	4.4	3.7	4.5	4.9	4.8	4.9	4.9	5.5	6.2	6.4	6.9	6.7	6.6	10.1	18.1	11.4	12.3	13.2	7.6	12.5	10.4	6.3
PM Limit	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
U5	547	541	546	551	621	604	564	600	596	441	574	615	629	621	642	619	621	631	580	555	571	613	646	643	588	593	551	600	627	591

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

Interpretation:
All daily averages below particulate emission limit of 50 mg/Nm^3.

Unit 6 particulate emissions

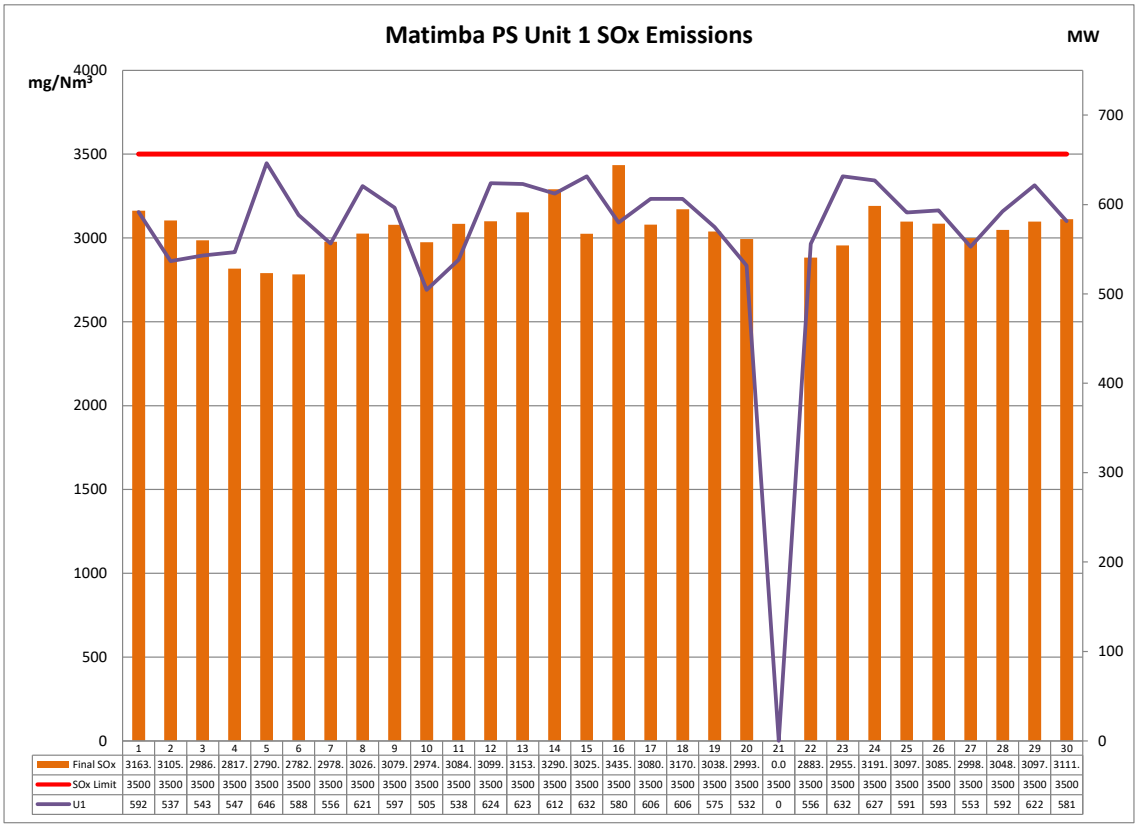


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final PM	17.9	19.2	23.4	25.1	24.7	24.4	21.3	19.5	14.9	11.9	13.1	37.3	32.2	30.8	37.3	32.3	37.4	34.6	38.0	53.3	55.1	35.1	30.1	25.6	21.8	23.0	21.5	21.0	23.1	23.7
PM Limit	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
U6	579	537	544	544	617	605	561	577	563	409	495	629	626	616	636	614	611	630	576	550	562	598	640	622	579	616	566	576	624	590

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

Interpretation:
Exceedances were recorded for Unit 6 on the 20th and 21st of June 2020. Exceedances were due to ash build-up on the monitor lens, blocking the optical path, and emissions normalised after lens was cleaned.

Unit 1 SO_2 emissions

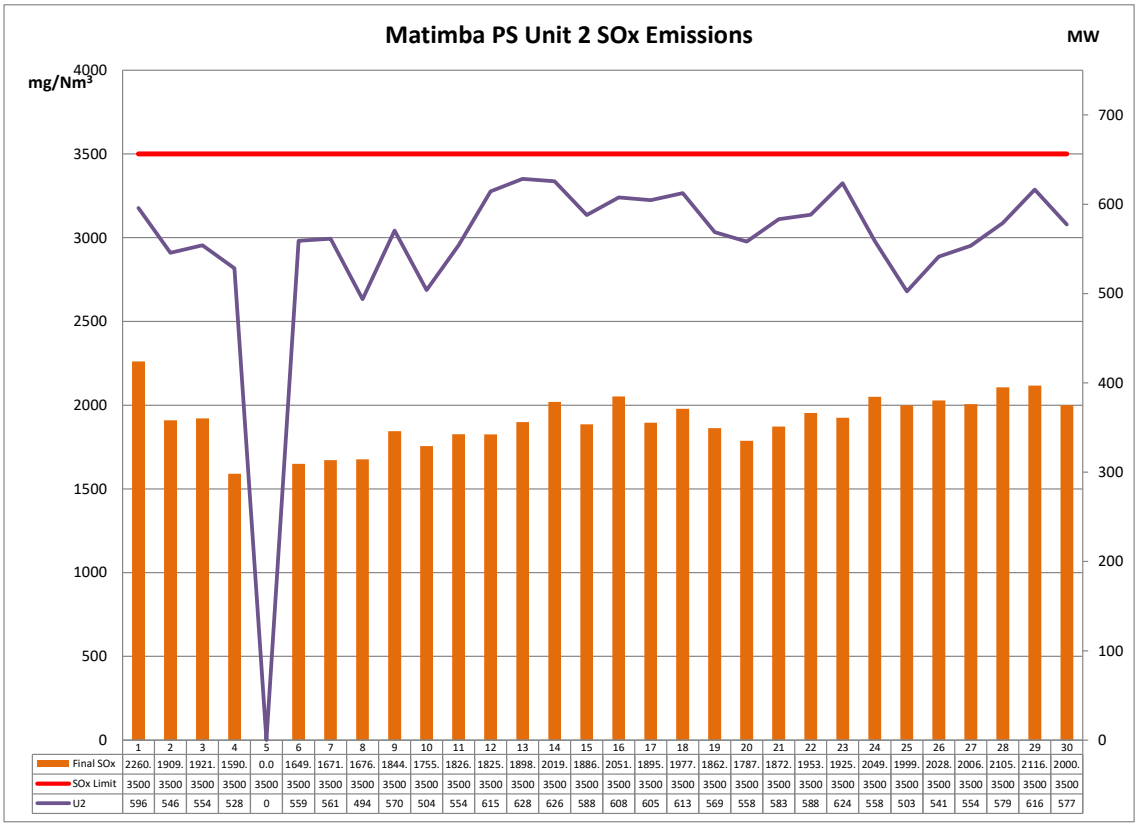


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final SOx	3163.	3105.	2986.	2817.	2790.	2782.	2978.	3026.	3079.	2974.	3084.	3099.	3153.	3290.	3025.	3435.	3080.	3170.	3038.	2993.	0.0	2883.	2955.	3191.	3097.	3085.	2998.	3048.	3097.	3111.
SOx Limit	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500
U1	592	537	543	547	646	588	556	621	597	505	538	624	623	612	632	580	606	606	575	532	0	556	632	627	591	593	553	592	622	581

Graph 7: SO_2 daily average emissions against emission limit for unit 1 for the month of June 2020

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

Unit 2 SO_2 emissions

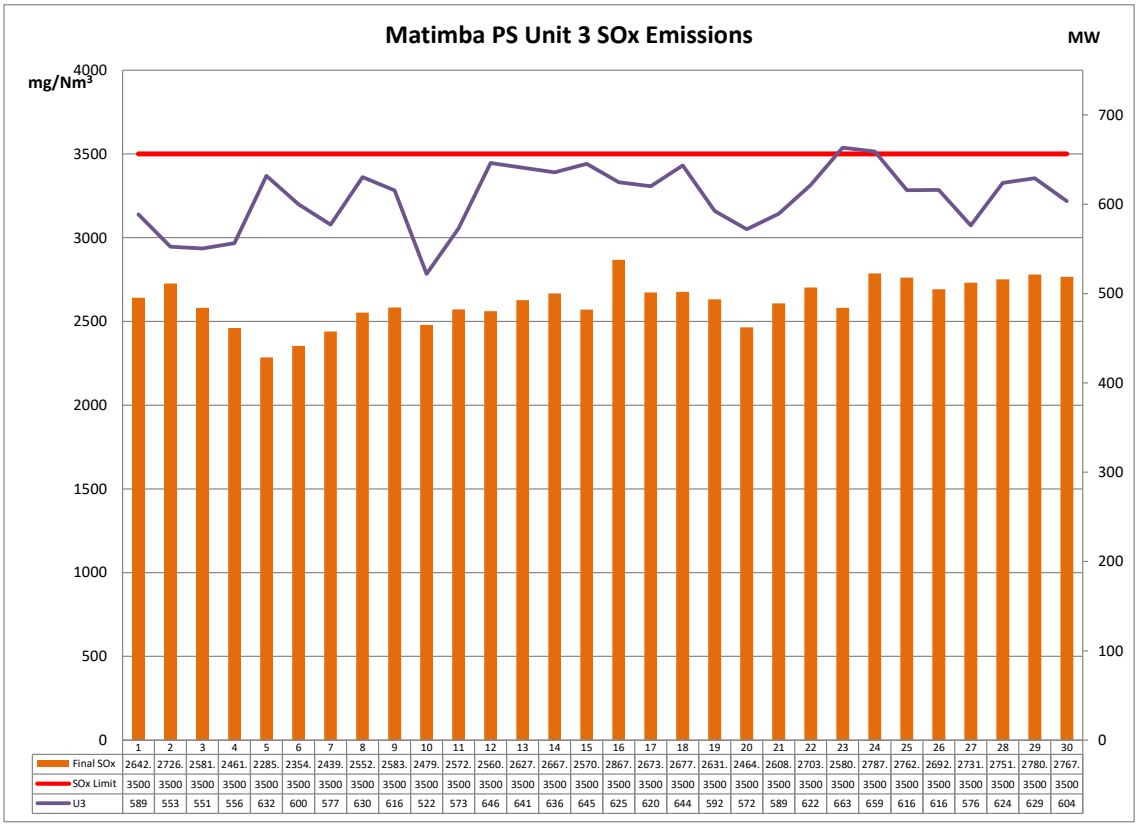


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final SOx	2260.	1909.	1921.	1590.	0.0	1649.	1671.	1676.	1844.	1755.	1826.	1825.	1898.	2019.	1886.	2051.	1895.	1977.	1862.	1787.	1872.	1953.	1925.	2049.	1999.	2028.	2006.	2105.	2116.	2000.
SOx Limit	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500
U2	596	546	554	528	0	559	561	494	570	504	554	615	628	626	588	608	605	613	569	558	583	588	624	558	503	541	554	579	616	577

Graph 8: SO_2 daily average emissions against emission limit for unit 2 for the month of June 2020

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

Unit 3 SO_2 emissions

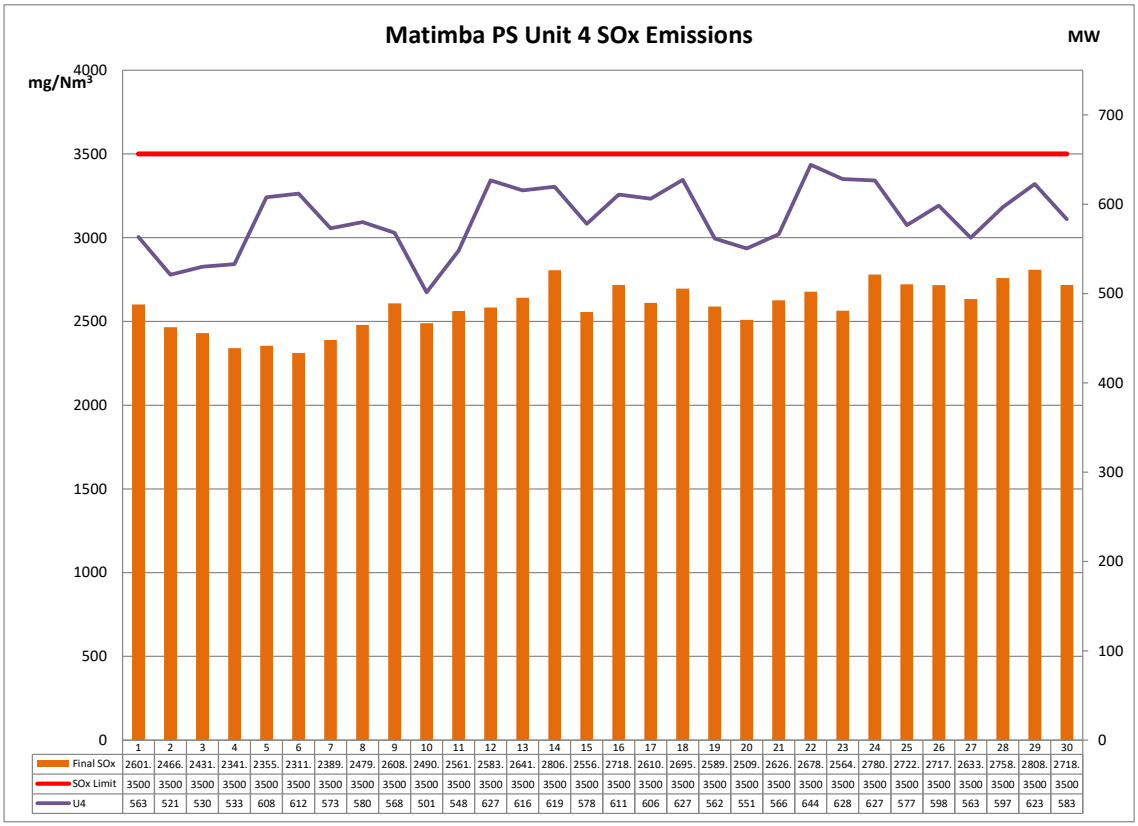


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final SOx	2642.	2726.	2581.	2461.	2285.	2354.	2439.	2552.	2583.	2479.	2572.	2560.	2627.	2667.	2570.	2867.	2673.	2677.	2631.	2464.	2608.	2703.	2580.	2787.	2762.	2692.	2731.	2751.	2780.	2767.
SOx Limit	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500
U3	589	553	551	556	632	600	577	630	616	522	573	646	641	636	645	625	620	644	592	572	589	622	663	659	616	616	576	624	629	604

Graph 9: SO_2 daily average emissions against emission limit for unit 3 for the month of June 2020

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

Unit 4 SO_2 emissions

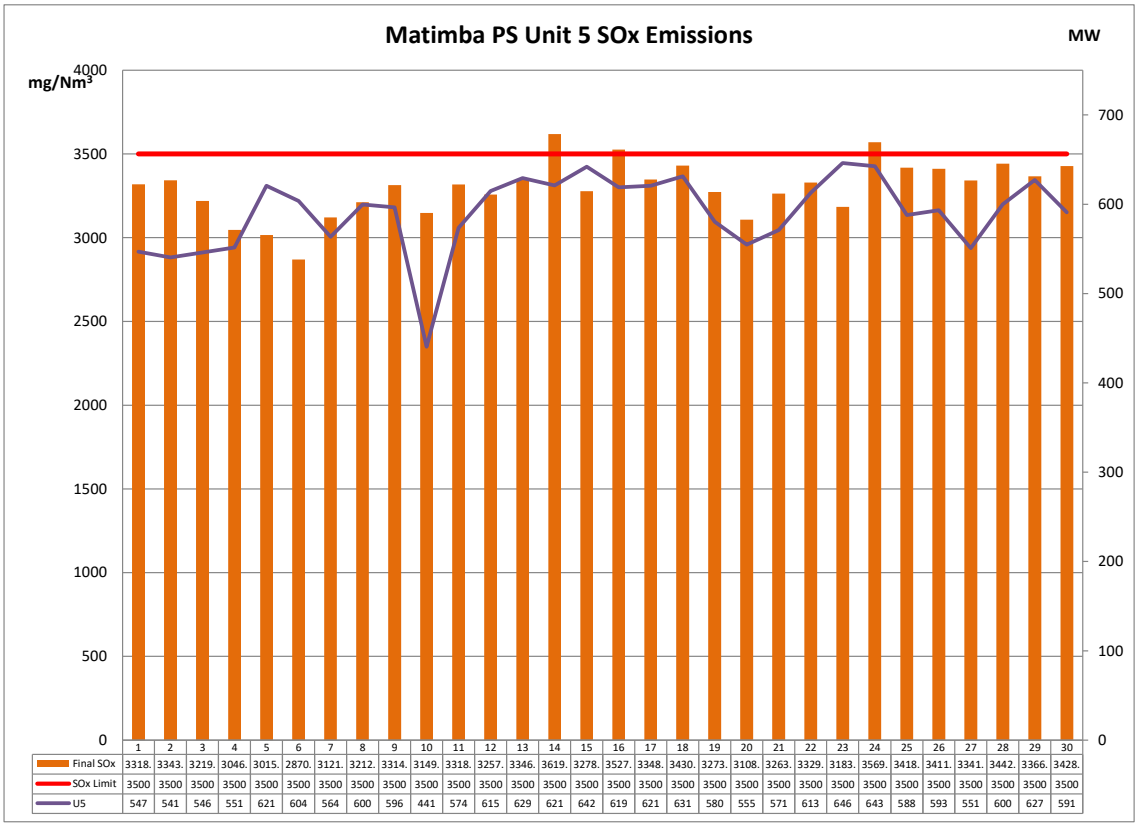


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final SOx	2601.	2466.	2431.	2341.	2355.	2311.	2389.	2479.	2608.	2490.	2561.	2583.	2641.	2806.	2556.	2718.	2610.	2695.	2589.	2509.	2626.	2678.	2564.	2780.	2722.	2717.	2633.	2758.	2808.	2718.
SOx Limit	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500
U4	563	521	530	533	608	612	573	580	568	501	548	627	616	619	578	611	606	627	562	551	566	644	628	627	577	598	563	597	623	583

Graph 10: SO_2 daily average emissions against emission limit for unit 4 for the month of June 2020

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

Unit 5 SO_2 emissions

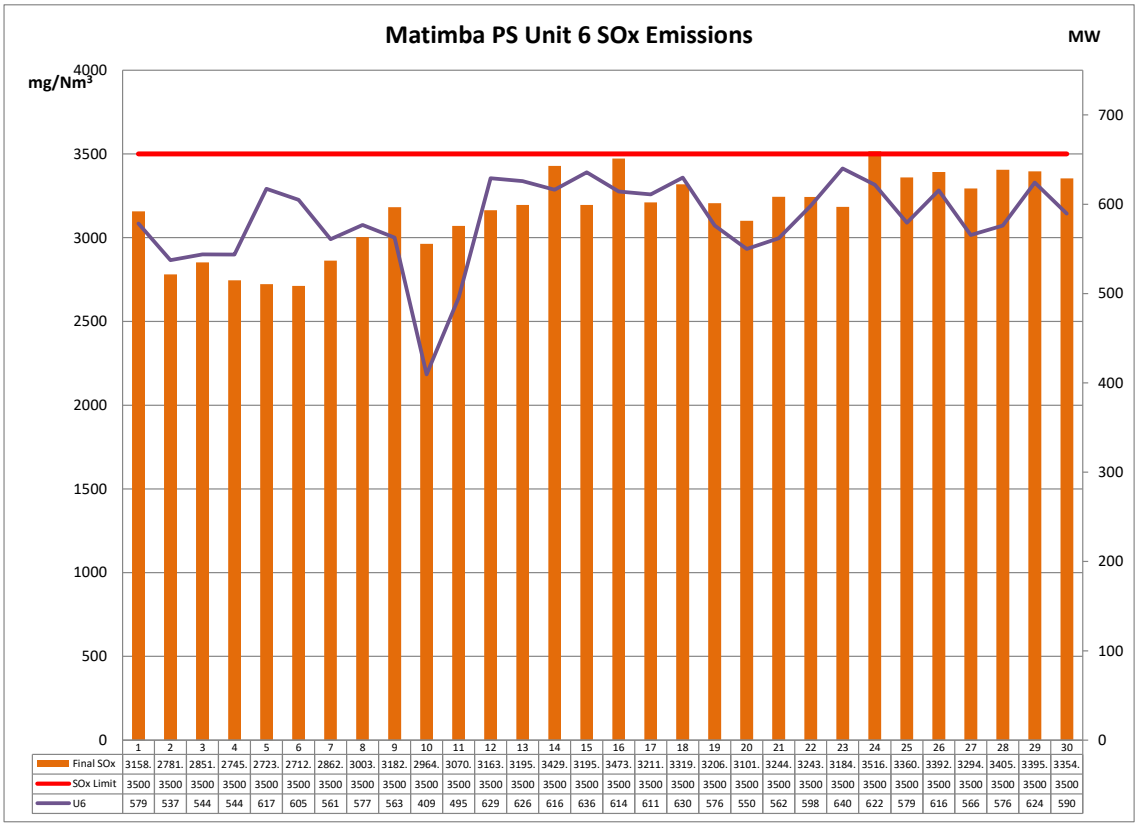


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final SOx	3318.	3343.	3219.	3046.	3015.	2870.	3121.	3212.	3314.	3149.	3318.	3257.	3346.	3619.	3278.	3527.	3348.	3430.	3273.	3108.	3263.	3329.	3183.	3569.	3418.	3411.	3341.	3442.	3366.	3428.
SOx Limit	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500
U5	547	541	546	551	621	604	564	600	596	441	574	615	629	621	642	619	621	631	580	555	571	613	646	643	588	593	551	600	627	591

Graph 11: SO_2 daily average emissions against emission limit for unit 5 for the month of June 2020

Interpretation:
The SO_2 daily emissions increased on the 14th, 16th and 24th of June 2020. The Monthly average SO_2 emissions remained below the limit of 3500 mg/Nm^3 with the monthly average SO_2 emissions recorded as 3296 mg/Nm^3.

Unit 6 SO_2 emissions

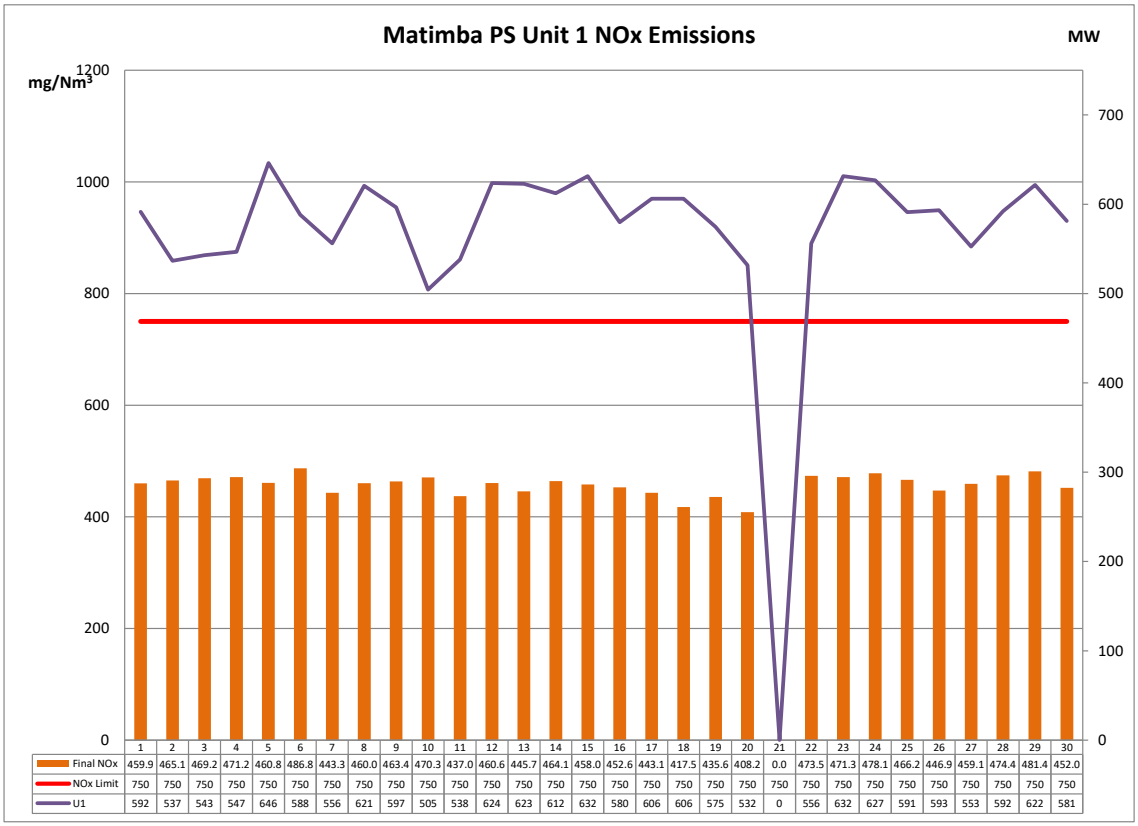


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final SOx	3158.	2781.	2851.	2745.	2723.	2712.	2862.	3003.	3182.	2964.	3070.	3163.	3195.	3429.	3195.	3473.	3211.	3319.	3206.	3101.	3244.	3243.	3184.	3516.	3360.	3392.	3294.	3405.	3395.	3354.
SOx Limit	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500
U6	579	537	544	544	617	605	561	577	563	409	495	629	626	616	636	614	611	630	576	550	562	598	640	622	579	616	566	576	624	590

Graph 12: SO_2 daily average emissions against emission limit for unit 6 for the month of June 2020

Interpretation:
The SO_2 daily emissions increased on the 24th of June 2020. The Monthly average SO_2 emissions remained below the limit of 3500 mg/Nm^3 with the monthly average SO_2 emissions recorded as 3158 mg/Nm^3.

Unit 1 NO_x emissions

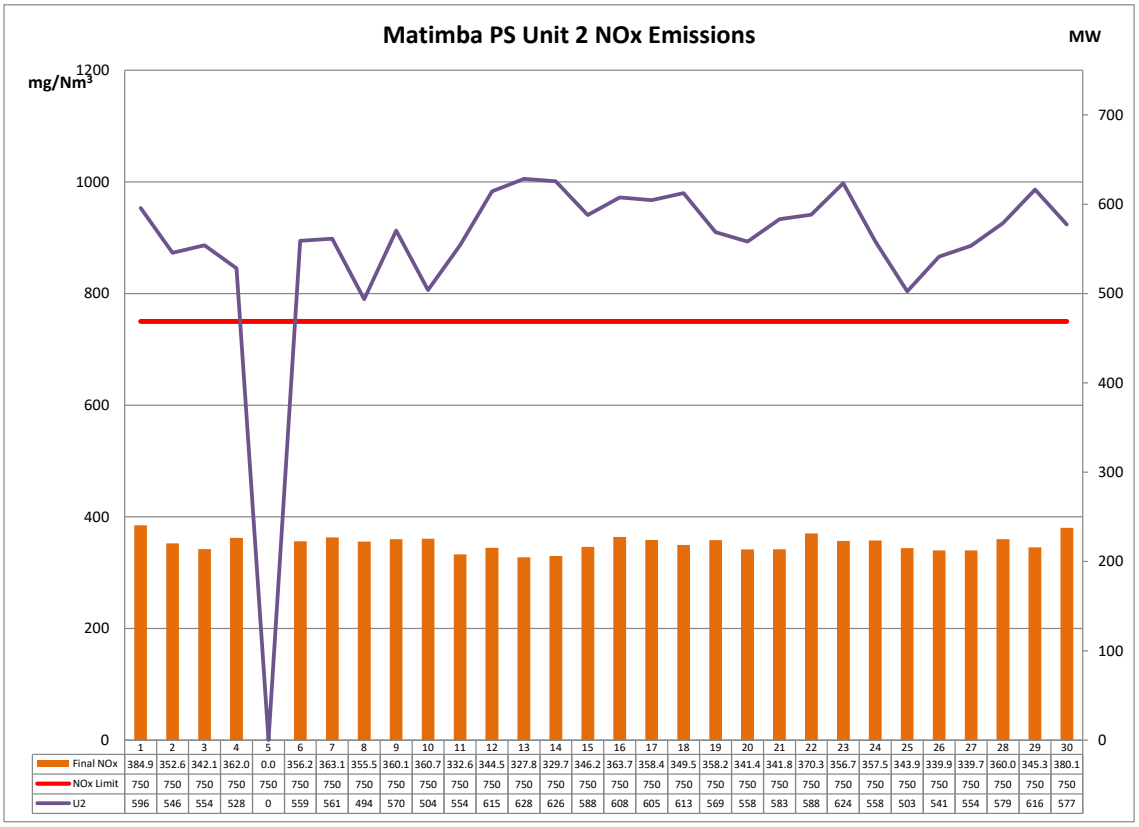


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final NOx	459.9	465.1	469.2	471.2	460.8	486.8	443.3	460.0	463.4	470.3	437.0	460.6	445.7	464.1	458.0	452.6	443.1	417.5	435.6	408.2	0.0	473.5	471.3	478.1	466.2	446.9	459.1	474.4	481.4	452.0
NOx Limit	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
U1	592	537	543	547	646	588	556	621	597	505	538	624	623	612	632	580	606	606	575	532	0	556	632	627	591	593	553	592	622	581

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

Interpretation:
All daily averages below NO_x emission limit of 750 mg/Nm^3.

Unit 2 NO_x emissions

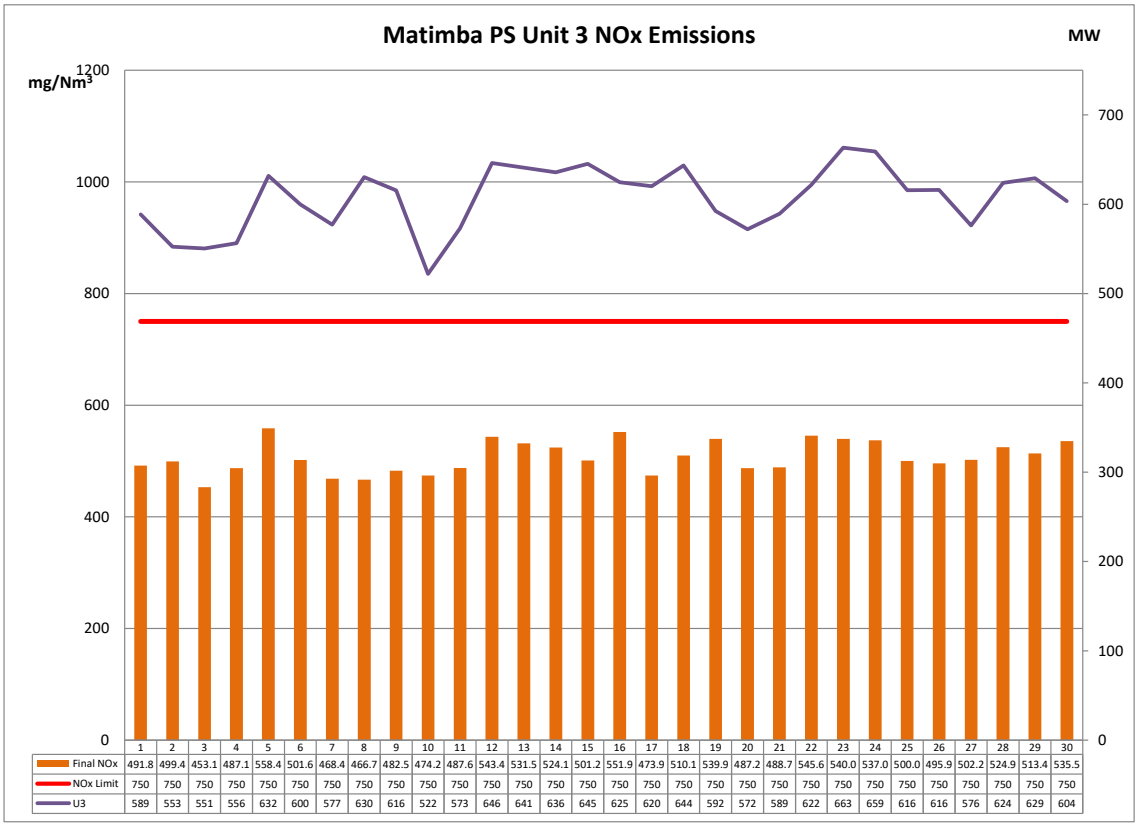


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final NOx	384.9	352.6	342.1	362.0	0.0	356.2	363.1	355.5	360.1	360.7	332.6	344.5	327.8	329.7	346.2	363.7	358.4	349.5	358.2	341.4	341.8	370.3	356.7	357.5	343.9	339.9	339.7	360.0	345.3	380.1
NOx Limit	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
U2	596	546	554	528	0	559	561	494	570	504	554	615	628	626	588	608	605	613	569	558	583	588	624	558	503	541	554	579	616	577

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

Interpretation:
All daily averages below NO_x emission limit of 750 mg/Nm^3.

Unit 3 NO_x emissions

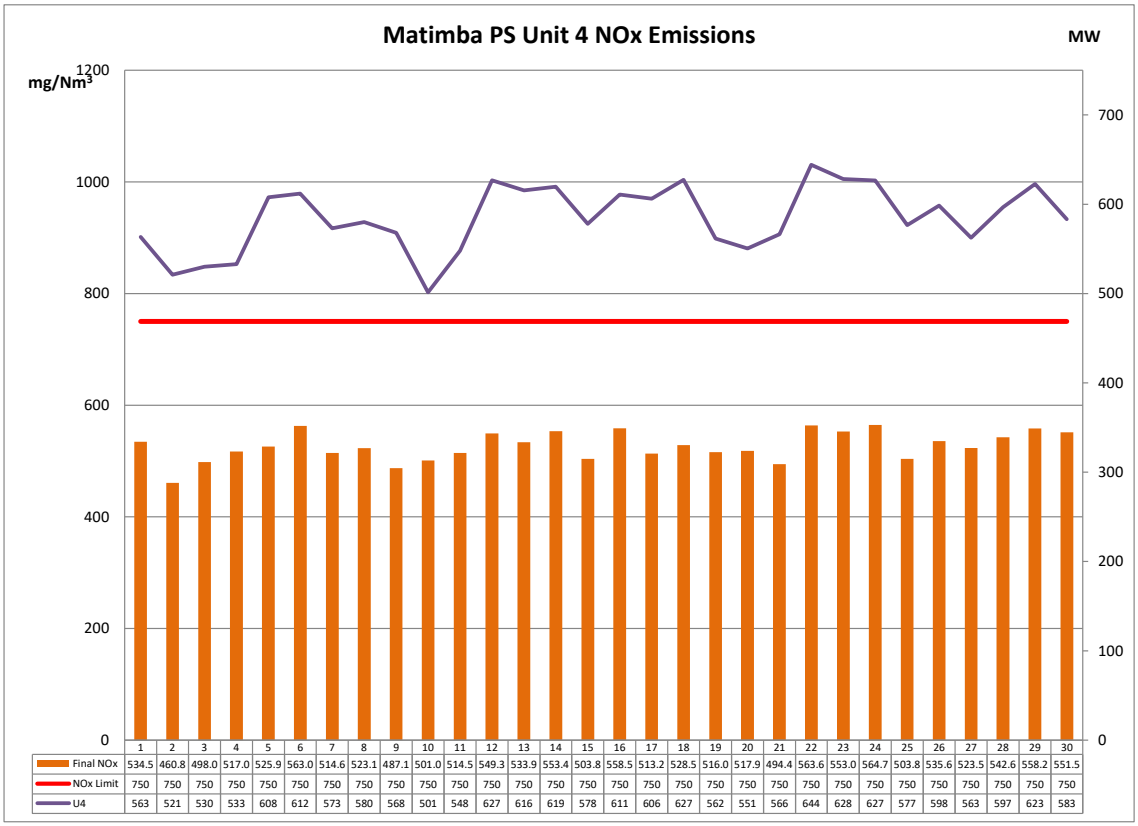


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final NOx	491.8	499.4	453.1	487.1	558.4	501.6	468.4	466.7	482.5	474.2	487.6	543.4	531.5	524.1	501.2	551.9	473.9	510.1	539.9	487.2	488.7	545.6	540.0	537.0	500.0	495.9	502.2	524.9	513.4	535.5
NOx Limit	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
U3	589	553	551	556	632	600	577	630	616	522	573	646	641	636	645	625	620	644	592	572	589	622	663	659	616	616	576	624	629	604

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

Interpretation:
All daily averages below NO_x emission limit of 750 mg/Nm^3.

Unit 4 NO_x emissions

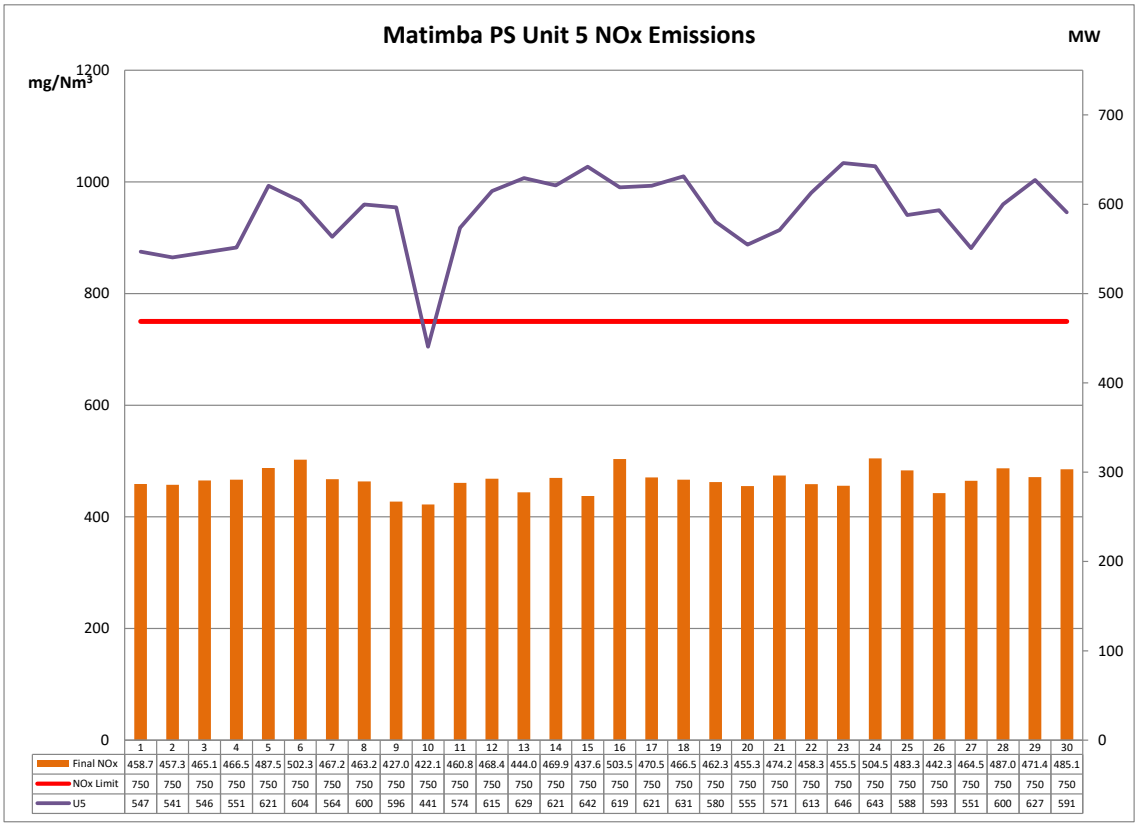


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final NOx	534.5	460.8	498.0	517.0	525.9	563.0	514.6	523.1	487.1	501.0	514.5	549.3	533.9	553.4	503.8	558.5	513.2	528.5	516.0	517.9	494.4	563.6	553.0	564.7	503.8	535.6	523.5	542.6	558.2	551.5
NOx Limit	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
U4	563	521	530	533	608	612	573	580	568	501	548	627	616	619	578	611	606	627	562	551	566	644	628	627	577	598	563	597	623	583

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

Interpretation:
All daily averages below NO_x emission limit of 750 mg/Nm^3.

Unit 5 NO_x emissions

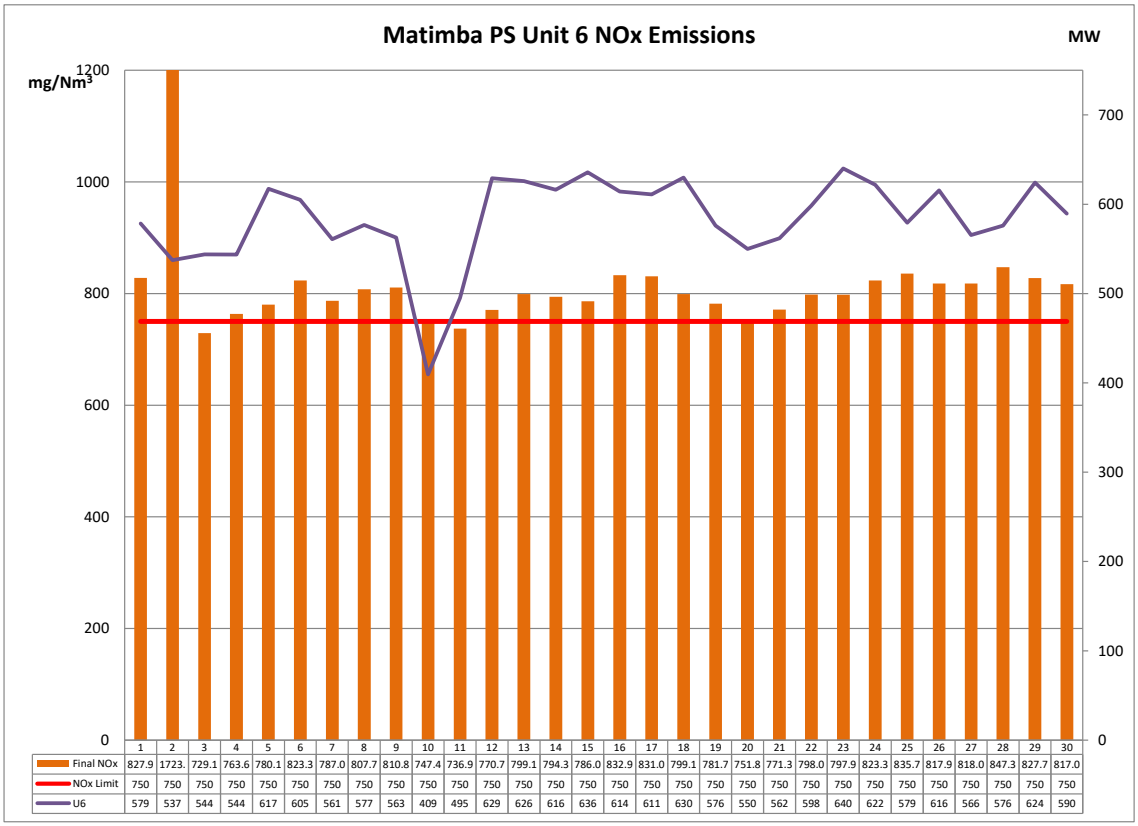


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final NOx	458.7	457.3	465.1	466.5	487.5	502.3	467.2	463.2	427.0	422.1	460.8	468.4	444.0	469.9	437.6	503.5	470.5	466.5	462.3	455.3	474.2	458.3	455.5	504.5	483.3	442.3	464.5	487.0	471.4	485.1
NOx Limit	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
U5	547	541	546	551	621	604	564	600	596	441	574	615	629	621	642	619	621	631	580	555	571	613	646	643	588	593	551	600	627	591

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

Interpretation:
All daily averages below NO_x emission limit of 750 mg/Nm^3.

Unit 6 NO_x emissions



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Final NOx	827.9	1723.	729.1	763.6	780.1	823.3	787.0	807.7	810.8	747.4	736.9	770.7	799.1	794.3	786.0	832.9	831.0	799.1	781.7	751.8	771.3	798.0	797.9	823.3	835.7	817.9	818.0	847.3	827.7	817.0
NOx Limit	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
U6	579	537	544	544	617	605	561	577	563	409	495	629	626	616	636	614	611	630	576	550	562	598	640	622	579	616	566	576	624	590

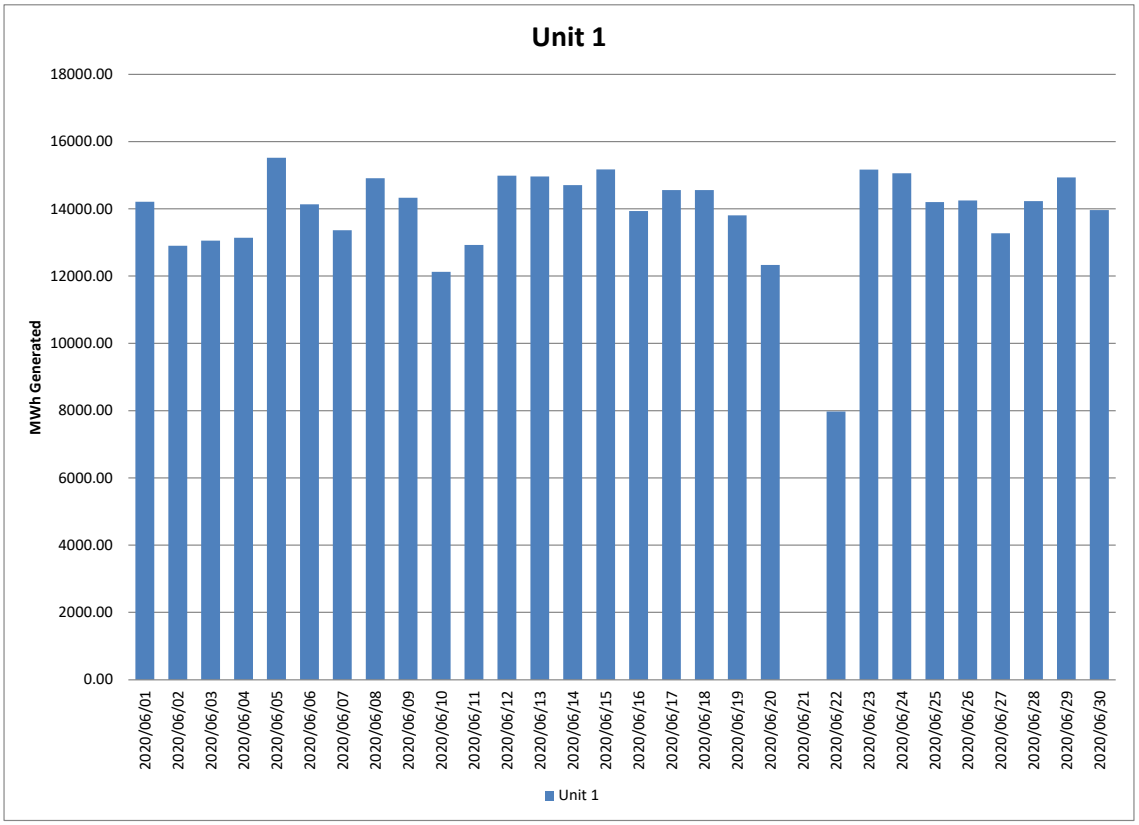
Graph 18: NO_x daily average emissions against emission limit for unit 6 for the month of June 2020

Interpretation:
Exceedances for Unit 6 NOx emissions were investigated and root cause has been determined to be incorrect settings on the gaseous monitor. The monitor has since been repaired and emissions normalised to below the daily limit.

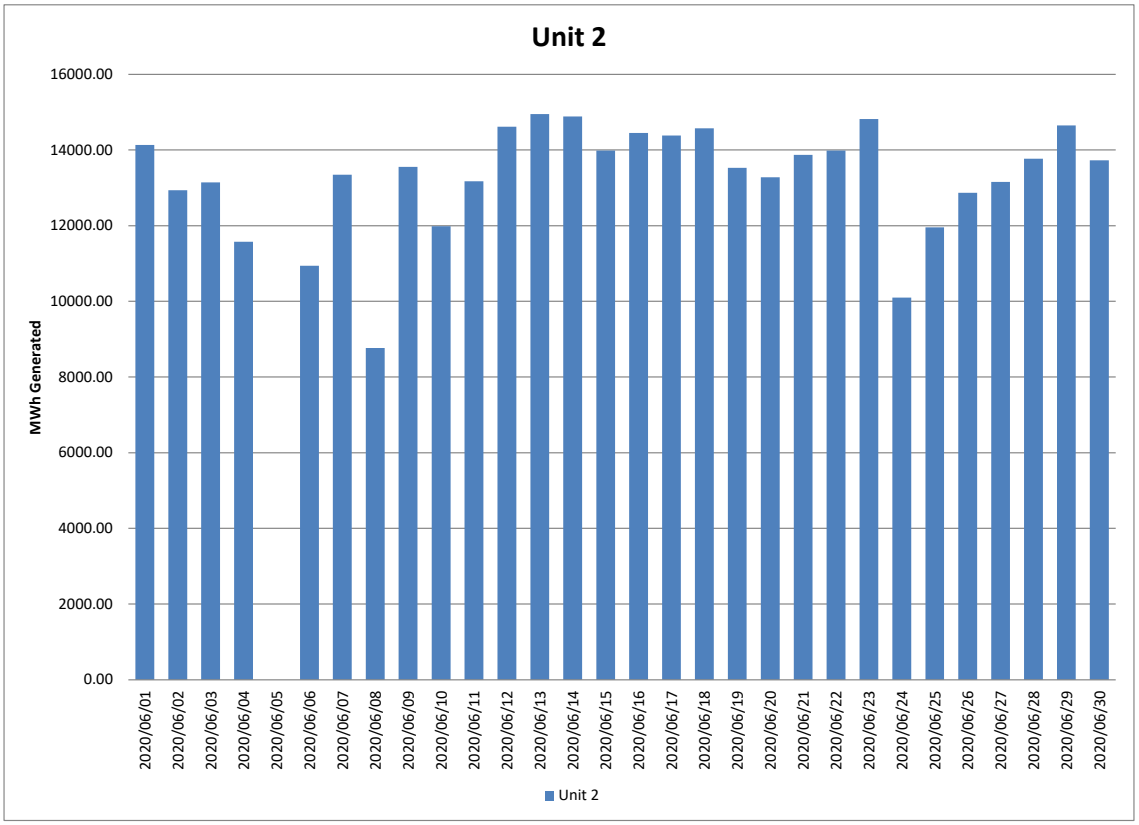
Table 4: Daily power generated per unit in MWh for the month of June 2020

Date	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
2020/06/01	14210.73	14132.33	13714.87	13463.47	10581.30	13757.60
2020/06/02	12904.00	12937.07	12865.47	12455.40	12869.60	12776.47
2020/06/03	13054.20	13142.33	12808.53	12668.00	13002.10	12932.13
2020/06/04	13138.33	11573.87	12952.87	12738.53	13130.40	12927.20
2020/06/05	15520.47	0.00	14766.40	14526.07	14775.20	14684.87
2020/06/06	14133.33	10938.80	13993.67	14625.87	14374.80	14379.53
2020/06/07	13362.20	13348.20	13450.00	13701.73	13420.20	13329.40
2020/06/08	14911.27	8765.93	14727.67	13862.13	14274.90	13750.07
2020/06/09	14332.07	13557.40	14371.53	13581.20	14198.00	13383.13
2020/06/10	12127.73	11981.40	12137.20	11987.00	10492.50	9727.73
2020/06/11	12929.00	13171.87	13343.00	13104.20	13656.30	11658.27
2020/06/12	14984.27	14613.60	15100.53	14981.53	14635.80	14969.73
2020/06/13	14960.13	14948.07	14986.00	14712.20	14980.90	14921.47
2020/06/14	14707.80	14886.67	14862.27	14805.00	14786.80	14656.87
2020/06/15	15172.80	13986.33	15100.20	13815.53	15282.00	15134.80
2020/06/16	13933.53	14451.87	14604.40	14598.53	14733.00	14610.80
2020/06/17	14562.87	14385.40	14498.00	14488.73	14773.90	14542.27
2020/06/18	14561.73	14571.27	15058.13	14995.40	15031.60	14977.33
2020/06/19	13808.27	13528.80	13822.67	13427.33	13815.20	13701.87
2020/06/20	12333.27	13279.80	13332.87	13160.60	13205.10	13088.00
2020/06/21	0.00	13870.00	13738.93	13539.27	13596.10	13377.87
2020/06/22	7976.47	13983.73	14498.67	15393.47	14586.90	14237.47
2020/06/23	15169.27	14818.80	15496.47	15014.60	15379.90	15222.67
2020/06/24	15058.07	10097.87	15406.73	14973.73	15294.90	14788.80
2020/06/25	14200.93	11957.67	14367.67	13782.47	13993.80	13773.27
2020/06/26	14250.93	12869.87	14372.07	14298.00	14119.20	14641.93
2020/06/27	13275.47	13160.13	13412.80	13441.07	13110.60	13447.00
2020/06/28	14230.00	13769.27	14556.93	14255.53	14279.60	13695.20
2020/06/29	14929.20	14653.20	14671.67	14879.07	14925.90	14841.20
2020/06/30	13965.13	13728.87	14064.67	13939.53	14063.70	14018.67

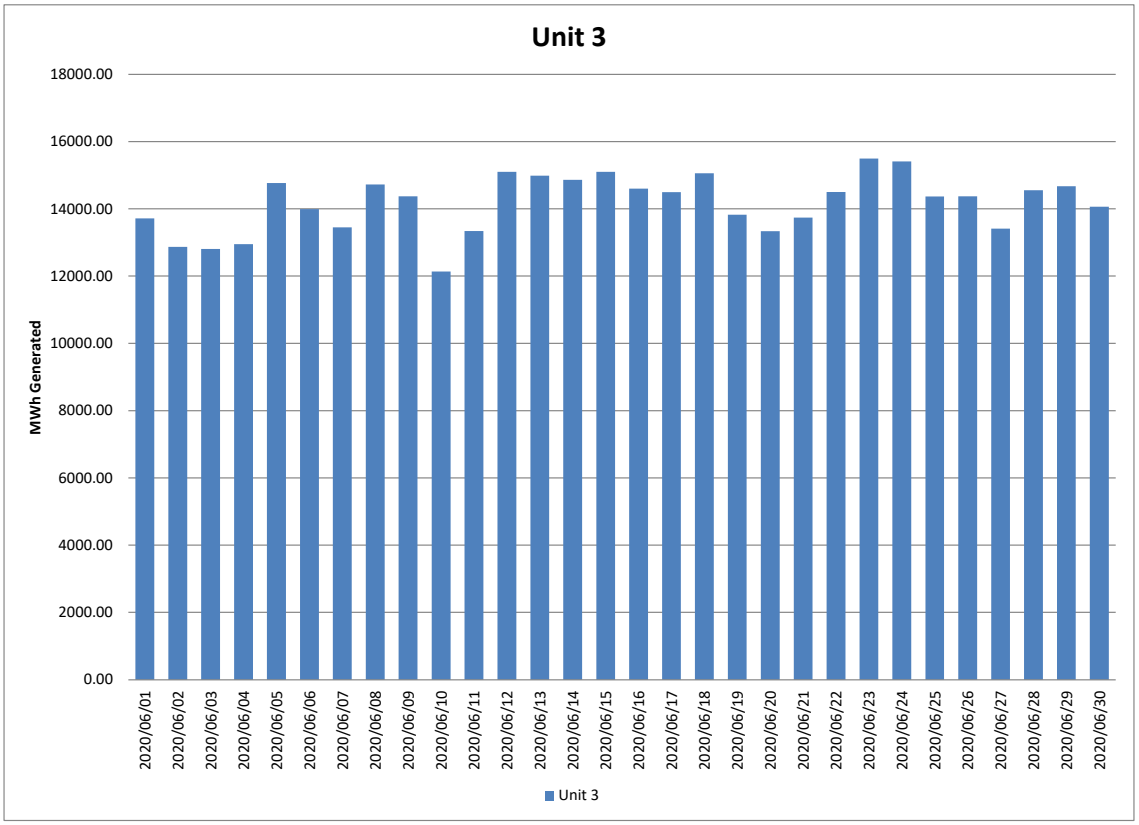
Graph 19: Unit 1 daily generated power in MWh for the month of June 2020



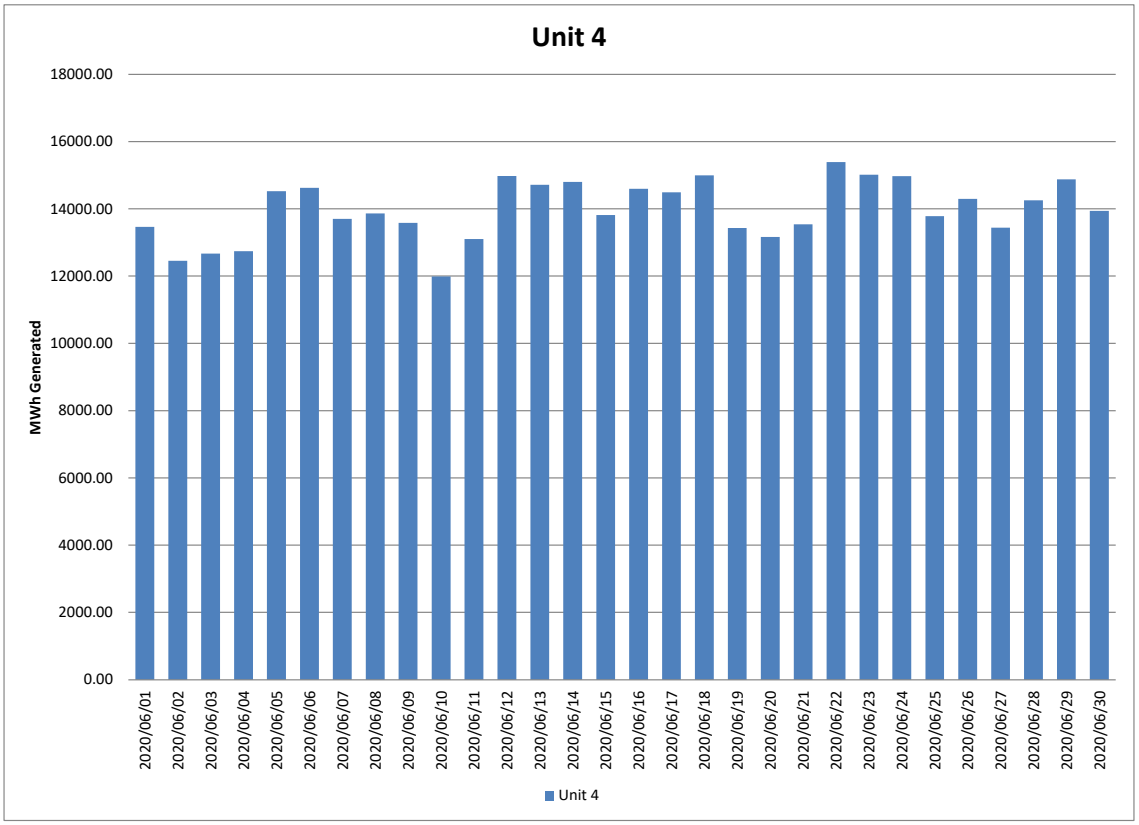
Graph 20: Unit 2 daily generated power in MWh for the month of June 2020



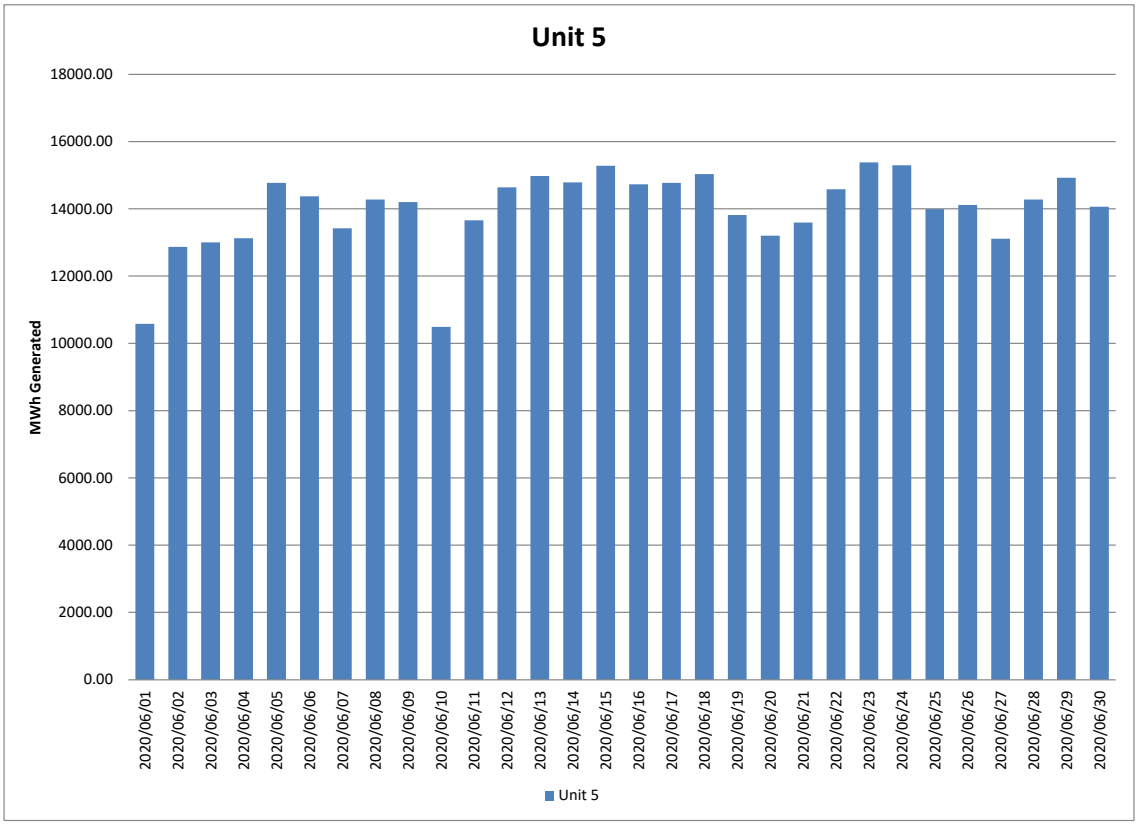
Graph 21: Unit 3 daily generated power in MWh for the month of June 2020



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



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



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

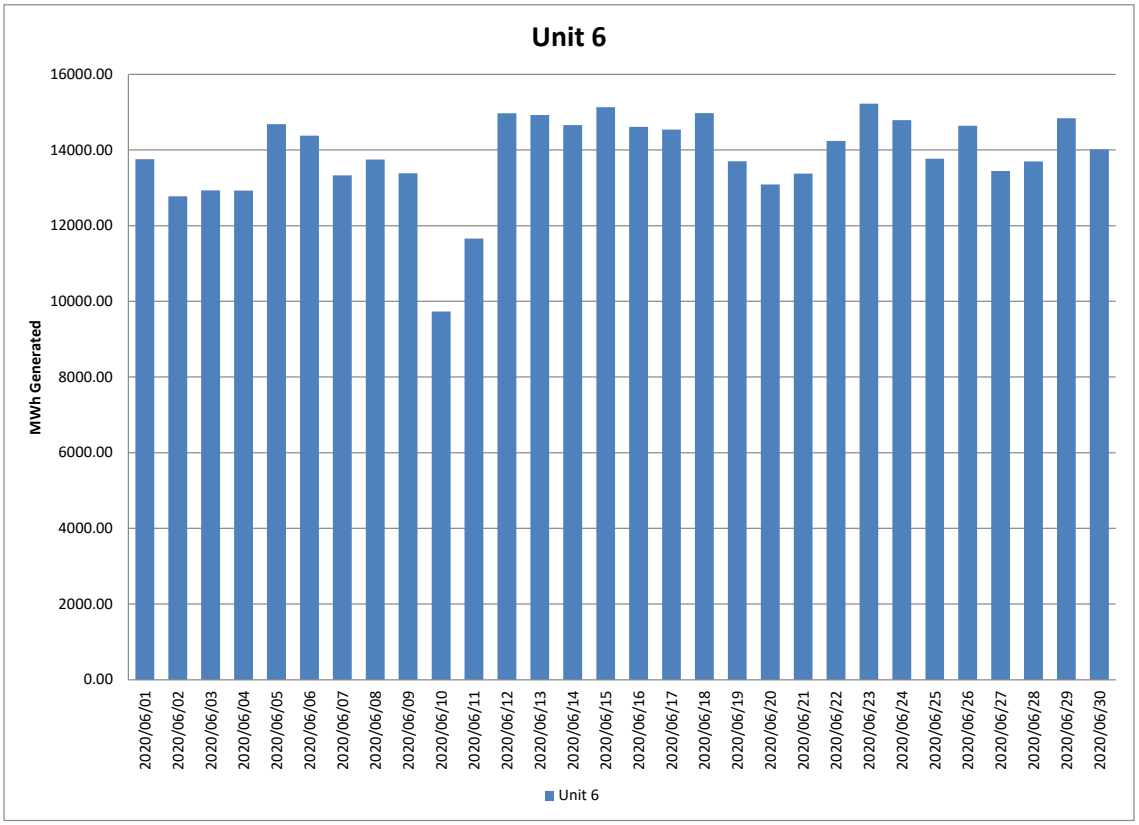


Table 5: Pollutant tonnages for the month of June 2020

Associated Unit/Stack	PM (tons)	SO_2 (tons)	NO_x (tons)	CO_2 (tons)
Unit 1	35.6	5 916.0	885.9	309 944
Unit 2	37.9	4 400.4	810.6	343 098
Unit 3	35.7	4 915.1	952.5	372 501
Unit 4	31.9	6 281.5	1 277.8	406 130
Unit 5	16.6	6 520.5	922.3	444 752
Unit 6	53.7	5 989.8	1 569.4	444 533
SUM	211.5	34 023.3	6 418.5	2 320 957

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	%	7.71	5.97	8.65	6.21	8.48	8.90
Moisture	%	4.71	3.61	3.76	5.15	3.99	4.34
Velocity	m/s	25.5	29.0	25.4	27.4	26.6	27.9
Temperature	°C	136.9	169.6	136.2	129.1	131.6	121.9
Pressure	mBar	938.3	942.7	934.2	938.2	932.9	858.0

Start-up information.

Table 7: Start-up information

Unit	5	
Fires in	06H37	2020-06-01
Synchronization with Grid	08H05	2020-06-01
Emissions below limit	08H46	2020-06-01
Fires in to synchronization	1.466	Hours
Synchronization to < Emission limit	0.684	Hours

Unit	2	
Fires in	00H30	2020-06-06
Synchronization with Grid	04H13	2020-06-06
Emissions below limit	05H00	2020-06-06
Fires in to synchronization	3.717	Hours
Synchronization to < Emission limit	0.783	Hours

Unit	2	
Fires in	13H15	2020-06-08
Synchronization with Grid	15H06	2020-06-08
Emissions below limit	16H00	2020-06-08
Fires in to synchronization	1.85	Hours
Synchronization to < Emission limit	0.9	Hours

Unit	6	
Fires in	03H19	2020-06-11
Synchronization with Grid	03H34	2020-06-11
Emissions below limit	03H34	2020-06-11
Fires in to synchronization	0.25	Hours
Synchronization to < Emission limit	0	Hours

Unit	1	
Fires in	05H46	2020-06-22
Synchronization with Grid	09H41	2020-06-22
Emissions below limit	09H41	2020-06-22
Fires in to synchronization	3.916	Hours
Synchronization to < Emission limit	0	Hours

Unit	2	
Fires in	16H53	2020-06-24
Synchronization with Grid	18H26	2020-06-24
Emissions below limit	21H00	2020-06-24
Fires in to synchronization	1.55	Hours
Synchronization to < Emission limit	2.567	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	173	158	199	199	195	191
Emergency Hours declared including hours after stand down	199	181	228	228	223	219
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.

Eskom

LATION OF EMISSIONS OF TOTAL VOLATILE COMPOUNDS FROM FUEL OIL STORAGE

Date:	Wednesday, 19 August 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

MONTHLY INPUT DATA FOR THE STATION

Please only insert relevant monthly data inputs into the *blue cells* below

Choose from a dropdown menu in the *green cells*

The total VOC emissions for the month are in the *red cells*

IMPORTANT: Do not change ***any*** other cells without consulting the AQ CoE

MONTH:	**June**	
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:	***542.709***	tons/month
Molecular weight of the fuel oil:	166.00	Lb/lb-mole
METEROLOGICAL DATA FOR THE MONTH	**Data**	**Unit**
Daily average ambient temperature	16.61	°C
Daily maximum ambient temperature	25.19	°C
Daily minimum ambient temperature	9.38	°C
Daily ambient temperature range	15.81	°C
Daily total insolation factor	3.45	kWh/m²/day
Tank paint colour	***Grey/medium***	NA
Tank paint solar absorbtance	0.68	NA
FINAL OUTPUT:	**Result**	**Unit**
Breathing losses:	0.54	kg/month
Working losses:	0.02	kg/month
TOTAL LOSSES (Total TVOC Emissions for the month):	**0.55**	**kg/month**

*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.

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

Associated Unit/Stack	PM	SO_2	NO	CO_2
Unit 1	*100.0*	*99.7*	*99.7*	*99.7*
Unit 2	*100.0*	*91.6*	*91.6*	*91.6*
Unit 3	*100.0*	*99.7*	*99.9*	*99.7*
Unit 4	*100.0*	*100.0*	*100.0*	*100.0*
Unit 5	*100.0*	*100.0*	*100.0*	*100.0*
Unit 6	*100.0*	*95.0*	*95.4*	*95.0*

Ambient Air quality Monitoring

Ambient report not yet available, will be communicated as soon as it is received.

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. S23^0 40' 2.8" E027^0 36' 34.8" 175m from ground level and 75m from the top.
    b. Gas:
        i. S23^0 40' 2.8" E027^0 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. S23^0 40' 14.8" E027^0 36' 47.5" 175m from ground level and 75m from the top.
    b. Gas:
        i. S23^0 40' 14.8" E027^0 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. 0 out of 32 precipitator fields is out of service.
1. No abnormalities on the SO_3 plant. Preventative maintenance done during the month.

Unit 2

1. 4 out of 32 precipitator fields is out of service. Repairs will be done during the next opportunity outage.
2. No abnormalities on the SO_3 plant. Preventative maintenance done during the month.

Unit 3

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

Unit 5

1. All precipitator fields in service.
2. No abnormalities on the SO_3 plant.

Unit 6

1. 3 out of 32 precipitator fields is out of service. Repairs will be done during the next opportunity outage.
2. No abnormalities on the SO_3 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 June 2020

Sampling dates and times

1. Continuous

Attachments

None

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

Mabatt 2020/09/04

GENERAL MANAGER: MATIMBA POWER STATION

RESEARCH, TESTING AND DEVELOPMENT

SUSTAINABILITY DEPARTMENT

MARAPONG AIR QUALITY MONTHLY REPORT

JUNE 2020

EXECUTIVE SUMMARY

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

The average data recovery for the period was 81.5% and the station availability was 99.9%.

There were six exceedances of the $PM_{2.5}$ national daily limit and eight exceedances of the PM_{10} national daily limit recorded during the monitoring period. There was one exceedance of the SO_2 national hourly limit and no other exceedances of the other parameters recorded during the period under review.

Ambient CO, $PM_{2.5}$, PM_{10}, NO_2 and SO_2 concentrations at Marapong monitoring site show influence of emissions from low level sources in the area.

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

DISCLAIMER

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 (SO_2), nitrogen dioxide (NO_2), ozone (O_3), mercury (Hg) and fine particulate matter (FPM) of particulate sizes <10µm and <2.5µm in diameter (PM_{10} 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 SO_2, O_3 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).

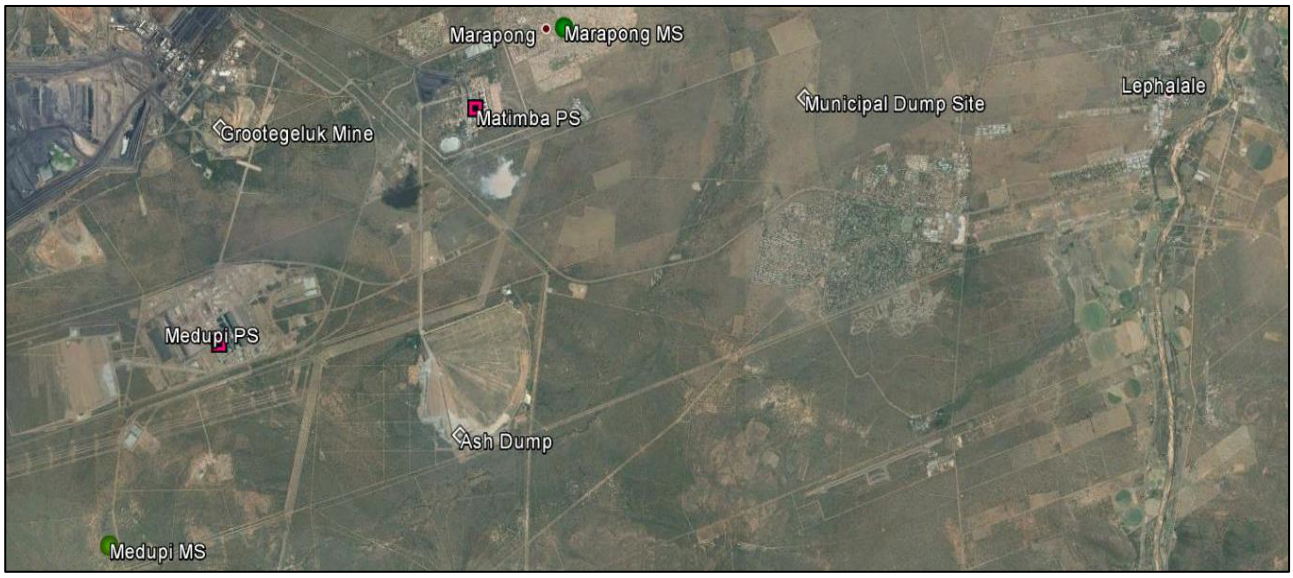


Figure 1: Marapong air quality monitoring site in relation to Matimba Power Station and other pollution sources.

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. The internal temperature of the monitoring hut is controlled at 25±5°C.

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 June 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.
June	51.7	51.7	51.7	0	99.9	99.9	99.9	99.9	99.9	99.9	99.9	60.1	58.5	76	99.9	81.5	99.9

The average data recovery for the period was 81.5% and the station availability was 99.9%. The low data capture of 60.1% recorded for PM_{10} analyser was because the pump of the analyser ceased after power interruptions. There were no data recorded for ozone since the analyser was removed

for repairs. The low data capture of 76% recorded for mercury (Hg) analyser was because the Argon carrier gas ran out during the month.

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}	$\mu g/m^3$	24hr	75	4	DEA
PM_{10}	$\mu g/m^3$	1year	40	0	DEA
$PM_{2.5}$	$\mu g/m^3$	24hr	40	4	DEA
$PM_{2.5}$	$\mu g/m^3$	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 June 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]	289.2		63.4	6		352.2	
FPM (PM-10) by Beta gauge [ug/m^3]	460.5		118.2	8		507.2	
Nitric oxide [ppb]	124.7		21.9			178.2	
Nitrogen dioxide [ppb]	53.9	0	16.2			59.6	
Nitrogen oxide [ppb]	167.		33.1			208.5	
Ozone [ppb]					0		
Sigma theta [deg]	47.8		29.4			78.5	
Sulphur dioxide [ppb]	163.7	1	33.5	0		185.4	0
Ambient temperature [deg C]	28.4		19.			28.8	
Wind speed [m/s]	6.1		2.8			7.1	
Wind velocity [m/s]	6.		2.6			6.9	

There were six exceedances of the $PM_{2.5}$ national daily limit and eight exceedances of the PM_{10} national daily limit recorded during the monitoring period. There was one exceedance of the SO_2 national hourly limit and no other exceedances of the other parameters recorded during the period under review.

Table 4: Exceedance table

SO_2 hourly exceedances								
Pollutant	**Limit**	**Year**	**Month**	**Day**	**Time**	**Conc.**	**WSP**	**WDR**
SO_2	134	2020	06	20	18:00	163.7	0.32	NNW
$PM_{2.5}$ daily exceedances								
Pollutant	**Limit**	**Year**	**Month**	**Day**	**Conc.**			
$PM_{2.5}$	40	2020	06	13	57.3			
$PM_{2.5}$	40	2020	06	15	45			
$PM_{2.5}$	40	2020	06	19	46.7			
$PM_{2.5}$	40	2020	06	24	43.9			
$PM_{2.5}$	40	2020	06	25	45.7			
$PM_{2.5}$	40	2020	06	26	63.4			
PM_{10} daily exceedances								
Pollutant	**Limit**	**Year**	**Month**	**Day**	**Conc.**			
$PM_{2.5}$	75	2020	06	01	75.5			
$PM_{2.5}$	75	2020	06	05	81.5			
$PM_{2.5}$	75	2020	06	17	118.2			
$PM_{2.5}$	75	2020	06	19	82.1			
$PM_{2.5}$	75	2020	06	24	75.1			
$PM_{2.5}$	75	2020	06	25	78.9			
$PM_{2.5}$	75	2020	06	26	114.2			
$PM_{2.5}$	75	2020	06	27	76.7			

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 and north-north-east. During the night, the most frequent directions were south-east, south-south-east and east-south-east sectors.

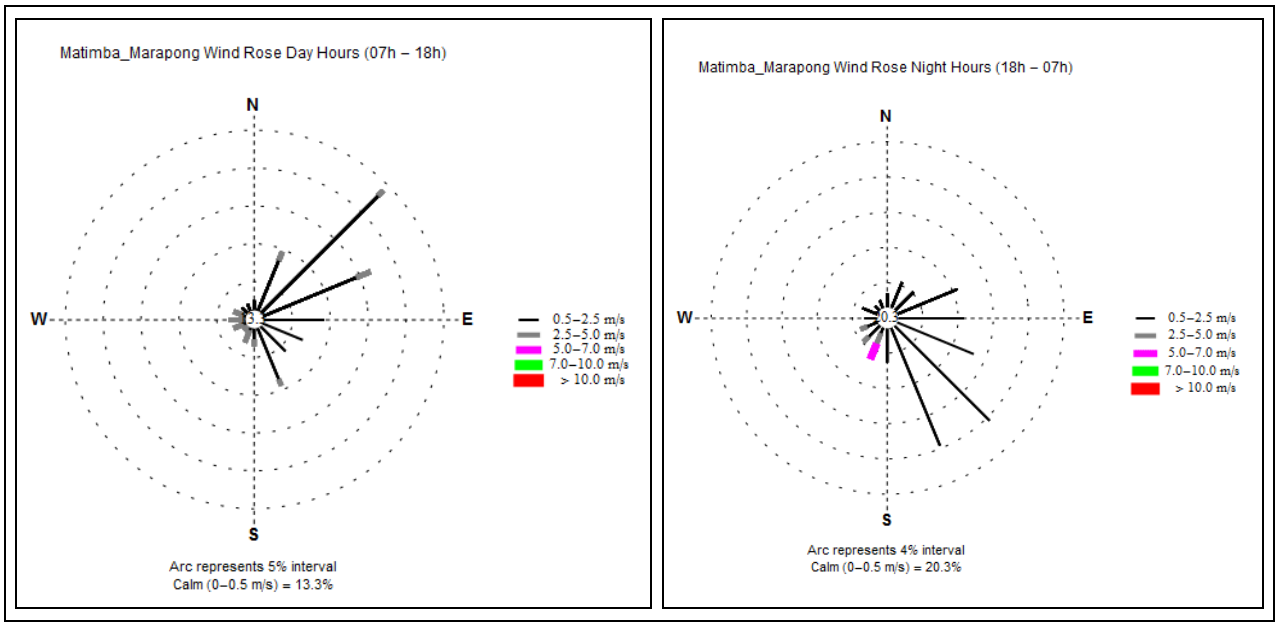


Figure 2: Wind roses at Marapong monitoring site during day and night hours

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 motor vehicle emissions are shown in the morning and in the evening with peaks observed at 09:00 in the morning and at 21:00 at night.

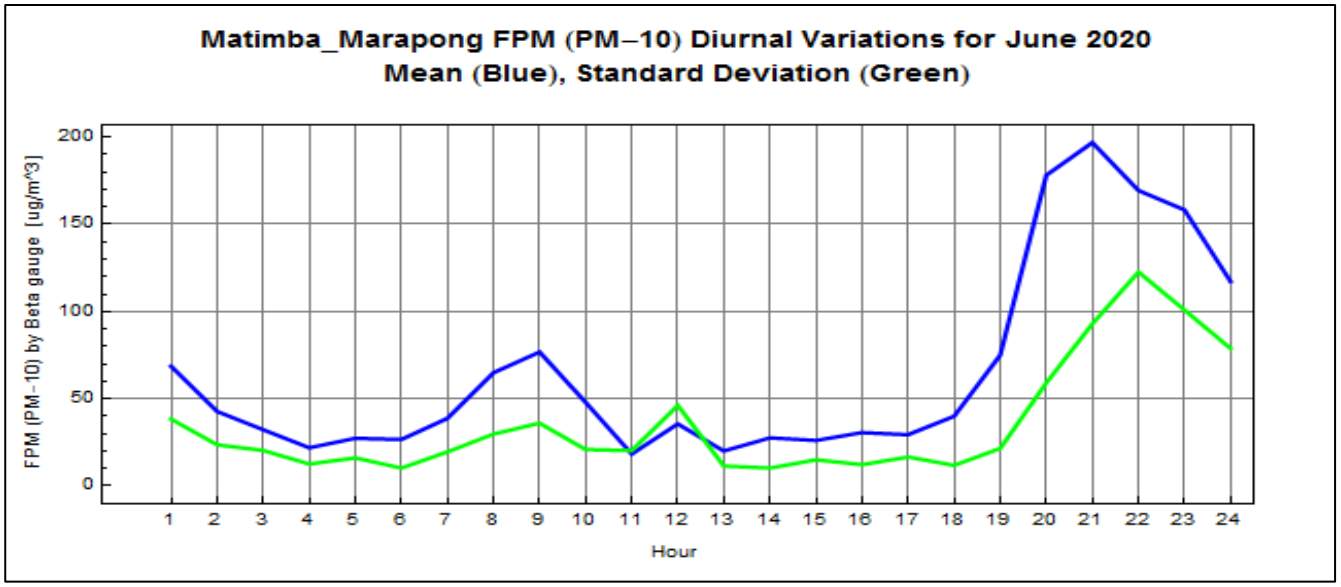


Figure 3: Diurnal variation by PM_{10} (Mean concentrations = Blue line, Standard Deviation = Green line)

6.1.2. PM_{10} hourly mean event roses and tables.

As there is no national hourly PM_{10} 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 115.66µg/m^3 (98th percentile value) at Marapong monitoring site during the daytime period were recorded from north, north-north-east, east and south-east sectors. The dominant hourly mean concentrations above 338.92µg/m^3 (98th percentile value) at Marapong monitoring site during the night-time period were recorded from south, north-north-east and south-south-east sectors. Traffic and domestic combustion emissions in and around Marapong could also be impacting on the ambient PM_{10} concentrations at the monitoring site.

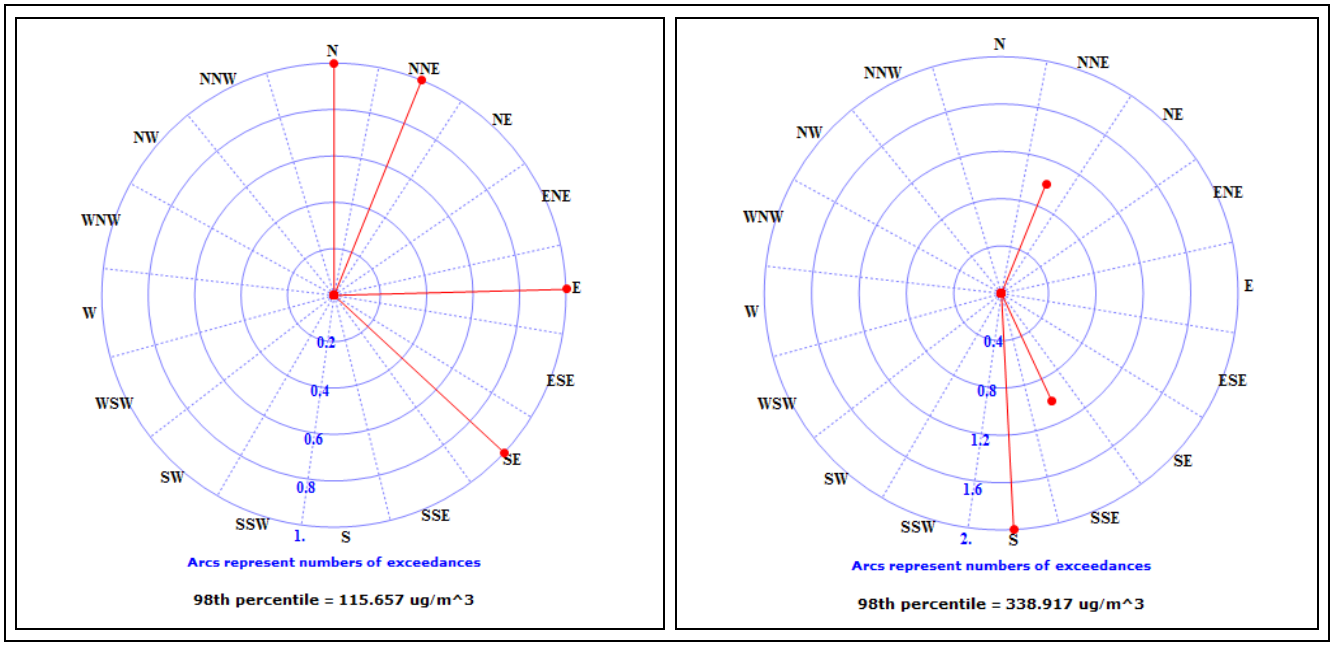


Figure 4: PM_{10} hourly mean 98th percentile event roses. Left - daytime (06:00-18:00) and right - night time (18:01-05:59)

Table 5: PM_{10} 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	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0
%	25	25	0	0	25	0	25	0	0	0	0	0	0	0	0	0

Table 6: PM_{10} 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	0	0	0	0	0	1	2	0	0	0	0	0	0	0
%	0	25	0	0	0	0	0	25	50	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 21:00 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 is also shown in the morning with a peak at 09:00.

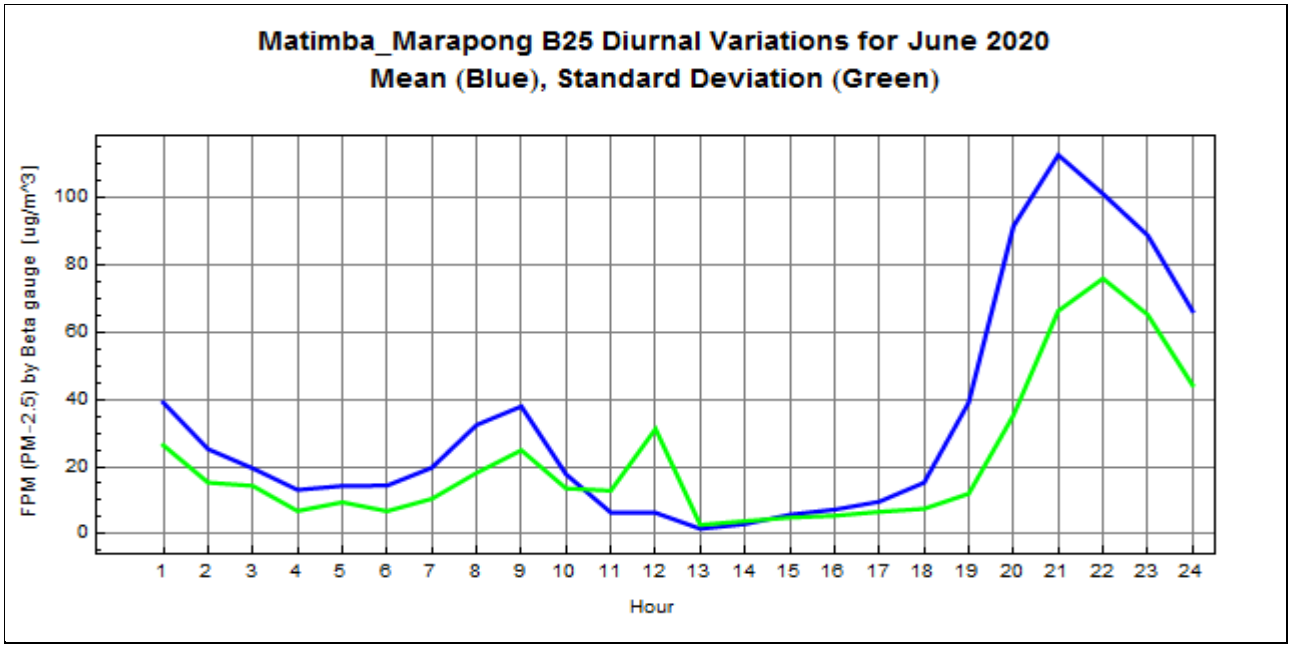


Figure 5: Diurnal variation by $PM_{2.5}$ (Mean concentrations = Blue line, Standard Deviation = Green line)

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 63.05µg/m^3 (98th percentile value) at Marapong monitoring site during the daytime period were recorded from east-north-east, east, south-east, west-north-west, north and north-north-east sectors. The most dominant hourly mean concentrations above 205.28µg/m^3 (98th percentile value) at Marapong monitoring site during the night-time period were recorded from north-east, south, north-north-west, north-north-east, east-north-east and south-south-east sectors.

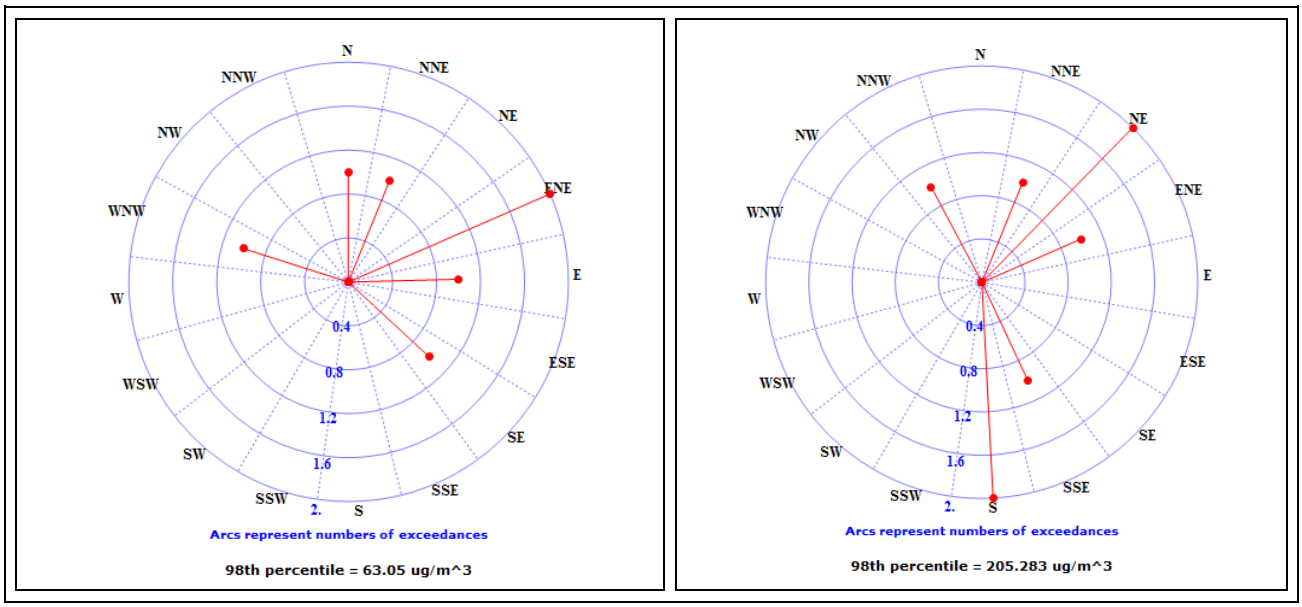


Figure 6: $PM_{2.5}$ hourly mean 98th percentile event roses. Left - daytime (06:00-18:00) and right - night time (18:01-05:59)

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.	1	1	0	2	1	0	1	0	0	0	0	0	0	1	0	0
%	14.29	14.29	0	28.57	14.29	0	14.29	0	0	0	0	0	0	14.29	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	1	2	1	0	0	0	1	2	0	0	0	0	0	0	1
%	0	12.5	25	12.5	0	0	0	12.5	25	0	0	0	0	0	0	12.5

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 between 20:00 and 22:00. Elevation in CO levels is also noticeable with a minor peak between 08:00 and 09:00 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.

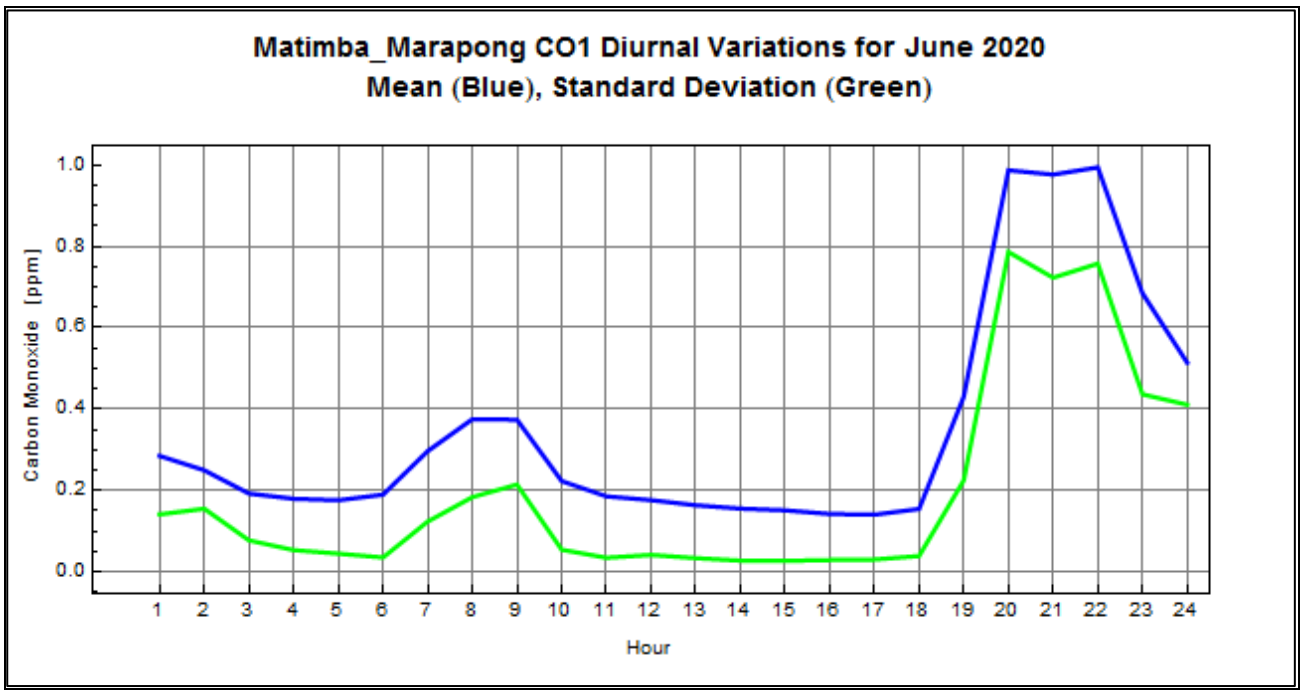


Figure 7: Diurnal variation by CO (Mean concentrations = Blue line, Standard Deviation = Green line)

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.

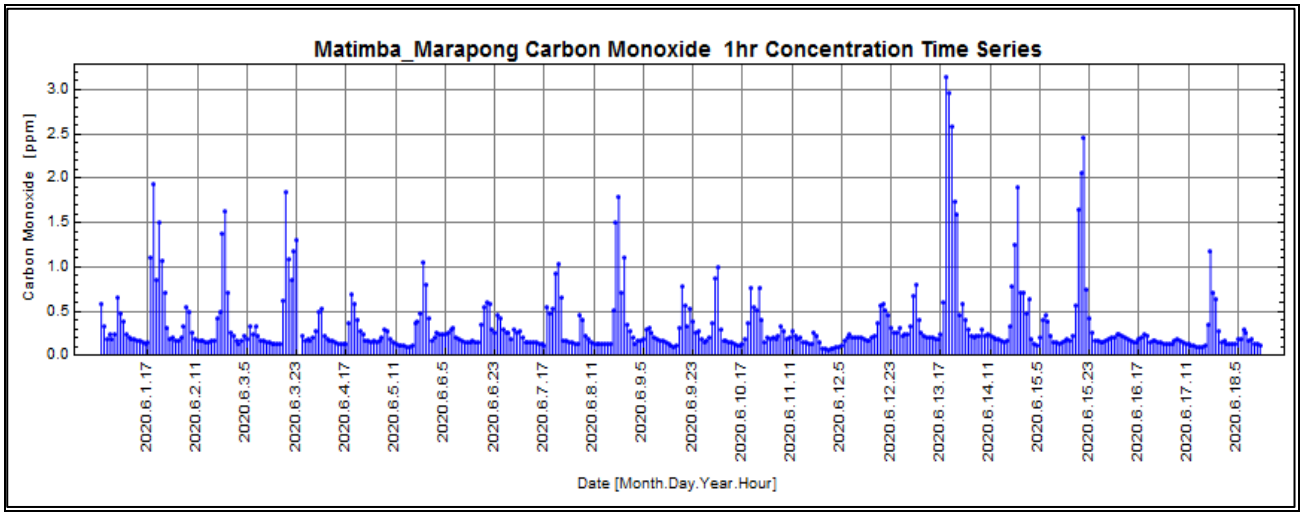


Figure 8: CO hourly Concentrations Time Series

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 0.67 ppm at Marapong monitoring site during the daytime period were recorded from west-south-west, west-north-west and south-south-east sectors. The most dominant night-time concentrations above 2.06 ppm (98th percentile value) were recorded from north-east and 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.

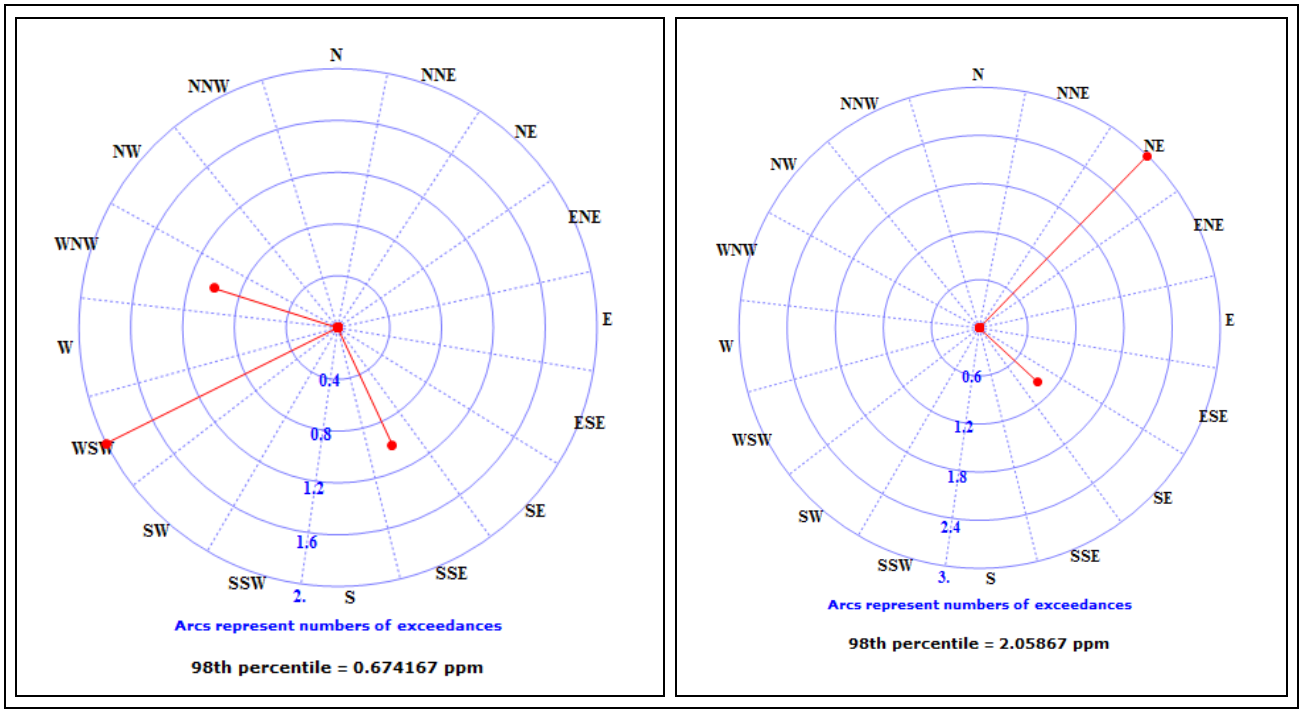


Figure 9: CO hourly mean 98th percentile event roses. Left - daytime (06:00-18:00) and right - night time (18:01-05:59)

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	0	0	0	0	0	0	1	0	0	0	2	0	1	0	0
%	0	0	0	0	0	0	0	25	0	0	0	50	0	25	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	3	0	0	0	1	0	0	0	0	0	0	0	0	0
%	0	0	75	0	0	0	25	0	0	0	0	0	0	0	0	0

6.4. SULPHUR DIOXIDE (SO_2)

6.4.1 Source identification by SO_2 diurnal variations

Figure 10 shows the SO_2 hourly mean diurnal variation. The graph shows that SO_2 levels are low in the morning and throughout the day, with a peak recorded at 20:00 at night before dropping down to background levels. This indicates that there are low level sources of SO_2 that influence the ambient SO_2 readings recorded at the site.

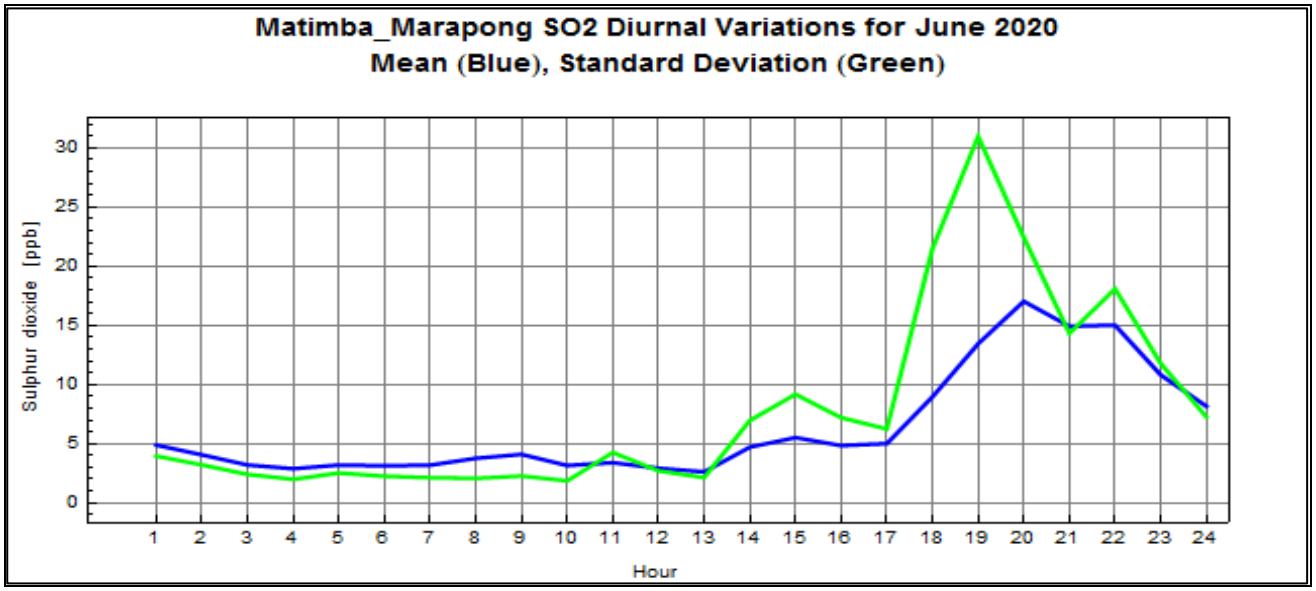


Figure 10: SO_2 diurnal variations (Mean concentrations = Blue line, Standard Deviation = Green line).

6.4.2 SO_2 daytime exceedance and night-time event roses and tables

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

There was one exceedance of the SO_2 national hourly limit of 134 ppb recorded in the north-north-west sector of the monitoring site. Morupole Power Station in Botswana is located in the north-north-west of the monitoring site. The most dominant night-time concentrations above 42.10 ppb (98th percentile value) were recorded from west-north-west, north-north-west, east-south-east, south-east, west-south-west and west sectors. Afrimat Lephalale is located in the south-south-west, Medupi Power Station in the west-south-west and Grootegeluk coal mine in the west sectors of the monitoring site.

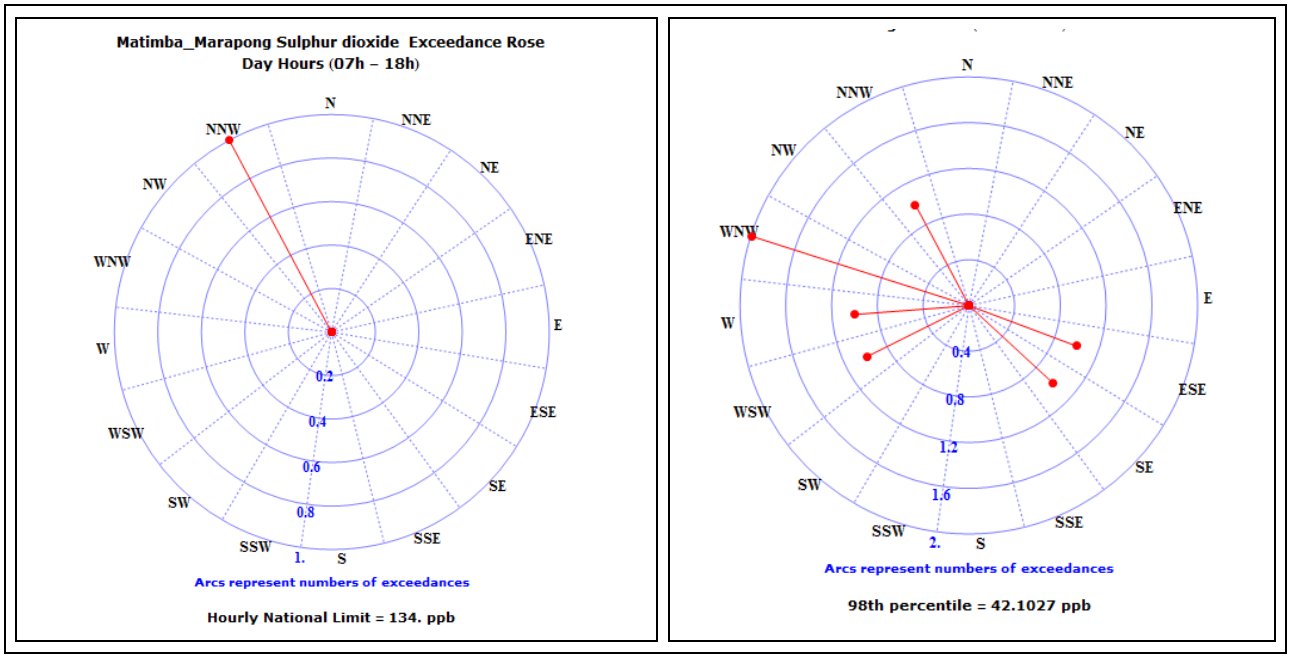


Figure 11: SO_2 daytime hourly mean exceedance and night-time hourly mean 98th percentile event roses. Left - daytime (06:00-18:00) and right - night time (18:01-05:59)

Table 11: SO_2 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	0	0	0	0	1
%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100

Table 12: SO_2 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	1	1	0	0	0	0	1	1	2	0	1
%	0	0	0	0	0	14.29	14.29	0	0	0	0	14.29	14.29	28.57	0	14.29

6.5. NITROGEN DIOXIDE (NO_2)

6.5.1 Source identification by NO_2 diurnal variations

Figure 12 below shows the NO_2 hourly mean diurnal variation. The graph shows concentration peaks at 08:00 in the morning and at 20:00 in the evening which are indicative of contribution of low level source emissions on ambient NO_2 concentrations, such as early morning and evening emissions from vehicles transporting workers from/to Marapong Township to/from Medupi, Matimba power stations, Grootegeluk coal mine and other industries in the area. The NO_2 concentrations are low during midday and throughout the afternoon as a result of absence or minimal number of vehicles and domestic burning activities in the township at those times.

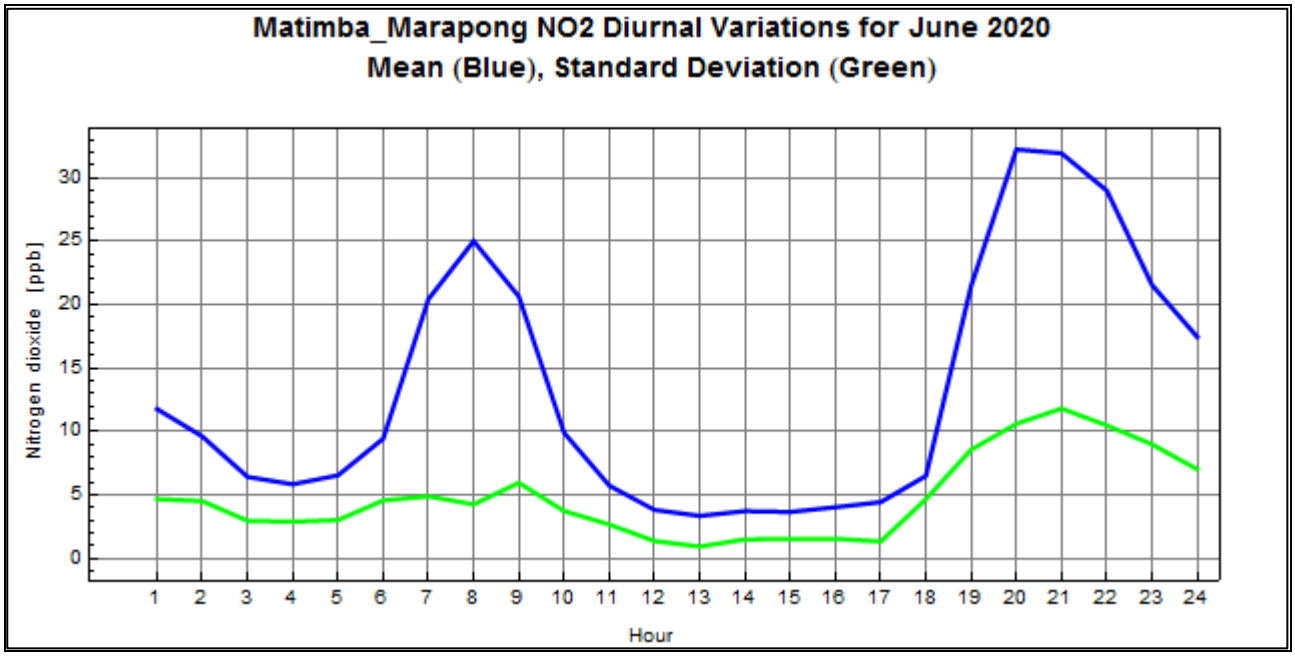


Figure 12: NO_2 diurnal variations (Mean concentrations = Blue line, Standard Deviation = Green line).

6.5.2. NO_2 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 30.44 ppb (98th percentile value) were from north-north-east, west-south-west and north-north-west sectors. The most dominant night-time concentrations above 45.31 ppb (98th percentile value) were recorded from north, south and west sectors. Traffic from Onverwacht and Marapong Township and trucks travelling to the municipal dump might have an influence in the NO_2 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 NO_2 readings.

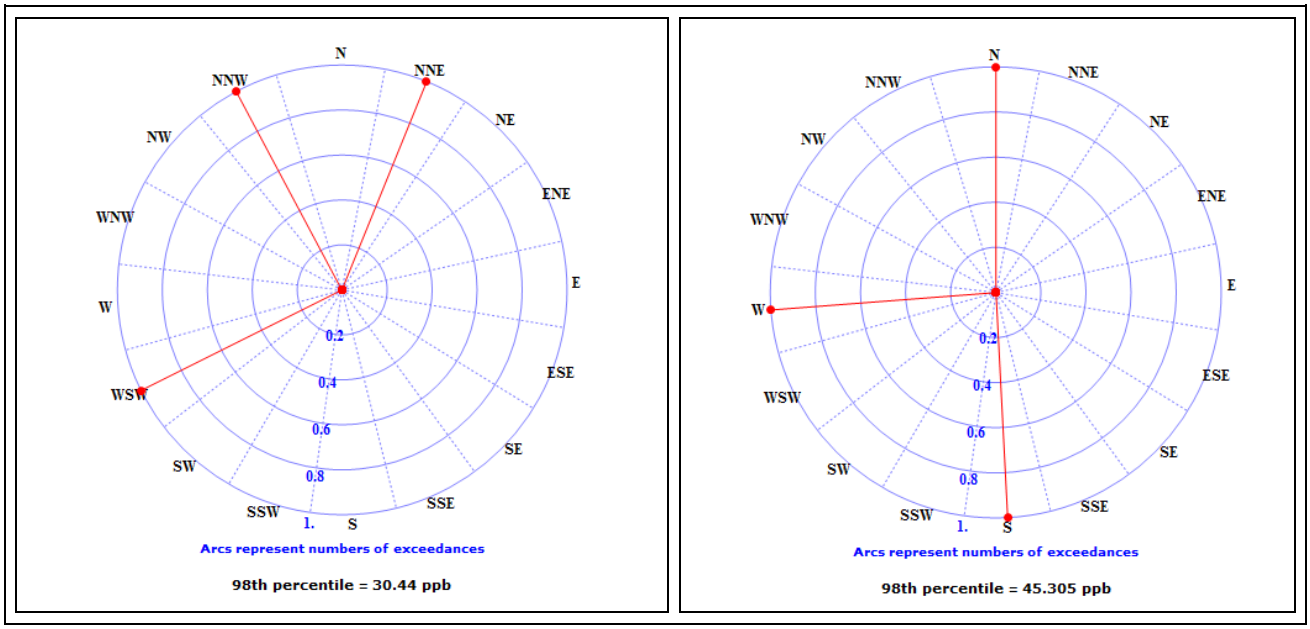


Figure 13: NO_2 hourly mean 98th percentile event roses. Left - daytime (06:00-18:00) and right - night time (18:01-05:59)

Table 13: NO_2 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	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1
%	0	33.33	0	0	0	0	0	0	0	0	0	33.33	0	0	0	33.33

Table 14: NO_2 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.	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
%	33.33	0	0	0	0	0	0	0	33.33	0	0	0	33.33	0	0	0

6.6. OZONE (O_3)

There were no data recorded for ozone because the analyser was removed from site for repairs.

7. HISTORICAL CONCENTRATIONS

7.1. RECENT TRENDS

Time series graphs (Figures 14 – 19) 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 NO_2 concentrations at the monitoring site are well within their national ambient limits with no exceedances from December 2018 until June 2020. The trends show higher concentrations during winter than summer. Ambient PM_{10} 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 SO_2 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 SO_2 daily limit during the period under review. Ambient O_3 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.

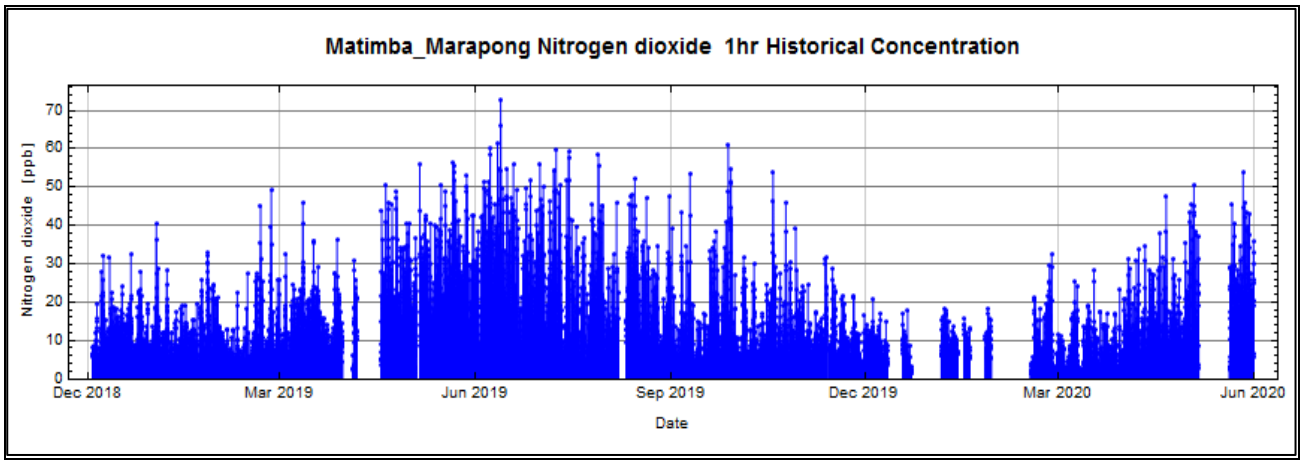


Figure 14: NO_2 Hourly Means

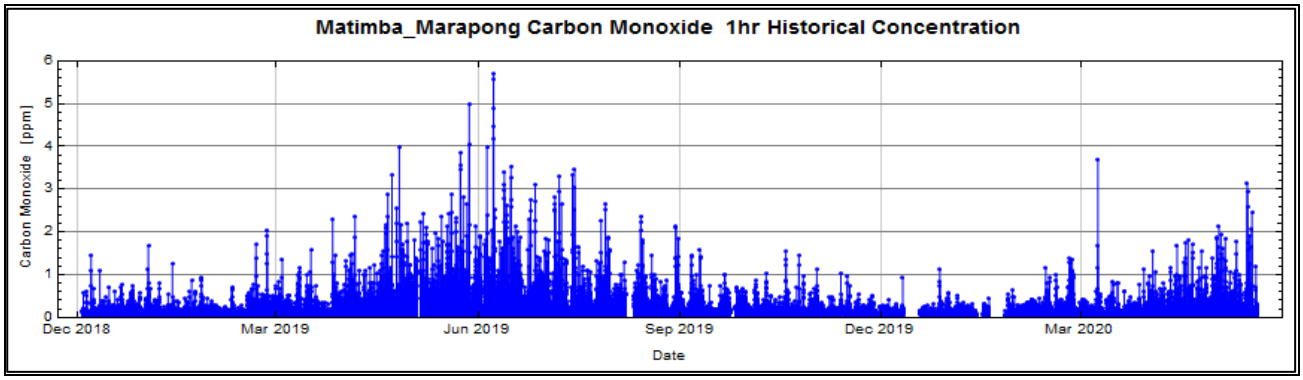


Figure 15: CO Hourly Means

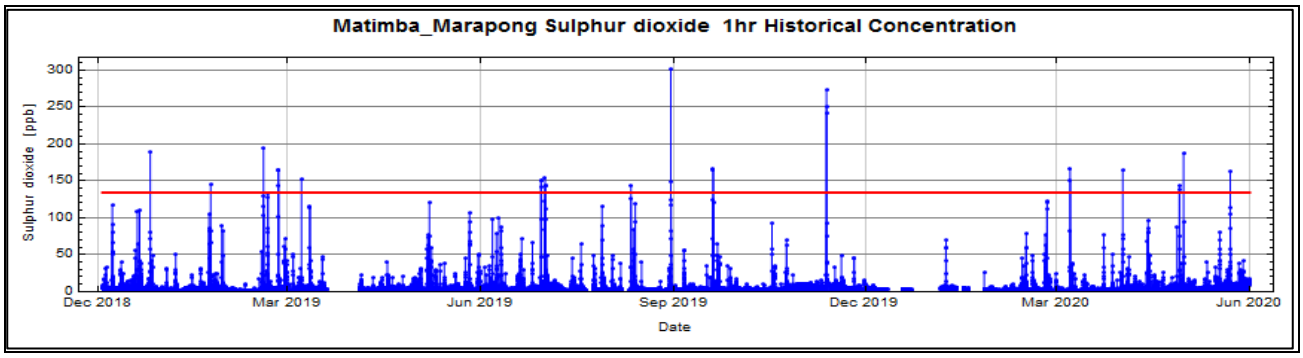


Figure 16: SO_2 Hourly Means

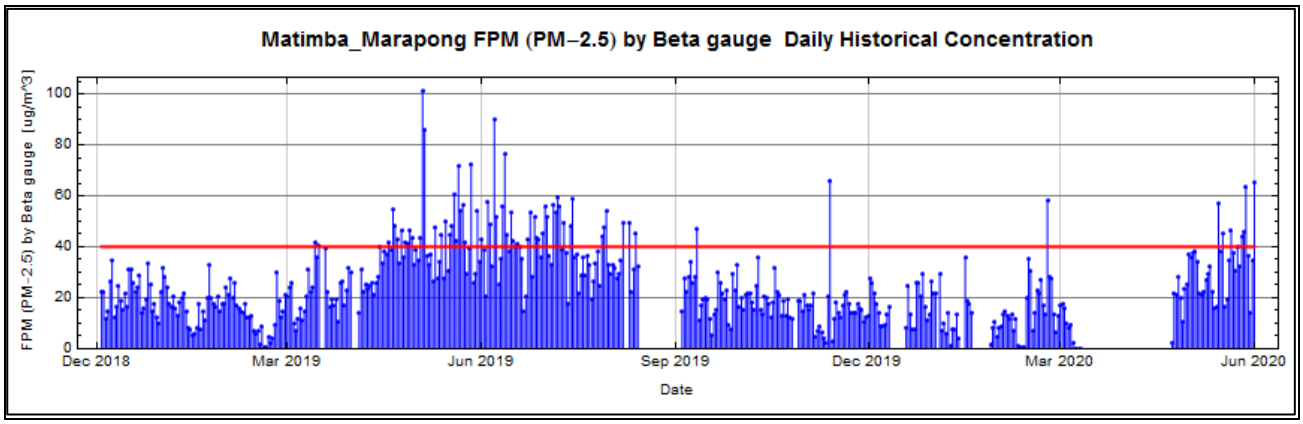


Figure 17: $PM_{2.5}$ Daily Means

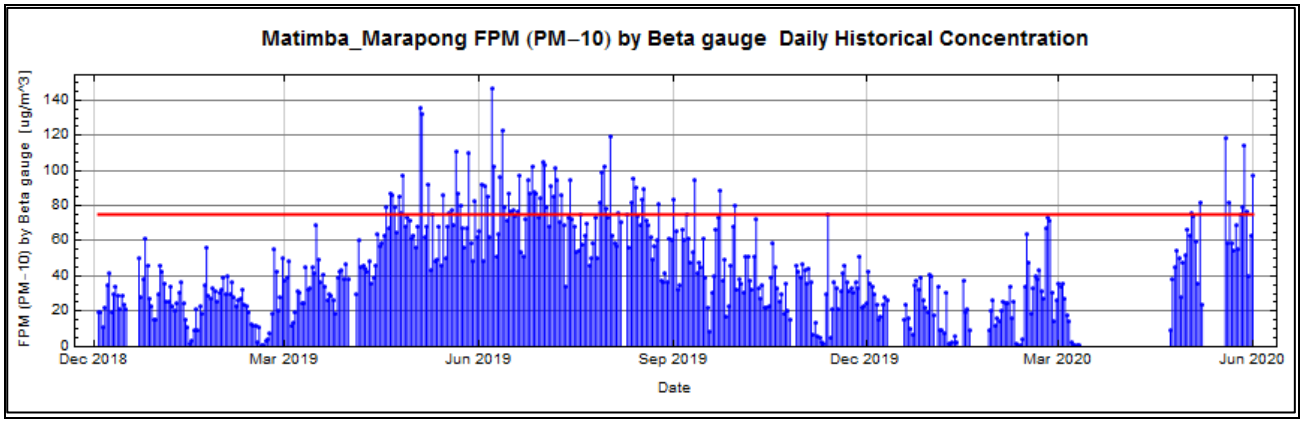


Figure 18: PM_{10} Daily Means

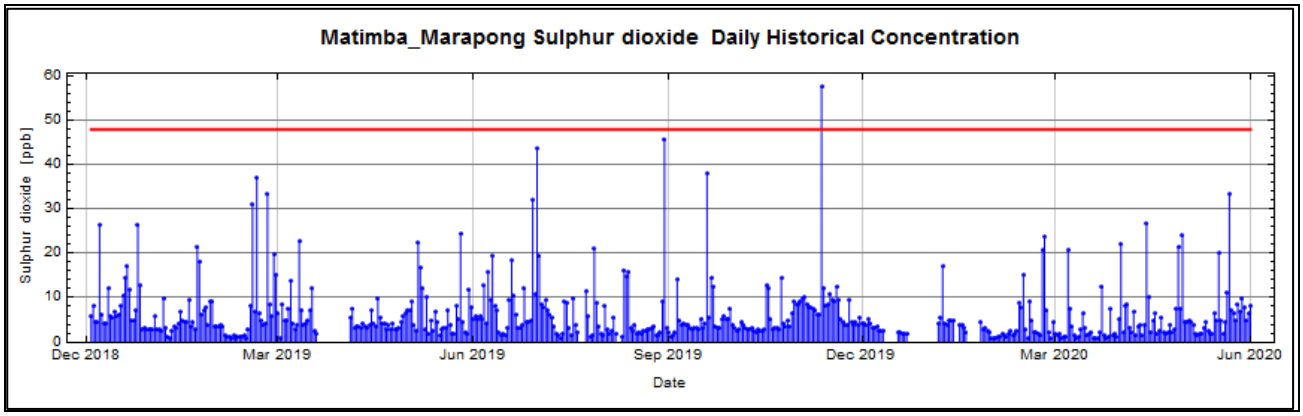


Figure 19: SO_2 Daily Means

7.2. MONTHLY MEANS FOR THE CURRENT CALENDAR YEAR 2020

Table 15: Monthly Means for current year 2020

Parameter measured	Jan	Feb	Mar	Apr	May	June
$PM_{2.5}$ ($\mu g/m^3$	17.2	9.4	16.3	5.7	24.1	32.8
PM_{10} ($\mu g/m^3$)	25.9	12.8	31.1	12.1	48.2	65.5
NO_2 (ppb)	5.6	8.4	6	4.7	8.4	13.2
CO (ppb)	0.1	0.1	0.2	0.2	0.3	0.3
O_3 (ppb)	27.6	24.2	23.3	23.7	ND	ND
SO_2 (ppb)	3	4.4	4.6	4	6.2	6.4

ND = No Data

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

Table 16: 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
Mar 2020	0	0	0	0	1	0	0	1
Apr 2020	3	0	0	0	0	0	0	7
May 2020	3	0	0	0	0	0	0	4
June 2020	1	0	0	8	6	0	0	0
Total No. of Exceedances	**7**	**0**	**0**	**8**	**7**	**0**	**0**	**12**
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 so far with the exception of PM_{10} and $PM_{2.5}$ daily limits. The number of PM_{10} and $PM_{2.5}$ exceedances has each exceeded the allowed number of exceedances per year of 4 with PM_{10} at 8 and $PM_{2.5}$ at 7.

8. CONCLUSIONS

There were six exceedances of the $PM_{2.5}$ national daily limit and eight exceedances of the PM_{10} national daily limit recorded during the monitoring period. There was one exceedance of the SO_2 national hourly limit and no other exceedances of the other parameters recorded during the period under review.

Ambient CO, $PM_{2.5}$, PM_{10}, NO_2 and SO_2 concentrations at Marapong monitoring site show influence of emissions from low level sources in the area.

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Reviewed and Authorised by: Date of Issue: 19 Aug 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
$\mu g/m^3$	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

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