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Date
24 February 2021

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Dear Mrs Mpho Nembilwi

Ref Kendal Power Station AEL (17/4/AEL/MP312/11/15)

KENDAL POWER STATION'S EMISSIONS REPORT FOR THE MONTH OF NOVEMBER 2020 TO JANUARY 2021.

This is a monthly report required in terms of Section 7.4 in the Kendal Power Station's Atmospheric Emission License. The emissions are for Eskom Kendal Power Station.

Compiled by:

Tshildzi Vilane
ENVIRONMENTAL OFFICER- KENDAL

Date: 24/02/2021

Supported by:

Solly Chokoe
ACTING ENVIRONMENTAL MANAGER- KENDAL

Date: 25/02/2021

KENDAL POWER STATION'S EMISSIONS REPORT FOR THE MONTHS OF NOVEMBER 2020 TO JANUARY 2021.

Verified by:



Filono Malatsi

SENIOR TECHNICIAN BOILER ENGINEERING- KENDAL

Date: 24/02/2021

Validated by:



pp

Tendani Rasivhetshela

ACTING BOILER ENGINEERING MANAGER-KENDAL

Date 25/02/2021

Supported by:



Malibongwe Mabizela

ACTING ENGINEERING MANAGER-KENDAL

Date 25/02/2021

Reviewed by:

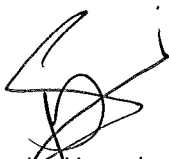


Bryan Mccourt

AIR QUALITY CENTRE OF EXCELLENCE MANAGER-ESKOM

Date 26/02/2021

Approved by:



Yangaphle Ngcashi

ACTING GENERAL MANAGER-KENDAL

2021.03.01
Date

KENDAL POWER STATION MONTHLY EMISSIONS REPORT

Atmospheric Emission License 17/4/AEL/MP312/11/15


1 RAW MATERIALS AND PRODUCTS

Raw Materials and Products	Raw Material Type	Units	Maximum Permitted Consumption rate	Consumption Rate Nov-2020
	Coal	Tons	2 260 000	806 351
	Fuel Oil	Tons	5 000	1857,86

Production Rates	Product / By-Product Name	Units		Production Rate Nov-2020
	Energy	GWh	4380	1 278,37
	Ash	Tons	Not specified	278 755,5
	RE Ash	kg/MWh	Not specified	2,600

2 ENERGY SOURCE CHARACTERISTICS

Coal Characteristic	Units	Stipulated Range	Monthly Average Content
Sulphur Content	%	0,7 TO >1 (%)	0,780
Ash Content	%	30 TO >40 (%)	34,570

3 EMISSION LIMITS (mg/Nm³)

Associated Unit/Stack	PM	SO _x	NO _x
Unit 1	100	3500	1100
Unit 2	100	3500	1100
Unit 3	100	3500	1100
Unit 4	100	3500	1100
Unit 5	100	3500	1100
Unit 6	100	3500	1100

4 ABATEMET TECHNOLOGY (%)

Associated Unit/Stack	Technology Type	Efficiency Nov-2020	Technology Type	Utilization Nov-2020
Unit 1	ESP + SO ₂	99,8%	SO ₂	91,9%
Unit 2	ESP + SO ₂	99,3%	SO ₂	94,5%
Unit 3	ESP + SO ₂	96,8%	SO ₂	31,5%- Data not available on most days
Unit 4	ESP + SO ₂	97,8%	SO ₂	99,0%
Unit 5	ESP + SO ₂	Unit off	SO ₂	Unit off
Unit 6	ESP + SO ₂	98,9%	SO ₂	Data not available due to power cable theft

Note: ESP plant does not have bypass mode operation, hence plant 100% Utilised.

5 MONITOR RELIABILITY (%)

Associated Unit/Stack	PM	SO ₂	NO	O ₂
Unit 1	99,4	0,0	0,0	0,0
Unit 2	99,8	0,0	0,0	0,0
Unit 3	80,0	0,0	0,0	0,0
Unit 4	75,1	0,0	0,0	0,0
Unit 5	Unit off	Unit off	Unit off	Unit off
Unit 6	70,2	0,0	0,0	0,0

Note: The QAL 2 parallel tests results have been used to calculate the gaseous emissions hence monitor reliability is zero
 Note: Unit 4 dust concentration signal was above 98%, the data was out of range which yield a lower monitor reliability

6 EMISSION PERFORMANCE

Table 6 1 Monthly tonnages for the month of November 2020

Associated Unit/Stack	PM (tons)	SO ₂ (tons)	NO _x (tons)
Unit 1	121.3	1 783	879
Unit 2	260.2	945	535
Unit 3	1 247.9	761	401
Unit 4	1 340.5	1 924	921
Unit 5	Unit off	Unit off	Unit off
Unit 6	350.5	1 270	718
SUM	3 320.35	6 683	3 454

Table 6 2 Operating days in compliance to PM AEL Limit - November 2020

Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Total Exceedance	Average PM (mg/Nm ³)
Unit 1	25	5	0	0	5	75,8
Unit 2	0	2	0	20	22	279,2
Unit 3	0	0	0	20	20	1 056,1
Unit 4	0	0	0	30	30	784,9
Unit 5	Unit off	Unit off	Unit off	Unit off	Unit off	Unit off
Unit 6	0	2	0	17	19	348,8
SUM	25	9	0	87	96	

Table 6 3 Operating days in compliance to SO_x AEL Limit - November 2020

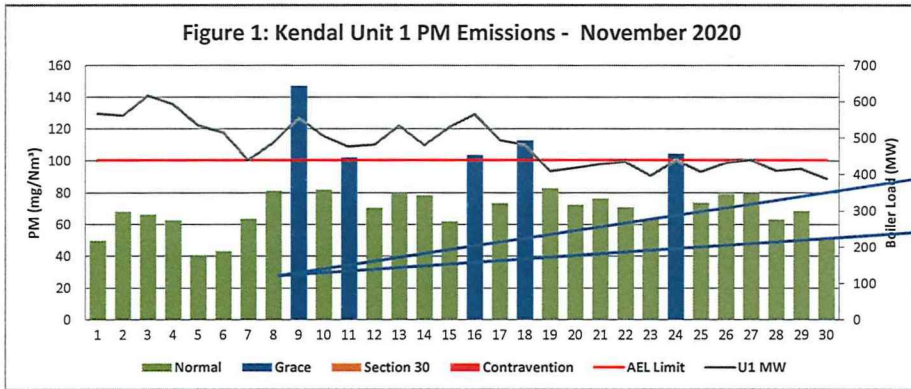
Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Total Exceedance	Average SO _x (mg/Nm ³)
Unit 1	30	0	0	0	0	800,9
Unit 2	23	0	0	0	0	808,6
Unit 3	21	0	0	0	0	619,6
Unit 4	30	0	0	0	0	1 038,8
Unit 5	Unit off	Unit off	Unit off	Unit off	Unit off	Unit off
Unit 6	20	0	0	0	0	897,7
SUM	124	0	0	0	0	

Table 6.4: Operating days in compliance to NOx AEL Limit - November 2020

Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Total Exceedance	Average NOx (mg/Nm³)
Unit 1	30	0	0	0	0	395,0
Unit 2	23	0	0	0	0	458,3
Unit 3	21	0	0	0	0	326,0
Unit 4	30	0	0	0	0	497,1
Unit 5	Unit off	Unit off	Unit off	Unit off	Unit off	Unit off
Unit 6	20	0	0	0	0	507,6
SUM	124	0	0	0	0	

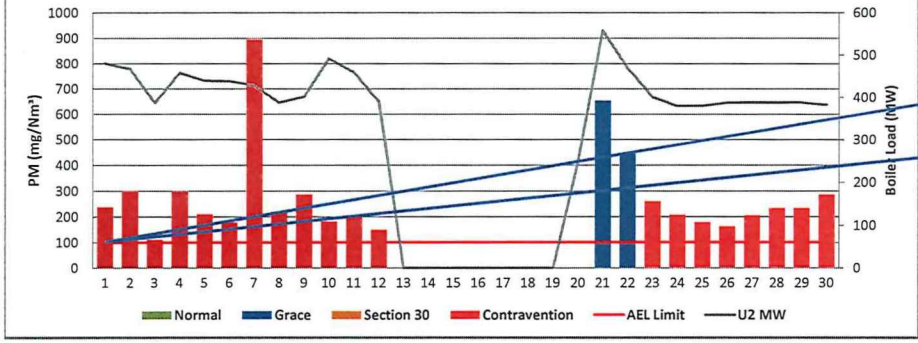
Table 6.5: Legend Description

Condition	Colour	Description
Normal	Green	Emissions below Emission Limit Value (ELV)
Grace	Blue	Emissions above the ELV during grace period
Section 30	Orange	Emissions above ELV during a NEMA S30 incident
Contravention	Red	Emissions above ELV but outside grace or S30 incident conditions



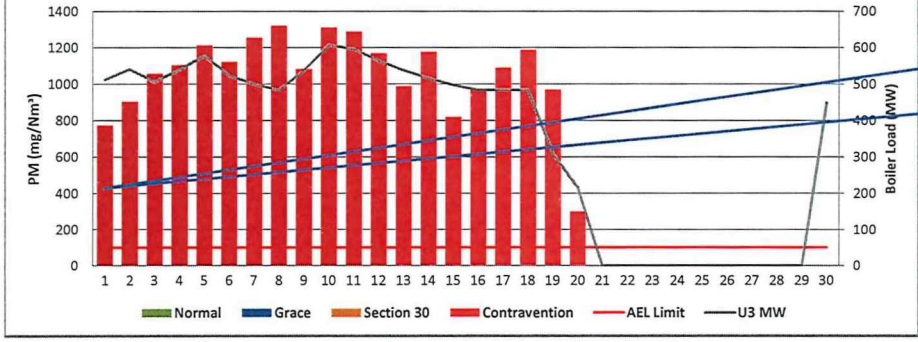
Unit 1 high PM emissions on 9 & 11 can be attributed to DHP conveyors not in service and on the 16 & 18 due to poor performance of the Electrostatic Precipitators and on 24 due to blocked top bunker conveyor & SO3 plant off

Figure 2: Kendal Unit 2 PM Emissions - November 2020

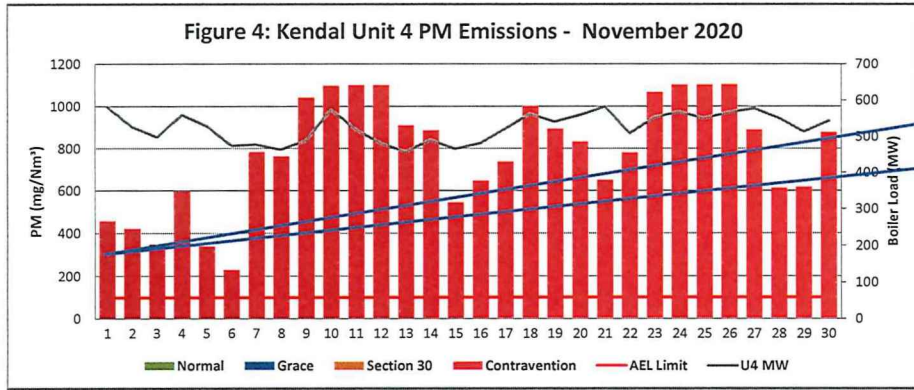


High PM emissions on 01 to 12 and 21 to 30 can be attributed to poor performance of the electrostatic precipitators

Figure 3: Kendal Unit 3 PM Emissions - November 2020



Unit 3 high PM emissions can be attributed to poor availability of Dust Handling Plant resulting to ash backlogs causing poor performance of the electrostatic precipitators fields.



Unit 4 high PM emissions can be attributed to poor availability of Dust Handling Plant resulting to ash backlogs causing poor performance of the electrostatic precipitators fields.

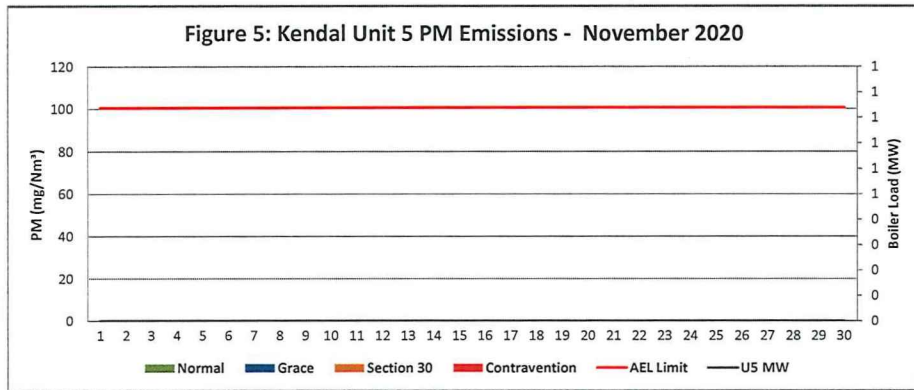
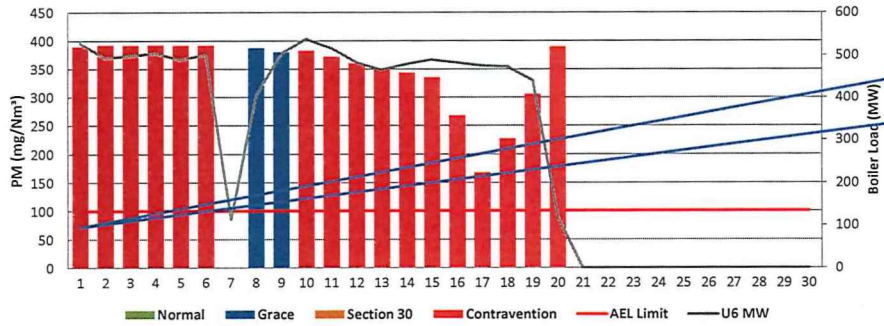


Figure 6: Kendal Unit 6 PM Emissions - November 2020



Unit 6 high PM emissions can be attributed to poor availability of Dust Handling Plant resulting to ash backlogs causing poor performance of the electrostatic precipitators fields.

Figure 7: Kendal Unit 1 SOx Emissions - November 2020

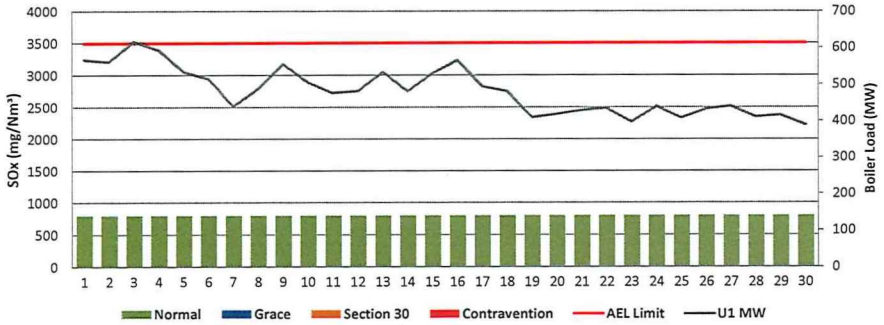


Figure 8: Kendal Unit 2 SOx Emissions - November 2020

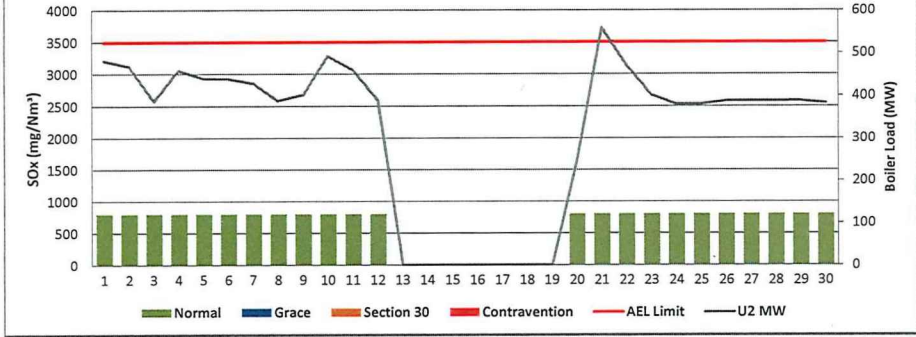


Figure 9: Kendal Unit 3 SOx Emissions - November 2020

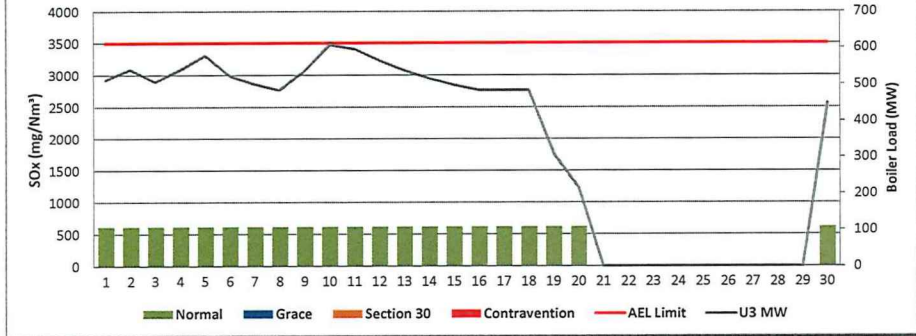


Figure 10: Kendal Unit 4 SOx Emissions - November 2020

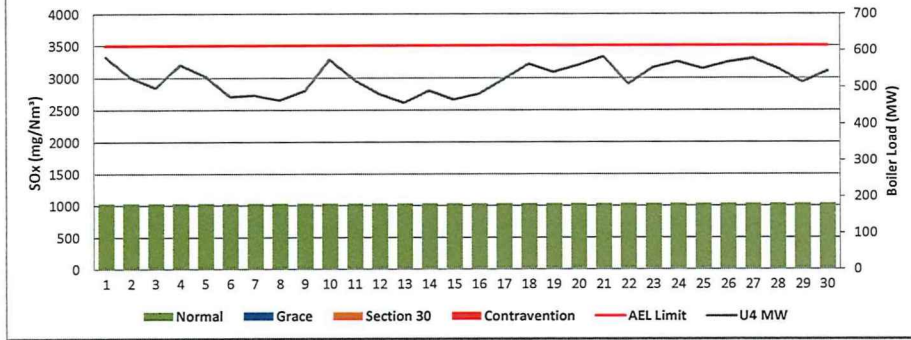


Figure 11: Kendal Unit 5 SOx Emissions - November 2020

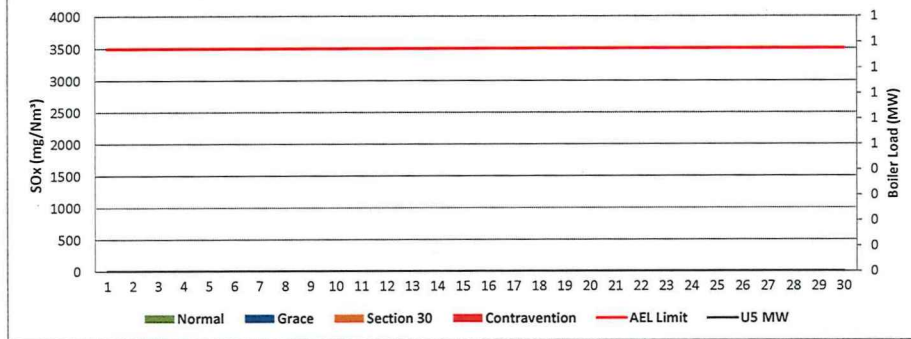


Figure 12: Kendal Unit 6 SOx Emissions - November 2020

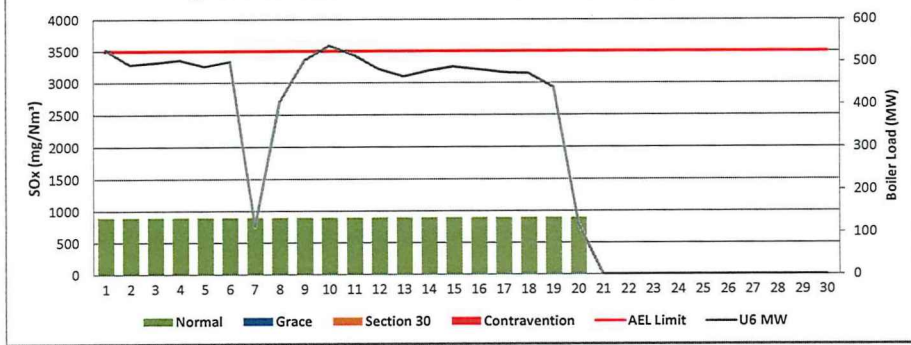


Figure 13: Kendal Unit 1 NOx Emissions - November 2020

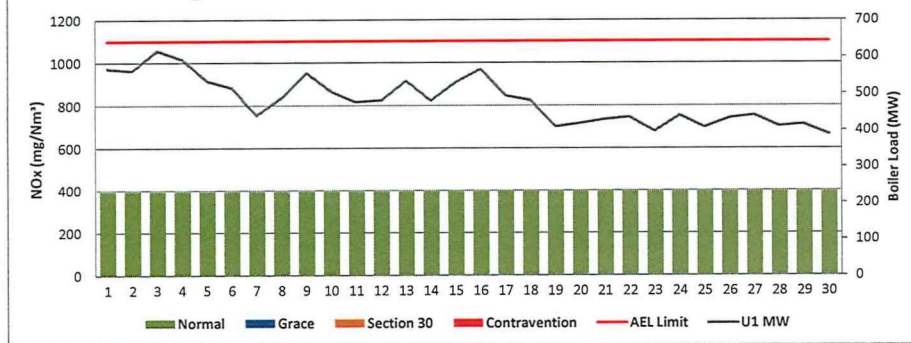


Figure 14: Kendal Unit 2 NOx Emissions - November 2020

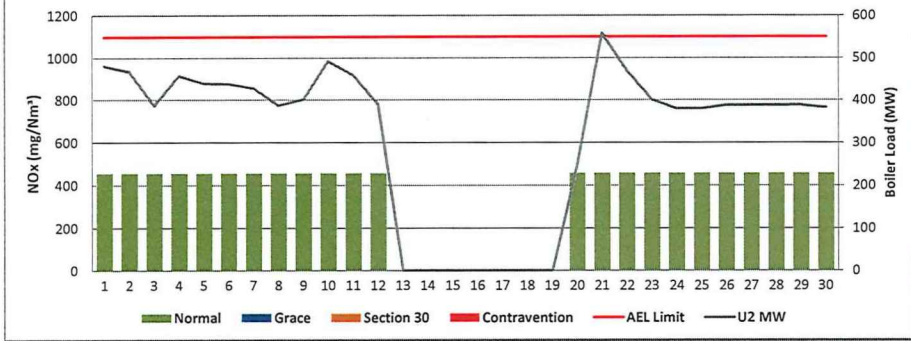


Figure 15: Kendal Unit 3 NOx Emissions - November 2020

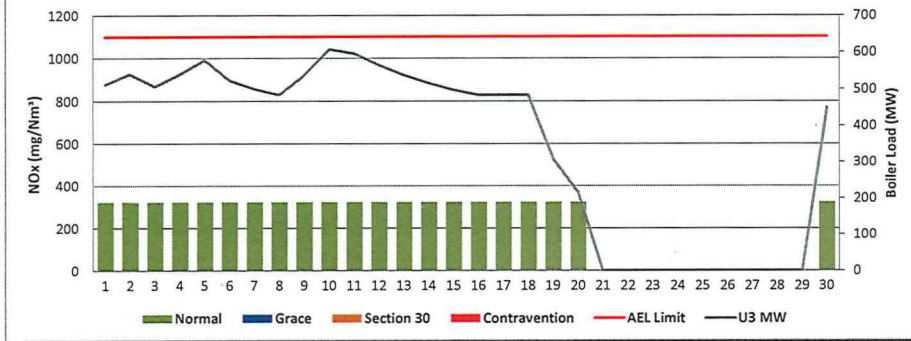


Figure 16: Kendal Unit 4 NOx Emissions - November 2020

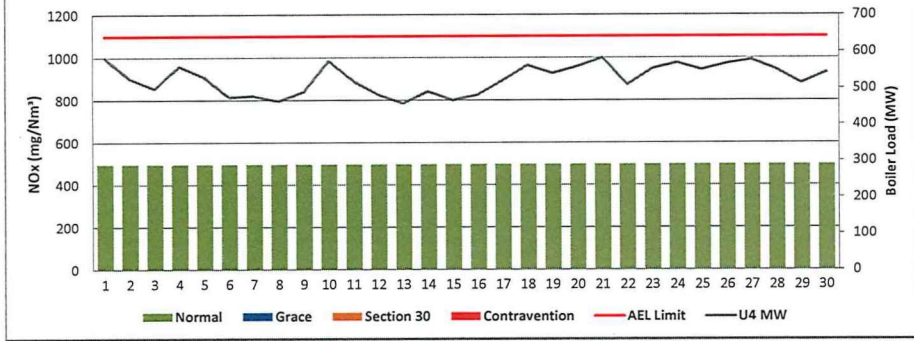
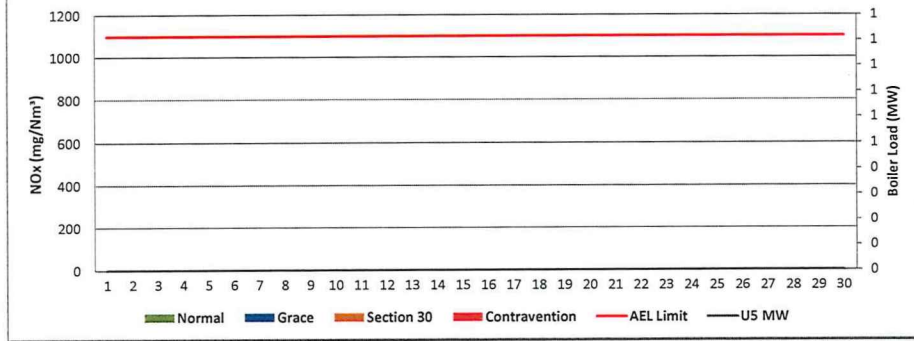
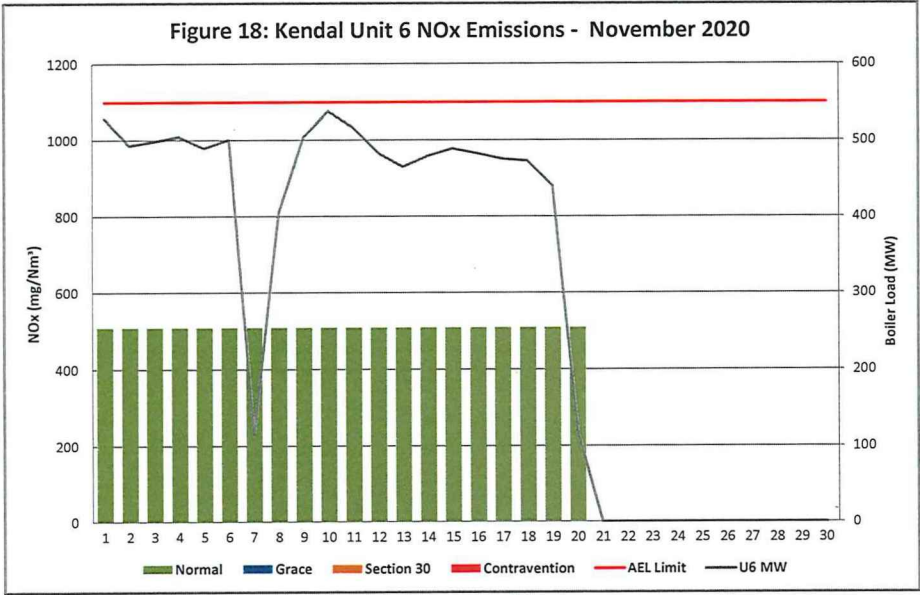


Figure 17: Kendal Unit 5 NOx Emissions - November 2020





7 COMPLAINTS

There were no complaints for the months of November 2020

Source Code / Name	Root Cause Analysis	Calculation of Impacts / emissions associated with the incident	Dispersion modeling of pollutants where applicable

ADDENDUM TO MONTHLY EMISSIONS REPORT

Abatement Technology-Table 4

In order to achieve the required operational dust removal efficiency based on measured values, several assumptions such as

- ☑ Coal ash content (%) and burnt rate mass
- ☑ Fly Coarse ash ratio of 80-20 - 80% of fly-ash mass obtained from burnt coal goes to ESP
- ☑ Measurement of dust emission by Dust Monitor over a period of time (monthly)

Operational Dust Removal Efficiency

$$\eta = (1 - (\text{Output}/\text{Input})) \times 100$$

$$\eta = 1 - \frac{(\text{Dust Emission From AQR Report} / \text{Dust Monitor (tons)}) \times 100}{(\text{Coal Burnt (tons)} \times \% \text{Ash Content} \times 80\%)}$$

Monitor Reliability-Table 5

In terms of the minimum emissions standard, the requirement is that a monitor should be 80% reliable on a monthly average. The **monitor reliability** refers to **data reliability** because the assumed value of 98% reliability is compared to the dust concentration signal. If the dust concentration signal is above 98% opacity, the data information is no longer reliable because the monitor reading is out of its maximum reading range. The data reliability looks at how many times did the dust concentration signal go above 98% over a period of time e.g. 24 hours.

The formula is as follows:

$$= (1 - (\text{count hours above 98\%/24hours})) \times 100$$

Emissions Performance

- Note that gaseous emissions were manually entered using Independent third party QAL2 parallel test reports due to the unreliability of the CEMS monitors data.
- Average velocity values from the latest correlation report were used on the gaseous emissions on Unit 1, 2, 3 & 4 due to defective CEMS monitors and velocity correction factors were set M=1 and C=0.
- Average velocity values from December 2019 correlation report were used for the gaseous emissions on unit 6 with the velocity correction factors.
- Unit 5 was still offload during the whole months of November 2020 for long term repairs to address emissions issues.

Unit 1

Findings

Unit 1 high PM emissions on 9 & 11 can be attributed to DHP conveyors not in service and on the 16 & 18 due to poor performance of the Electrostatic Precipitators and on 24 due to blocked top bunker conveyor & SO3 plant off.

Resolution: Electrostatic Precipitators (ESP) were during opportunity maintenance and SO3 plant was returned back to service after repairs.

Unit 2

Findings

High PM on 01 to 12 and 21 to 30 can be attributed to poor performance of the electrostatic precipitators.

Resolution: ESP were repaired during outage opportunity.

Unit 3

Unit 3 high PM can be attributed to poor availability of Dust Handling Plant resulting to ash backlogs causing poor performance of the electrostatic precipitators fields

Resolution The Dust handling plant was repaired and ESP also repaired during outage opportunity maintenance

Unit 4

Unit 4 high PM can be attributed to poor availability of Dust Handling Plant resulting to ash backlogs causing poor performance of the electrostatic precipitators fields

Resolution The Dust handling plant was repaired and ESP also repaired during outage opportunity maintenance

Unit 4 PM Emissions

Unit 4 dust concentration signal was above 98%, the data was out of range which yield a lower monitor

Unit 6 high PM can be attributed to poor availability of Dust Handling Plant resulting to ash backlogs causing poor performance of the electrostatic precipitators fields

Resolution The Dust handling plant was repaired and ESP also repaired during outage opportunity maintenance

KENDAL POWER STATION MONTHLY EMISSIONS REPORT
 Atmospheric Emission License 17/4/AEL/MP312/11/15



1 RAW MATERIALS AND PRODUCTS

Raw Materials and Products	Raw Material Type	Units	Maximum Permitted Consumption	Consumption Rate Dec-2020
	Coal	Tons	2 260 000	417 883
Fuel Oil	Tons	5 000	670,69	

Production Rates	Product / By-Product Name	Units		Production Rate Dec-2020
	Energy	GWh	4380	683,81
Ash	Tons	Not specified	117 508,7	
RE Ash	kg/MWh	Not specified	0,860	

2 ENERGY SOURCE CHARACTERISTICS

Coal Characteristic	Units	Stipulated Range	Monthly Average Content
Sulphur Content	%	0.7 TO >1 (%)	0,690
Ash Content	%	30 TO >40 (%)	28,120

3 EMISSION LIMITS (mg/Nm³)

Associated Unit/Stack	PM	SOx		NOx
Unit 1	100	3500		1100
Unit 2	100	3500		1100
Unit 3	100	3500		1100
Unit 4	100	3500		1100
Unit 5	100	3500		1100
Unit 6	100	3500		1100

4 ABATEMET TECHNOLOGY (%)

Associated Unit/Stack	Technology Type	Efficiency Dec-2020	Technology Type	Utilization Dec-2020
Unit 1	ESP + SO ₂	99.9%	SO ₂	100.0%
Unit 2	ESP + SO ₂	99.5%	SO ₂	97.3%
Unit 3	ESP + SO ₂	99.0%	SO ₂	79.0%
Unit 4	ESP + SO ₂		SO ₂	100.0%
Unit 5	ESP + SO ₂	Unit off	SO ₂	Unit off
Unit 6	ESP + SO ₂		SO ₂	Unit off

Note: ESP plant does not have bypass mode operation, hence plant 100% Utilised.

5 MONITOR RELIABILITY (%)

Associated Unit/Stack	PM	SO ₂	NO	O ₂
Unit 1	99.1	0.0	0.0	0.0
Unit 2	99.7	0.0	0.0	0.0
Unit 3	99.7	0.0	0.0	0.0
Unit 4	0.0	0.0	0.0	0.0
Unit 5	Unit off	Unit off	Unit off	Unit off
Unit 6	Unit off	Unit off	Unit off	Unit off

Note: The QAL 2 parallel tests results have been used to calculate the gaseous emissions hence monitor reliability is zero

Note: Unit 4 dust concentration signal was above 98%, the data was out of range due to unit shutdown

6 EMISSION PERFORMANCE

Table 6 1 Monthly tonnages for the month of December 2020

Associated Unit/Stack	PM (tons)	SO ₂ (tons)	NO _x (tons)
Unit 1	15.7	553	273
Unit 2	188.4	1 372	778
Unit 3	381.8	1 250	658
Unit 4	1.2	2	1
Unit 5	Unit off	Unit off	Unit off
Unit 6	Unit off	Unit off	Unit off
SUM	587.14	3 178	1 710

Table 6 2 Operating days in compliance to PM AEL Limit - December 2020

Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Total Exceedance	Average PM (mg/Nm ³)
Unit 1	8	1	0	0	1	35,6
Unit 2	13	6	0	12	18	135,3
Unit 3	11	6	0	14	20	266,4
Unit 4	0	0	0	1	1	997.9
Unit 5	Unit off	Unit off	Unit off	Unit off	Unit off	Unit off
Unit 6	Unit off	Unit off	Unit off	Unit off	Unit off	Unit off
SUM	32	13	0	27	40	

Table 6 3 Operating days in compliance to SO_x AEL Limit - December 2020

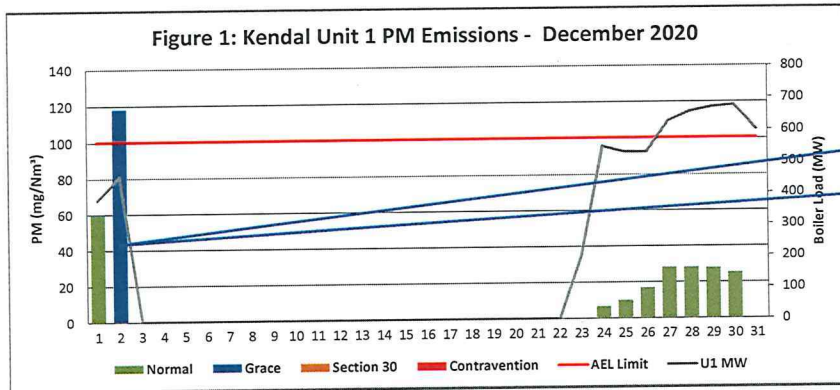
Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Total Exceedance	Average SO _x (mg/Nm ³)
Unit 1	11	0	0	0	0	800.9
Unit 2	31	0	0	0	0	808,6
Unit 3	31	0	0	0	0	619,6
Unit 4	1	0	0	0	0	1 036.8
Unit 5	Unit off	Unit off	Unit off	Unit off	Unit off	Unit off
Unit 6	Unit off	Unit off	Unit off	Unit off	Unit off	Unit off
SUM	74	0	0	0	0	

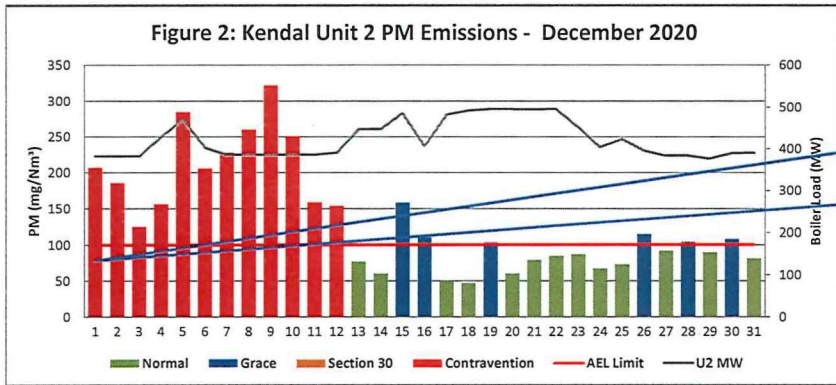
Table 6.4: Operating days in compliance to NOx AEL Limit - December 2020

Associated Unit/Stack	Normal	Grace	Section 30	Contra-vention	Total Exceedance	Average NOx (mg/Nm ³)
Unit 1	11	0	0	0	0	395,0
Unit 2	31	0	0	0	0	458,3
Unit 3	31	0	0	0	0	326,0
Unit 4	1	0	0	0	0	497,1
Unit 5	Unit off	Unit off	Unit off	Unit off	Unit off	Unit off
Unit 6	Unit off	Unit off	Unit off	Unit off	Unit off	Unit off
SUM	74	0	0	0	0	

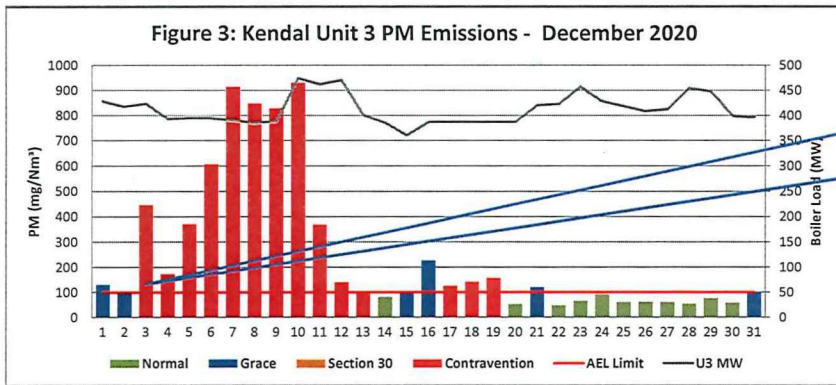
Table 6.5: Legend Description

Condition	Colour	Description
Normal	Green	Emissions below Emission Limit Value (ELV)
Grace	Blue	Emissions above the ELV during grace period
Section 30	Orange	Emissions above ELV during a NEMA S30 incident
Contra-vention	Red	Emissions above ELV but outside grace or S30 incident conditions

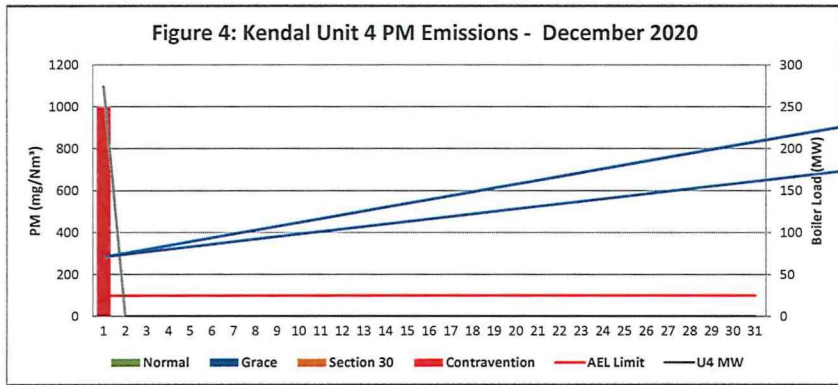




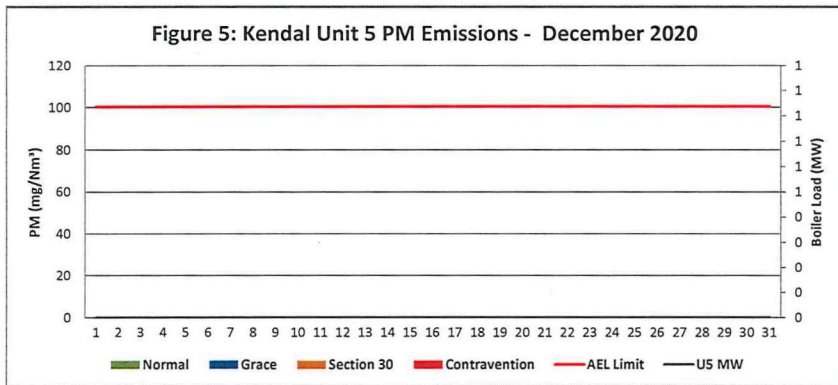
High PM emissions on 01 to 12 can be attributed to Dust Handling Plant standing/off and SO3 plant off/tripping

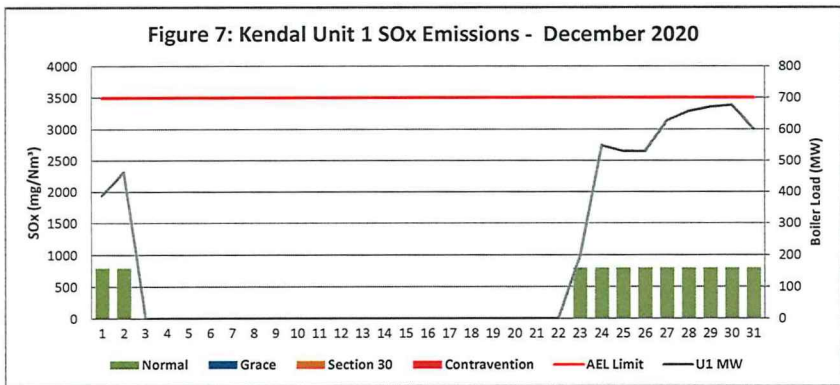
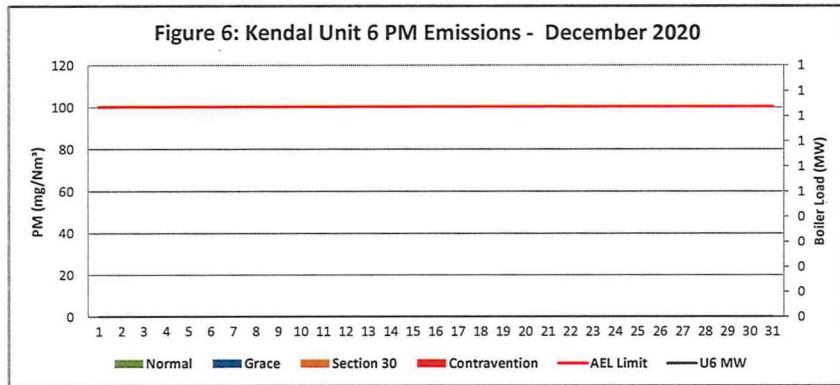


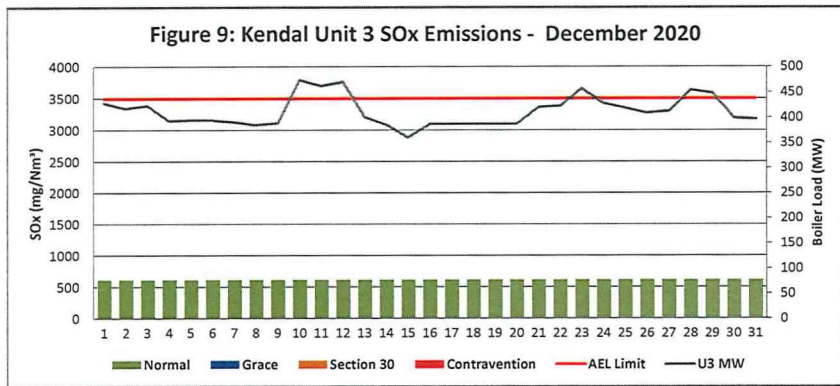
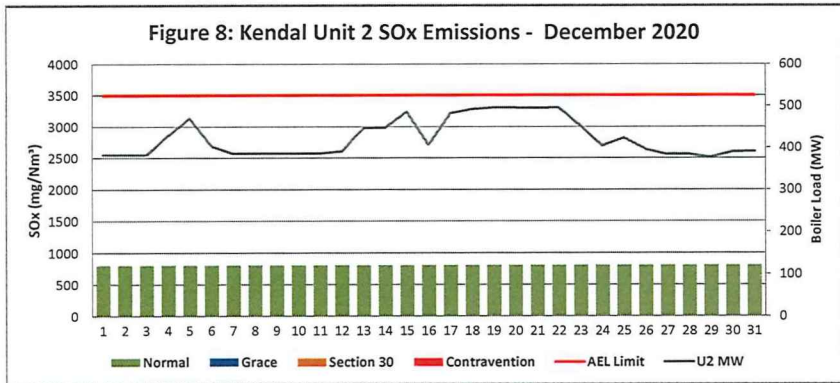
Unit 3 high PM emissions on 03 to 13 can be attributed Dust Handling Plant standing resulting to ash backlogs causing poor performance of the electrostatic precipitators fields and on 17 to 19 due to SO3 plant being off

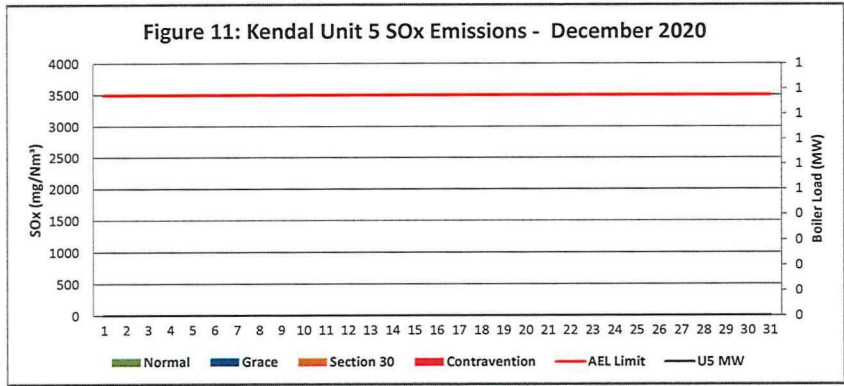
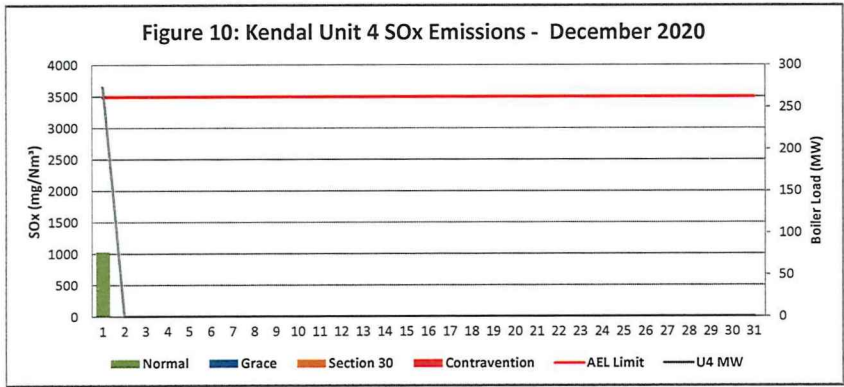


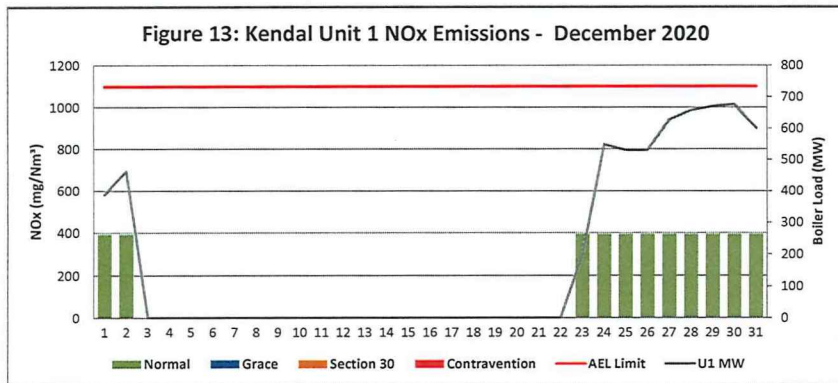
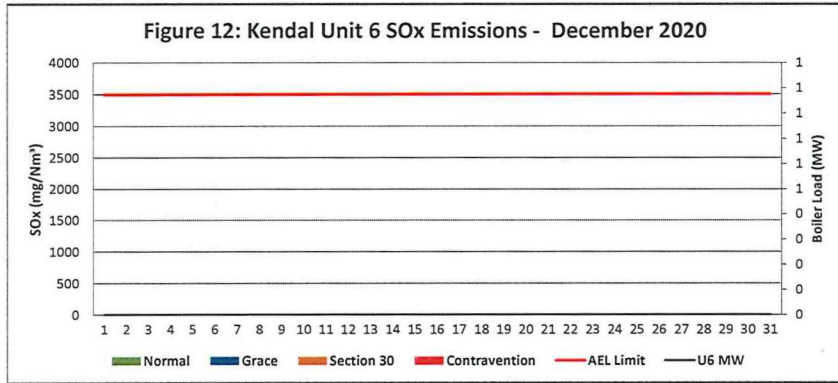
Unit 4 shutdown











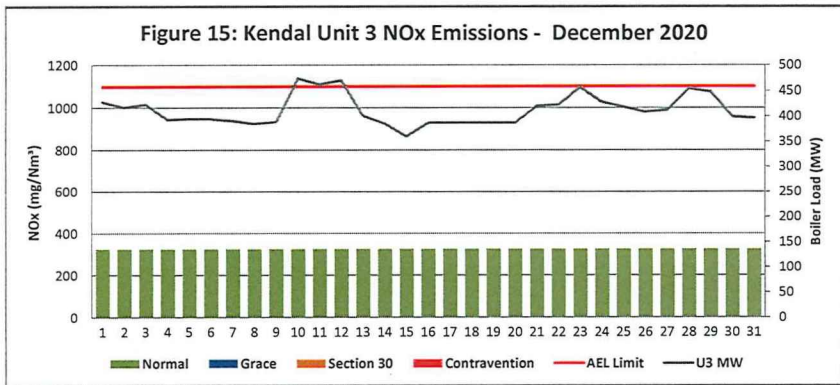
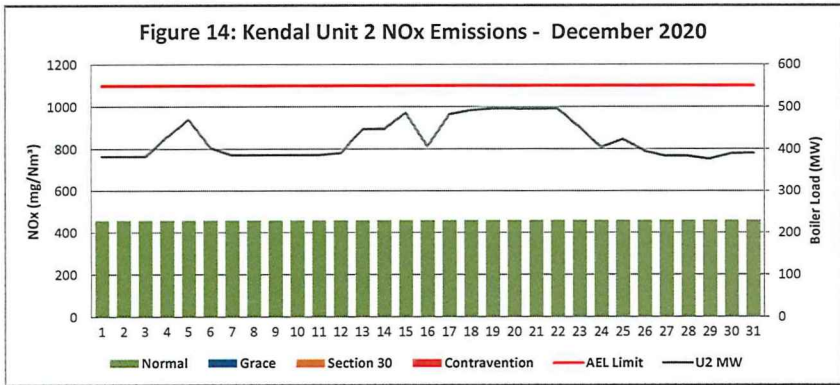


Figure 16: Kendal Unit 4 NOx Emissions - December 2020

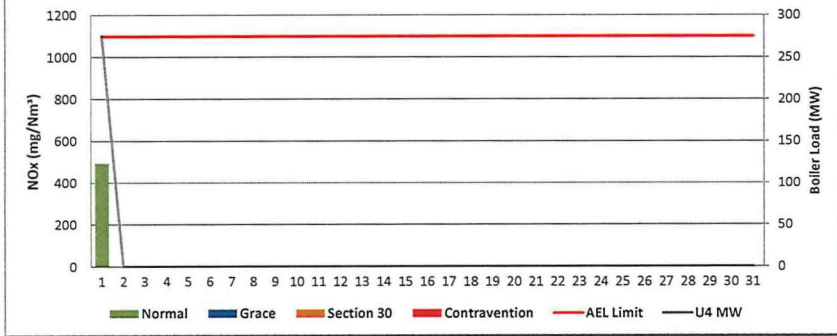
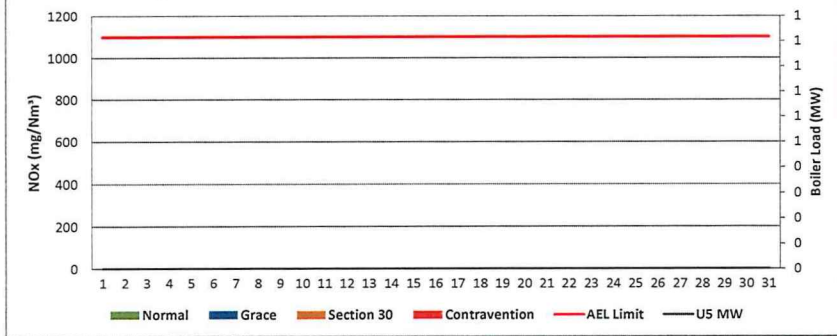
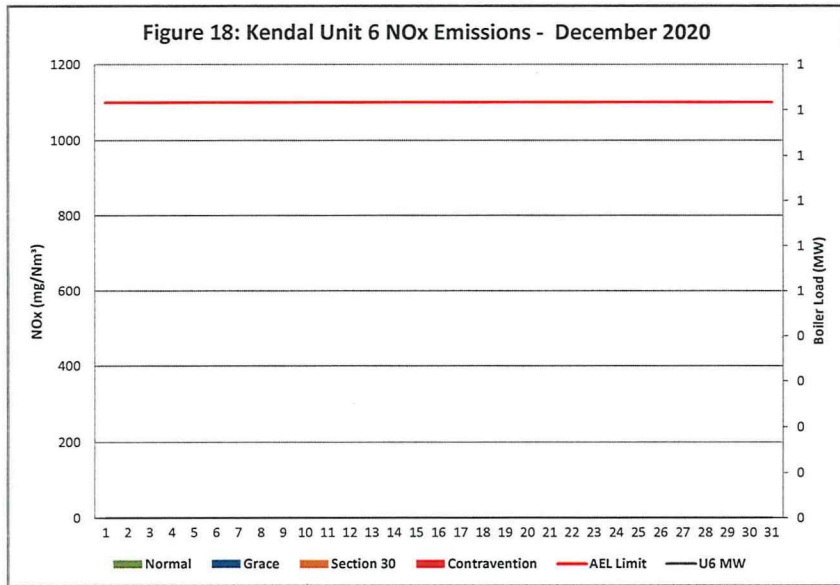


Figure 17: Kendal Unit 5 NOx Emissions - December 2020





7 COMPLAINTS

There were no complaints for the months of December 2020

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

ADDENDUM TO MONTHLY EMISSIONS REPORT

Abatement Technology-Table 4

In order to achieve the required operational dust removal efficiency based on measured values, several assumptions such as

- ☑ Coal ash content (%) and burnt rate mass
- ☑ Fly Coarse ash ratio of 80 20 - 80% of fly-ash mass obtained from burnt coal goes to ESP
- ☑ Measurement of dust emission by Dust Monitor over a period of time (monthly)

Operational Dust Removal Efficiency

$$\eta = (1 - (\text{Output}/\text{Input})) \times 100$$

$$\eta = 1 - \frac{(\text{DustEmissionFromAQR ReportDustMonitor(tons)} \times 100)}{(\text{CoalBurnt(tons)} * \%AshContent * 80\%)}$$

Monitor Reliability-Table 5

In terms of the minimum emissions standard, the requirement is that a monitor should be 80% reliable on a monthly average. The **monitor reliability** refers to **data reliability** because the assumed value of 98% reliability is compared to the dust concentration signal. If the dust concentration signal is above 98% opacity, the data information is no longer reliable because the monitor reading is out of its maximum reading range. The data reliability looks at how many times did the dust concentration signal go above 98% over a period of time e.g. 24 hours.

The formula is as follows

$$= (1 - (\text{count hours above 98\%/24hours})) \times 100$$

Emissions Performance

- Note that gaseous emissions were manually entered using Independent third party QAL2 parallel test reports due to the unreliability of the CEMS monitors data
- Average velocity values from the latest correlation report were used on the gaseous emissions on Unit 1, 2, 3 & 4 due to defective CEMS monitors and velocity correction factors were set M=1 and C=0
- Average velocity values from December 2019 correlation report were used for the gaseous emissions on unit 5 with the velocity correction factors
- Unit 5 & 6 were offload during the whole months of December 2020 for repairs to address emissions issues

Unit 1

Findings

Unit 1 high PM emissions on 02nd can be attributed to shutdown conditions

Unit 2

Findings

High PM emissions on 01 to 12 can be attributed to Dust Handling Plant standing/off and SO3 plant off/tripping

Resolution The Dust handling Plant and SO3 plant were returned back to service after repairs

Unit 3

Unit 3 high PM emissions can be attributed to Dust Handling Plant standing/off on the 03rd until the 12 and 17 to 19 and SO3 plant off/tripping

Resolution The Dust handling Plant and SO3 plant were returned back to service after repairs

Unit 4

Unit 4 high PM emissions on 01st can be attributed to shutdown conditions

Unit 4 PM Emissions

Unit 4 dust concentration signal was above 98%, the data was out of range due to unit shutdown