Eskom

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Date:
03 April 2024

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Dear Ms. Nompumelelo Simelane

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

**RESUBMISSION OF KENDAL POWER STATION'S EMISSIONS REPORT FOR THE MONTH OF NOVEMBER 2023.**

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.

Resubmission is made due to the engineering's analysis that was made on the reports to utilize Deutsch equation where monitors maxed out to get the surrogation value and this resulted in a increase in tonnages.

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**KENDAL POWER STATION'S EMISSIONS REPORT FOR THE MONTH OF NOVEMBER 2023**

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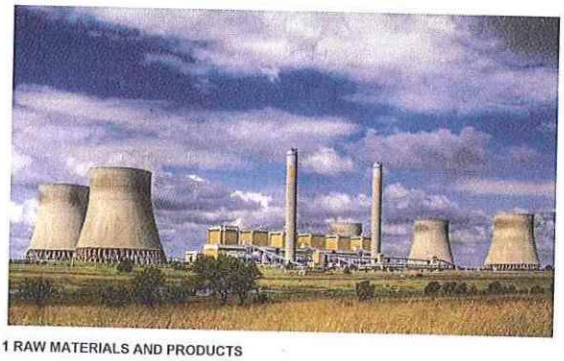
2024/04/22

Eskom

NOVEMBER 2023

**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-2023 |
|---|---|---|---|---|
| | Coal | Tons | 2 260 000 | 616 890 |
| | Fuel Oil | Tons | 5 000 | 8947.630 |
| | | | | |
| Production Rates | Product / By-Product Name | Units | Maximum Production Capacity Permitted | Indicative Production Rate Nov-2023 |
| | Energy | GWh | 2 983.520 | 1 020.321 |
| | Ash | Tons | 770 000 | 200 427.561 |
| | RE Ash | kg/MWh | not specified | 1.268 |

*Note: Maximum energy rate is as per the maximum capacity stated in the AEL: [4 116 MW] x 24 hrs x days in Month/1000 to convert to GWh*

**2 ENERGY SOURCE CHARACTERISTICS**

| Coal Characteristic | Units | Stipulated Range | Monthly Average Content |
|---|---|---|---|
| CV Content | MJ/kg | 16-24 (MJ/kg) | 18.840 |
| Sulphur Content | % | <1 (%) | 0.810 |
| Ash Content | % | 40 (%) | 32.490 |

**3 EMISSION LIMITS (mg/Nm³)**

| Associated Unit/Stack | PM | $SO_2$ | 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 ABATEMENT TECHNOLOGY (%)

| Associated Unit/Stack | Technology Type | Efficiency Nov-2023 | Technology Type | $SO_3$ Utilization Nov-2023 |
|---|---|---|---|---|
| Unit 1 | $ESP + SO_3$ | 99.089% | $SO_3$ | 86.8% |
| Unit 2 | $ESP + SO_3$ | 99.341% | $SO_3$ | 92.4% |
| Unit 3 | $ESP + SO_3$ | Off-line | $SO_3$ | Off-line |
| Unit 4 | $ESP + SO_3$ | 99.439% | $SO_3$ | 0.0% |
| Unit 5 | $ESP + SO_3$ | 98.695% | $SO_3$ | 65.7% |
| Unit 6 | $ESP + SO_3$ | 99.354% | $SO_3$ | 83.7% |

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

SO3 plant not running due to low Sulphur flow. SO3 pipe line blocked. SO3 Plant not communicating

Stations very old and obsolete windows 97 SCADA system which the station has to replaced during the unit 4 GO outage. Commissioning of the server is still on going.

## 5 MONITOR RELIABILITY (%)

| Associated Unit/Stack | PM | $SO_2$ | NO | $O_2$ |
|---|---|---|---|---|
| Unit 1 | 96.8 | 99.3 | 99.7 | 99.7 |
| Unit 2 | 82.8 | 98.0 | 98.2 | 54.0 |
| Unit 3 | Off | Off | Off | Off |
| Unit 4 | 95.8 | 74.6 | 74.6 | 63.3 |
| Unit 5 | 85.3 | 98.2 | 91.5 | 100.0 |
| Unit 6 | 99.0 | 85.0 | 100.0 | 69.8 |

Note: NOx emissions is measured as NO in PPM. Final NOx value is expressed as total $NO_2$

Note: Unit 4 SO2 and Nox monitors realiability is low due to defective monitors. Unit 2,4 and 6 O2 monitors reliability low due to defective monitors

## 6 EMISSION PERFORMANCE

Table 6.1: Monthly tonnages for the month of November 2023

| Associated Unit/Stack | PM (tons) | $SO_2$ (tons) | $NO_x$ (tons) |
|---|---|---|---|
| Unit 1 | 340.9 | 3 106 | 1 252 |
| Unit 2 | 237.9 | 1 317 | 561 |
| Unit 3 | Off | Off | Off |
| Unit 4 | 211.8 | 1 565 | 633 |
| Unit 5 | 370.0 | 1 090 | 437 |
| Unit 6 | 133.5 | 0 | 0 |
| SUM | 1 294.16 | 7 078 | 2 883 |

Please note the reported figures in tonnage calculation are an under estimate since the station did not use the Maxing out PM monitor quantification excersice which is the use of Surrogate values on days when the monitor maxed out

Table 6.2: Operating days in compliance to PM AEL Limit - November 2023

| Associated Unit/Stack | Normal | Grace | Section 30 | Contravention | Total Exceedance | Average PM (mg/Nm³) |
|---|---|---|---|---|---|---|
| Unit 1 | 16 | 7 | 0 | 7 | 14 | 197.1 |
| Unit 2 | 0 | 2 | 0 | 22 | 24 | 188.4 |
| Unit 3 | Off | Off | Off | Off | Off | Off |
| Unit 4 | 10 | 8 | 0 | 12 | 20 | 207.3 |
| Unit 5 | 2 | 3 | 0 | 14 | 17 | 426.4 |
| Unit 6 | 3 | 3 | 0 | 10 | 13 | 173.3 |
| SUM | 31 | 23 | 0 | 65 | 88 | |

Table 6.3: Operating days in compliance to $SO_2$ AEL Limit - November 2023

| Associated Unit/Stack | Normal | Grace | Section 30 | Contravention | Total Exceedance | Average $SO_2$ (mg/Nm³) |
|---|---|---|---|---|---|---|
| Unit 1 | 30 | 0 | 0 | 0 | 0 | 1 366.7 |
| Unit 2 | 25 | 0 | 0 | 0 | 0 | 2 220.0 |
| Unit 3 | Off | Off | Off | Off | Off | Off |
| Unit 4 | 30 | 0 | 0 | 0 | 0 | 1 912.4 |
| Unit 5 | 21 | 0 | 0 | 0 | 0 | 1 626.0 |
| Unit 6 | 17 | 0 | 0 | 0 | 0 | 815.4 |
| SUM | 123 | 0 | 0 | 0 | 0 | |

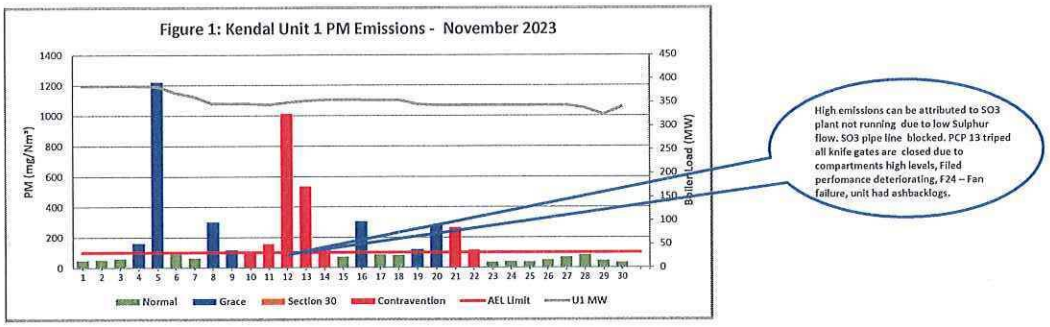
Table 6.4: Operating days in compliance to NOx AEL Limit - November 2023

| Associated Unit/Stack | Normal | Grace | Section 30 | Contravention | Total Exceedance | Average NOx (mg/Nm³) |
|---|---|---|---|---|---|---|
| Unit 1 | 30 | 0 | 0 | 0 | 0 | 554.5 |
| Unit 2 | 25 | 0 | 0 | 0 | 0 | 965.2 |
| Unit 3 | Off | Off | Off | Off | Off | Off |
| Unit 4 | 30 | 0 | 0 | 0 | 0 | 773.7 |
| Unit 5 | 21 | 0 | 0 | 0 | 0 | 652.1 |
| Unit 6 | 17 | 0 | 0 | 0 | 0 | 618.9 |
| SUM | 123 | 0 | 0 | 0 | 0 | |

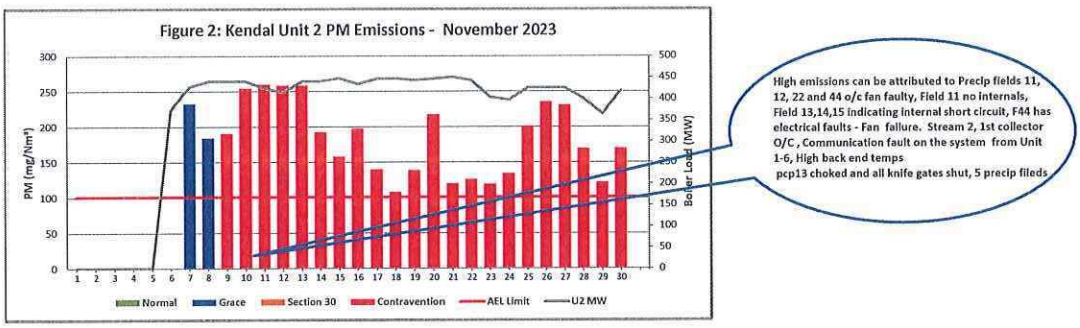
*Note: NOx emissions is measured as NO in PPM. Final NOx value is expressed as total $NO_2$*

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 monitor maxed out on the 4th and 5th, 12th, 13th and 16th




Unit 2 monitor maxed out from the 10th to the 14th and the 26th

Figure 3: Kendal Unit 3 PM Emissions - November 2023

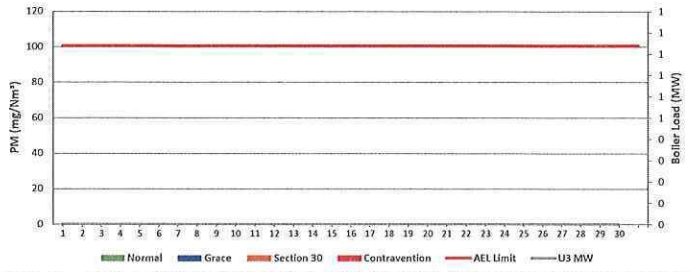
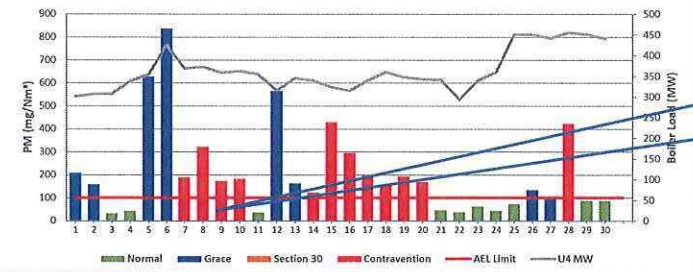
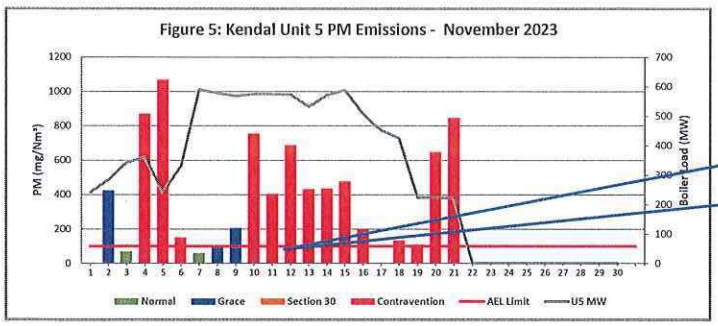



Figure 4: Kendal Unit 4 PM Emissions - November 2023



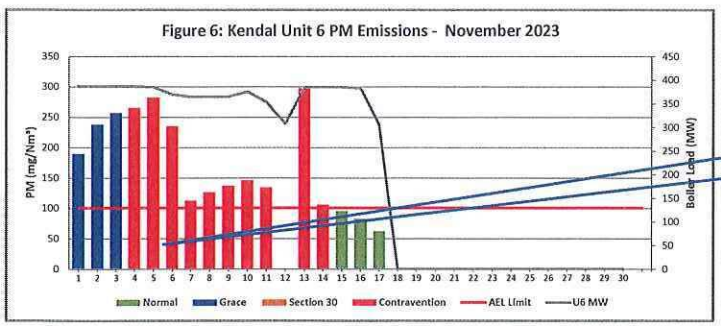

*High PM emissions can be attributed to LHS on pcp 11_14 standing with all knife gates shut, faulty on first collection stream 1, pcp 11-14 all knife gates closed (stream 1 tripped) faulty on first collection stream 1 , Stream 1 2nd collector not available, LH draught group was shud down,*
*Stream 2 1st collector gearbox mechanically defective, First collector stream 1 kept tripping, Stream 1 First Collector chocked (PCP 11-14 OFF and all Knife gates closed) bucket elevator blockage -*

Figure 5: Kendal Unit 5 PM Emissions - November 2023




*High PM emissions can be attributed to DHP Stream 2 1st collecting conveyor tripped, DHP tripped due to High compartment 10, compartment 10 full chute onto top bunker conveyer blocked - knife gates closed. Ash constraints due to ash plant standing*
*DHP standing on unit 05 bucket elevator, DHP standing due Stream 2 Second Collector tripped and fails to reset and stream 1 not available.*
*Stream 2 bucket elevator tightening on the knots Precip fields 12, 23, 31, 32, 42, 43 not performing DHP standing ,*

Figure 6: Kendal Unit 6 PM Emissions - November 2023




*High PM emissions can be attributed to SO3 Plant not communicating Precip conveyor 11 faulty*

Figure 7: Kendal Unit 1 $SO_2$ Emissions - November 2023

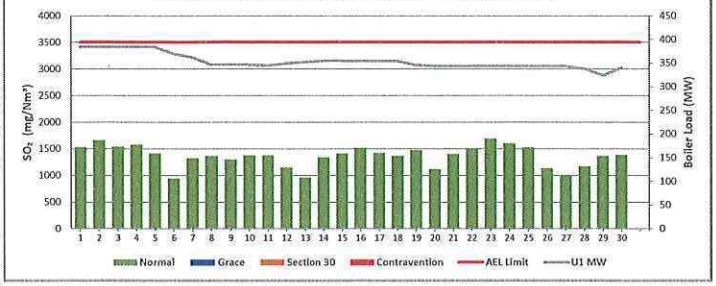



Figure 8: Kendal Unit 2 $SO_2$ Emissions - November 2023

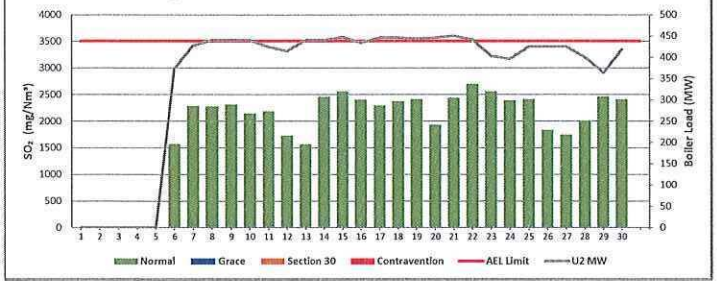



Figure 9: Kendal Unit 3 $SO_2$ Emissions - November 2023

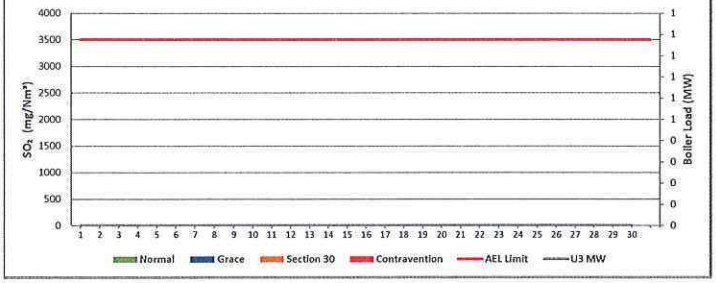


Figure 10: Kendal Unit 4 $SO_2$ Emissions - November 2023

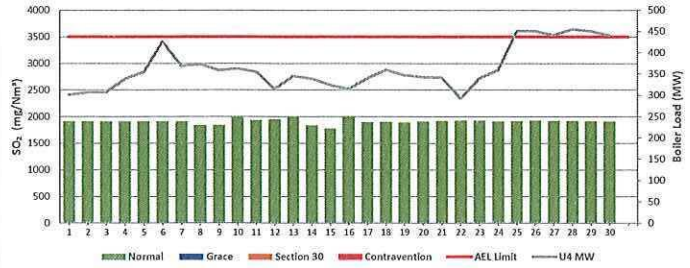



Figure 11: Kendal Unit 5 $SO_2$ Emissions - November 2023

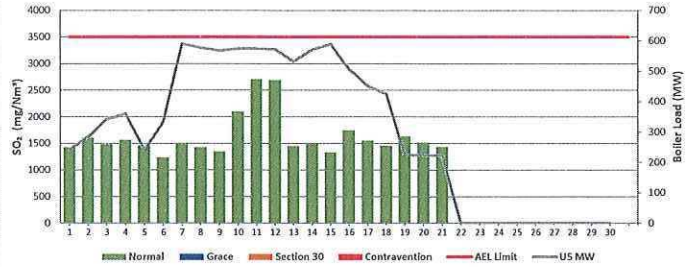



Figure 12: Kendal Unit 6 $SO_2$ Emissions - November 2023

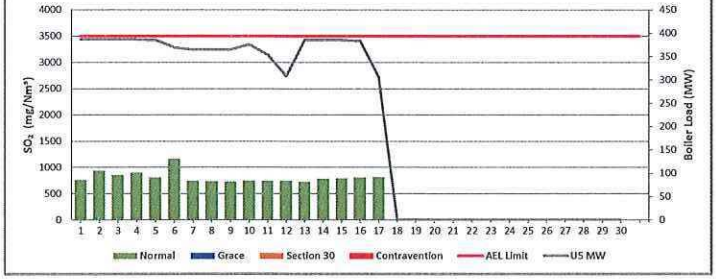



Figure 13: Kendal Unit 1 NOx Emissions - November 2023

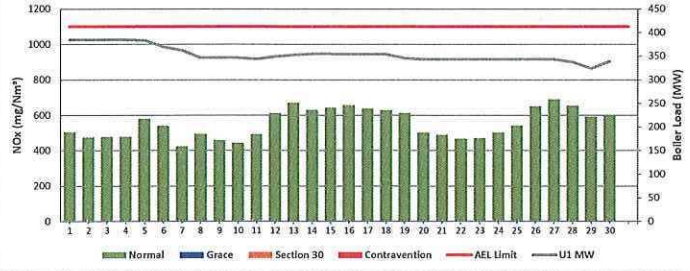


Figure 14: Kendal Unit 2 NOx Emissions - November 2023

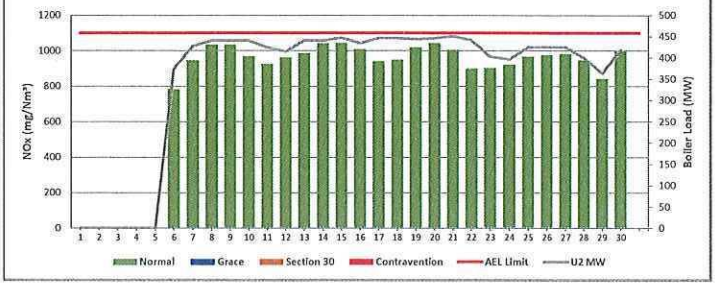



Figure 15: Kendal Unit 3 NOx Emissions - November 2023

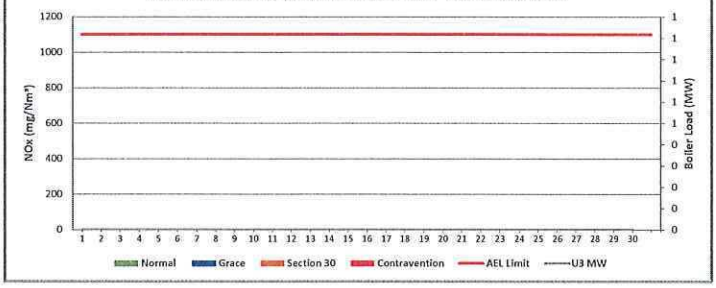



Figure 16: Kendal Unit 4 NOx Emissions - November 2023

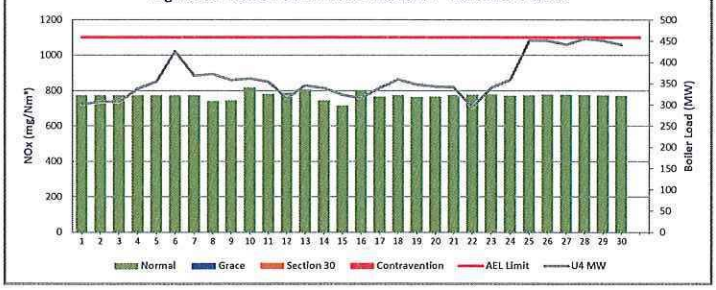



Figure 17: Kendal Unit 5 NOx Emissions - November 2023

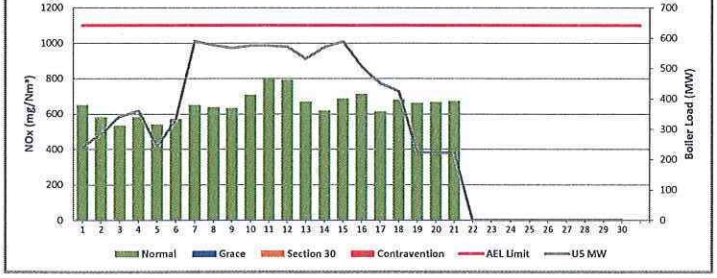
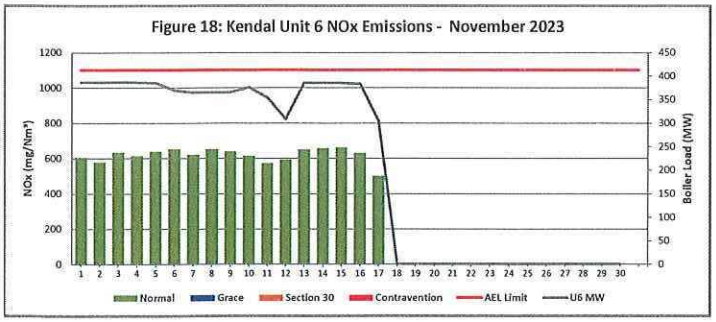



Figure 18: Kendal Unit 6 NOx Emissions - November 2023



## 7 COMPLAINTS

There were no complaints for this months

| Source Code / Name | Root Cause Analysis | Calculation of Impacts / emissions associated | Dispersion modeling of pollutants where applicable | Measures implemented to prevent reoccurrence |
|---|---|---|---|---|
| | | | | |
| | | | | |

**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

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

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

**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 99.325% reliability is compared to the dust concentration signal. If the dust concentration signal is above 99.325% 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 24hours
The formula is as follows:
= (1 – (count hours above 99.325%/24hours) )x 100

**Emissions Performance:**

- Average velocity values from the latest correlation report were used on the gaseous emissions on Unit 1, 2,4,5 &6 due to defective CEMS monitors and velocity correction factors were set M=1 and C=0
- Unit 5 Monitor still using the old monitor correlation. After new correlations are done, new correlation factors will be implemeted and backfitted to the date of monitor installation.
- U1 and 2 monitor maxed out, meaning the the emissions were higher than what the monitor was correlated for. In which case we use surrogate values. This is attributted to abnormal plant conditions.
- Please note the reported figures in tonnage calculation are the figures after the station used the Maxing out PM monitor quantification exercise which is the use of "surrogate values" on days when the monitor maxed out. The following are the days when the monitor was maxing out: Unit 1 from the 4th&5th, 12th -13th and 16th, U2 on the 12th - 14th & 26th. Figures were restated based on the surrogate value determination that Kendal conducted.
- Average emeissions for unit 2 ,4 and 5 were taken from QAL2 report as the CO2 and O2 Faulty instrument (CEMS/monitors) get wrong readings impacting the AQR's calculations.
- Unit 2 burner tilt positions.

- Unit 1
- Findings: The high emissions can be attributed to SO3 plant not running due to low Sulphur flow, SO3 pipe line blocked. PCP 13 triped all knife gates are closed due to compartments high levels, Field perfomance deteriorating, F24 – Fan failure, unit had ashbacklogs.
- Resolution: Plant repaired

- Unit 2
- Findings: The high emissions can be attributed to pcp13 choked and all knife gates shut, 5 precip fileds underperfoming, Precip fields 11, 12, 22 and 44 o/c fan faulty, Field 11 no internals, Field 13,14,15 indicating internal short circuit, F44 has electrical faults - Fan failure. Stream 2, 1st collector O/C , Communication fault on the system from Unit 1-6, High back end temps.
- Resolution: Plant repaired.

- Unit 3 - Unit on Outage

- Unit 4
- Findings: High PM emissions can be attributed to LHS on pcp 11_14 standing with all knife gates shut, faulty on first collection stream 1, pcp 11-14 all knife gates closed (stream 1 tripped) faulty on first collection stream 1 , Stream 1 2nd collector not available, LH draught group was shud down, Stream 2 1st collector gearbox mechanically defective, First collector stream 1 kept tripping, Stream 1 First Collector chocked (PCP 11-14 OFF and all Knife gates closed) bucket elevator blockage.
- Resolution: Plant repaired.

- Unit 5
- Findings: High PM emissions can be attributed toDHP Stream 2, 1st collecting conveyor tripped, DHP tripped due to High compartment 10, comparrment 10 full chute onto top bunker conveyer blocked - knife gates closed. Ash constraints due to ash plant standing, DHP standing on unit 05 bucket elevator, DHP standing due Stream 2 Second Collector tripped and fails to reset and stream 1 not available. Stream 2 bucket elevator tightening on the knots, Precip fields 12, 23, 31, 32, 42, 43 not performing DHP standing ,
- Resolution: Plant repaired.

- Unit 6
- Findings: High PM emissions can be attributed to SO3 Plant not communicating Precip conveyor 11 faulty
- Resolution: Plant repaired.