Eskom

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Date:
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Ref*:* 17/4/AEL/MP312/11/09

Dear Ms Nembilwi

**KRIEL POWER STATION'S MONTHLY STACK EMISSIONS REPORT FOR THE MONTH OF FEBRUARY 2021**

This serves as the monthly report required in terms of Section 7.4 in Kriel Power Station's Atmospheric Emission License 17/4/AEL/MP312/11/09. The emissions are for the month of February 2021. Verified emissions of particulates matter, $SO_2$ and $NO_x$ (as $NO_2$) are also included.

**Raw Materials and Products**

**Table 1:** Quantity of Raw Materials and Products used/produced for the month of February 2021

| **Raw Materials and Products used** | **Raw Material Type** | **Units** | **Maximum Permitted Consumption / Rate (Quantity)** | **Consumption / Rate in Month of February 2021** |
|---|---|---|---|---|
| | Coal | Tons/month | 1 227 600 | 778 519 |
| | Fuel Oil | Tons/month | 5 000 | 3 033.36 |
| | | | | |
| **Production Rates** | **Product/ By-Product Name** | **Unit** | **Maximum Production Capacity Permitted (Quantity)** | **Production Rate in Month of February 2021** |
| | Ash | Tons/month | not specified | 877.5 |
| | RE PM | kg/MWh | not specified | 0.97 |

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**Abatement Technology**

**Table 2:** Abatement Equipment Control Technology for February 2021.

| Associated Unit/Stack | Technology Type | Actual Efficiency (%) February 2021 |
|---|---|---|
| Unit 1 | ESP | 99.29% |
| Unit 2 | ESP | Outage |
| Unit 3 | ESP | 99.23% |
| Unit 4 | ESP | 99.68% |
| Unit 5 | ESP | 99.76% |
| Unit 6 | ESP | 99.73% |

**Energy Source Characteristics**

**Table 3:** Energy Source Material Characteristics for the month of February 2021

| Characteristic | Stipulated Range (Unit) | Monthly Average Content |
|---|---|---|
| **Sulphur Content** | 0.6-1.2 (%) | 0.86 |
| **Ash Content** | 21-36 (%) | 26.94 |

**Monthly Monitor Reliability**

| Associated Unit/Stack | PM (%) | SOx (%) | NOx (%) |
|---|---|---|---|
| North | 55.80 | 88.36 | 89.14 |
| South | 95.39 | 94.64 | 97.47 |

**Emissions Reporting**

**Table 6.5: Graph Legend Description**

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

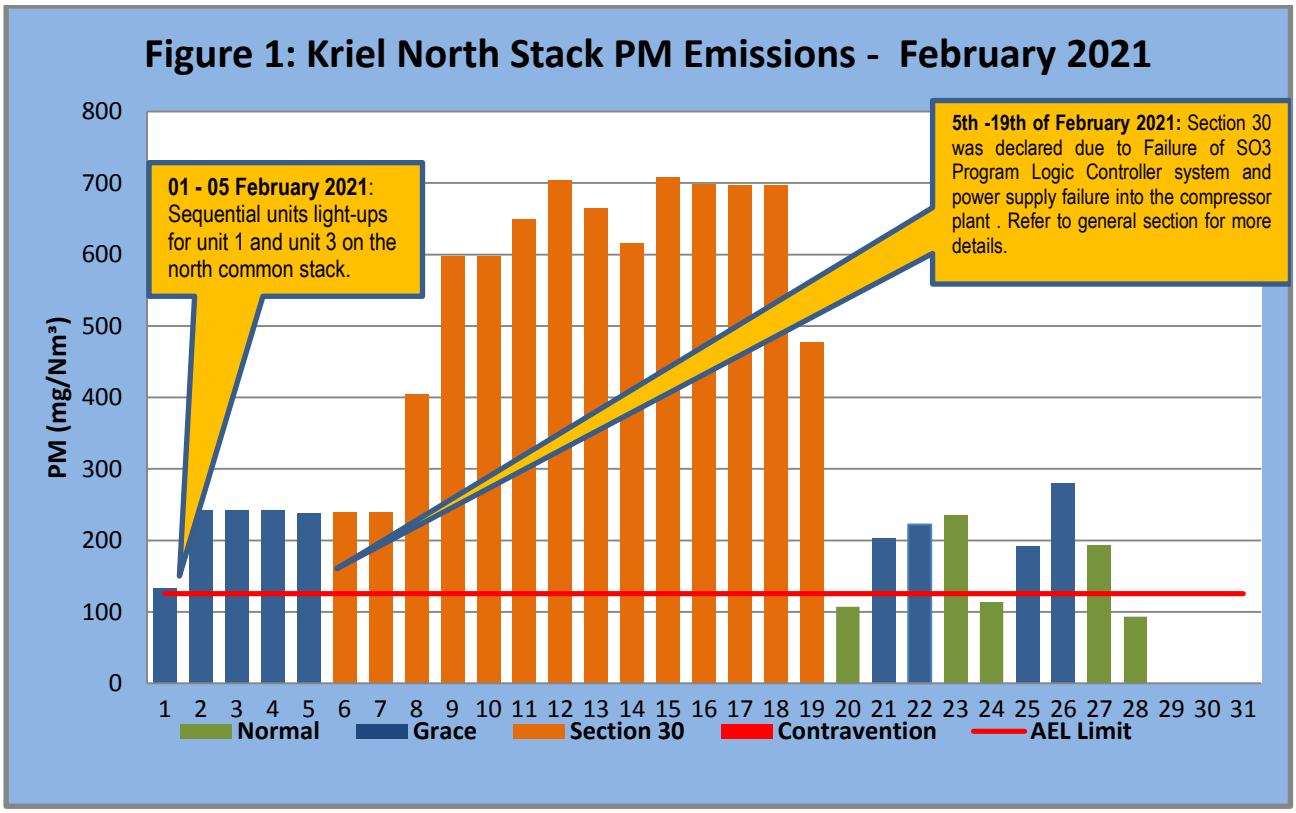


***Figure 1: PM emissions (daily averages) for the month of February 2021 against emission limit for the North Stack***

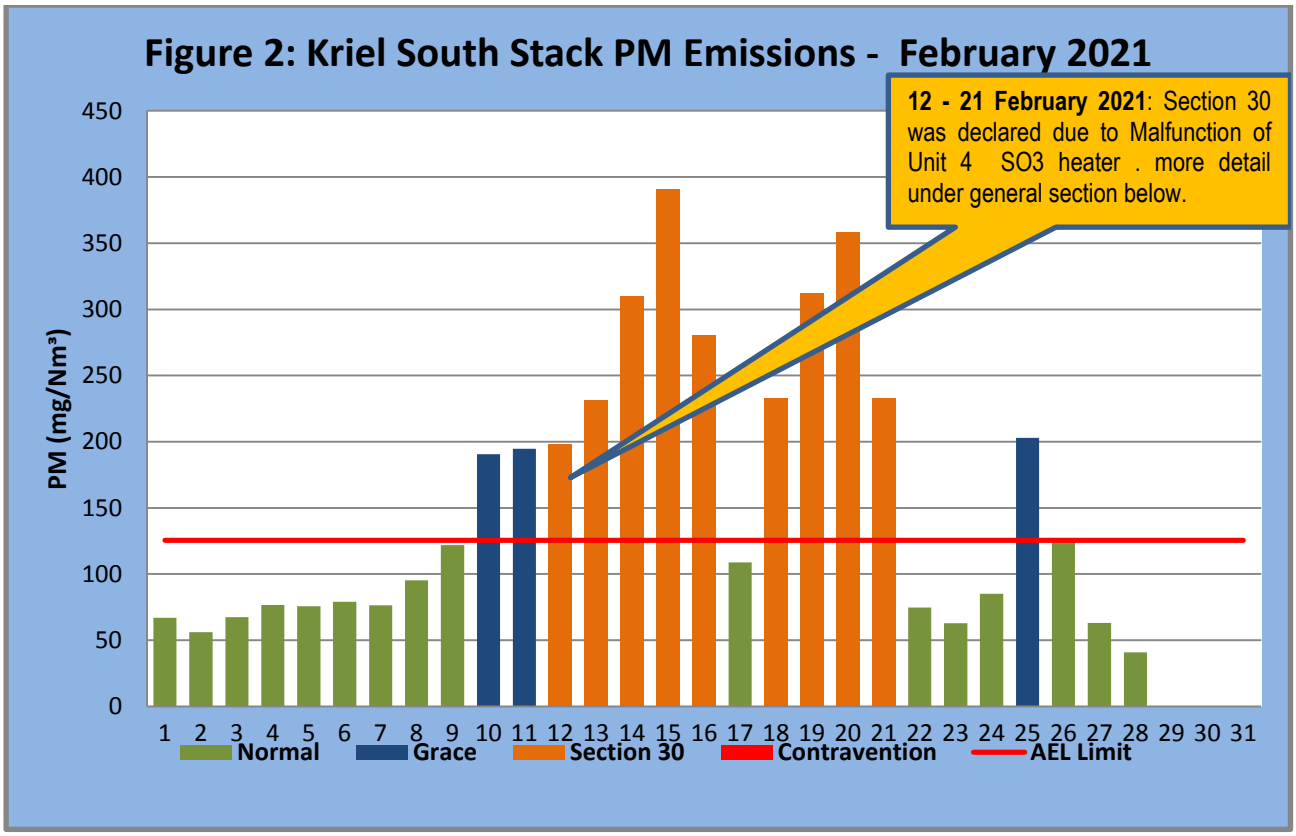


***Figure 2: PM emissions (daily averages) for the month of February 2021 against emission limit for the South Stack***

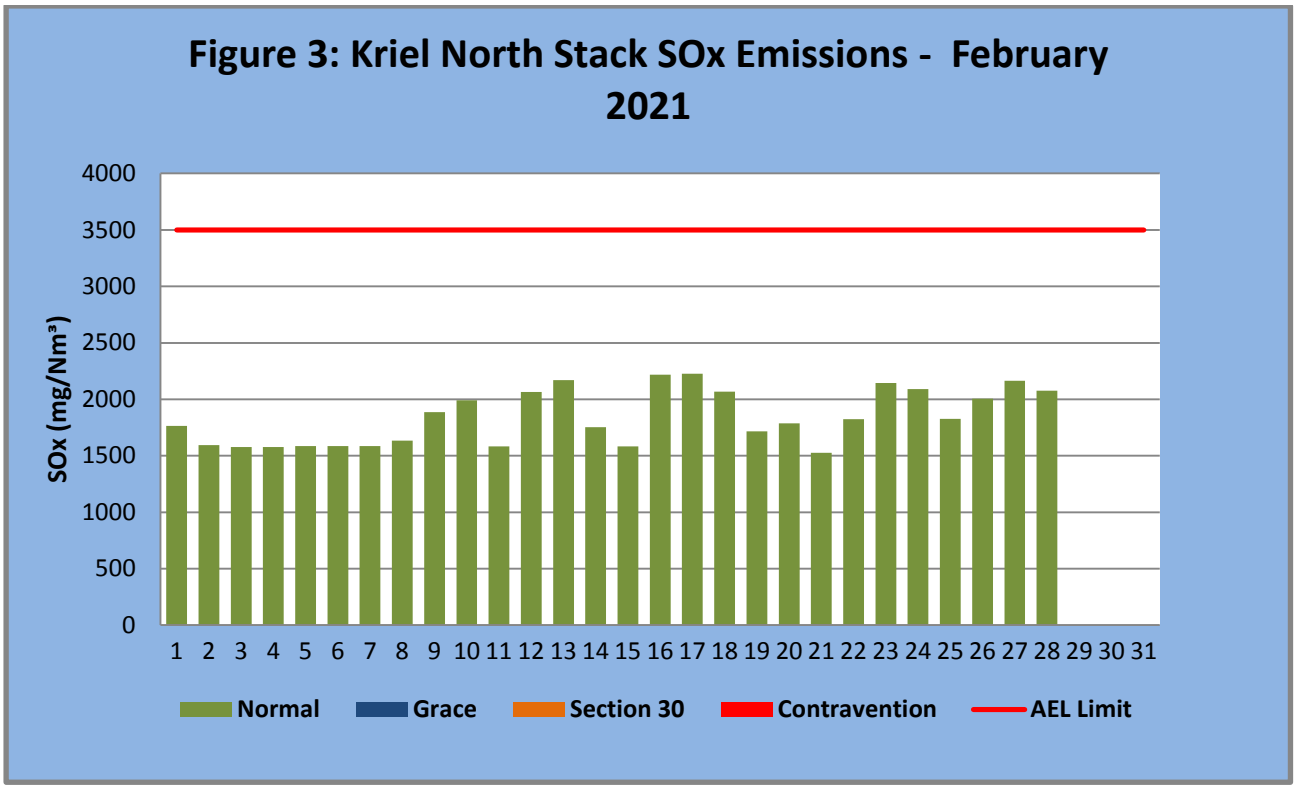


***Figure 3. SO2 emissions (daily averages) for the month of February 2021 against emission limit for the North Stack. The SOx Limit is 3500mg/Nm3.***

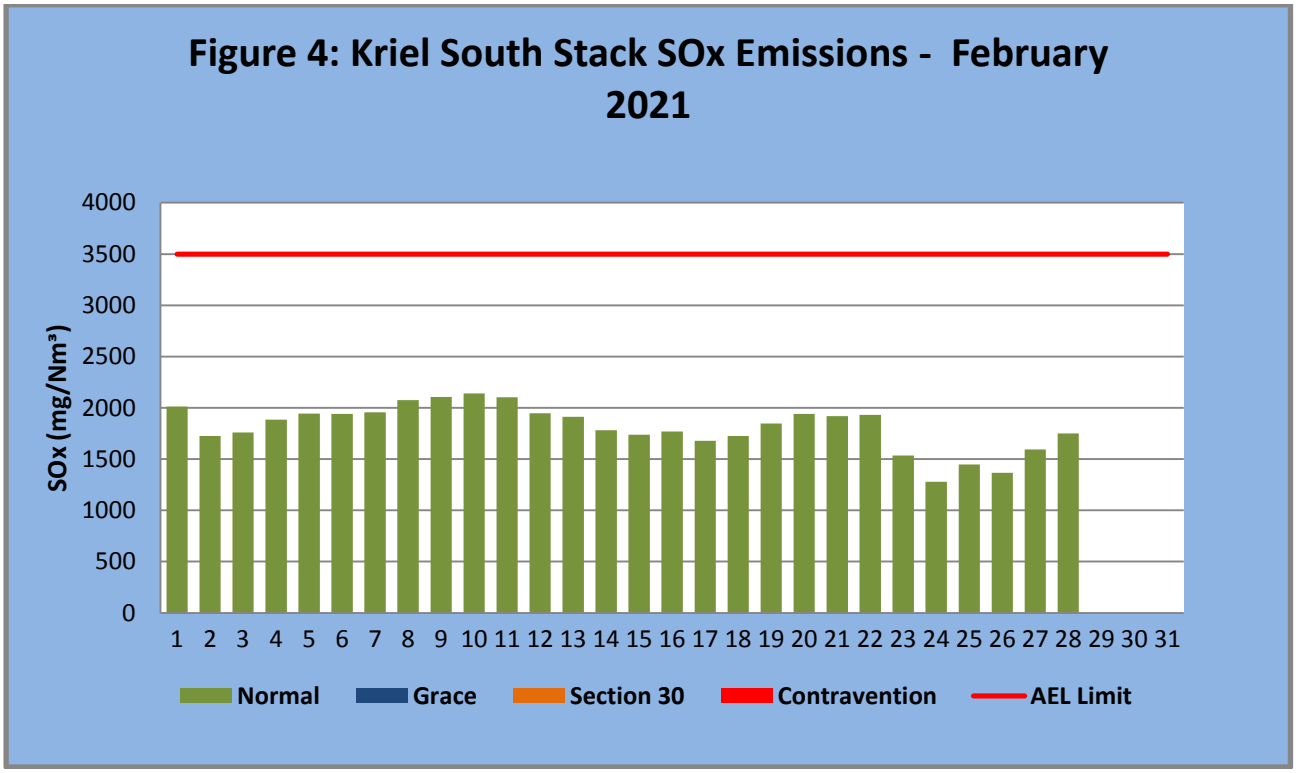


***Figure 4. SO2 emissions (daily averages) for the month of February 2021 against emission limit for the South Stack. The SOx Limit is 35000mg/Nm3.***

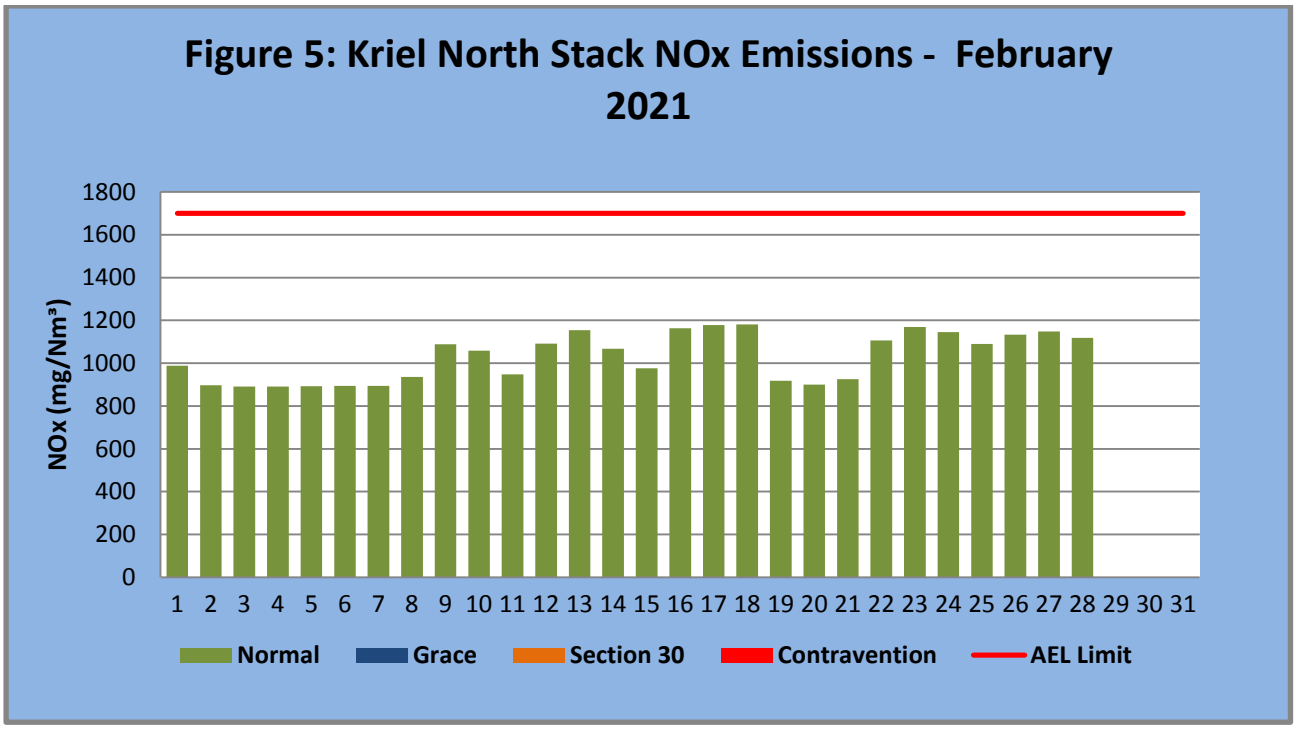


***Figure 5. NO2 emissions (daily averages) for the month of February 2021 against emission limit for the North Stack. The NOx Limit is 1600mg/Nm3.***

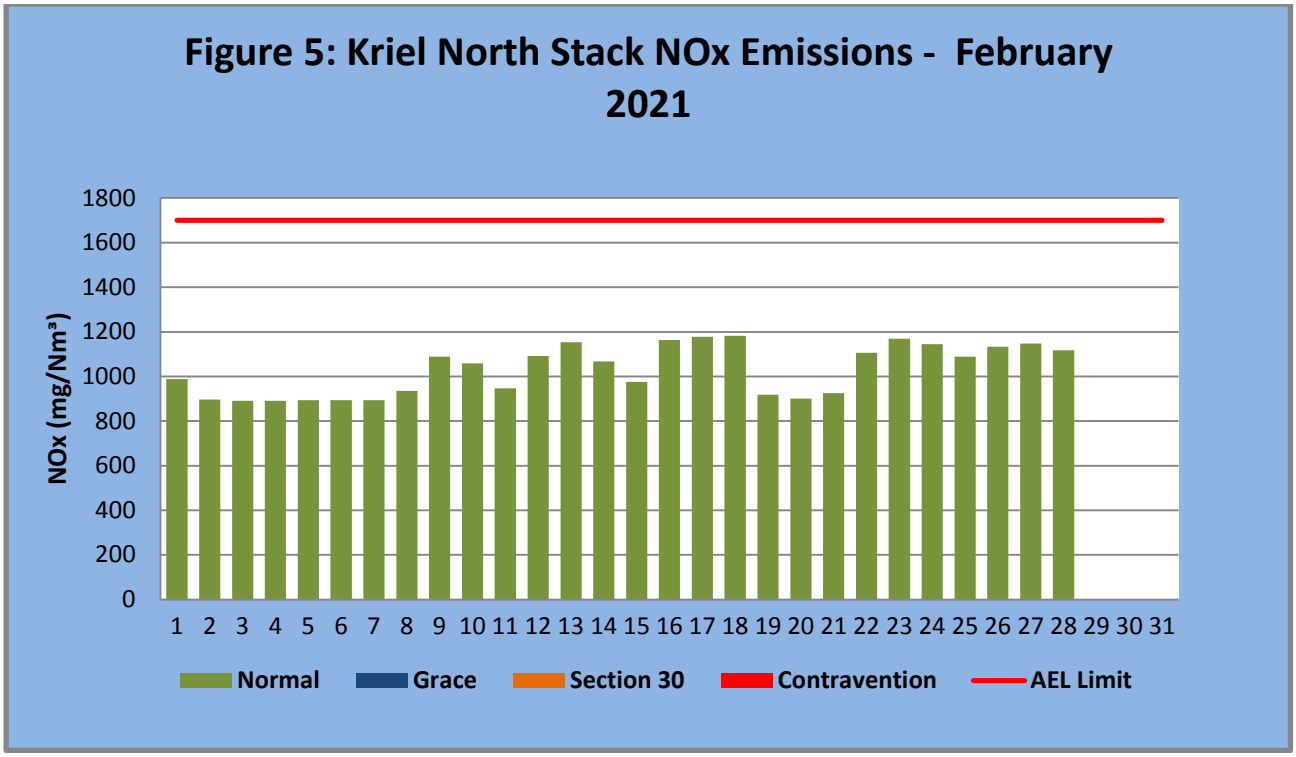


***Figure 6. NO2 emissions (daily averages) for the month of February 2021 against emission limit for the South Stack. The NOx Limit is 1600mg/Nm3.***

**Table 4:** Monthly tonnages for the month February 2021

| Unit | PM (tons) | $SO_2$ (tons) | $NO_2$ (tons) |
|---|---|---|---|
| SUM | 877.5 | 8113.7 | 4073.9 |

**Table 5:** Each unit and respective days operating under normal operation and section 30 days respectively

Table 5.1: Operating days in compliance to PM AEL Limit - February 2021

| Associated Unit/Stack | Normal | Section 30 | Contravention | Grace | Average PM (mg/Nm³) |
|---|---|---|---|---|---|
| North | 5 | 14 | 0 | 9 | 383.17 |
| South | 16 | 9 | 0 | 3 | 157.52 |

Table 5.2: Operating days in compliance to SOx AEL Limit - February 2021

| Associated Unit/Stack | Normal | Grace | Section 30 | Contravention | Total Exceedance | Average SOx (mg/Nm³) |
|---|---|---|---|---|---|---|
| North | 28 | 0 | 0 | 0 | 0 | 1 843.4 |
| South | 28 | 0 | 0 | 0 | 0 | 1 814.7 |

Table 5.3: Operating days in compliance to NOx AEL Limit - February 2021

| Associated Unit/Stack | Normal | Grace | Section 30 | Contravention | Total Exceedance | Average NOx (mg/Nm³) |
|---|---|---|---|---|---|---|
| North | 28 | 0 | 0 | 0 | 0 | 1 030.0 |
| South | 28 | 0 | 0 | 0 | 0 | 875.3 |

**Light up information**

**Table 6:** PM Start-up information for the month of fabricate February 2021

| North Stack | *Event 1* | | *Event 2* | |
|---|---|---|---|---|
| Unit No. | *Unit 1* | | *Unit 3* | |
| Breaker Open (BO) | *7:30 AM* | *2021/02/02* | *BO previously* | *BO previously* |
| Draught Group (DG) Shut Down (SD) | *7:15 PM* | *2021/02/02* | *n/a* | *n/a* |
| BO to DG SD (duration) | *00:11:45* | DD:HH:MM | *n/a* | DD:HH:MM |
| Fires in time | *8:05 AM* | *2021/02/05* | *9:35 PM* | *2021/02/01* |
| Synch. to Grid (or BC) | *3:00 PM* | *2021/02/07* | *2:50 AM* | *2021/02/04* |
| Fires in to BC (duration) | *02:06:55* | DD:HH:MM | *02:05:15* | DD:HH:MM |
| Emissions below limit from BC (end date) | *12:00 AM* | *2021/01/26* | *12:00 AM* | *2021/01/26* |
| Emissions below limit from BC (duration) | | DD:HH:MM | | DD:HH:MM |

| South Stack | *Event 1* | | *Event 2* | |
|---|---|---|---|---|
| Unit No. | *Unit 4* | | *Unit 4* | |
| Breaker Open (BO) | *12:05 AM* | *2021/02/04* | *10:50 AM* | *2021/02/12* |
| Draught Group (DG) Shut Down (SD) | *12:50 PM* | *2021/02/04* | *DG did not trip or SD* | *DG did not trip or SD* |
| BO to DG SD (duration) | *00:12:45* | DD:HH:MM | *n/a* | DD:HH:MM |
| Fires in time | *10:50 AM* | *2021/02/06* | *10:50 AM* | *2021/02/12* |
| Synch. to Grid (or BC) | *12:55 AM* | *2021/02/07* | *3:45 PM* | *2021/02/12* |
| Fires in to BC (duration) | *00:14:05* | DD:HH:MM | *00:04:55* | DD:HH:MM |
| Emissions below limit from BC (end date) | *not > limit* | *not > limit* | *12:00 AM* | *2021/01/26* |
| Emissions below limit from BC (duration) | *n/a* | DD:HH:MM | | DD:HH:MM |

| South Stack | Event 3 | | Event 4 | |
|---|---|---|---|---|
| Unit No. | Unit 6 | | Unit 6 | |
| Breaker Open (BO) | 2:55 AM | 2021/02/17 | 7:10 PM | 2021/02/19 |
| Draught Group (DG) Shut Down (SD) | 10:50 AM | 2021/02/17 | 8:20 PM | 2021/02/19 |
| BO to DG SD (duration) | 00:07:55 | DD:HH:MM | 00:01:10 | DD:HH:MM |
| Fires in time | 11:45 AM | 2021/02/17 | 11:50 PM | 2021/02/19 |
| Synch. to Grid (or BC) | 4:55 PM | 2021/02/17 | 5:35 AM | 2021/02/20 |
| Fires in to BC (duration) | 00:05:10 | DD:HH:MM | 00:05:45 | DD:HH:MM |
| Emissions below limit from BC (end date) | not > limit | not > limit | not > limit | not > limit |
| Emissions below limit from BC (duration) | n/a | DD:HH:MM | n/a | DD:HH:MM |

**Complaints Register**

**Table 9**: Complaints for the month of February 2021.

| 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 |
|---|---|---|---|---|---|
| There was no complaint related to air quality received during the month of February 2021. | | | | | |

**General**

The particulate matter (PM10) emissions were above the **monthly limit** on both North and South Stacks due to NEMA section 30 upset conditions which were declared (refer to incident details below). North stack recorded the monthly PM10 average figure of **383.2 mg/Nm3** while south stack recorded PM10 monthly average figure of **157.5 mg/Nm3**.

**NB**: North Stack's PM10 monitor fell short of the legal threshold in terms of availability; the monitor availability was around 55.80%. The aforementioned monitor issue was caused by events of high emissions (upset conditions resulting into NEMA section 30 incident) which have been explained below; thus, when the emissions reading exceed 400mg/Nm3, the monitor reliability also becomes compromised.

The gaseous (NOx & SOx) emissions on the north and south common stack were also within the **daily limit** during the month of February 2021; refer to graphs above.

<u>North Stack NEMA Section 30 Incident</u>

- On Friday, 5 February 2021 (at around 15:49) Operating Department noted a sudden increase a gradual increase on north stack's emissions performance, averaging above 125mg/Nm3.
- Maintenance team was later called out to investigate the cause for high emissions. The preliminary investigation depicted that Unit 1 $SO_3$ heater (white phase) was defective, thus resulting to no sulphur flow into the burner to produce $SO_2$ required for catalytic conversion. This upset condition resulted into a dysfunctional $SO_3$ system at Unit 1 and therefore causing Unit 1's Electrostatic Precipitators (ESP's) to perform below the desired efficiency of 99%.

- On Saturday 6 February 2021 the Electrical Maintenance Department (EMD) replaced the main $SO_3$ heater isolator which burnt the white phase
- On the 6th of February 2021, during the commissioning of Unit 1 $SO_3$ heater (at around 23:30), the $SO_3$ power pack failed on two phases while the system was running.
- On Sunday, 7 February 2021 (at around13:09), EMD successfully completed the removal of the damaged power pack and they also installed and commissioned a new pack. Unit1 $SO_3$ system then started running
- Later on the 7th of February 2021 (at around 18:53) it was noted that Unit 1 $SO_3$ was running but the sulphur dosing pump had failed to start. Maintenance Department was called to resolve the matter with the assistance of a service provider and at around 21:14 the dosing pump was in service.
- On Monday, 8 February 2021 (at 13:21), airflow and sulphur flow indications were oscillating above process values. Maintenance and Engineering Department (Control &Instrumentations teams) were requested to address the issue. Maintenance team successfully replaced the airflow transmitter at around 15:52 on the same day.
- Just when Unit 1 $SO_3$ system was stabilizing , Unit 3 sulphur dosing pump as well as the standby pump failed to start on Thursday 2021 (at around 15:24) and the OEM was called to assist. The issue was resolved on the 12th of February 2021 and Unit 3 $SO_3$ system stabilized on the 15th of February 2021.
- On the 12th of February 2021, outside plant power supply board tripped and there was power failure on the compressor plant. The maintenance and OEM implemented the corrective actions on return the plant in service, however , on the 14th of February 2021, the service air compressor failed on stage 04 vibration and therefore affecting the fly ash conveying system
- On the 17th of February 2021, the defective service air compressor (Centac 03) was stripped on site for repairs, while the mobile compressor was being sourced in.
- Still on the 17th of February 2021 , the hired mobile compressor was connected to the system
- The aforementioned service air compressor trip immediately resulted into ash backlog as well as high hopper levels particularly at Unit 3 .The high hopper levels also resulted into Unit 3's Electrostatic precipitators fields (left hand side) tripping under voltage as the plate rappers kept on jamming
- Despite the improved service air flow, slow progress was noted regard the clearance of ash backlog at Unit 3 resulted to a decision being taken to shut down unit 3 for 55 hours on Friday the 19th of February 2021(around 11:30).
- On the 20th of February 2021 (11:30), north stack emissions were noted reading a daily average of around 105mg/Nm3.
- NB: North stack SO3 plants were maintained in the recent Outages carried in the respective units.

<u>South Stack NEMA Section 30 Incident</u>

- On Wednesday, 10 February 2021 (at around 02:33), Operating Department noted a sudden increase on the South Stack's particulate matter emissions, averaging above 125mg/Nm3.
- Maintenance team was called out to investigate the cause of high emissions. At around 06:00, the preliminary investigation by the team depicted that one phase of Unit 04 SO3 power pack was damaged. This upset condition resulted into a dysfunctional $SO_3$ system at Unit 04 and therefore causing Unit 04's Electrostatic Precipitators (ESPs) to perform below the desired efficiency of 99%.
- On the same day, (at around 11:30) Electrical Maintenance Department (EMD) successfully completed the removal of the damaged power pack; and they also installed and commissioned a new power pack heater; around 14:00, Unit 04 $SO_3$ system was running.
- On Wednesday evening, (at around 23:48), Operating Department reported that there was an unknown defect at Unit 04 $SO_3$ plant resulting to high emissions on the South Stack; the unit load was also immediately reduced to control emission. Maintenance team was then called out to site to investigate the cause of high emissions.
- On Thursday, 11 February 2021 (at around 00:44), the defect at unit 04 was found to be the $SO_3$ converter temperatures that were not increasing. The Maintenance team (Control and

Instrumentation, as well as EMD) attempted to resolve the issue to no success until (around 03:08).

- At around 06:31, EMD confirmed that the $SO_3$ heater had lost its heating efficiency and Electrical Engineering was requested to verify all heater parameters before the heater replacement process started. The $SO_3$ was indeed confirmed by Electrical Plant Engineering (EPE) and (at around 11:17) the heater replacement process had started.
- On the 12th of February 2021(10:50), the breaker opened due to Unit 4 trip, and the unit was immediately returned to service as the national energy grid was constrained.
- On Saturday the 13th February 2021 (at around 10:00), Maintenance successfully completed the replacement of unit 04 $SO_3$ heater, including commissioning of the new heater.
- On Monday the 15th of February 2021 (at around 23:34), Operating Department once again noted an issue with Unit 04 $SO_3$ converter temperature; CID was immediately called to investigate and address the issue. On the same day (at around 12:31), the issue was resolved and the Unit 04 $SO_3$ plant was fully operational.
- On Thursday the 18th February 2021 (at around 11:19), Unit 06 $SO_3$ blower motor was reported by EMD to have been burnt and had to be replaced. Unit 06 $SO_3$ plant was reported to be tripping every 2 hours and CID was attending to the problem.
- At around 12:30, EMD started the process of replacing the burnt Unit 06 blower motor. EMD successfully replaced the burnt motor and the commissioning of new motor started (at around 21:08).
- On Friday, 19 February (at around 08:16) the Unit 06 $SO_3$ heater was reported to have tripped and Maintenance was called to attend to the issue.
- On Saturday, 20 February (at around 11:58), five Unit 06 CE rappers were noted to be stuck and $SO_3$ plant temperatures increasing.

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

Kriel Power Station's List of NEMA Section 30 Incidents for 2021/2021 Financial Year

| Month | Description of Section30 Incidents - including the reference number | Root Cause (s) | Status of S30 Incident with DEFF (open or closed) | Remarks |
|---|---|---|---|---|
| **April – 2020** | No section 30 incident reported. | | | No event to report. |
| **May – 2020** | No section 30 incident reported. | | | No event to report. |
| **June – 2020** | No section 30 incident reported. | | | No event to report. |
| **July – 2020** | No section 30 incident reported. | | | No event to report. |
| **Aug - 2020** | Upset condition in unit 4, 5&6 exceeded 48 hours grace period. Section 30 compiled in terms of Section 7.3.2 Kriel's Atmospheric Emissions License | High hopper levels and ash transportation backlog at Unit 5 due to MCB | Open | 1 Event reported |
| **Sep – 2020** | No section 30 incident reported. | | | No event to report. |
| **Oct – 2020** | No section 30 incident reported. | | | No event to report. |
| **Nov – 2020** | No section 30 incident reported. | | | No event to report. |
| **Dec – 2020** | Upset conditions in unit 1 & 2 exceeded 48hours grace period | Failure of 11KV overhead line due development of hotspot on the conductor. | Open | 1 Event reported |
| **Jan – 2021** | Upset conditions in unit 1,2 and 3 exceeded 48hours grace period | •Misfiring SO3 electric heater due to heater phase failure.<br>•Contaminated sulphur in the storage tank. | Open | 1 Event reported |
| **Feb - 2021** | Upset conditions in unit 1,2 and 3 exceeded 48hours grace period<br><br>Upset Condition in Units 4&6 exceeded 48 ours Grace period | Failure of SO3 Program Logic Controller system and power supply failure into the compressor plant<br><br>Malfunction of Unit 4 SO3 heater | Open | 2 Events |
| **Mar - 2021** | | | | |