

**Ms Mpho Nembilwi**  
 Nkangala District Municipality  
 PO BOX 437  
 MIDDLEBURG  
 1050

Date:  
 09 March 2022

Enquiries:  
 Livhuwani Tshilate  
 017 615 2317

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

Dear Ms Nembilwi

### **KRIEL POWER STATION'S MONTHLY STACK EMISSIONS REPORT FOR THE MONTH OF DECEMBER 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 December 2021. Verified emissions of particulates matter, SO<sub>2</sub> and NO<sub>x</sub> (as NO<sub>2</sub>) are also included.

#### **Raw Materials and Products**

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

Raw Materials and Products used	Raw Material Type	Units	Maximum Permitted Consumption / Rate (Quantity)	Consumption / Rate in Month of December 2021
	Coal	Tons/month	1 227 600	723 705
	Fuel Oil	Tons/month	5 000	2 822.90
Production Rates	Product/ By-Product Name	Unit	Maximum Production Capacity Permitted (Quantity)	Production Rate in Month of December 2021
	Ash	Tons/month	not specified	1111.9
	RE PM	kg/MWh	not specified	1.01

1/...

## Abatement Technology

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

Associated Unit/Stack	Technology Type	Actual Efficiency (%)	
		Actual Efficiency(%)	Utilization (%)
Unit 1	ESP	99.46%	76.7%
Unit 2	ESP	99.32%	88.3%
Unit 3	ESP	99.19%	91.1%
Unit 4	ESP	99.10%	85.5%
Unit 5	ESP	99.06%	100%
Unit 6	ESP	99.05%	72.1%

## Energy Source Characteristics

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





Characteristic	Stipulated Range (Unit)	Monthly Average Content
Sulphur Content	0.6-1.2 (%)	0.83
Ash Content	21-36 (%)	24.91

## Monthly Monitor Reliability

Associated Unit/Stack	PM (%)	SOx (%)	NOx (%)
North	94.95	95.50	96.91
South	94.89	100.00	100.00

## 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

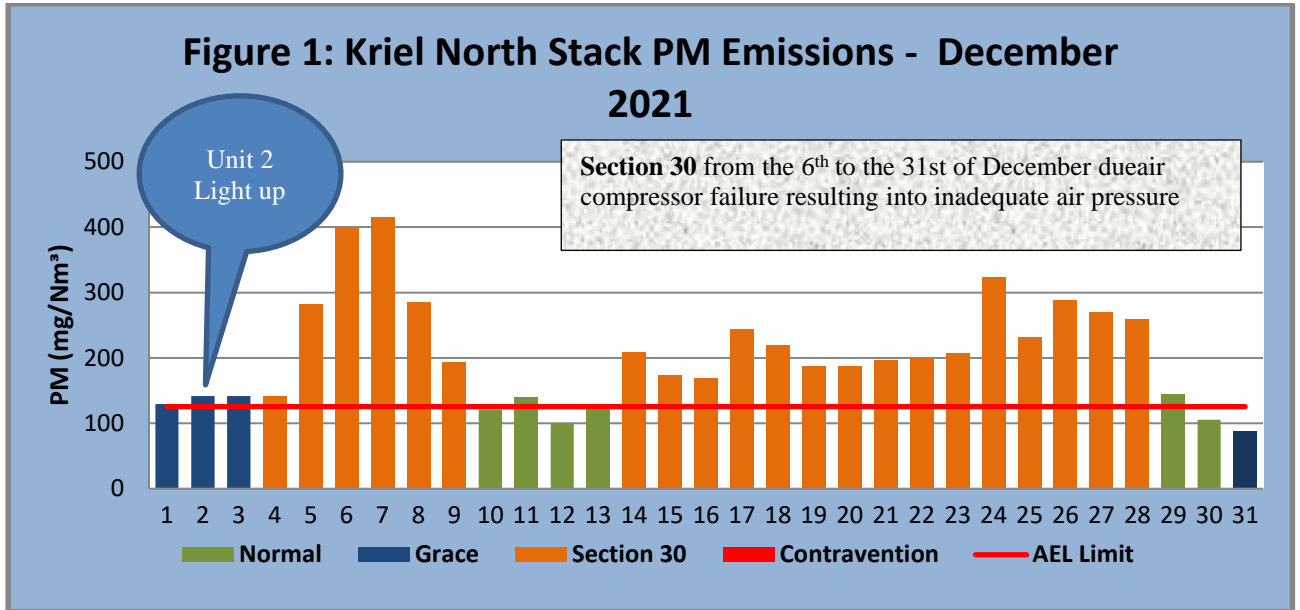


Figure 1: PM emissions for the month of December 2021 against emission limit for the North Stack. Monthly average was 110 mg/Nm<sup>3</sup>

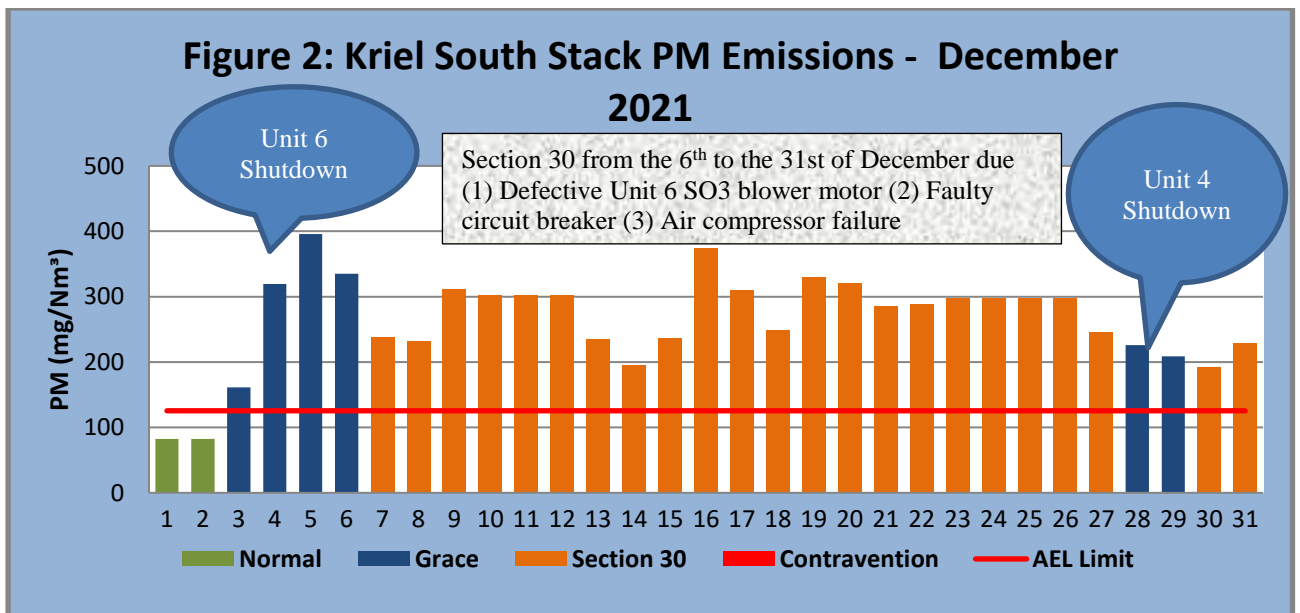


Figure 2: PM emissions for the month of December 2021 against emission limit for the South Stack. Monthly average was 203.9 mg/Nm<sup>3</sup>

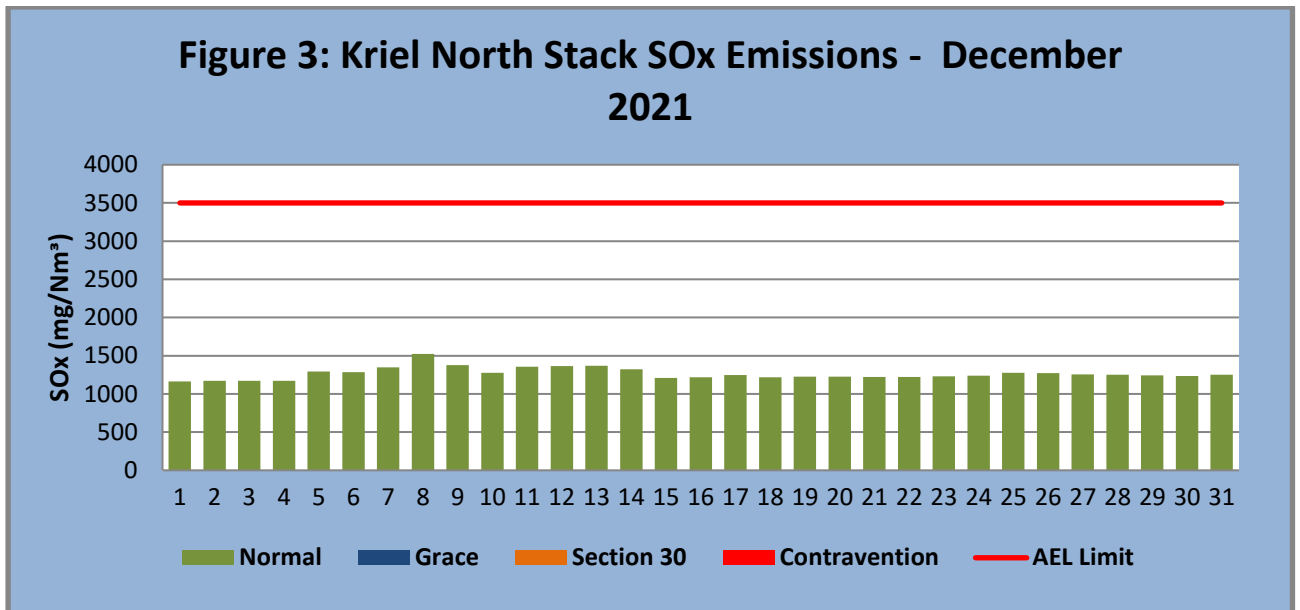


Figure 3. SO<sub>2</sub> emissions for the month of December 2021 against emission limit for the North Stack. The SO<sub>x</sub> Limit is 3500mg/Nm<sup>3</sup>.

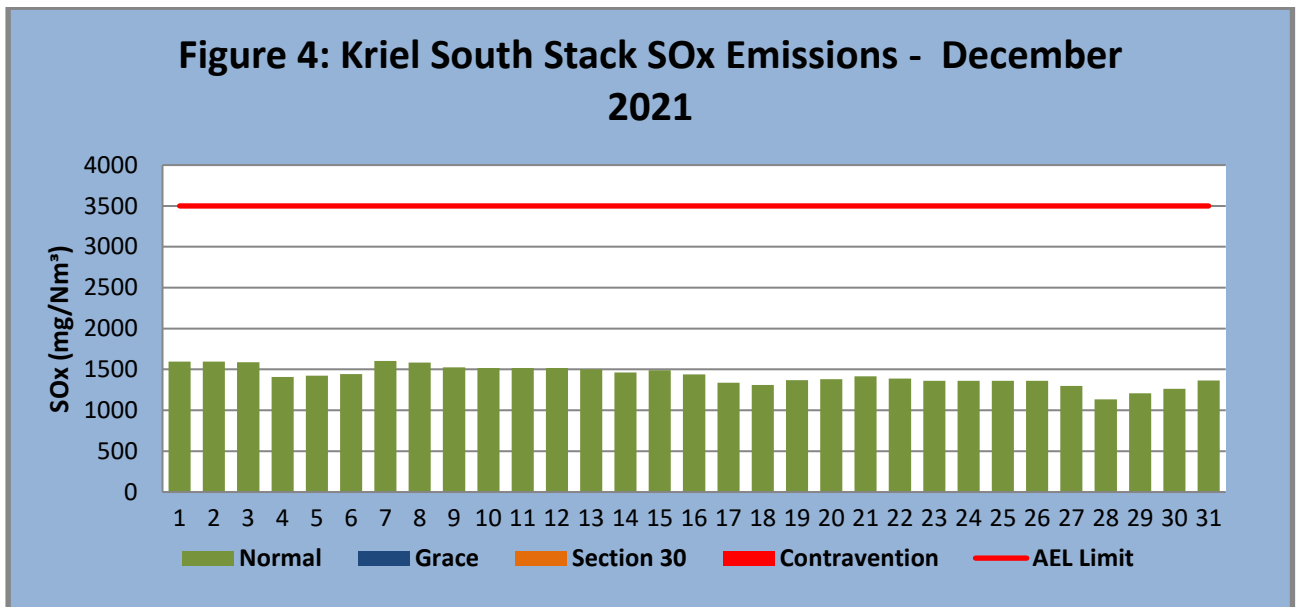


Figure 4. SO<sub>2</sub> emissions for the month of December 2021 against emission limit for the South Stack. The SO<sub>x</sub> Limit is 3500mg/Nm<sup>3</sup>.

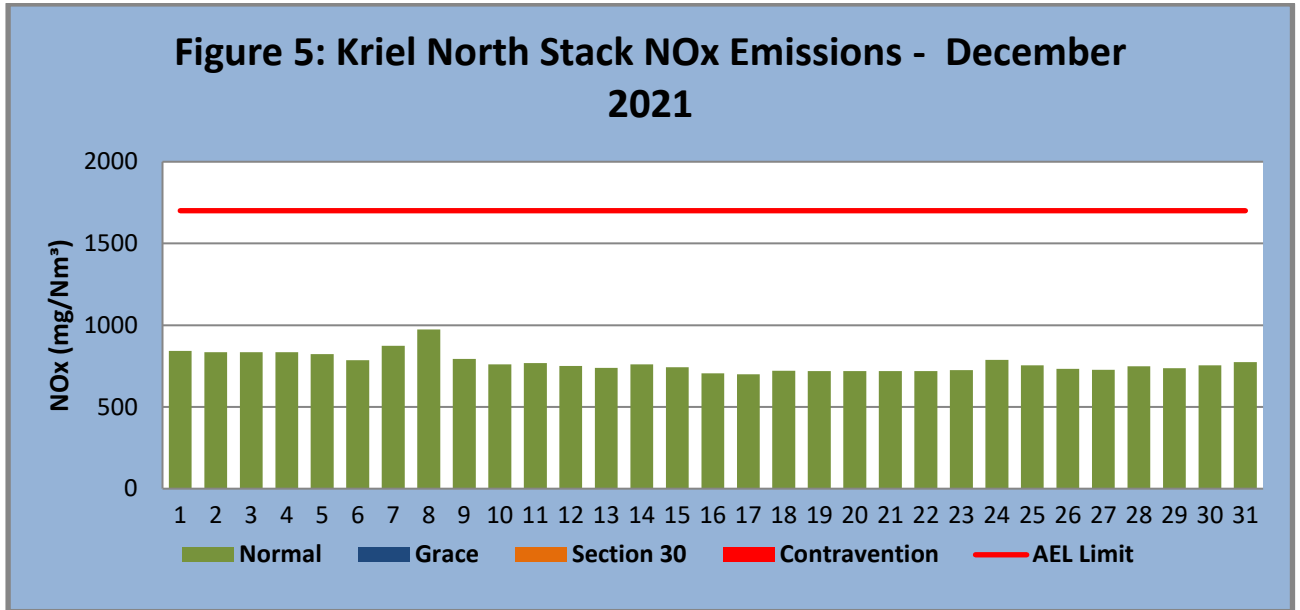


Figure 5. NO<sub>2</sub> emissions for the month of December 2021 against emission limit for the North Stack. The NO<sub>x</sub> Limit is 1600mg/Nm<sup>3</sup>.

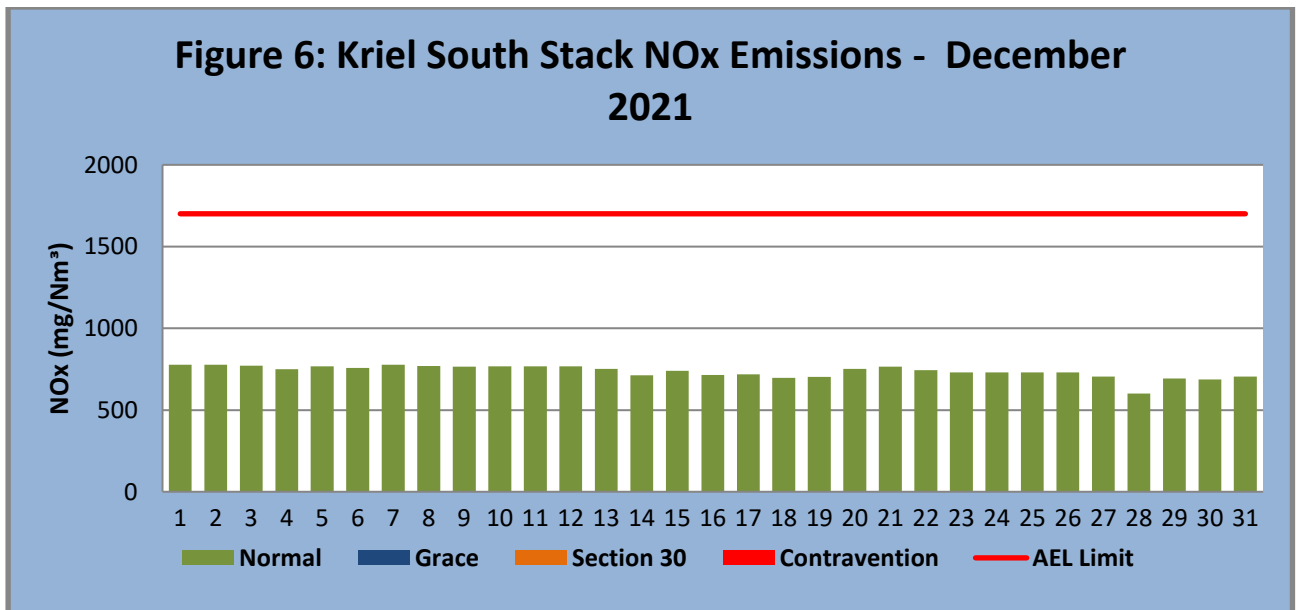


Figure 6. NO<sub>2</sub> emissions for the month of December 2021 against emission limit for the South Stack. The NO<sub>x</sub> Limit is 1600mg/Nm<sup>3</sup>.

Table 4: Monthly tonnages for the month December 2021

Unit	PM (tons)	SO <sub>2</sub> (tons)	NO <sub>2</sub> (tons)
SUM	1 111.9	6 866.0	3 825.4

**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 - December 2021

Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Monthly Limit Exceedance	Average PM (mg/Nm <sup>3</sup> )
North	6	4	21	0	24	203.9
South	5	6	21	0	27	263.7

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

Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Total Exceedance	Average SOx (mg/Nm <sup>3</sup> )
North	31	0	0	0	0	1 265.7
South	31	0	0	0	0	1 423.4

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

Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Total Exceedance	Average NOx (mg/Nm <sup>3</sup> )
North	31	0	0	0	0	769.9
South	31	0	0	0	0	736.0

**Light up information**

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

North Stack	Event 1		Event 2		Event 3	
Unit No.	Unit 2		Unit 1		Unit 3	
Breaker Open (BO)			1:00 PM	2021/12/15	2:50 PM	2021/12/15
Draught Group (DG) Shut Down (SD)			1:15 AM	2021/12/16	5:05 AM	2021/12/16
BO to DG SD (duration)		DD:HH:MM	00:12:15	DD:HH:MM	00:14:15	DD:HH:MM
Fires in time	11:00 AM	2021/12/01	3:00 PM	2021/12/20	2:50 AM	2021/12/18
Synch. to Grid (or BC)	6:05 AM	2021/12/04	10:05 PM	2021/12/22	8:50 AM	2021/12/20
Fires in to BC (duration)	02:19:05	DD:HH:MM	02:07:05	DD:HH:MM	02:06:00	DD:HH:MM
Emissions below limit from BC (end date)	not > limit	not > limit	not > limit	not > limit	not > limit	not > limit
Emissions below limit from BC (duration)	n/a	DD:HH:MM	n/a	DD:HH:MM	n/a	DD:HH:MM

North Stack	Event 4		Event 5		Event 6	
Unit No.	Unit 1		Unit 1		Unit	
Breaker Open (BO)	7:10 PM	2021/12/25	11:05 AM	2021/12/31	3:15 PM	2021/12/29
Draught Group (DG) Shut Down (SD)	9:20 AM	2021/12/26	DG did not trip or SD	DG did not trip or SD	5:35 AM	2021/12/30
BO to DG SD (duration)	00:14:10	DD:HH:MM	n/a	DD:HH:MM	00:14:20	DD:HH:MM
Fires in time	4:15 AM	2021/12/27	11:05 AM	2021/12/31		
Synch. to Grid (or BC)	9:10 AM	2021/12/27	5:10 PM	2021/12/31		
Fires in to BC (duration)	00:04:55	DD:HH:MM	00:06:05	DD:HH:MM		DD:HH:MM
Emissions below limit from BC (end date)	not > limit	not > limit	not > limit	not > limit		

South Stack	Event 1		Event 2		Event 3	
Unit No.	Unit 6		Unit		Unit	
Breaker Open (BO)	8:25 PM	2021/12/04	10:20 AM	2021/12/05	9:05 AM	2021/12/14
Draught Group (DG) Shut Down (SD)	9:10 PM	2021/12/04	5:40 AM	2021/12/07	9:05 AM	2021/12/16
BO to DG SD (duration)	00:00:45	DD:HH:MM	01:19:20	DD:HH:MM	02:00:00	DD:HH:MM
Fires in time	8:40 AM	2021/12/09				
Synch. to Grid (or BC)	3:00 PM	2021/12/12				
Fires in to BC (duration)	03:06:20	DD:HH:MM		DD:HH:MM		DD:HH:MM
Emissions below limit from BC (end date)	not > limit	not > limit				

South Stack	Event 4		Event 2	
Unit No.	Unit		Unit 6	
Breaker Open (BO)	12:00 PM	2021/12/27	10:45 PM	2021/12/18
Draught Group (DG) Shut Down (SD)	1:30 PM	2021/12/27	11:50 AM	2021/12/19
BO to DG SD (duration)	00:01:30	DD:HH:MM	00:13:05	DD:HH:MM
Fires in time			9:35 AM	2021/12/22
Synch. to Grid (or BC)			3:55 PM	2021/12/26
Fires in to BC (duration)		DD:HH:MM	04:06:20	DD:HH:MM
Emissions below limit from BC (end date)			not > limit	not > limit

### Complaints Register

Table 9: Complaints for the month of December 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 December 2021.

## **General**

The particulate matter (PM10) emissions on the North and South Common Stack exceeded the monthly limit; North stack recorded the monthly PM10 average emissions figure of 203.9 mg/Nm<sup>3</sup> while south stack recorded PM10 monthly average figure of 263.7 mg/Nm<sup>3</sup>. The gaseous (NO<sub>x</sub> & SO<sub>x</sub>) emissions on the north and south common stacks were also within the daily limit during the month of December 2021; refer to graphs above.

### **Hereunder is the sequence of events resulting into North stack experiencing high emissions during the months of December 2021**

- On Saturday, the 4<sup>th</sup> of December 2021 (At around 06:00), Operating Department noted a sudden increase on the North Stack's Emissions performance resulting on emissions averaging above the limit of 125mg/Nm<sup>3</sup>; this upset condition was experienced subsequent to Unit 01's to return to service after a long-term outage
- Maintenance Team was immediately called out to conduct fault finding; the preliminary investigation found that the main issue was insufficient air pressure that resulted into inadequate ash transportation. This ultimately caused high hopper levels. The investigation also found that one of the compressors was running against a blocked filter.
- From the 10<sup>th</sup> to the 13<sup>th</sup> of December 2021 efforts to try and mitigate against the air pressure challenges were materializing until the 14<sup>th</sup> of December 2021 where the situation regressed. On the 18<sup>th</sup> of December 2021 there three (3) hired diesel compressors were already on site to supplement the air pressure
- Secondly, during the return to service of Unit 01 after long term outage there were commissioning challenges which resulted into the light up exceeding the prescribed 72 hours. As a result, the Unit had to be operated on half load in order to fix the commissioning related problems and complete electrical tests. The electrical tests are conducted as part of the plant safety control measures.
- Aforementioned commissioning tests had to be executed while the Unit was online
- Prolonged operation of the Unit on half load resulted into high fuel usage and also ash stickiness. The ash stickiness adversely affected the ash transportation therefore resulting to ash backlog and high hopper levels.

### **Hereunder is the sequence of events resulting into south stack experiencing high emissions during the months of December 2021**

- On Monday the 6<sup>th</sup> of December 2021 (at around 20:20), Operating Department noted an increase on South stack's emissions performance resulting on emissions averaging above the 125mg/Nm<sup>3</sup> licenced limit. The matter was immediately reported and investigated by maintenance team.
- On the 7<sup>th</sup> of December 2021, the incident investigation team discovered that the issue was Unit 06's SO<sub>3</sub> system which was malfunctioning, and therefore negatively impacting the dust trapping mechanism on the Electrostatic Precipitators (ESPs).
- Further online investigations were carried out to understand the cause of Unit 06's SO<sub>3</sub> plant malfunction. On the 9<sup>th</sup> of December 2021, the investigation team found that Unit 06's SO<sub>3</sub> plant blower motor was the underlying problem as it was defective.
- From the 9<sup>th</sup> to the 16<sup>th</sup> of December 2021, a three phased 24-points action plan to repair and restore the defective blower motor was established and implemented.
- On the 17<sup>th</sup> of December 2021, Unit 06's SO<sub>3</sub> plant was still ineffective; and it was also further noted that the repair work done and the return to service for unit 06's SO<sub>3</sub> plant was unsuccessful.
- On the 19<sup>th</sup> of December 2021, an environmental duty of care decision was taken to shut down Unit 06 to address SO<sub>3</sub> plant issues which could not be addressed while the unit was online.
- NB: It needs to be noted that a decision to shut down unit 06 was taken despite the system constraints on the national power supply grid at the time.



- The benefits of shutting down Unit 06 started to materialise on the 25<sup>th</sup> of December 2021 as the PM10 emissions started to trend downward from the 25<sup>th</sup> to the 27<sup>th</sup> of December 2021; although it remained above the limit.
- While PM10 emissions were showing signs of improvement and recovery, on the 28<sup>th</sup> of December 2021, South Stack's emissions increased above the limit again.
- On the 29<sup>th</sup> of December 2021, it was then discovered that South Stack was also affected by insufficient air pressure from the common air compressor system which services Unit 01 to Unit 06; the system was defective (another upset condition). This resulted into inadequate ash transportation, particularly on Unit 05 which ultimately caused high hopper levels.
- Consequently, Unit 05 high hopper levels led to ESP fields underperforming as the rapping system was clogged by dust. This further adversely affected the PM10 emissions performance from the 28<sup>th</sup> of December 2021 to the 7<sup>th</sup> of January 2022 as operating and maintenance teams were battling to clear the high hopper levels.
- During this period, maintenance team also hired three (3) rental diesel air compressors (emergency) to supplement the air pressure.
- As it was evident that efforts to reduce high hopper levels while unit 05 was online were not bearing desired outcome, Kriel Power Station's management then took a decision to shut down unit 05 on the 7<sup>th</sup> of January 2022 as an environmental duty of care measure to mitigate against further high emissions.

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 2021/2022 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 2021	Upset condition I Unit 1,2 and 3 exceeded 48 hours Grace Period	1.Castlet Key System failure 2.Defective Pyrometers	Open	1 Event reported
May 2021	None			
June 2021	None			
December 2021	None			
Aug 2021	Upset condition in Unit 4,5 &5 exceeded 48 hours grace period	Spark from loose electrical connection on the motor terminal at the South SO3 pump house resulting into flashover	Open	1 Event reported
Sep 2021	None			
Oct 2021	None			
Nov 2021	None			
Dec 2021	<p><b>North Stack:</b> Upset condition in Units 1,2 and 3 exceeded 48 hours Grace Period</p> <p><b>South Stack:</b> Upset condition in Units 4,5 and 6 exceeded 48 hours grace period</p>	<p>Air compressor failure resulting into inadequate air pressure</p> <p>Unit 6's defective SO<sub>3</sub> plant blower motor</p> <p>Air compressor failure resulting to inadequate air pressure</p> <p>-Defective circuit breaker resulting into loss of power supply to South Stack's SO3 PLC</p>	<p>Open</p> <p>Open</p>	2 events reported
Jan 2022				
Feb 2022				
Mar 2022				