Eskom

Dr Patience Gwaze
National Air Quality Officer
Department of Forestry, Fisheries and the Environment
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Date: 24 June 2024
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Dear Dr Gwaze,

MAY 2024 MONTHLY PROGRESS REPORT ON THE POSTPONEMENT OF MINIMUM EMISSION STANDARD CONDITIONS FOR KUSILE POWER STATION: REF: LSA223027

ESKOM WAS ISSUED A MINIMUM EMISSION STANDARDS (MES) POSTPONEMENT IN RESPECT OF KUSILE'S SO_2 LEVELS BY THE DFFE ON 5 JUNE 2023. THE VARIED ATMOSPHERIC EMISSION LICENCE (AEL) WAS ISSUED BY THE NKANGALA DISTRICT MUNICIPALITY ON 13 JUNE 2023. BOTH THE MES APPROVAL AND THE AEL ALLOW ESKOM TO OPERATE THE TEMPORARY STACKS WITHOUT FGD. THE APPROVALS ARE ISSUED SUBJECT TO SEVERAL CONDITIONS, INCLUDING THAT ESKOM IMPLEMENT MEASURES TO MINIMISE THE IMPACT ON HUMAN HEALTH.

This letter provides an update on key issues, including specific reporting requirements identified by the authorities in the various approvals for the Kusile temporary stacks project. Monitoring and mitigation is being implemented as far as practical in line with the programme in the Kusile Power Station Temporary Stack Monitoring Framework approved by the authorities on 18 September 2023.

As an initial point, I would like to confirm that no exceedances of the stack or ambient trigger level conditions were recorded during May 2024.

1. **Progress of repairs of permanent stacks for the duration of the operation of the temporary stacks.**
    I. The target date for the recovery of the West stack remains 31 December 2024.

MONTHLY PROGRESS REPORTS ON THE POSTPONEMENT OF MINIMUM EMISSION STANDARD CONDITIONS FOR KUSILE POWER STATION: REF: LSA223027

Risks:

I. Alimak operation is not possible during windy conditions and wind direction can result in flue gas contamination at the top of the stack from units 1 or 3 preventing safe access to the stack.

II. Product removed with the cleaning process, totally different as expected from original samples taken, imposing a risk with the cleaning process.

The Permanent Stack recovery progress report is attached **(Annexures A).**

2. Temporary Stack Emission Monitoring

Continuous Emission Monitoring (CEMS):

I. Unit 1, 2 and 3 CEMS are installed and commissioned.

II. Unit 1 is operated with unity curve for PM and 3 is operating on spot curve for PM, due to monitor replaced and Unit 2 PM is also operating with a spot check due to a failed correlation test. New correlation tests are planned and information on the outcomes of the test will be included in the future monthly progress report. Unit 2 emissions monitoring will be retrofitted upon finalization of correlation test and implementation of correlation curves.

III. All units are operating with valid parallel curves.

Stack Performance:

I. The Kusile Monthly Emission report for May 2024, which includes emission data for Units 1,2, 3 and 4 is attached **(Annexure B**).

II. **Based on the available data information, Kusile Unit 1, 2 and 3 operated in compliance with the AEL emission limits for PM, NOx or SO_2** during May 2024.

3. Health Screening for the increased SO_2 emission and associated health impacts

I. Communication system is developed to enable communication with the health ambassadors in the various receptor areas.

II. An SMS system had been developed. The contact details of ambassadors have been loaded on the SMS system and they are grouped according to receptor areas. SMS messages are sent regularly to keep the ambassadors updated on status of SO2 emissions.

III. IT department has finalised the toll-free line for the communities around us regarding the SO2 emission. A pre-loaded voice messaging will be loaded on the toll free line, which will guide the community members on the various health enquiries that they will be having. The process is at it final stage.

IV. Engagement with specific businesses is taking place (GHB Farms and Topigs). Those businesses will be visited to provide awareness as soon as they have confirmed a date for a visit.

4. Occupational Health and Hygiene status

4.1. Continuous SO_2 Perimeter Monitoring:

I. Weekly monitoring of the plant's perimeter for SO_2 surges were conducted throughout May 2024.

II. SO_2 levels along the perimeter remained below detection levels, meeting the statutory requirement of 0.5 ppm OEL-STEL/C.

4.2. Conclusion:

Our continuous SO2 perimeter monitoring indicated compliance with regulatory limits with no ongoing issues. We will continue to monitor and investigate any anomalies to ensure the safety and well-being of both our workers and the surrounding community.

5. Stakeholder Engagement Plan and Status

Stakeholders	Method of engagement	Involvement	Status
Employees	• Awareness sessions Leadership briefings (GM's address) Employee engagements	• Once a month • Every Friday Monthly	Complete
Local Municipalities • Emalahleni • Victor Khanye • Bronkhorstspruit	Face-to-face meeting	Once a quarter	Next engagement will be in July 2024
Media • Emalahleni FM • Witbank News	• Advert • Print	When required	Eskom media desk to publish

6. Ambient Air Quality Monitoring

I. In order to better assess compliance with national ambient air quality standards, identify potential sources of pollution, protect public health and the environment and establish a baseline for future mitigation measures Eskom has installed additional ambient air quality monitoring stations at Balmoral and Wilge. The existing air quality monitoring stations (Kendal, Phola and Chicken Farm) will complement the additional monitoring sites to reduce uncertainties and improve the understanding of air quality issues in the area.

II. The Balmoral and Wilge monitoring stations are equipped to monitor ambient concentrations of sulphur dioxide (SO_2) continuously. In addition, meteorological parameters of wind velocity, wind direction and ambient temperature, humidity, ambient pressure and rainfall, amongst others, are also recorded.

III. The following parameters, nitrogen dioxide (NO_2), ozone (O_3) and fine particulate matter of particulate size <10µm and particulate size <2.5µm in diameter (PM_{10} and $PM_{2.5}$) will be monitored from 01 July 2024.

IV. The data for this reporting period (01 – 31 May 2024) were analysed for ambient SO2 as monitored at Balmoral, Chicken Farm, Phola and Wilge air quality monitoring stations. The Particulate Matter and NO2 data were further analysed for Chicken Farm and Phola.

V. Full dynamic calibration audits are carried out on the gas analysers (SO_2, NO_2 and O_3 analysers) quarterly and particulate matter analysers are calibrated every six months. All calibration results and certificates are filed in the laboratory for assessment purposes. Inter-laboratory calibrations are routinely carried out with other accredited laboratories, to enhance quality control.

VI. There were no exceedances of the NO2 hourly limit of 106 ppb recorded at the monitoring stations during the May 2024 monitoring period.

VII. There were three (3) exceedances of the SO2 hourly limit of 134 ppb and six (6) exceedances of SO2 10-minutes limit of 191 ppb at Wilge air quality monitoring site

and one (1) exceedance of SO2 10-minutes limit of 191 ppb recorded during the monitoring period at Phola air quality monitoring site.

VIII. There were twenty-two (22) exceedances of the PM2.5 daily limit of 40 µg/m3 at Phola, and twelve (12) exceedances of the PM2.5 daily limit of 40 µg/m3the Chicken Farm monitoring station. There were twenty-three (23) exceedances of PM10 daily limit of 75 µg/m3 at Phola air quality monitoring station and sixteen (16) exceedances of PM10 daily limit of 75 µg/m3 recorded at Chicken Farm air quality monitoring station.

IX. There were no events that triggered the notification of stakeholders in terms of the agreed AEGL recorded in May 2024.

Table 1 Highest SO_2 concentrations recorded (in ppb)

Monitoring Stations	10-min average	Date	Hourly average	Date	Daily average	Date
Balmoral	158.6	21/05/2024 10:50	81.0	21/05/2024 12h00	21.9	21/05/2024
Chicken Farm	169.7	04/05/2024 11:40	129.7	10/05/2024 02:00	36.4	10/05/2024
Phola	329.4	16/05/2024 20:20	126.6	10/05/2024 01:00	41.6	10/05/2024
Wilge	285.4	09/05/2024 10:50	162.1	10/05/2024 01:00	45.8	10/05/2024

X. Good representative percentage data was recovered for all the parameters monitored during the monitoring period under review at the monitoring stations. Chicken Farm data was low due to power interruption and faulty instrument for Ozone. However, the Ozone instrument has been repaired and is back at site for monitoring. All the faulty instrument for all the air quality monitoring site under review has been repaired, functional and the June report will not have gaps in the data sets.

XI. The raw monitoring data, downloaded at 1-minute averages, is available in real-time to the DFFE-managed South African Air Quality Information System (SAAQIS) since the 14th of December 2023 for all Eskom air quality monitoring sites.

XII. The detailed May 2024 Kusile ambient monitoring report is attached (**Annexure C).**

7. Poultry Health Monitoring

I. A service provider had been appointed for Kendal Poultry monitoring per the condition of environmental authorisation (record of decision) and the MES approval. Execution of the monitoring is on hold due to the outbreak of Avian Influenza.

II. Eskom Kusile representatives scheduled meeting with Kendal Poultry Farms for the 04 June 2024 to discuss status of lockdown and way-forward. Alternative options are been explored by Kendal Poultry and Eskom on how to resume monitoring.

8. Animal Health Monitoring

I. Eskom has reached an agreement with Topigs and GHB farms regarding animal/pig health monitoring continues since March 2024.

II. Monitoring is carried out according to prescribed protocol.

III. Animal monitoring report attached **(Annexure D).**

9. Emergency preparedness and response

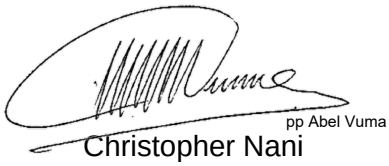
I. There has been no incidence of exceedance that required emergency response from Kusile Power Station, however the Emergency Response Team (ERT) remain on high alert.

II. The ERT is in regular communication with Emalahleni Local Municipality Emergency Services as per the Mutual Aid Agreement.
III. Emalahleni Local Municipality Emergency Services representatives in Disaster Management, Fire and Emergency Services, and Environment were added in Kusile Power Station Distribution List for regular updates.
IV. All other Service Level Agreement (SLA's) with relevant stakeholder (Kendal Power Station) remain in force for duration of the temporal stack.

In conclusion, I believe the above illustrates that Eskom is committed to complying with the conditions of the approvals granted with respect to the Kusile temporary stacks. Eskom is implementing measures to ensure that it understands its impact and can limit its operations' environmental and health impact. Further, where full implementation of the conditions is not yet completed, Eskom is working with relevant stakeholders with focus to ensure the remaining issues are resolved as soon as possible.

I hope the above is in order. Please contact our team if you require any further information.

Yours sincerely



pp Abel Vuma
Christopher Nani
ACTING GENERAL MANAGER (KUSILE POWER STATION)

DATE: 2024-06-28

List of annexures

Annexure A: Kusile West Chimney Recovery Project – May 2024
Annexure B: Kusile Monthly Emission Report – May 2024
Annexure C: Kusile Ambient Air Quality Report – May 2024
Annexure D: Animal Health Monitoring report 2024

Eskom

Dr P. Gwaze
National Air Quality Officer
Department of Forestry, Fisheries and Environment
Private Bag X 447
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0001

Date: 11 June 2024

Enquiries: S Mahlangu
Tel: 013 699 7097

Monthly Progress Report for Kusile Power Station West Stack Recovery June 2024:

		Status	Start Date	End Date
	Cleaning Lobster K1			
	Cleaning Damaged lobster	100%	20 May 2024	24 May 2024
	Vertical Flue Cleaning unit 3			
	Clean vertical flue unit 3 first pass.	100%	19 April 2024	7 June 2024
	Clean vertical flue unit 2			
	Clean vertical flue unit 1	5%	6 June 2024	19 July 2024
	Clean vertical flue unit 3: 2nd Pass if required		12 June 2024	12 July 2024
	Fabricate new Lobster for K1	0%	7 June 2024	22 July2024
	Fabricate new 55 m platform	20%	7 June 2024	6 Aug 2024
	Suspended platform installation flue 3	30%	3 June 2024	13 June 2024

NOTES:

West Stack:

- The target date for the recovery of the West stack remains the 31 December 2024.

Risks

- Alimak operation is not possible during windy conditions and wind direction can result in flue gas contamination at the top of the stack from units 1 or 3 preventing safe access to the stack.
- **Product removed with the cleaning process, totally different as expected from original samples taken, imposing a risk with the cleaning process.**

Trust, you find the above in order.

Kind Regards,

……..
Zandi Shange
General Manager - Kusile Power Station Project

Generation Division - Group Capital
Kusile Power Station Project
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Eskom

Ms Nompumelelo Simelane
Nkangala District Municipality
PO Box 437
Middleburg
1050

Date:

June 2024

Enquiries: Lesiba Kgobe
Tel: +27 13 699 7817

Ref: *Kusile Power Station AEL (17/4/AEL/MP311/12/01)*

Dear Ms. Simelane

KUSILE POWER STATION'S MONTHLY EMISSIONS REPORT FOR MAY 2024

This serves as the monthly report required in terms of Section 7.6 in Kusile Power Station's Atmospheric Emission License: 17/4/AEL/MP311/12/01. The emissions are for the month of May 2024.

Hoping the above will meet your satisfaction.

Yours sincerely

Christopher Nani pp A. Vuma
ACTING GENERAL MANAGER
DATE: 2024-06-28

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Management Department (Kusile Power Station)
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1. KUSILE POWER STATION MONTHLY EMISSIONS REPORT: Atmospheric Emission License 17/4/AEL/MP311/12/01

2. Raw Materials and Products

Raw Materials and Products	**Raw Material Type**	**Units**	**Max Permitted Consumption Rate**	**Consumption Rate May-2024**
	Coal	Tons	*1 818 083*	*713 464*
	Fuel Oil	Tons	*5 533*	*2 164.74*
	Limestone	Tons	*72 917*	*8772*
Production Rates	**Product / By-Product Name**	**Units**	**Max Production Capacity Permitted**	**Indicative Production Rate May-2024**
	Energy	GWh	*3 321.216*	*1 374.74*
	Ash	Tons	*796 300*	*226952.82*
	Gypsum	Tons	*155 100*	*4 912.84*
	RE PM	kg/MWh	*not specified*	*0.02*
	RE SOx	kg/MWh	*not specified*	*5.09*

3. Energy source characteristics

Fuel Characteristic	Units	Stipulated Range	Monthly Average Content
Coal Sulphur	%	*1.3*	*0.79*
Ash in Coal	%	*38*	*31.81*

4. Emissions Limits (mg/Nm³)

Associated Unit/Stack	PM	SO_2	NOx
North	*50*	*3500*	*750*
South	*50*	*1000*	*750*

5. Abatement Technology (%)

Associated Unit/Stack	Technology Type	Efficiency May-2024	Utilisation May - 2024	Technology Type	Efficiency May-2024	Utilisation May- 2024
Unit 1	*FFP*	*99.961%*	*100%*	*FGD*	*Out of service*	*Out of service*
Unit 2	*FFP*	*99.977%*	*100%*	*FGD*	*Out of service*	*Out of service*
Unit 3	*FFP*	*99.980%*	*100%*	*FGD*	*Out of service*	*Out of service*
Unit 4	*FFP*	*99.998%*	*100%*	*FGD*	*99.989%*	*100%*

Note: Both the FFP and FGD does not have bypass mode operation, hence plant 100% Utilised.

6. Monitoring reliability (%)

Associated Unit/Stack	PM	SO_2	NO
Unit 1	*0*	*100.0*	*100.0*
Unit 2	*100.0*	*99.3*	*99.3*
Unit 3	*100.0*	*100.0*	*100.0*
Unit 4	*100.0*	*98.6*	*89.1*

Unit 1:PM monitor was identified to be faulty and reading faulty emissions figures for the month of May 2024. The faulty emissions figures were removed and replaced with the monthly average emission figure for the month of March 2024 when the monitor was not faulty.
The monitor was replaced and returned to service on the 10th of June 2024.

7. Emissions Performance

Table 7.1: Monthly tonnages for the month of May - 2024

Associated Unit/Stack	PM	SO_2	NO_x
Unit 1	5.0	2 671	865
Unit 2	9.8	1 228	383
Unit 3	11.3	2 811	672
Unit 4	0.9	289	727
SUM	26.9	6 999	2 647

Table 7.2: Operating days in compliance to PM AEL Limit - May 2024

Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Total Exceedance	Average PM (mg/Nm³)
Unit 1	26	0	0	0	0	3.3
Unit 2	23	0	0	0	0	11.7
Unit 3	30	0	0	0	0	5.9
Unit 4	30	0	0	0	0	0.7
SUM	**109**	**0**	**0**	**0**	**0**	

Table 7.3: Operating days in compliance to SO_2 AEL Limit – May 2024

Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Total Exceedance	Average SO_2 (mg/Nm³)
Unit 1	27	0	0	0	0	1 654.3
Unit 2	25	0	0	0	0	1 380.4
Unit 3	31	0	0	0	0	1 496.2
Unit 4	31	0	0	0	0	153.8
SUM	**114**	**0**	**0**	**0**	**0**	

Table 7.4: Operating days in compliance to NOx AEL Limit - May 2024

Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Total Exceedance	Average NOx (mg/Nm³)
Unit 1	27	0	0	0	0	535.8
Unit 2	25	0	0	0	0	425.8
Unit 3	31	0	0	0	0	355.0
Unit 4	31	0	0	0	0	397.1
SUM	**114**	**0**	**0**	**0**	**0**	

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

Table 7.5: 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

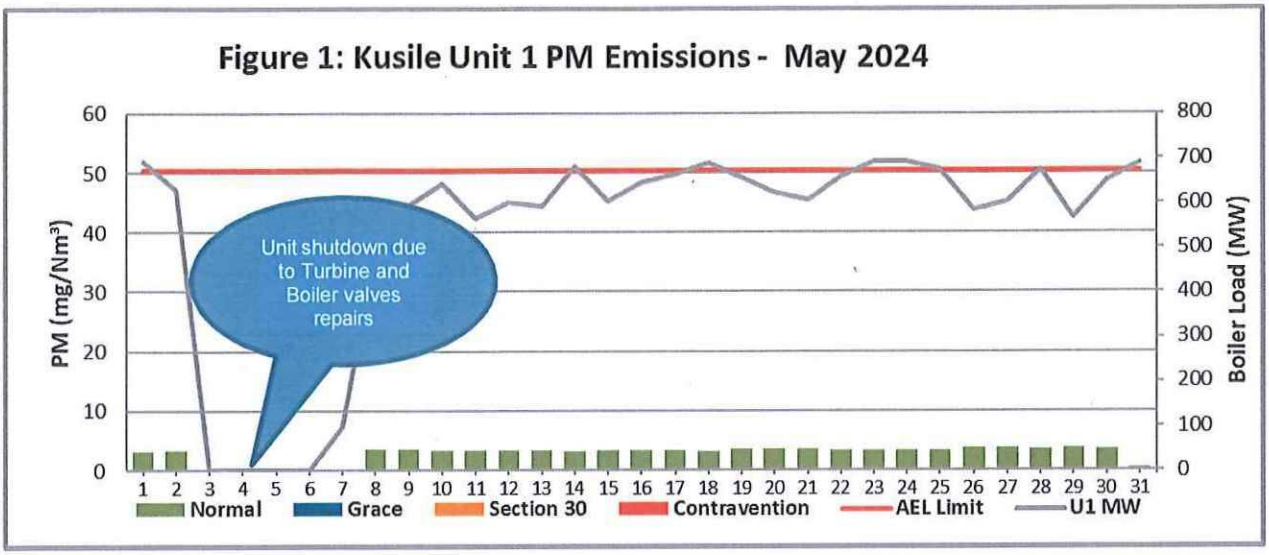


Figure 1: Kusile Unit 1 PM Emissions - May 2024
PM (mg/Nm³)
Boiler Load (MW)
Unit shutdown due to Turbine and Boiler valves repairs
Normal
Grace
Section 30
Contravention
AEL Limit
U1 MW

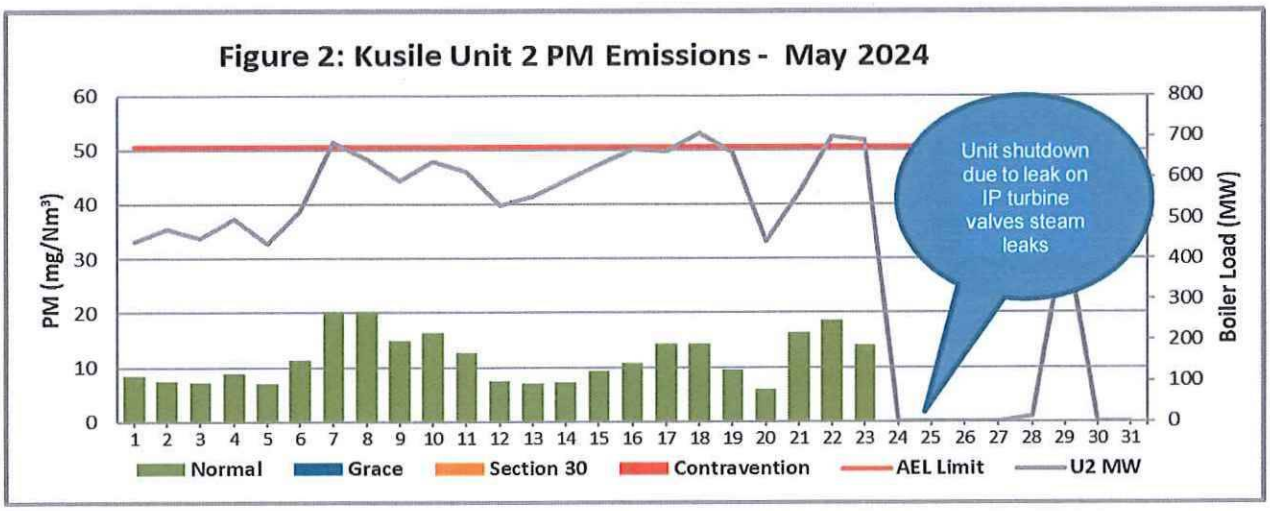


Figure 2: Kusile Unit 2 PM Emissions - May 2024
PM (mg/Nm³)
Boiler Load (MW)
Unit shutdown due to leak on IP turbine valves steam leaks
Normal
Grace
Section 30
Contravention
AEL Limit
U2 MW

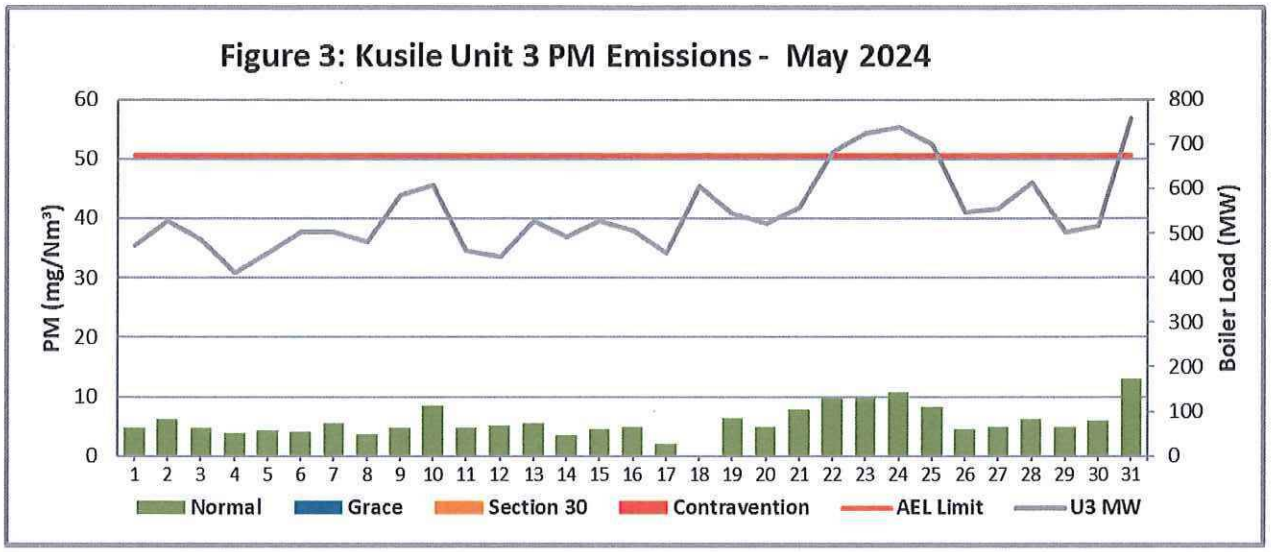


Figure 3: Kusile Unit 3 PM Emissions - May 2024
PM (mg/Nm³)
Boiler Load (MW)
Normal
Grace
Section 30
Contravention
AEL Limit
U3 MW

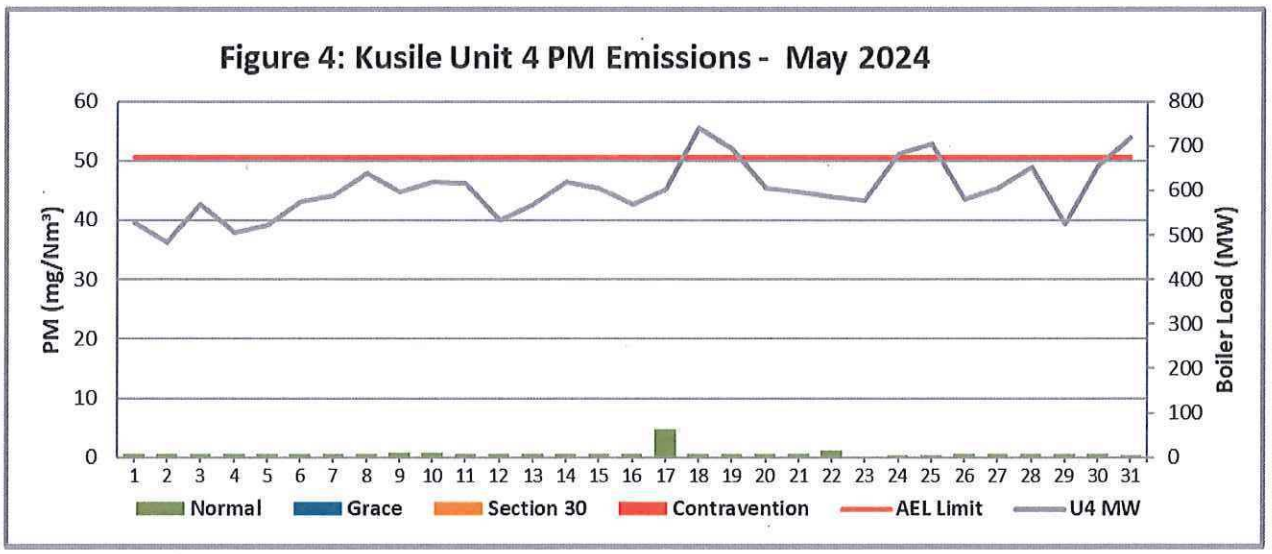


Figure 4: Kusile Unit 4 PM Emissions - May 2024
PM (mg/Nm³)
Boiler Load (MW)
Normal
Grace
Section 30
Contravention
AEL Limit
U4 MW

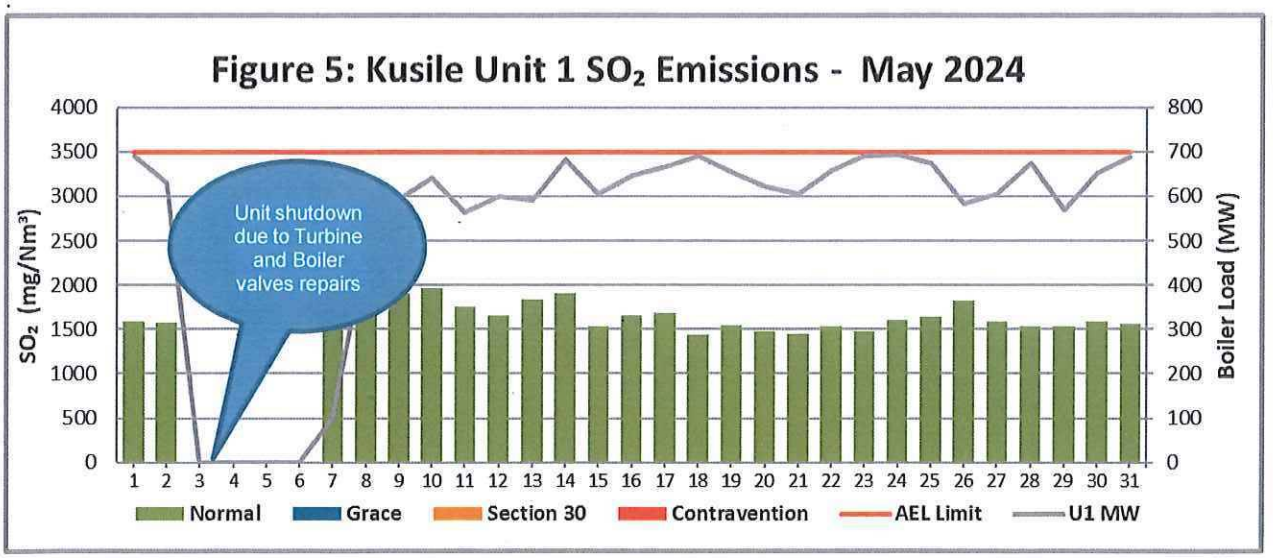


Figure 5: Kusile Unit 1 SO₂ Emissions - May 2024
SO₂ (mg/Nm³)
Boiler Load (MW)
Unit shutdown due to Turbine and Boiler valves repairs
Normal
Grace
Section 30
Contravention
AEL Limit
U1 MW

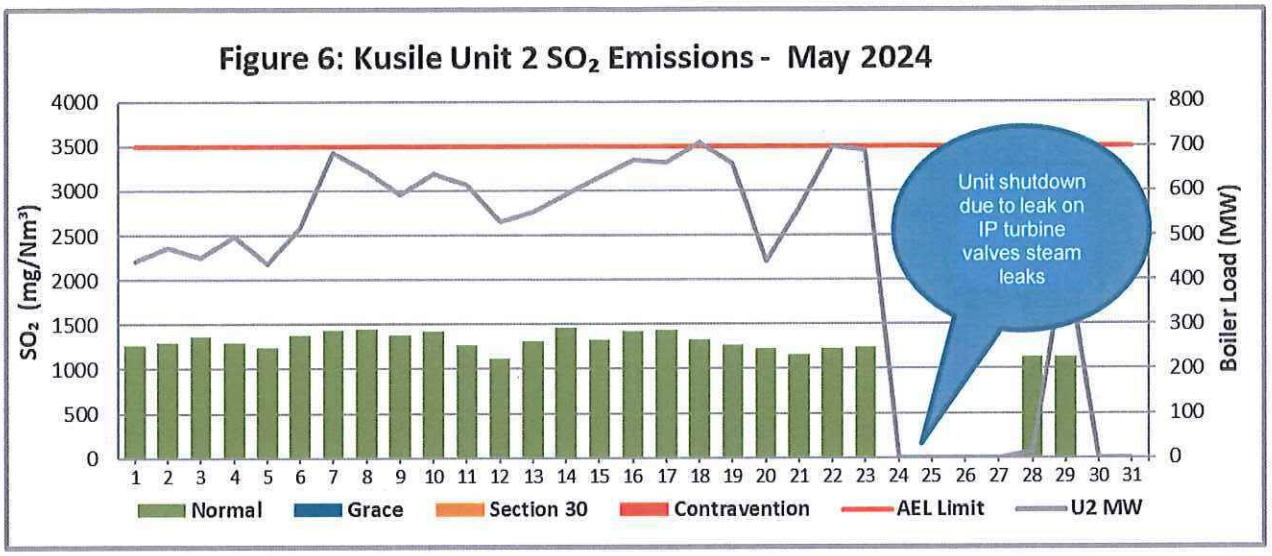


Figure 6: Kusile Unit 2 SO2 Emissions - May 2024
SO2 (mg/Nm3)
Boiler Load (MW)
Unit shutdown due to leak on IP turbine valves steam leaks
Normal
Grace
Section 30
Contravention
AEL Limit
U2 MW

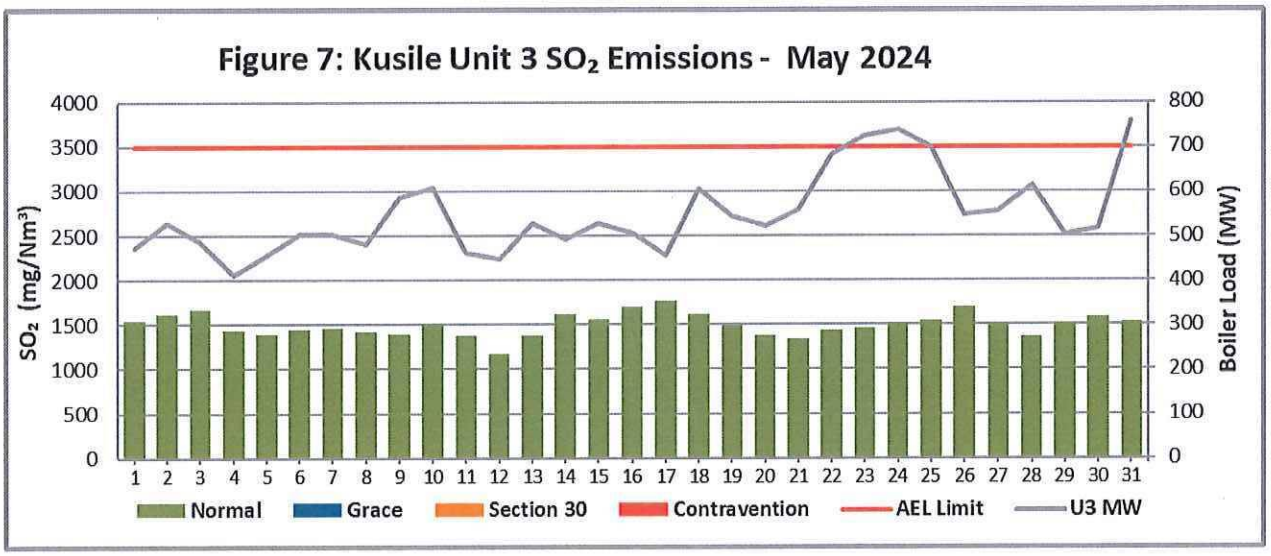


Figure 7: Kusile Unit 3 SO2 Emissions - May 2024
SO2 (mg/Nm3)
Boiler Load (MW)
Normal
Grace
Section 30
Contravention
AEL Limit
U3 MW

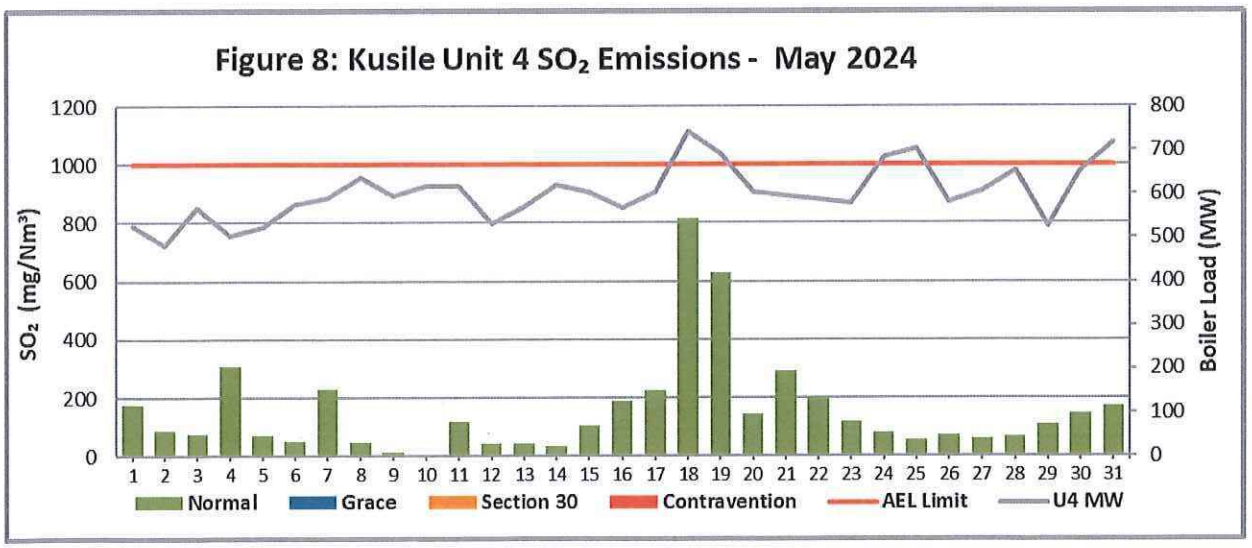


Figure 8: Kusile Unit 4 SO2 Emissions - May 2024
SO2 (mg/Nm3)
Boiler Load (MW)
Normal
Grace
Section 30
Contravention
AEL Limit
U4 MW

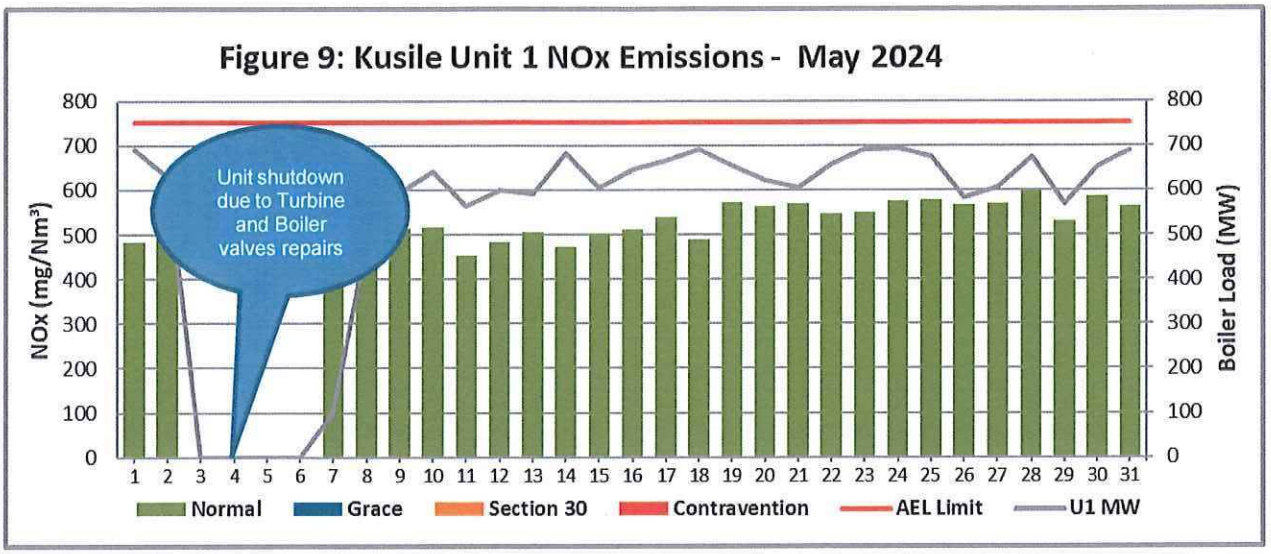


Figure 9: Kusile Unit 1 NOx Emissions - May 2024
NOx (mg/Nm³)
Boiler Load (MW)
Unit shutdown due to Turbine and Boiler valves repairs
Normal
Grace
Section 30
Contravention
AEL Limit
U1 MW

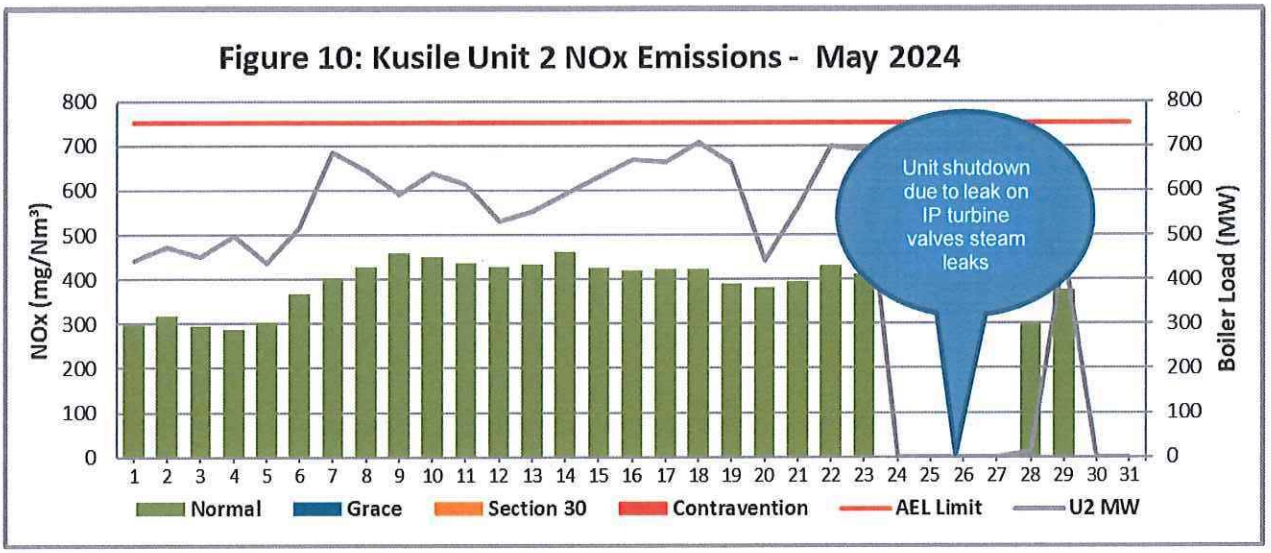


Figure 10: Kusile Unit 2 NOx Emissions - May 2024
NOx (mg/Nm³)
Boiler Load (MW)
Unit shutdown due to leak on IP turbine valves steam leaks
Normal
Grace
Section 30
Contravention
AEL Limit
U2 MW

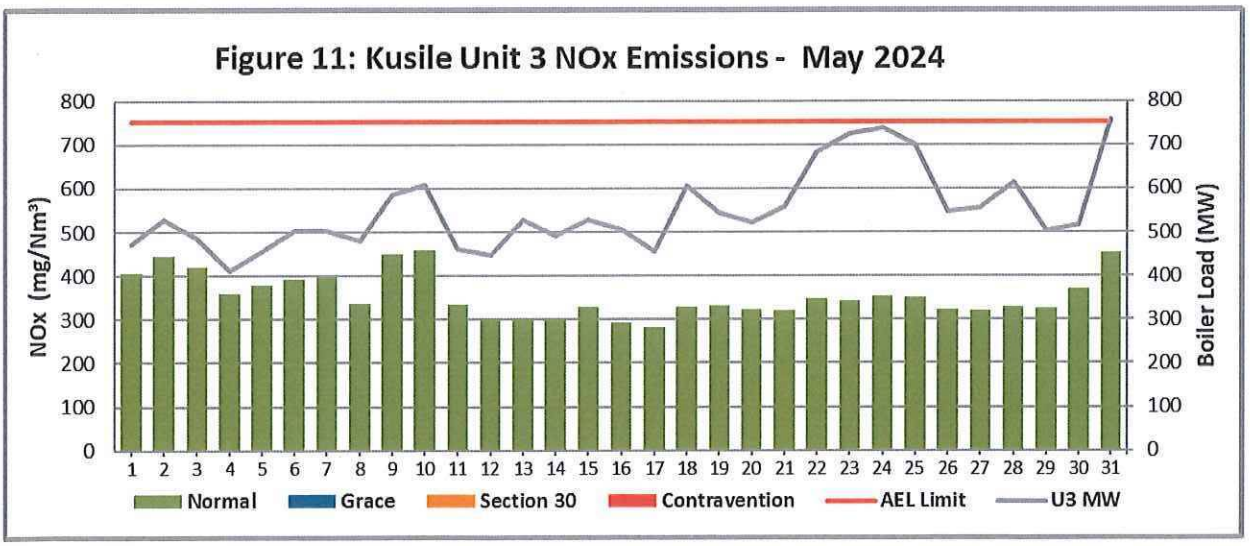
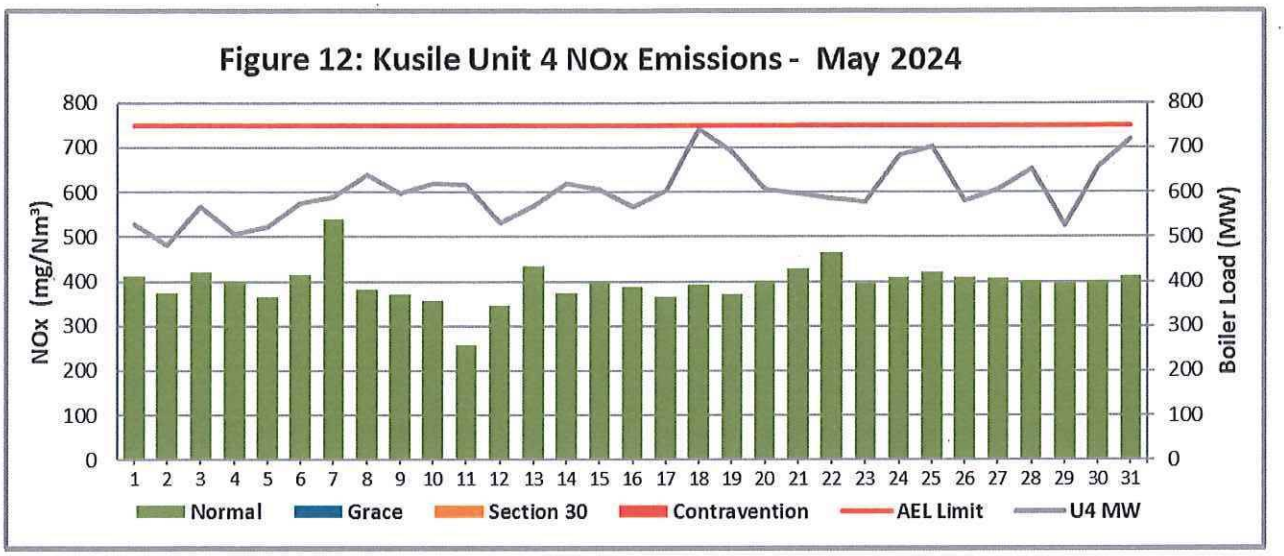


Figure 11: Kusile Unit 3 NOx Emissions - May 2024
NOx (mg/Nm³)
Boiler Load (MW)
Normal
Grace
Section 30
Contravention
AEL Limit
U3 MW



8. Correlation and Parallel test status

Unit 1:

- Unit 1 is operating with unity curve for PM. PM correlation test is invalid due to the monitor that was replaced, and the full correlation test is planned.
- The unit is operating with a valid parallel curve.

Unit 2:

- Unit 2 is operating with spot check. The full PM correlation test was conducted, and it failed. A new correlation test will be conducted.
- The unit is operating with a valid parallel curve.

Unit 3

- Correlation test curve invalid. Spot check test curve implemented.

Unit 4:

- Unit 4 is operated with valid correlation and parallel curves.

9. Shut down and Light up information

Unit No. 1	*Event 1*		*Event 2*	
Breaker Open (BO)	11:50 pm	2024/05/02	11:00 am	2024/05/09
Draught Group (DG) Shut Down (SD)	8:00 am	2024/05/04	DG did not trip or SD	DG did not trip or SD
BO to DG SD (duration)	01:08:10	DD:HH:MM	n/a	DD:HH:MM
Fires in time	3:40 pm	2024/05/04		
Synch. to Grid (or BC)	11:25 pm	2024/05/07		
Fires in to BC (duration)	03:07:45	DD:HH:MM		DD:HH:MM
Emissions below limit from BC (end date)	not > limit	not > limit		
Emissions below limit from BC (duration)	n/a	DD:HH:MM		DD:HH:MM

Unit No. 2	*Event 1*		*Event 2*	
Breaker Open (BO)	4:20 am	2024/05/20	9:50 am	2024/05/23
Draught Group (DG) Shut Down (SD)	4:20 am	2024/05/20	7:45 am	2024/05/24
BO to DG SD (duration)	00:00:00	DD:HH:MM	00:21:55	DD:HH:MM
Fires in time	5:20 am	2024/05/20		
Synch. to Grid (or BC)	10:25 pm	2024/05/20		
Fires in to BC (duration)	00:17:05	DD:HH:MM		DD:HH:MM
Emissions below limit from BC (end date)	not > limit	not > limit		
Emissions below limit from BC (duration)	n/a	DD:HH:MM		DD:HH:MM

Unit No. 3	*Event 1*	
Breaker Open (BO)	8:50 am	2024/05/17
Draught Group (DG) Shut Down (SD)	DG did not trip or SD	DG did not trip or SD
BO to DG SD (duration)	n/a	DD:HH:MM
Fires in time		
Synch. to Grid (or BC)		
Fires in to BC (duration)		DD:HH:MM
Emissions below limit from BC (end date)		
Emissions below limit from BC (duration)		DD:HH:MM

Unit No. 4	*Event 1*		*Event 2*		*Event 3*	
Breaker Open (BO)	10:45 am	2024/05/03	12:25 am	2024/05/17	1:30 am	2024/05/22
Draught Group (DG) Shut Down (SD)	DG did not trip or SD	DG did not trip or SD	DG did not trip or SD	DG did not trip or SD	DG did not trip or SD	DG did not trip or SD
BO to DG SD (duration)	n/a	DD:HH:MM	n/a	DD:HH:MM	n/a	DD:HH:MM
Fires in time						
Synch. to Grid (or BC)						
Fires in to BC (duration)		DD:HH:MM		DD:HH:MM		DD:HH:MM
Emissions below limit from BC (end date)						
Emissions below limit from BC (duration)		DD:HH:MM		DD:HH:MM		DD:HH:MM

11.Complaints

No complaints reported for the month of May 2024

Date and time complaint was received	Complaint received	Source code name	Root cause analysis	Calculation of impact/emissions associated with incidents and dispersion modelling of pollutants where applicable.	Measures implemented or to be implemented to prevent recurrence	Date by which measures will be implemented
No complaints reported for the month of May 2024						

Kusile Ambient Air Quality Monitoring

MAY 2024

1. INTRODUCTION

At the request of Environmental Management, Research, Testing and Development Department (RT&D) air quality team initiated an additional ambient air quality monitoring site at Balmoral and Wilge, in the vicinity of Kusile power station. The objective is to assess compliance with national ambient air quality standards, identify potential sources of pollution, protect public health and the environment and establish a baseline for future mitigation measures to enable Eskom to operate temporary stacks at the Kusile power stations at emission levels above the levels authorised in the station's Atmospheric Emission Licence (AEL). The existing air quality monitoring stations (Phola and Chicken Farm) will complement the additional monitoring stations to reduce uncertainties, as each monitoring station has an objective linked to a power station of interest.

The commissioning of Ogies air quality monitoring station has been delayed due to procurement issues, however Kusile Power station, Research, Testing and Development and Generation Environmental Management (GEM) are working tirelessly to resolve it and a new date will be communicated to the Department of Fisheries, Forestry and Environment.

Kendal (K2) air quality monitoring data does not form part of the analysis for this reporting since the Kendal monitoring site is solely used for research purposes and needs identified to understand the short-range impacts from the station and to assess the localised impacts on ambient air quality from stack emissions and low-level activities, such as coal stockpile, ash disposal activities and open cast mining in the area and the Kendal power station. Monitoring at Kendal (K2) commenced in 1993 and annual research report is produced and submitted to Eskom Research Technical Committee for Clean Coal Technologies. The monitoring station is located about 2 km south-east from the Kendal power station in the prevailing wind direction. Data recorded at the station reflects the impact of Kendal power station downwind of the station and other sources. and has no impact for

The Balmoral and Wilge monitoring stations are currently equipped to continuously monitor ambient concentrations of sulphur dioxide (SO_2). In addition, meteorological parameters of wind velocity, wind direction and ambient temperature, humidity, ambient pressure and rainfall, amongst others are also recorded.

The following parameters, nitrogen dioxide (NO_2), ozone (O_3) and fine particulate matter of particulate size <10µm and particulate size <2.5µm in diameter (PM_{10} and $PM_{2.5}$) will be monitored from 01 July 2024.

The data for this reporting period (01 – 31 May 2024) were analysed for ambient SO_2 as monitored at Balmoral, Chicken Farm, Phola and Wilge air quality monitoring stations. The Particulate Matter and NO_2 data were further analysed for Chicken Farm and Phola.

This report focuses on the results of the ambient air quality monitoring stations; results from stack monitoring, fugitive dust and animal health are addressed in other reports.

2. DATA ACQUISITION AND QUALITY CONTROL

Each monitoring station is visited every two weeks by trained technicians for routine service. Zero and span checks are carried out on each analyser during routine services and any discrepancies are logged and used during data verification at Eskom RT&D Sustainability Department.

Full dynamic calibration audits are carried out on the gas analysers (SO_2, NO_2 and O_3 analysers) quarterly and particulate matter analysers are calibrated every six months. All calibration results and certificates are filed in the laboratory for assessment purposes. Inter-laboratory calibrations are routinely carried out with other accredited laboratories, to enhance quality control.

Data at the monitoring stations are logged directly using dedicated CR-1000 Campbell Scientific data loggers. Permanent data records of all calculated 10-minutes mean values of all parameters monitored, together with minimum and maximum values, are stored on the logging device. These are derived from 10-second scans and are also logged and saved in 1-minute intervals. The raw 1-minute average data is also transferred live to the South African Ambient Air Quality Information System (SAAQIS) server since the 14th of December 2023. Recorded data are downloaded remotely from the site through communicators that are connected to the Eskom network and transferred onto a central computer for verification and validation.

3. MONITORING STATION LOCATIONS

Figure 1 below indicates the locations of the air quality monitoring stations in relation to the Kusile power station. The new monitoring stations, Balmoral and Wilge, are denoted by green icons and the pre-existing monitoring stations, Chicken Farm and Phola, by yellow icons.

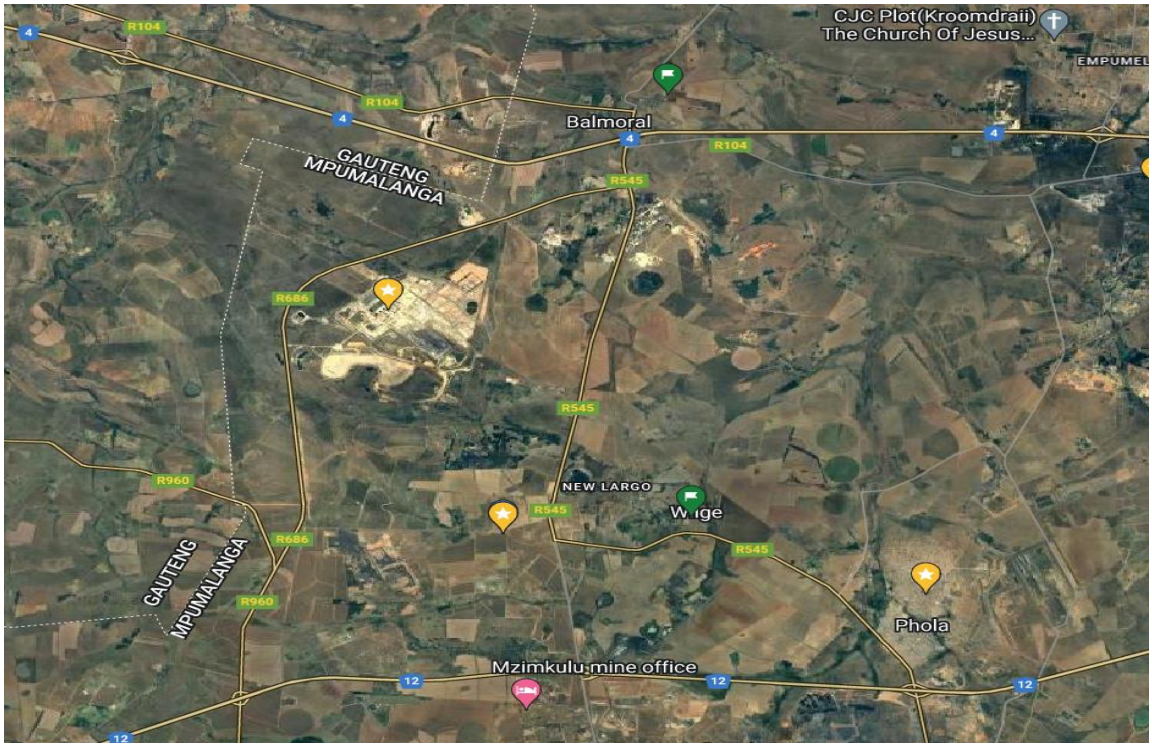


Figure 1: Air Quality Monitoring stations in relation to Kusile power station

4. MONITORING RESULTS AND DISCUSSIONS

The data is statistically analysed to assess the diurnal and monthly variations of the air pollutants, as well as to evaluate it against the current national ambient air quality standards for SO_2, NO_2, O_3, $PM_{2.5}$ and PM_{10}.

4.1. DATA RECOVERY

The SANAS guideline figure of 90% data availability 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. Station 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 per parameter monitored in May 2024

Stations name	SO_2	NO_2	O_3	$PM_{2.5}$	PM_{10}	WSP	WDR	Station Availability
Balmoral (BL)	99.5					100	100	100
Chicken Farm (CF)	59.0	59.7	11.3	60.1	59.3	68.7	68.7	60.2
Phola (PO)	78.5	78.5	78.5	78.1	78.8	80.1	80.1	78.8
Wilge (WL)	99.6					100	100	99.9

Good representative percentage data was recovered for all the parameters monitored during the monitoring period under review at the monitoring stations. Chicken Farm data was low due to power interruption and faulty instrument for Ozone. However, the Ozone instrument has been repaired and is back at site for monitoring. All the faulty instrument for all the air quality monitoring site under review has been repaired, functional and the June report will not have gaps in the data sets.

4.2. METEOROLOGICAL OBSERVATIONS

The distributions of wind direction and wind speed for daytime and night-time hours for the reporting period are summarised on polar diagrams. The centre of the wind rose depicts the position of the air quality monitoring site. 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.

4.2.1. BALMORAL AIR QUALITY MONITORING STATION

The wind at Balmoral monitoring station was coming from the north-north-easterly to north-east directions during the day and from the west-south-westerly to westerly directions during the night time. The monitoring station is north-east of Kusile power station.

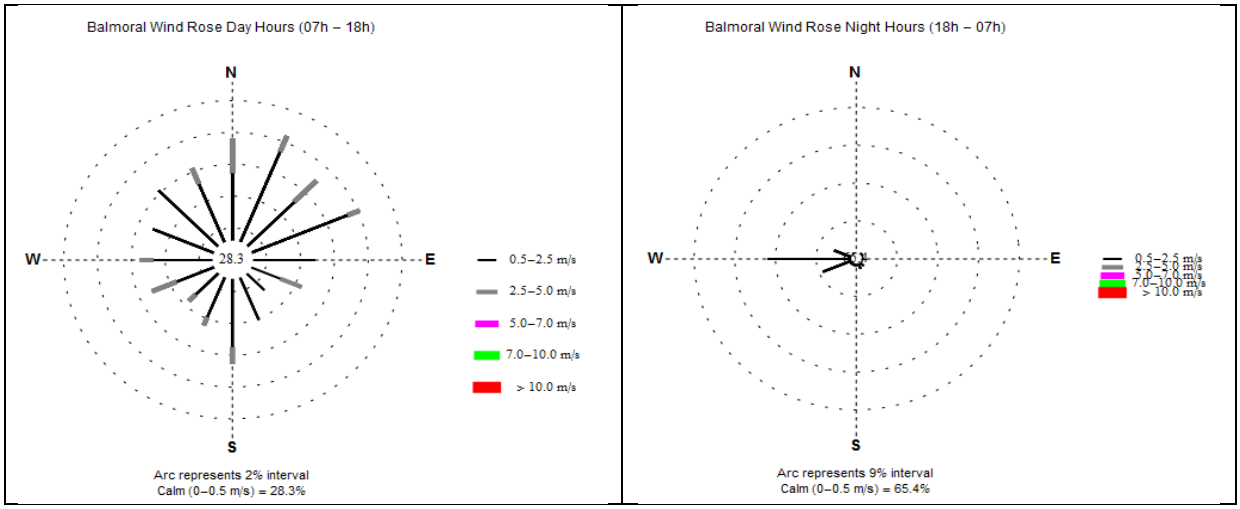


Figure 2: Wind profiles at Balmoral monitoring station

4.2.2. CHICKEN FARM AIR QUALITY MONITORING STATION

The dominant wind directions at Chicken Farm monitoring station during the day were north, south-east, south-south-east and north-west. During the night, the dominant wind directions were east-north-east, east, east-south-east and south. The monitoring station is south of Kusile power station.

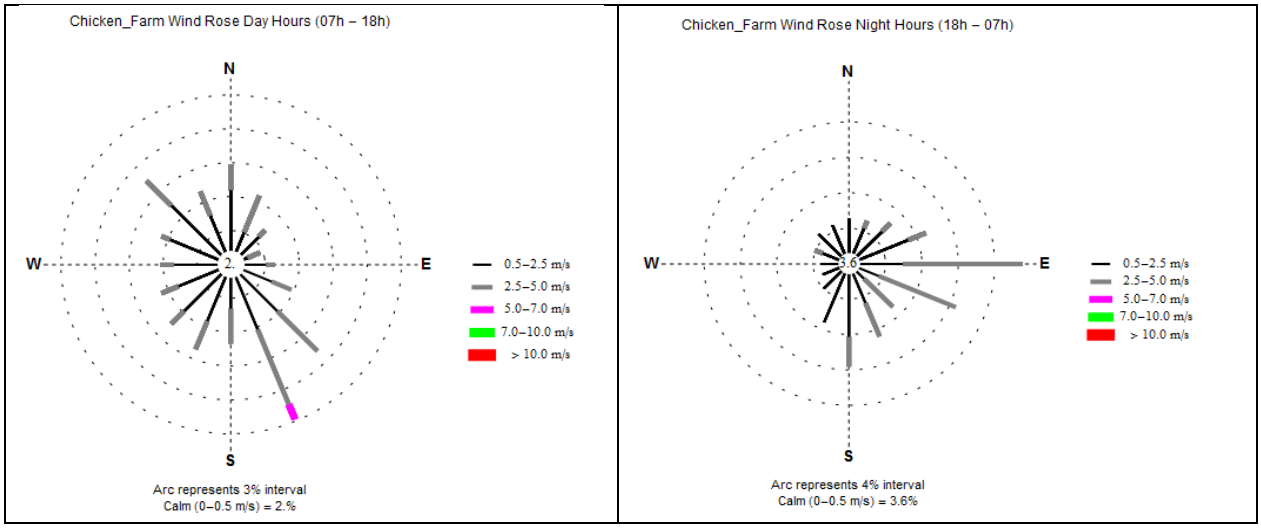


Figure 3: Wind profiles at Chicken Farm monitoring station

4.2.3. PHOLA AIR QUALITY MONITORING STATION

The dominant wind directions at Phola monitoring station during the day were east-south-east. west-north-west and north-west. During the night, the dominant wind directions were east-south-east and south-south-east. The monitoring station is south-east of Kusile power station.

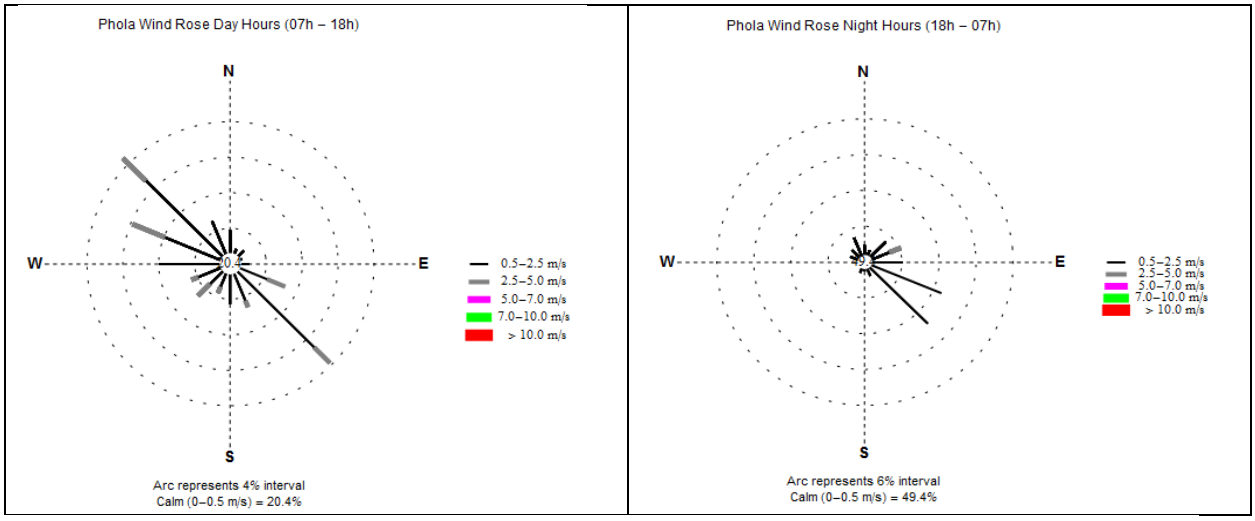


Figure 4: Wind profiles at Phola monitoring station.

4.2.4. WILGE AIR QUALITY MONITORING STATION

The wind at Wilge monitoring station was coming from the north, north-north-east to north-east and south-south-west directions during the day. The dominant wind sectors during the night are south-west and west-south-west. The monitoring station is south-east of Kusile power station.

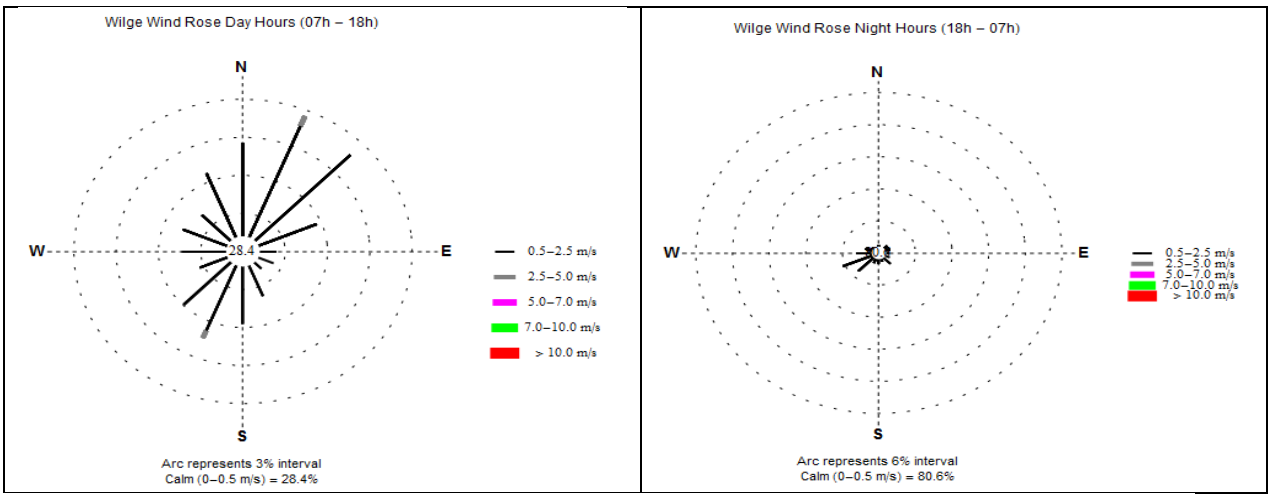


Figure 5: Wind profiles at Wilge monitoring station.

4.3. EXCEEDANCES OF THE NATIONAL AMBIENT AIR QUALITY LIMITS

Table 2: National Ambient Air Quality Standards

Pollutant	Unit	Period	Limit	Number of annual exceedances allowed	Source
Carbon Monoxide	Ppm	1hr	26.	88.	DFFE
Carbon Monoxide	Ppm	8hr	8.7	11.	DFFE
(PM_{10}) by Beta gauge	µg/m^3	24hr	75.	4.	DFFE
(PM_{10}) by Beta gauge	µg/m^3	1year	40.	0.	DFFE
($PM_{2.5}$) by Beta gauge	µg/m^3	24hr	40	4	DFFE
($PM_{2.5}$) by Beta gauge	µg/m^3	1year	20	0	DFFE
Nitrogen dioxide	Ppb	1year	21.	0.	DFFE
Nitrogen dioxide	Ppb	1hr	106.	88.	DFFE
Ozone	Ppb	8hr	61.	11.	DFFE
Sulphur dioxide	Ppb	1hr	134.	88.	DFFE
Sulphur dioxide	Ppb	10min	191.	526.	DFFE
Sulphur dioxide	Ppb	24hr	48.	4.	DFFE
Sulphur dioxide	Ppb	1year	19.	0.	DFFE

The National Department of Forestry, Fisheries and the Environment (DFFE) has set the South African Ambient Air Quality Standards for the criteria pollutants as illustrated in Table 2.

Table 3: Highest SO_2 concentration recorded (in ppb).

Monitoring Stations	10-min average	Date	Hourly average	Date	Daily average	Date
Balmoral	158.6	21/05/2024 10:50	81.0	21/05/2024 12h00	21.9	21/05/2024
Chicken Farm	169.7	04/05/2024 11:40	129.7	10/05/2024 02:00	36.4	10/05/2024
Phola	329.4	16/05/2024 20:20	126.6	10/05/2024 01:00	41.6	10/05/2024
Wilge	285.4	09/05/2024 10:50	162.1	10/05/2024 01:00	45.8	10/05/2024

There were three (3) exceedances of the SO_2 hourly limit of 134 ppb and six (6) exceedances of SO_2 10-minutes limit of 191 ppb at Wilge air quality monitoring site and one (1) exceedance of SO_2 10-minutes limit of 191 ppb recorded during the monitoring period at Phola air quality monitoring site. The highest SO_2 concentrations recorded at the monitoring stations are indicated in Table 3 and figures 6 to 9 below.

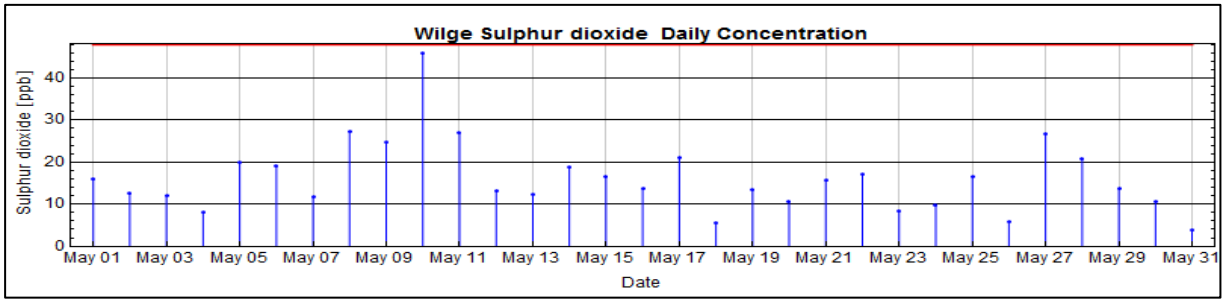


Figure 6: Time series graph for the SO_2 daily mean concentrations at Wilge AQM station

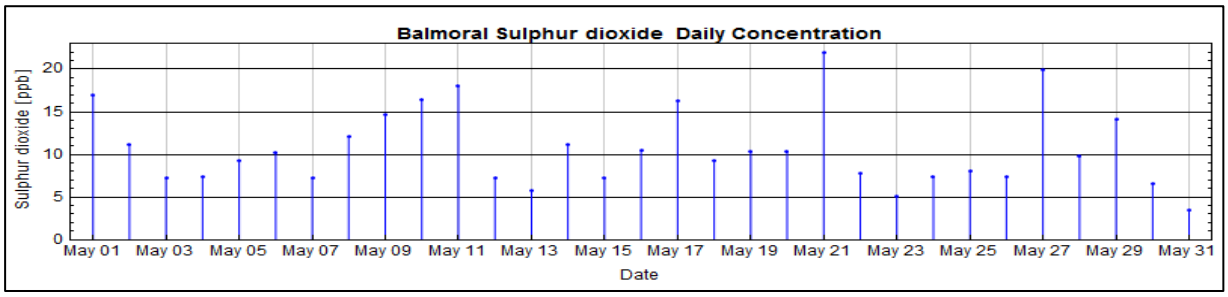


Figure 7: Time series graph for the SO_2 daily mean concentrations at Balmoral AQM station

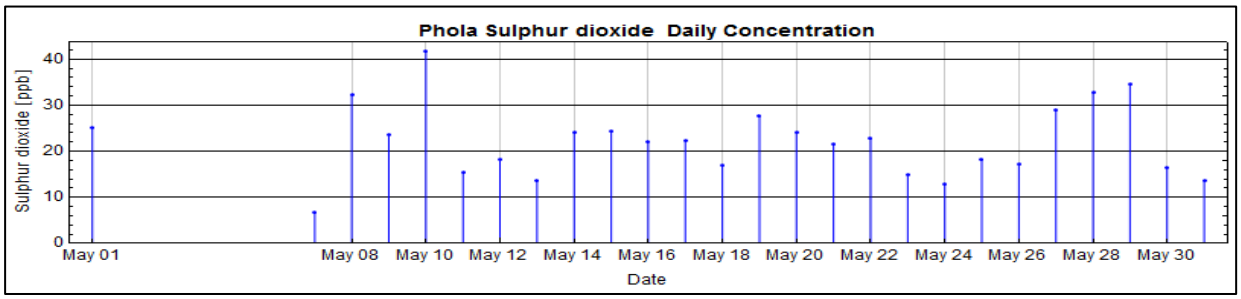


Figure 8: Time series graph for the SO_2 daily mean concentrations at Phola AQM station

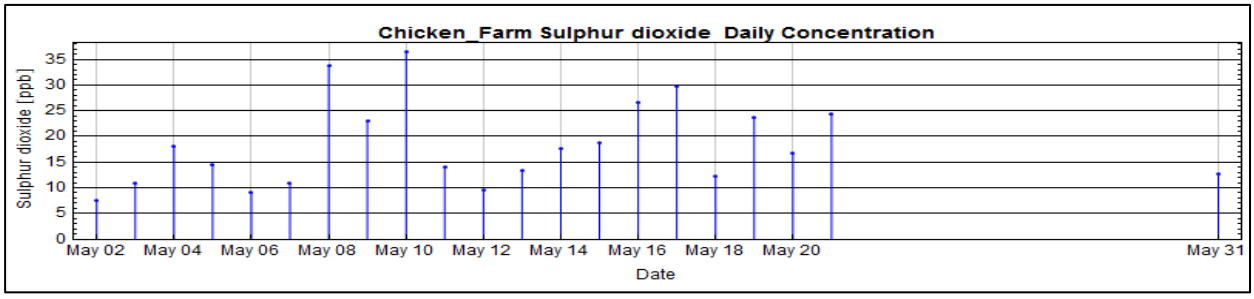


Figure 9: Time series graph for the SO_2 daily mean concentrations at Chicken Farm AQM station

There were no exceedances of the NO_2 hourly limit of 106 ppb recorded at the monitoring stations during the May 2024 monitoring period. There were twenty-two (22) exceedances of the $PM_{2.5}$ daily limit of 40 µg/m^3 at Phola, and twelve (12) exceedances of the $PM_{2.5}$ daily limit of 40 µg/m^{3}the Chicken Farm monitoring station. There were twenty-three (23) exceedances of PM_{10} daily limit of 75 µg/m^3 at Phola air quality monitoring station and sixteen (16) exceedances of PM_{10} daily

limit of 75 µg/m^3 recorded at Chicken Farm air quality monitoring station. See Figure 10 to 11 below.

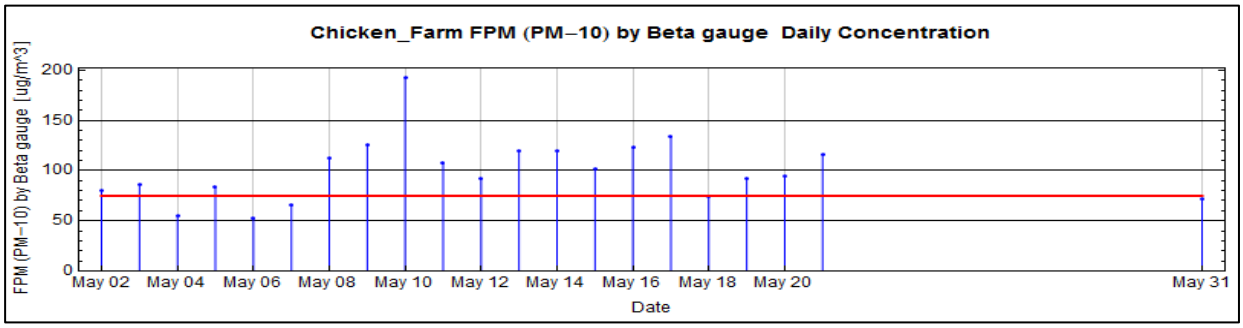


Figure 10: Time series graph for the PM_{10} daily mean concentrations at Chicken Farm AQM station

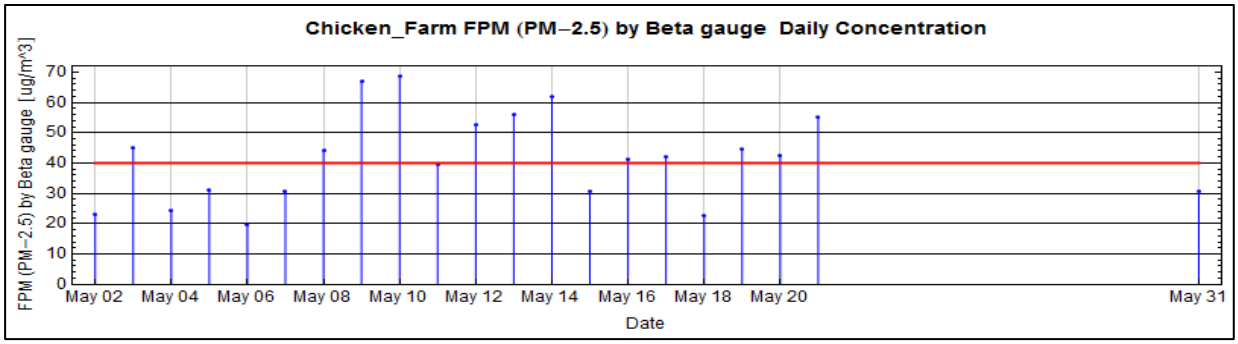


Figure 10: Time series graph for the $PM_{2.5}$ daily mean concentrations at Chicken Farm AQM station

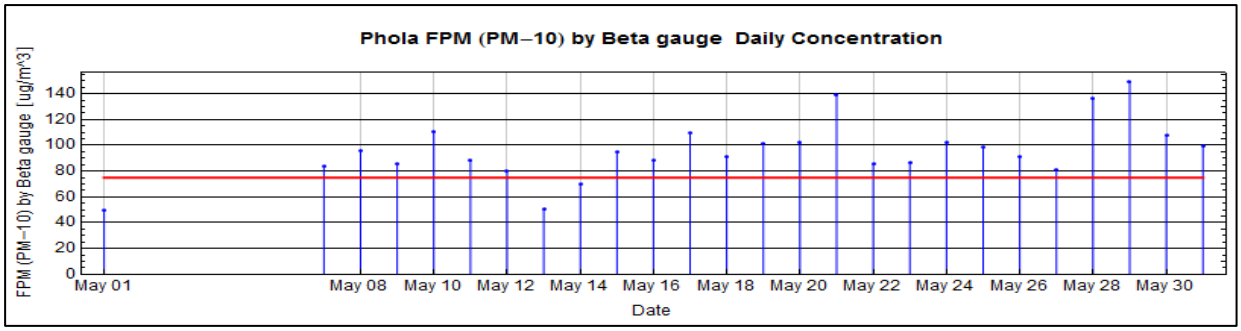


Figure 11: Time series graph for the PM_{10} daily mean concentrations at Phola AQM station

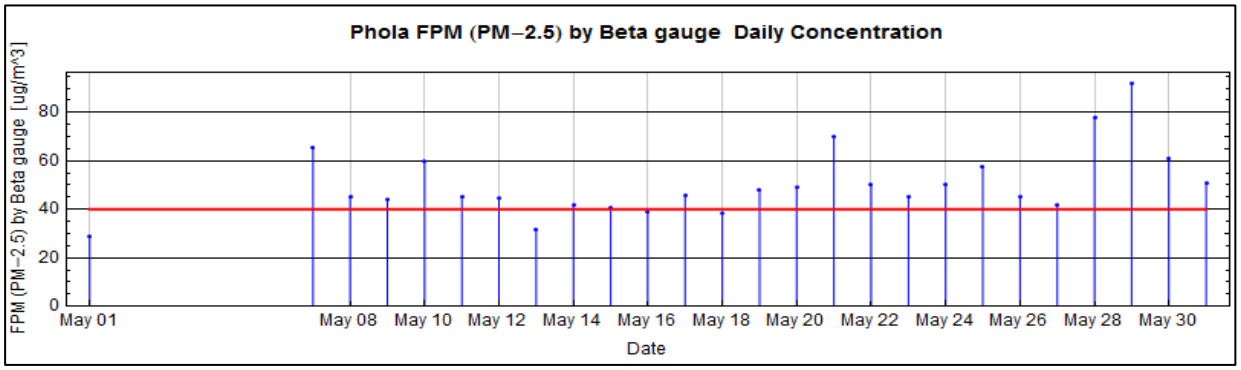


Figure 12: Time series graph for the $PM_{2.5}$ daily mean concentrations at Phola AQM station

Table 4: Exceedances above national ambient air quality limits

PM_{10} Daily Exceedances (Phola)					
Pollutant	**Limit**	**Year**	**Month**	**Day**	**Conc. (µg/m³)**
$PM_{10.}$	75	2024	May	07	83.7
$PM_{10.}$	75	2024	May	08	95.4
$PM_{10.}$	75	2024	May	09	85.5
$PM_{10.}$	75	2024	May	10	110.8
$PM_{10.}$	75	2024	May	11	88.3
$PM_{10.}$	75	2024	May	12	80.4
$PM_{10.}$	75	2024	May	15	94.5
$PM_{10.}$	75	2024	May	16	88.3
$PM_{10.}$	75	2024	May	17	110.1
$PM_{10.}$	75	2024	May	18	91.2
$PM_{10.}$	75	2024	May	19	101.2
$PM_{10.}$	75	2024	May	20	102.1
$PM_{10.}$	75	2024	May	21	139.3
$PM_{10.}$	75	2024	May	22	85.9
$PM_{10.}$	75	2024	May	23	86.9
$PM_{10.}$	75	2024	May	24	102.3
$PM_{10.}$	75	2024	May	25	98.5
$PM_{10.}$	75	2024	May	26	91.0
$PM_{10.}$	75	2024	May	27	79.5
$PM_{10.}$	75	2024	May	28	107.4
$PM_{10.}$	75	2024	May	29	87.1
$PM_{10.}$	75	2024	May	30	79.5
$PM_{10.}$	75	2024	May	31	107.4
$PM_{2.5}$ Daily Exceedances (Phola)					
$PM_{2.5}$	40	2024	May	07	65.6
$PM_{2.5}$	40	2024	May	08	45.3
$PM_{2.5}$	40	2024	May	09	43.8
$PM_{2.5}$	40	2024	May	10	59.6
$PM_{2.5}$	40	2024	May	11	45.3
$PM_{2.5}$	40	2024	May	12	44.7
$PM_{2.5}$	40	2024	May	14	41.6
$PM_{2.5}$	40	2024	May	15	40.4
$PM_{2.5}$	40	2024	May	17	45.5
$PM_{2.5}$	40	2024	May	19	48.2
$PM_{2.5}$	40	2024	May	20	48.9
$PM_{2.5}$	40	2024	May	21	70.3
$PM_{2.5}$	40	2024	May	22	50.4
$PM_{2.5}$	40	2024	May	23	45.0
$PM_{2.5}$	40	2024	May	24	50.1
$PM_{2.5}$	40	2024	May	25	57.6
$PM_{2.5}$	40	2024	May	26	45.0
$PM_{2.5}$	40	2024	May	27	41.7
$PM_{2.5}$	40	2024	May	28	78.1
$PM_{2.5}$	40	2024	May	29	92.0
$PM_{2.5}$	40	2024	May	30	600.8
$PM_{2.5}$	40	2024	May	31	50.7
PM_{10} Daily Exceedances (Chicken Farm)					
$PM_{10.}$	75	2024	May	02	80.6
$PM_{10.}$	75	2024	May	03	85.8
$PM_{10.}$	75	2024	May	05	84.1
$PM_{10.}$	75	2024	May	08	112.7

$PM_{10.}$	75	2024	May	09	125.7
$PM_{10.}$	75	2024	May	10	192.7
$PM_{10.}$	75	2024	May	11	108.3
$PM_{10.}$	75	2024	May	12	91.8
$PM_{10.}$	75	2024	May	13	119.4
$PM_{10.}$	75	2024	May	14	120.1
$PM_{10.}$	75	2024	May	15	101.2
$PM_{10.}$	75	2024	May	16	123.5
$PM_{10.}$	75	2024	May	17	133.7
$PM_{10.}$	75	2024	May	19	91.7
$PM_{10.}$	75	2024	May	20	94.4
$PM_{10.}$	75	2024	May	21	116.3
$PM_{2.5}$ Daily Exceedances (Chicken Farm)					
Pollutant	**Limit**	**Year**	**Month**	**Day**	**Conc. (µg/m^3)**
$PM_{2.5}$	40	2024	May	03	45.0
$PM_{2.5}$	40	2024	May	08	44.2
$PM_{2.5}$	40	2024	May	09	67.1
$PM_{2.5}$	40	2024	May	10	68.5
$PM_{2.5}$	40	2024	May	12	52.7
$PM_{2.5}$	40	2024	May	13	56.0
$PM_{2.5}$	40	2024	May	14	61.9
$PM_{2.5}$	40	2024	May	16	41.4
$PM_{2.5}$	40	2024	May	17	42.0
$PM_{2.5}$	40	2024	May	19	44.6
$PM_{2.5}$	40	2024	May	20	42.3
$PM_{2.5}$	40	2024	May	21	55.0

SO_2 Hourly Exceedances (Wilge)								
Pollutant	**Limit**	**Year**	**Month**	**Day**	**WSP**	**WDR**	**Time**	**Conc.**
SO_2	134	2024	May	10	0.69	NNE	13h00	162.1
SO_2	134	2024	May	10	1.14	N	14h00	154.72
SO_2	134	2024	May	11	1.29	WSW	11h00	153.82

Table 5: Exceedances of the NAAQ Limits per pollutant- May 2024

Averaging Period	Balmoral	Chicken Farm	Phola	Wilge
SO_2 10-min	0	0	1	6
SO_2 Hourly	0	0	0	3
SO_2 Daily	0	0	0	0
NO_2 Hourly		0	0	
O_3 8-hourly		0	2	
$PM_{2.5}$ Daily		12	22	
PM_{10} Daily		16	23	

A summary of all exceedances per pollutant for May 2024 is shown in Table 5.

SO_2 trigger levels or emergency response levels will be based on the United States Acute Exposure Guideline Levels for Hazardous Substances. (AEGL) as amended for South African circumstances. Levels confirmed with the authorities are as follows.

a. AEGL 1 – the cautionary notification level (non-disabling level) - is based on the South African NAAQS limit – for SO_2 this will be 191 ppb over 10-minute for exposure more than 4 hours.

b. AEGL 2 – the warning notification level (disabling level for those with asthma) – is aligned to the US AEGL approach – for SO_2 will be 744 ppb over a 10-minute for exposure up to 8 hours.

c. AEGL – the lethality level – for SO_2, this will be 29 771 ppb over a 10-minute period.

There were no events that triggered the notification of stakeholders in terms of the agreed AEGL recorded in May 2024.

Table 6: Number of exceedances recorded from November 2023 to May 2024

SITES	CF	PO	BL	WL	Allowed No. of Exceedances (November 2023 to May 2024)
PM_{10} (Daily)	16	26	ND	ND	**4**
$PM_{2.5}$ (Daily)	43	23	ND	ND	**4**
NO_2 (hourly)	0	0	ND	ND	**88**
SO_2 (Hourly	0	0	0	4	**88**
SO_2 (Daily)	0	0	0	0	**4**
O_3 (8h moving)	355	69	ND	ND	**11**
SO_2 (10 minute)	0	1	0	8	**526**

Chicken Farm air quality monitoring station is in non-compliance with national ambient air quality limits of $PM_{2.5}$ daily limit of 40 µg/m³, PM_{10} daily limit of 75 µg/m³ and O_3 8 hourly limit of 61 ppb. The sources that have an impact on Chicken farm are Eva high Steel and Vanadium in the north-east, Phola Township in the east-south-east, Klipspruit Colliery in the south-east and Kusile Power station in the north to north-west sectors. The monitoring of particulate matter ($PM_{2.5}$) at Chicken Farm was started with the temporary stack project in November 2023. Phola air quality monitoring station is in non-compliance with national ambient air quality limits of $PM_{2.5}$ daily limit of 40 µg/m³, PM_{10} daily limit of 75 µg/m³ and O_3 8 hourly limit of 61 ppb.

5. DFFE AND SAAQIS REPORTING

The raw monitoring data, downloaded at 1-minute averages is available in real-time to the DFFE-managed South African Air Quality Information System (SAAQIS) since the 14th of December 2023 for all Eskom air quality monitoring stations.

6. CONCLUSIONS

There were no exceedances of the NO_2 hourly limit of 106 ppb recorded at the monitoring stations during the May 2024 monitoring period.

There were three (3) exceedances of the SO_2 hourly limit of 134 ppb and six (6) exceedances of SO_2 10-minutes limit of 191 ppb at Wilge air quality monitoring site and one (1) exceedance of SO_2 10-minutes limit of 191 ppb recorded during the monitoring period at Phola air quality monitoring site.

There were twenty-two (22) exceedances of the $PM_{2.5}$ daily limit of 40 µg/m^3 at Phola, and twelve (12) exceedances of the $PM_{2.5}$ daily limit of 40 µg/m^{3}the Chicken Farm monitoring station. There were twenty-three (23) exceedances of PM_{10} daily limit of 75 µg/m^3 at Phola air quality monitoring station and sixteen (16) exceedances of PM_{10} daily limit of 75 µg/m^3 recorded at Chicken Farm air quality monitoring station.

Both Chicken Farm air quality monitoring station and Phola are in non-compliance with national ambient air quality limits of $PM_{2.5}$ daily limit of 40 µg/m³, PM_{10} daily limit of 75 µg/m³ and O_3 8 hourly limit of 61 ppb.

There were no events that triggered the notification of stakeholders in terms of the agreed AEGL recorded in May 2024.

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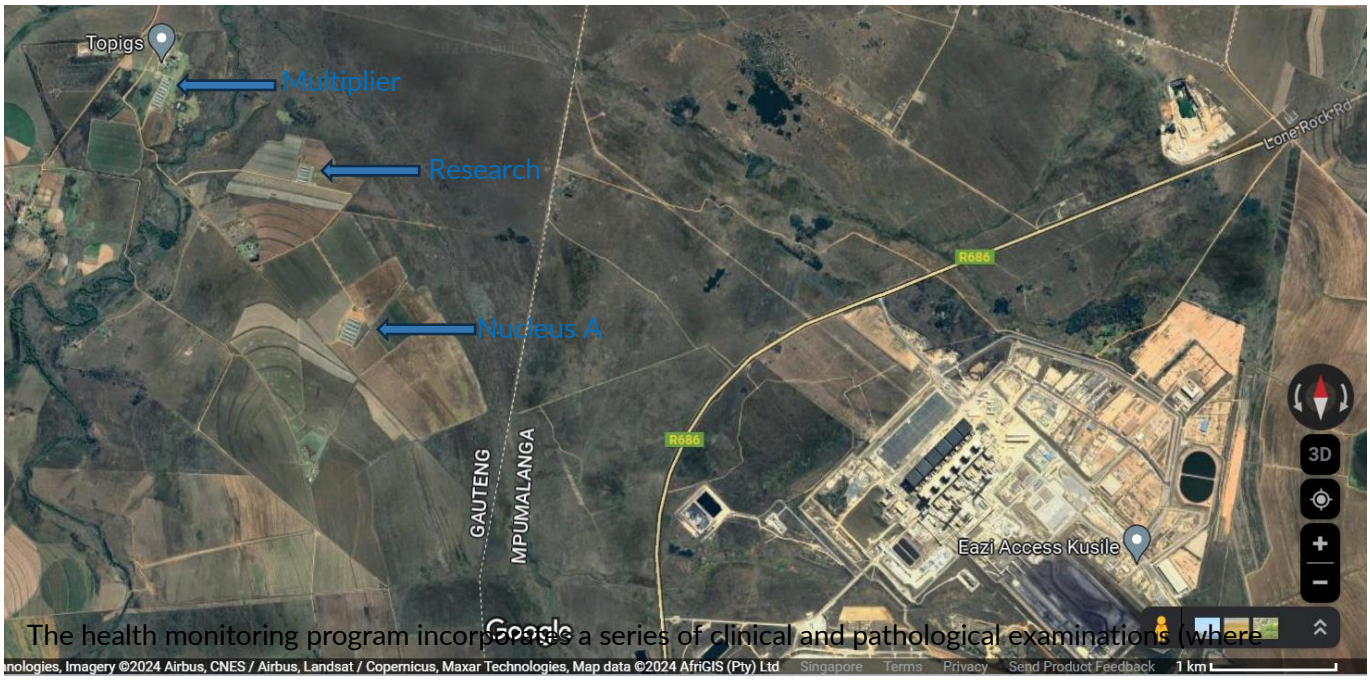
Animal Health Monitoring Summary Report April 2024

A comprehensive animal health monitoring program was designed to encompass five piggeries, including a control piggery, Rietfontein, situated in Mpumalanga Province near Villers, away from any power station. The study aims to compare the health status of pigs at Rietfontein with those at four other piggeries—Nucleus A, Multiplier, Research, and GHB Spitskop—located near the Khusile Power Plant (see location of piggeries on maps below). The primary objective is to assess any differences in health status, focusing on clinical disease, infection, and inflammation, potentially influenced by the proximity to the power plant.



The health monitoring program incorporates a series of clinical and pathological examinations (where

The health monitoring program incorporates a series of clinical and pathological examinations (where applicable), as well as laboratory analyses. Clinical examinations are conducted on 30 pigs from each piggery, including sows, suckling piglets, and replacement gilts. Parameters such as habitus, respiratory rate, nasal discharge, heart rate, rectal temperature, and depth of breathing are assessed, and coughing severity is recorded in gilt houses. The objective is to determine if the animals are clinically sound.

Laboratory analyses involve the following tests:

- Haemoglobin determinations from suckling piglets using a HemoCue Hb 201+ autoanalyzer. Haemoglobin is the protein in red blood cells responsible for transporting oxygen throughout the body. In piglets, haemoglobin levels can be influenced by various factors, including nutrition, iron levels, disease, and environmental conditions. Poor air quality can potentially affect haemoglobin synthesis.
- Full blood counts (FBC) on sows and gilts. FBC is a comprehensive blood test that measures various components of the blood, including red blood cells, white blood cells, and platelets. By examining the levels and types of white blood cells (such as neutrophils, lymphocytes, eosinophils, basophils, and monocytes), FBC can help detect signs of infection and inflammation.
- Acute phase biomarker (Amyloid A) levels from sows and replacement gilts. Amyloid A is an acute-phase protein whose levels in the blood increase in response to inflammation making it an indicator of the body's reaction to various stressors, including infections and environmental stress.
- Nasal swabs collected from replacement gilts to test for Glaesserella parasuis (Glässer's disease). Glaesserella parasuis is a commensal organism in the upper respiratory tract of pigs, under stressful conditions, such as poor air quality, it can potentially proliferate and cause disease.

Elevated rates of positive tests, even in the absence of clinical signs, can indicate a compromised respiratory environment.

Findings:

Rietfontein (Control Piggery):
Clinical examinations found all animals clinically normal. Haemoglobin levels were normal in 80% of piglets, with 20% showing low levels but not anaemic. Amyloid A levels were below the reference range, indicating no significant inflammation. Full blood counts revealed one gilt with lowered lymphocyte and neutrophil counts, suggesting a possible subclinical infection or lowered immune system. Nasal swabs detected one positive and one weak positive result for Glaesserella parasuis, though no clinical signs of Glässer's disease were observed.

Nucleus A:
Clinical examinations identified one gilt with an elevated rectal temperature, with other animals normal. Haemoglobin levels were normal in 37% of piglets, with 20% showing low levels and 43% anaemic. Amyloid A levels were normal. Full blood counts indicated increased neutrophil counts in two gilts and lowered lymphocyte counts in another two. Nasal swabs detected two positive results for Glaesserella parasuis, no clinical signs of Glässer's disease were observed.

Multiplier:
All animals were clinically normal. Haemoglobin levels were normal in 86.7% of piglets, with 13.3% showing low levels. Amyloid A levels were normal. Full blood counts revealed some animals with lowered lymphocyte and neutrophil counts, suggesting potential subclinical infections or immune system issues. One nasal swab tested positive for Glaesserella parasuis, no clinical signs of Glässer's disease were observed.

Research:
Clinical examinations found all animals normal. Haemoglobin levels were normal in 70% of piglets, with 26.7% showing low levels and 3.3% anaemic. Amyloid A levels were normal. Full blood counts indicated one sow with a lowered lymphocyte count and one gilt with a lowered neutrophil count. One nasal swab tested positive for Glaesserella parasuis, no clinical signs of Glässer's disease were observed.

GHB Spitskop:
All animals were clinically normal. Haemoglobin levels were normal in 20% of piglets, with 66.7% showing low levels and 13.3% anaemic. Amyloid A levels were normal. Full blood counts revealed one sow with a

moderately high neutrophil count and another with elevated neutrophil and lowered lymphocyte counts, suggesting potential subclinical infection. Two nasal swabs tested positive for Glaesserella parasuis, no clinical signs of Glässer's disease were observed.

Discussion:

In the initial results of the animal health monitoring program, the control piggery, Rietfontein, showed better overall health metrics compared to the piggeries near the Khusile Power Station. Lower haemoglobin levels and more frequent subclinical infections were observed in the piggeries near the power station. However, since only the initial dataset is available, these results should be interpreted with caution. Continuous monitoring and further investigation are recommended to understand the long-term effects and potential health risks associated with air quality around the piggeries included in the health monitoring program.

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GHB Farms Health Monitoring system 2023/10/12

The Proposed health monitoring system will include bi-weekly clinical visits and sampling procedures across all units at GHB Farms Spitskop farm. Clinical visits and sampling procedures will be done monthly at GHB Farms Rooipoort unit in Gauteng, which will serve as the control unit for result comparison. The bi-weekly and monthly visits will encompass the following activities:

<u>Clinical and pathological examination</u>

- Clinical examination of 30 pigs (10 sows, 10 suckling piglets, 10 replacement gilts):
    - The clinical examination will include an evaluation of the habitus, respiratory rate, nasal discharge, heart rate, rectal temperature, and depth of breathing.
    - Clinical assessments will be scored as follows:
        - Habitus:
            - 0 – normal
            - 1 - listless
        - Respiratory rate:
            - 0 – normal
            - 1 – slightly elevated
            - 2 – moderately elevated
            - 3 – clearly elevated, distinct abdominal breathing
        - Nasal Discharge:
            - 0 – absent
            - 1 – present
        - Coughing:
            - 0 – normal
            - 1 – mild
            - 2 – moderate
            - 3 – severe
        - Sneezing:
            - 0 – absent

        - 1 – present
    - Rectal temperature:
        - 0 – normal
        - 1 – elevated (above 40°C)
  - Gilt houses will be monitored for signs of coughing. The procedure will entail spending 10 min in a house, listening and recording signs of coughing and the severity thereof.
- Post-mortem examinations will be performed by the veterinarian on all mortalities that occurred on the day of the visit and from the day before. The post-mortem examinations will include the following:
  - Examination of all organs.
  - Specific emphasis will be placed on the respiratory tract and circulatory system.
    - This includes the presence or absence of pulmonary cranioventral multifocal consolidation and extension.
    - Changes in apical, cardiac, intermediate, and diaphragmatic lobes are recorded as per routine methods to arrive at a cumulative Final Visual Lung Score of 0 -100%.
  - Where any relevant pathological lesions are detected, samples will be collected for further laboratory analysis.
  - Routine sampling during post-mortems will include:
    - One lung sample per unit for histopathological testing.
    - One lung sample per unit for bacterial culture and antibiogram.
    - One liver sample per unit for heavy metal analysis. (Heavy metal testing required to analyse the effect of polluted wastewater)

<u>Sample collection and laboratory analysis:</u>

- Blood sampling protocol:
  - Peripheral venous blood will be obtained from the caudal auricular vein (lateral or central) and be used for Haemoglobin determination, this being measured on farm using a HemoCue Hb 201+ autoanalyzer.
  - Blood samples will be collected for onsite haemoglobin from 30 piglets prior to weaning.
  - If indicated based on clinical outcomes additional animals may be monitored for Haemoglobin.
- Where blood samples are required for laboratory examination for haematology (full blood count) and acute phase biomarkers (amyloid A), samples will be obtained as per laboratory requirements using 10 sows and 10 replacement gilts.

- Nasal swabs collected from 10 of the oldest replacement gilts.
    - Individual PCR testing performed on each swab to detect the presence of Glaesserella parasuis (Glässer's disease).
    - Poor air quality compromising the respiratory tract could exacerbate or provide an optimal lung environment for Glaesserella parasuis to proliferate. PCR testing for Glässer's is a way of monitoring lung health on the farm.

Training

- Routine staff training will involve the following:
    - Bi-annual training on the potential risks and clinical effects of poor environmental air quality on animal health.
        - The focus here will be on identifying clinical signs such as coughing, increased respiratory rates, sneezing, nasal discharges, and an increase in sudden deaths from heart failure.
    - Bi-annual post-mortem training
        - The focus here will be on identifying pathology related to poor air quality in respiratory and circulatory systems. Lesions to be noted will include signs of lung emphysema, heart failure and any pathology related to an infectious organism such as Glässers disease.
        - Staff members will be required to send photos of post-mortem findings to the responsible consulting veterinarian.

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TPSA Health Monitoring Protocol 2023/10/06

The Proposed health monitoring system will include bi-weekly clinical visits and sampling procedures across all units at Topigs Dalplaas farm. Clinical visits and sampling procedures will be done monthly at Topigs Rietfontein unit in Mpumalanga, which will serve as the control unit for result comparison. The bi-weekly and monthly visits will encompass the following activities:

<u>Clinical and pathological examination</u>

- Clinical examination of 30 pigs (10 sows, 10 suckling piglets, 10 replacement gilts):
    - The clinical examination will include an evaluation of the habitus, respiratory rate, nasal discharge, heart rate, rectal temperature, and depth of breathing.
    - Clinical assessments will be scored as follows:
        - Habitus:
            - 0 – normal
            - 1 - listless
        - Respiratory rate:
            - 0 – normal
            - 1 – slightly elevated
            - 2 – moderately elevated
            - 3 – clearly elevated, distinct abdominal breathing
        - Nasal Discharge:
            - 0 – absent
            - 1 – present
        - Coughing:
            - 0 – normal
            - 1 – mild
            - 2 – moderate
            - 3 – severe
        - Sneezing:
            - 0 – absent

        - 1 – present
    - Rectal temperature:
        - 0 – normal
        - 1 – elevated (above 40°C)
  - Gilt houses will be monitored for signs of coughing. The procedure will entail spending 10 min in a house, listening and recording signs of coughing and the severity thereof.
- Post-mortem examinations will be performed by the veterinarian on all mortalities that occurred on the day of the visit and from the day before. The post-mortem examinations will include the following:
  - Examination of all organs.
  - Specific emphasis will be placed on the respiratory tract and circulatory system.
    - This includes the presence or absence of pulmonary cranioventral multifocal consolidation and extension.
    - Changes in apical, cardiac, intermediate, and diaphragmatic lobes are recorded as per routine methods to arrive at a cumulative Final Visual Lung Score of 0 -100%.
  - Where any relevant pathological lesions are detected, samples will be collected for further laboratory analysis.
  - Routine sampling during post-mortems will include:
    - One lung sample per unit for histopathological testing.
    - One lung sample per unit for bacterial culture and antibiogram.
    - One liver sample per unit for heavy metal analysis. (Heavy metal testing required to analyse the effect of polluted wastewater)

<u>Sample collection and laboratory analysis:</u>

- Blood sampling protocol:
  - Peripheral venous blood will be obtained from the caudal auricular vein (lateral or central) and be used for Haemoglobin determination, this being measured on farm using a HemoCue Hb 201+ autoanalyzer.
  - Blood samples will be collected for onsite haemoglobin from 30 piglets prior to weaning.
  - If indicated based on clinical outcomes additional animals may be monitored for Haemoglobin.
- Where blood samples are required for laboratory examination for haematology (full blood count) and acute phase biomarkers (amyloid A), samples will be obtained as per laboratory requirements using 10 sows and 10 replacement gilts.
- Nasal swabs collected from 10 of the oldest replacement gilts.

- Individual PCR testing performed on each swab to detect the presence of Glaesserella parasuis (Glässer's disease).
- Poor air quality compromising the respiratory tract could exacerbate or provide an optimal lung environment for Glaesserella parasuis to proliferate. PCR testing for Glässer's is a way of monitoring lung health on the farm.

Training

- Routine staff training will involve the following:
  - Bi-annual training on the potential risks and clinical effects of poor environmental air quality on animal health.
    - The focus here will be on identifying clinical signs such as coughing, increased respiratory rates, sneezing, nasal discharges, and an increase in sudden deaths from heart failure.
  - Bi-annual post-mortem training
    - The focus here will be on identifying pathology related to poor air quality in respiratory and circulatory systems. Lesions to be noted will include signs of lung emphysema, heart failure and any pathology related to an infectious organism such as Glässers disease.
    - Staff members will be required to send photos of post-mortem findings to the responsible consulting veterinarian.

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TPSA Health Monitoring Costing table:

Dalplaas

Procedure	Quantity	Units	Visits per month	Hours	Travel	Price per unit	Total Price
Clinical visit and sampling Dalplaas		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
Haemoglobin testing Dalplaas	[redacted]	[redacted]	[redacted]			[redacted]	[redacted]
Haematology (Full blood count)	[redacted]	[redacted]	[redacted]			[redacted]	[redacted]
Acute phase reactants - Amyloid A	[redacted]	[redacted]	[redacted]			[redacted]	[redacted]
Nasal swab PCR Dalplaas	[redacted]	[redacted]	[redacted]			[redacted]	[redacted]
Lung histopathology Dalplaas	[redacted]	[redacted]	[redacted]			[redacted]	[redacted]
Heavy metal analysis liver Dalplaas	[redacted]	[redacted]	[redacted]			[redacted]	[redacted]
Lung bacterial culture and antibiogram Dalplaas	[redacted]	[redacted]	[redacted]			[redacted]	[redacted]
Interpretation of results and report writing (All units)	[redacted]		[redacted]	[redacted]		[redacted]	
Lab handling fee	[redacted]					[redacted]	[redacted]
Total excl. VAT							[redacted]

Rietfontein

Procedure	Quantity	Units	Visits per month	Hours	Travel	Price per unit	Total Price
Clinical visit and sampling Rietfontein		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
Haemoglobin testing Rietfontein	[redacted]	[redacted]	[redacted]			[redacted]	[redacted]
Haematology (Full blood count)	[redacted]	[redacted]	[redacted]			[redacted]	[redacted]
Acute phase reactants - Amyloid A	[redacted]	[redacted]	[redacted]			[redacted]	[redacted]
Nasal swab PCR Rietfontein	[redacted]	[redacted]	[redacted]			[redacted]	[redacted]
Lung histopathology Rietfontein	[redacted]	[redacted]	[redacted]			[redacted]	[redacted]
Heavy metal analysis liver Rietfontein	[redacted]	[redacted]	[redacted]			[redacted]	[redacted]
Lung bacterial culture and antibiogram Rietfontein	[redacted]	[redacted]	[redacted]			[redacted]	[redacted]
Lab handling fee	[redacted]					[redacted]	[redacted]
Total excl. VAT							[redacted]

Training All units

Procedure	Quantity	Units	Training per year	Hours	Travel	Price per unit	Total Price
Staff training Dalplaas		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
Staff training Rietfontein		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
Annual cost excl. VAT							[redacted]
Monthly cost excl. VAT							[redacted]

Total monthly cost excl. VAT	[redacted]

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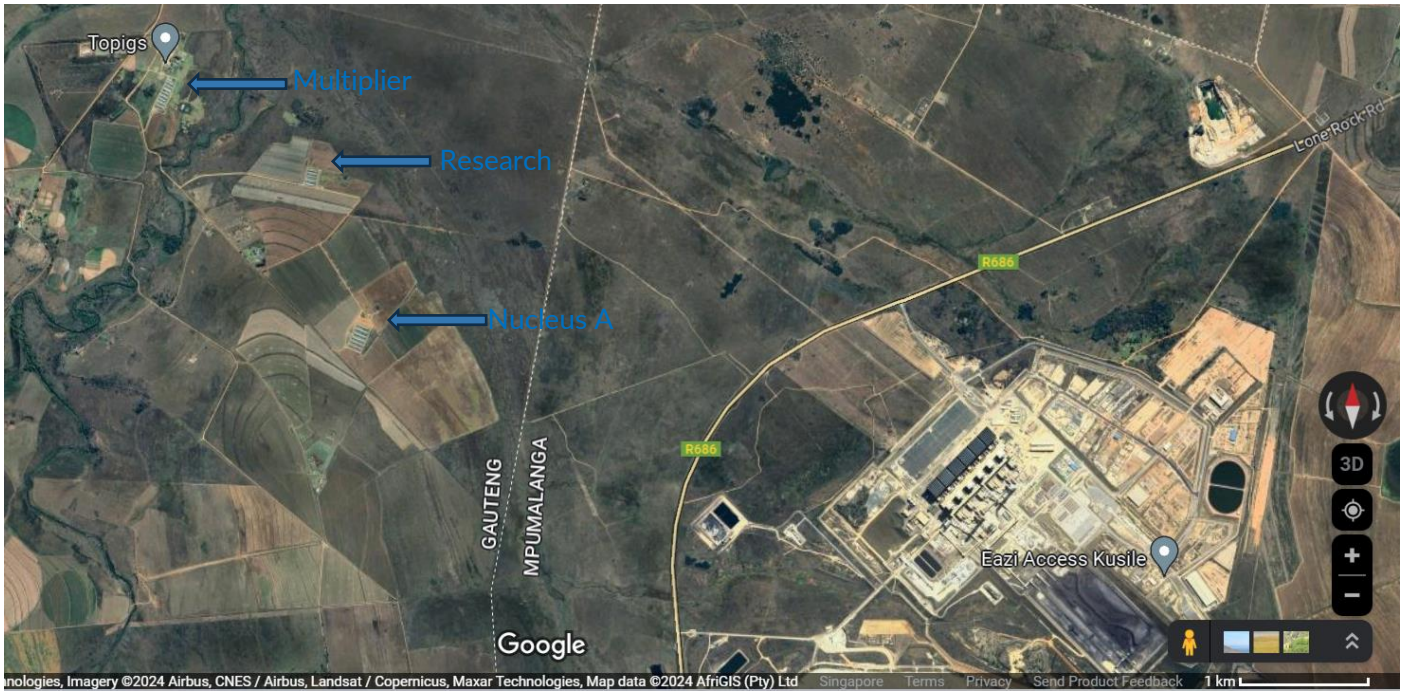
Animal Health Monitoring Summary Report May 2024



Rietfontein (Control Piggery in Mpumalanga province near Villiers):
Clinical examinations found all animals clinically normal and within expected parameters. Haemoglobin levels were normal in 73.3% of piglets, with 16.7% showing low levels and 10% anaemic. Amyloid A levels were below the reference range, indicating no significant inflammation. Full blood counts revealed one sow with an increased neutrophil count, suggesting a possible mild subclinical infection. Nasal swabs detected four positive and two weak positive results for Glaesserella parasuis, though no clinical signs of Glässer's disease were observed.

Nucleus A:
Clinical examinations identified all animals as clinically normal. Haemoglobin levels were normal in 16,7% of piglets, with 53,3% showing low levels and 30% anaemic. Haemoglobin levels in suckling piglets prior to weaning remain lower at Nucleus A compared to the other units. Amyloid A levels were normal. Full blood counts showed increased neutrophil counts in one sow alongside lowered lymphocyte counts in another three sows which may suggest possible sub clinical infections or low-level immune challenge. Nasal swab PCR tests indicated seven positive results for Glaesserella parasuis, no clinical signs of Glässer's disease were observed.

Multiplier:
All animals were clinically normal. Haemoglobin levels were normal in 100% of piglets, indicating a good result. Amyloid A levels were normal. Full blood counts revealed one gilt with an increased neutrophil count and a few animals with lowered lymphocyte counts, suggesting potential subclinical infections or immune system issues. Two nasal swabs tested positive for Glaesserella parasuis, with no clinical signs of Glässer's disease observed.

Research:
Clinical examinations found all animals normal. Haemoglobin levels were normal in 76,7% of piglets, with 20% showing low levels and 3.3% anaemic. Amyloid A levels were normal. Full blood counts indicated one sow with a lowered lymphocyte count and another sow with an increased neutrophil count possibly indicating subclinical infections. Four weak positive and three strong positive results detected on PCR for Glaesserella parasuis, no clinical signs of Glässer's disease were observed.

GHB Spitskop:
All animals were clinically normal. Haemoglobin levels were normal in 20% of piglets, with 60% showing low levels and 20% anaemic. Amyloid A levels were normal. Haematology results for all 20 animals tested were within the normal expected limits. Two nasal swabs tested positive for Glaesserella parasuis, with no clinical signs of Glässer's disease observed.

Discussion:

The health monitoring reports for Topigs SA farms indicate that, although most pigs appear clinically normal, there are significant concerns regarding low hemoglobin levels among suckling piglets, particularly in Nucleus A at Topigs Dalplaas, where anemia is prevalent. In GHB Spitskop, 80% of piglets show low to anemic hemoglobin levels. Furthermore, some sows and gilts exhibit mild hematological changes, which may suggest subclinical infections or immune challenges, with a higher prevalence noted at Dalplaas.

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