



Generation

Nkangala District Municipality
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Attention:

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AND

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Total number of pages:14

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DUVHA POWER STATION

Atmospheric Emission License 17/4/AEL/MP312/11/07

GENERAL MANAGER

2024/01/29

DATE

DUVHA POWER STATION MONTHLY EMISSIONS REPORT

Atmospheric Emission License
17/4/AEL/MP312/11/07



1 RAW MATERIALS AND PRODUCTS

Raw Materials and Products	Raw Material Type	Units	Maximum Permitted Consumption Rate	Consumption Rate Dec-2023
	Coal	Tons	1 400 000.00	519 013.75
Fuel Oil	Tons	5 000.00	6036.95	

Production Rates	Product / By-Product Name	Units	Maximum Production Capacity Permitted	Indicative Production Rate Dec-2023
	Energy	GWh	2 678.40	981.52
Ash	Tons	not specified	130 168.60	

Note: Maximum energy rate is as per the maximum capacity stated in the AEL: [3 600 MW] x 24 hrs x days in Month/1000 to convert to GWh

2 ENERGY SOURCE CHARACTERISTICS

Coal Characteristic	Units	Stipulated Range	Monthly Average Content
Sulphur Content	%	0.60 TO >1.20	0.60
Ash Content	%	27.00 TO 30.00	25.08

3 EMISSION LIMITS (mg/Nm³)

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

4 ABATEMENT TECHNOLOGY (%)

Associated Unit/Stack	Technology Type	Efficiency Dec-2023	Technology Type	SO ₃ Utilization Dec-2023
Unit 1	FFP	Off		
Unit 2	FFP	99.9%		
Unit 4	ESP + SO ₃	99.7%	SO ₃	99.9%
Unit 5	ESP + SO ₃	99.8%	SO ₃	99.6%
Unit 6	ESP + SO ₃	99.4%	SO ₃	97.2%

Note: ESP and FFP plants do not have a bypass mode operation, hence plant 100% utilised.

5 MONITOR RELIABILITY (%)

Associated Unit/Stack	PM	SO ₂	NO
Unit 2	100.0	95.2	95.2
Unit 4	100.0	99.5	100.0
Unit 5	100.0	100.0	98.8
Unit 6	100.0	100.0	100.0

Note: NO_x emissions is measured as NO in PPM. Final NO_x value is expressed as total NO₂

6 EMISSION PERFORMANCE

Table 6.1: Monthly tonnages for the month of December 2023

Associated Unit/Stack	PM (tons)	SO ₂ (tons)	NO _x (tons)
Unit 2	13.90	3 182	999
Unit 4	86.30	2 025	1 028
Unit 5	60.40	2 012	517
Unit 6	134.80	3 172	1 606
SUM	295.46	10 391	4 149

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

Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Total Exceedance	Average PM (mg/Nm ³)
Unit 2	25	0	0	0	0	11.40
Unit 4	28	0	0	0	0	65.70
Unit 5	21	2	0	0	2	58.30
Unit 6	20	4	0	0	4	91.50
SUM	94	6	0	0	6	

Table 6.3: Operating days in compliance to SO₂ AEL Limit - December 2023

Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Total Exceedance	Average SO ₂ (mg/Nm ³)
Unit 2	26	0	0	0	0	2 345.10
Unit 4	30	0	0	0	0	1 420.40
Unit 5	24	0	0	0	0	1 660.30
Unit 6	26	0	0	0	0	1 948.00
SUM	106	0	0	0	0	

Table 6.4: Operating days in compliance to NO_x AEL Limit - December 2023

Associated Unit/Stack	Normal	Grace	Section 30	Contravention	Total Exceedance
Unit 2	26	0	0	0	0
Unit 4	30	0	0	0	0
Unit 5	24	0	0	0	0
Unit 6	26	0	0	0	0
SUM	106	0	0	0	0

Note: NO_x emissions is measured as NO in PPM. Final NO_x value is expressed as total NO₂

Table 6.5: 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: Duvha Unit 2 PM Emissions - December 2023

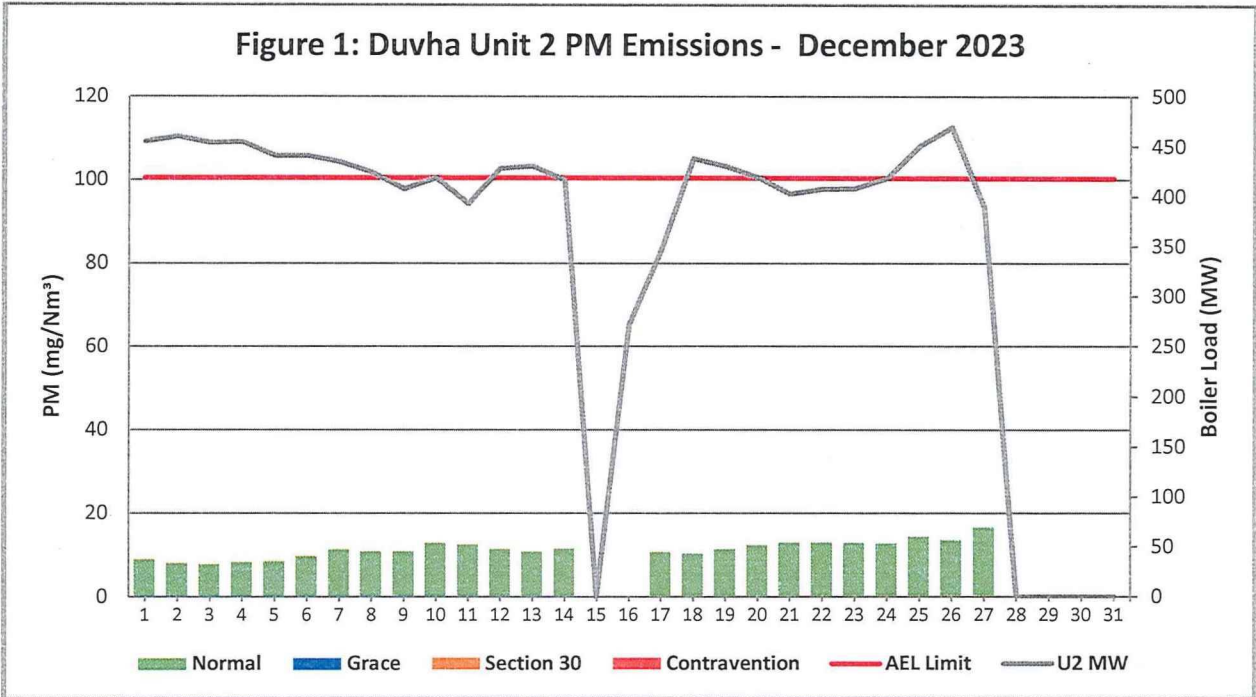


Figure 2: Duvha Unit 4 PM Emissions - December 2023

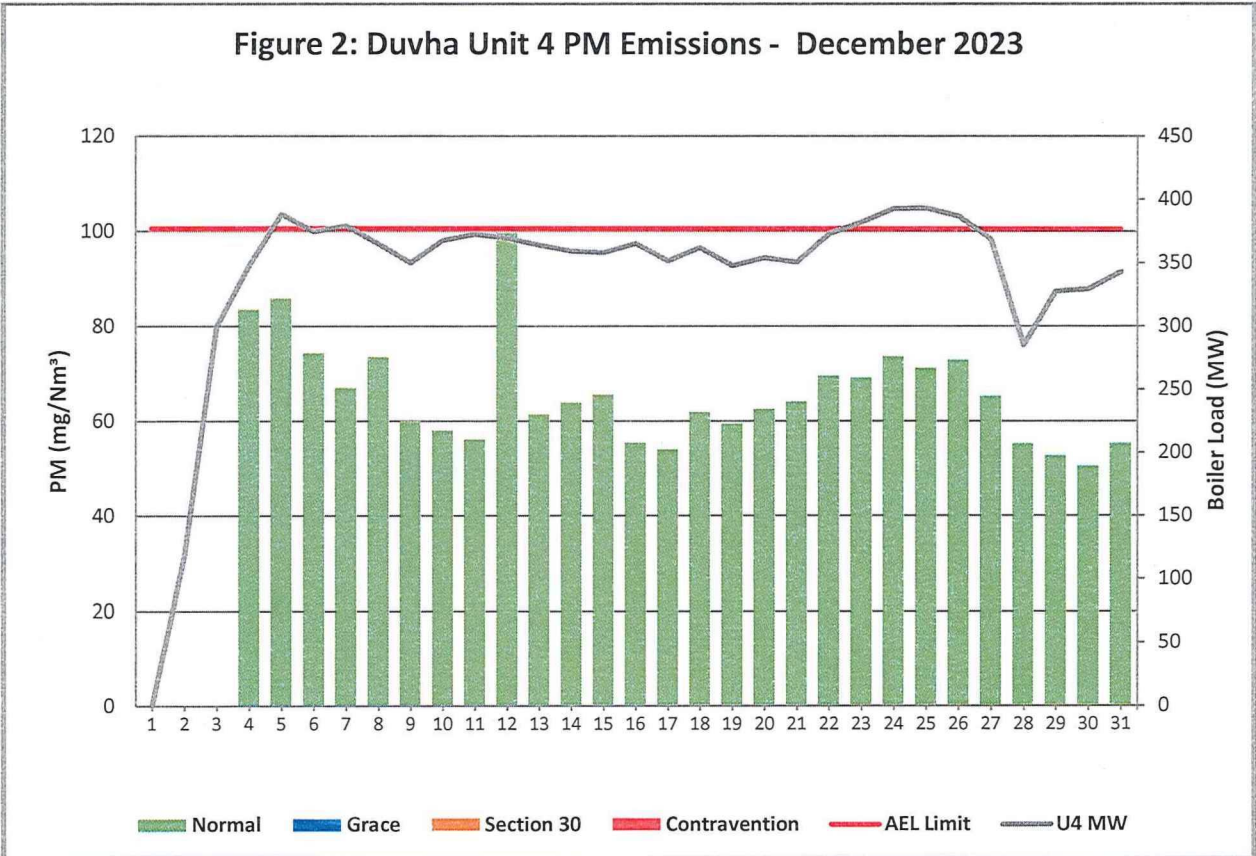


Figure 3: Duvha Unit 5 PM Emissions - December 2023

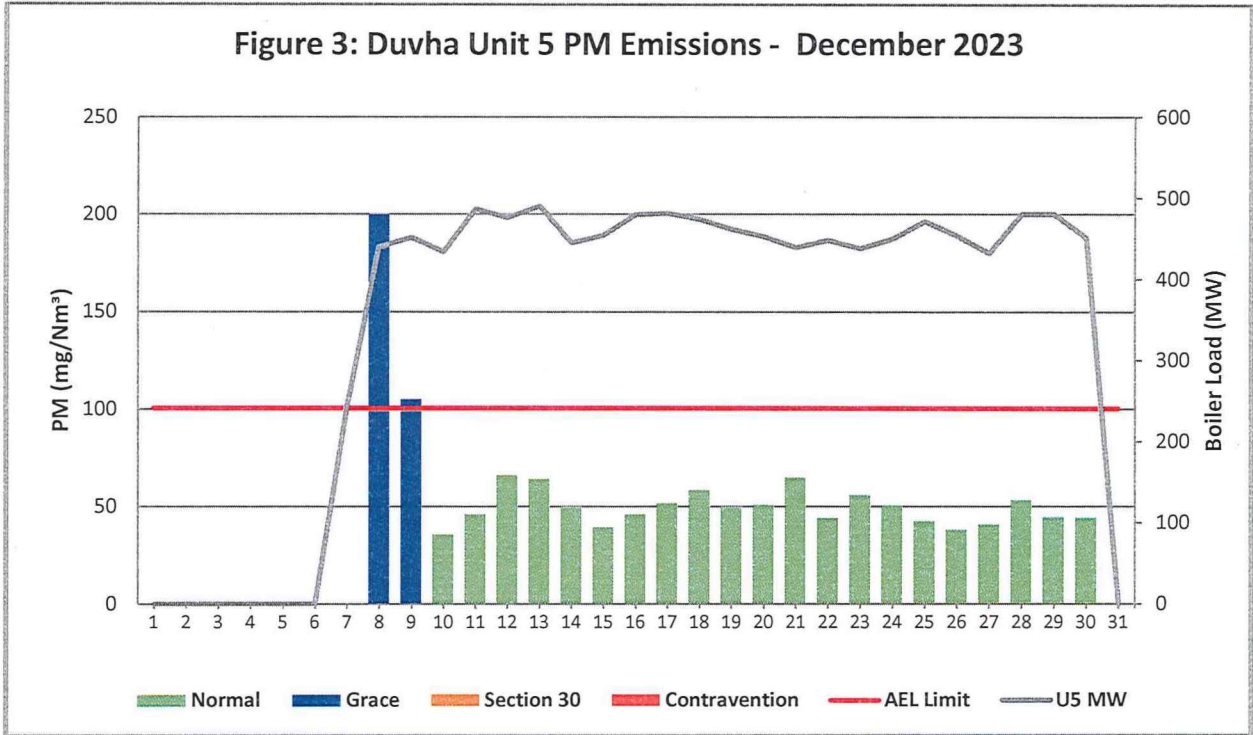


Figure 4: Duvha Unit 6 PM Emissions - December 2023

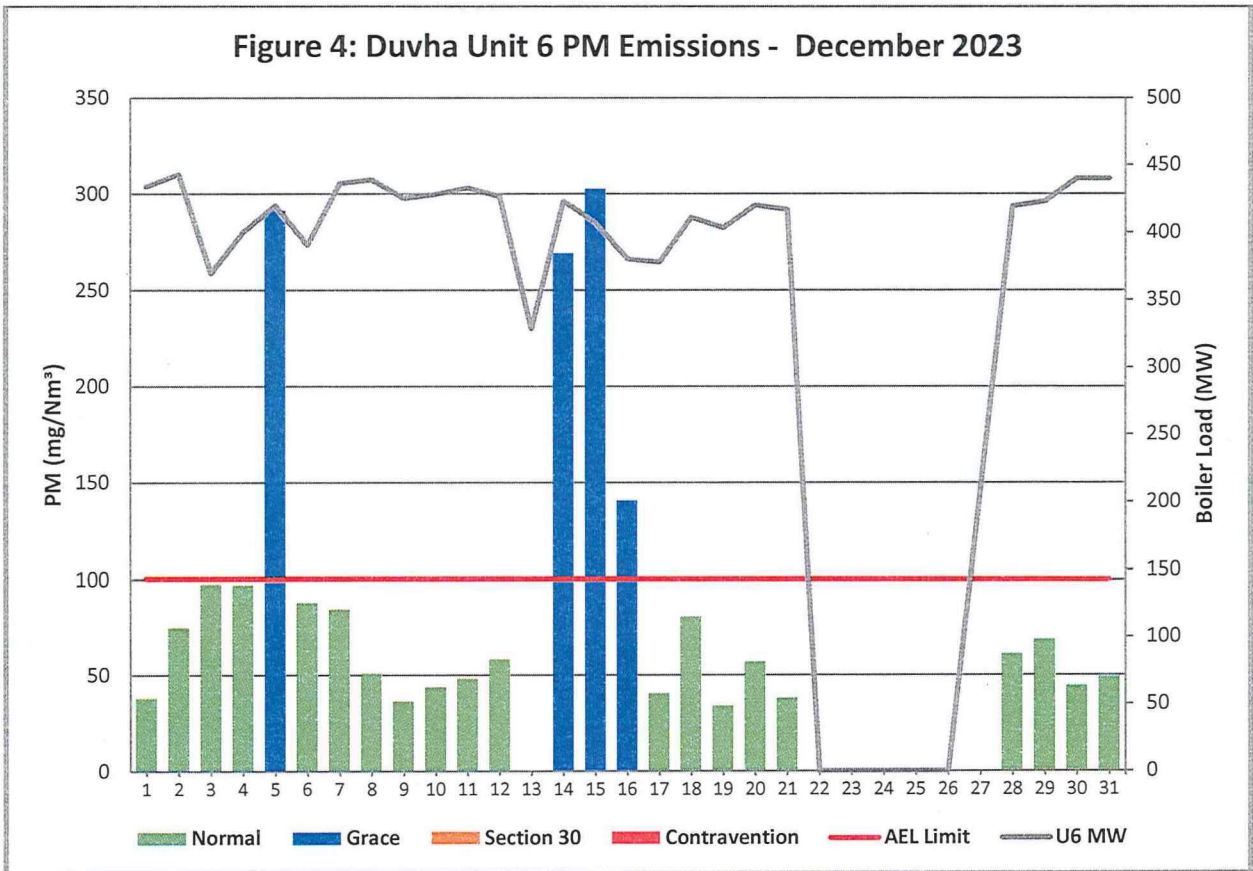


Figure 5: Duvha Unit 2 SO₂ Emissions - December 2023

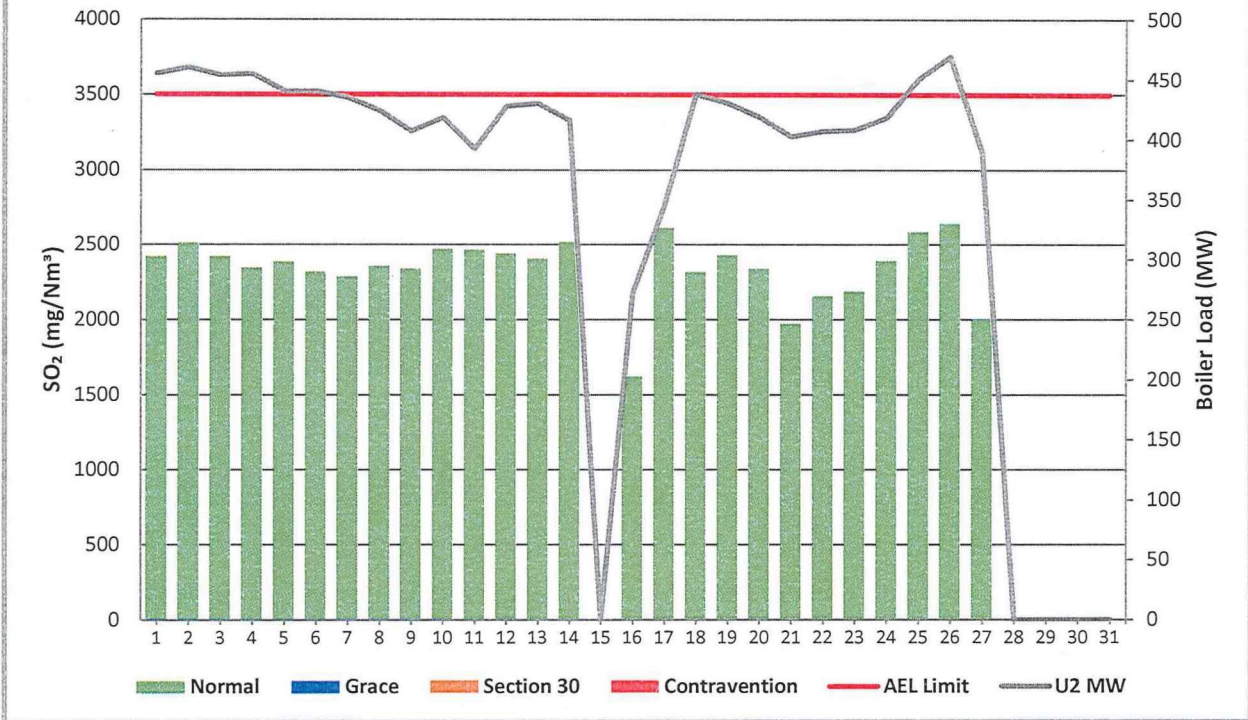


Figure 6: Duvha Unit 4 SO₂ Emissions - December 2023

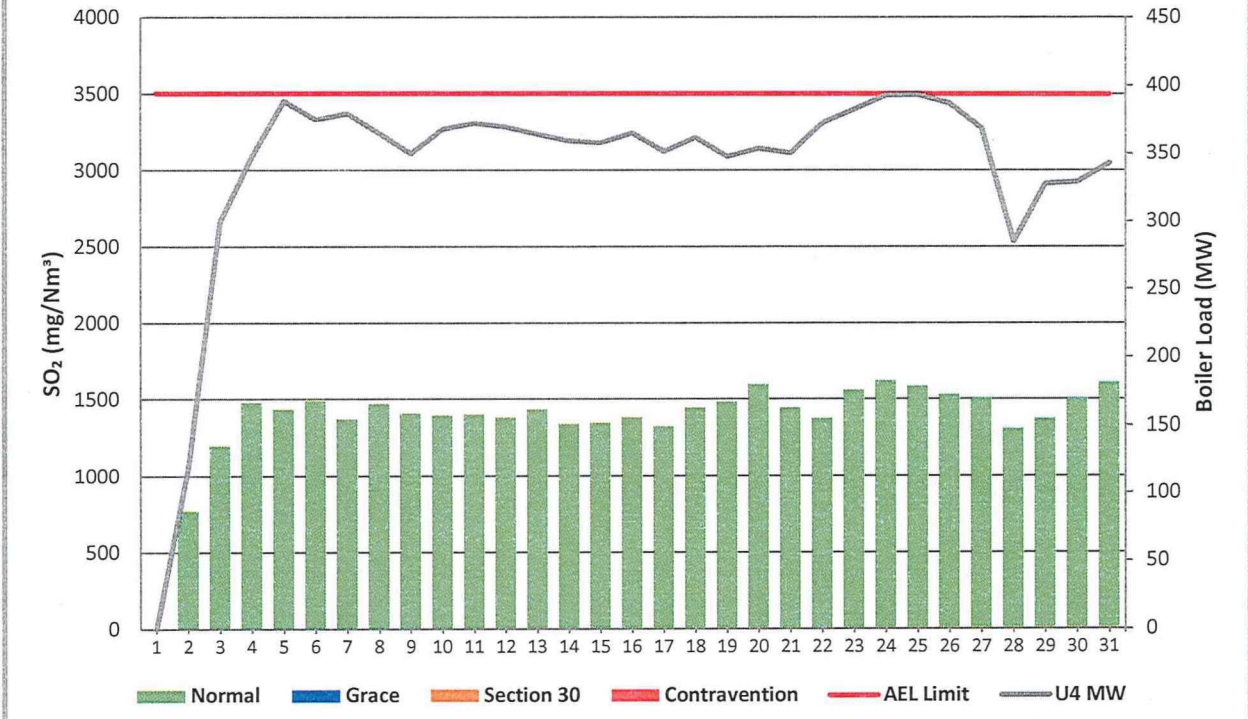


Figure 7: Duvha Unit 5 SO₂ Emissions - December 2023

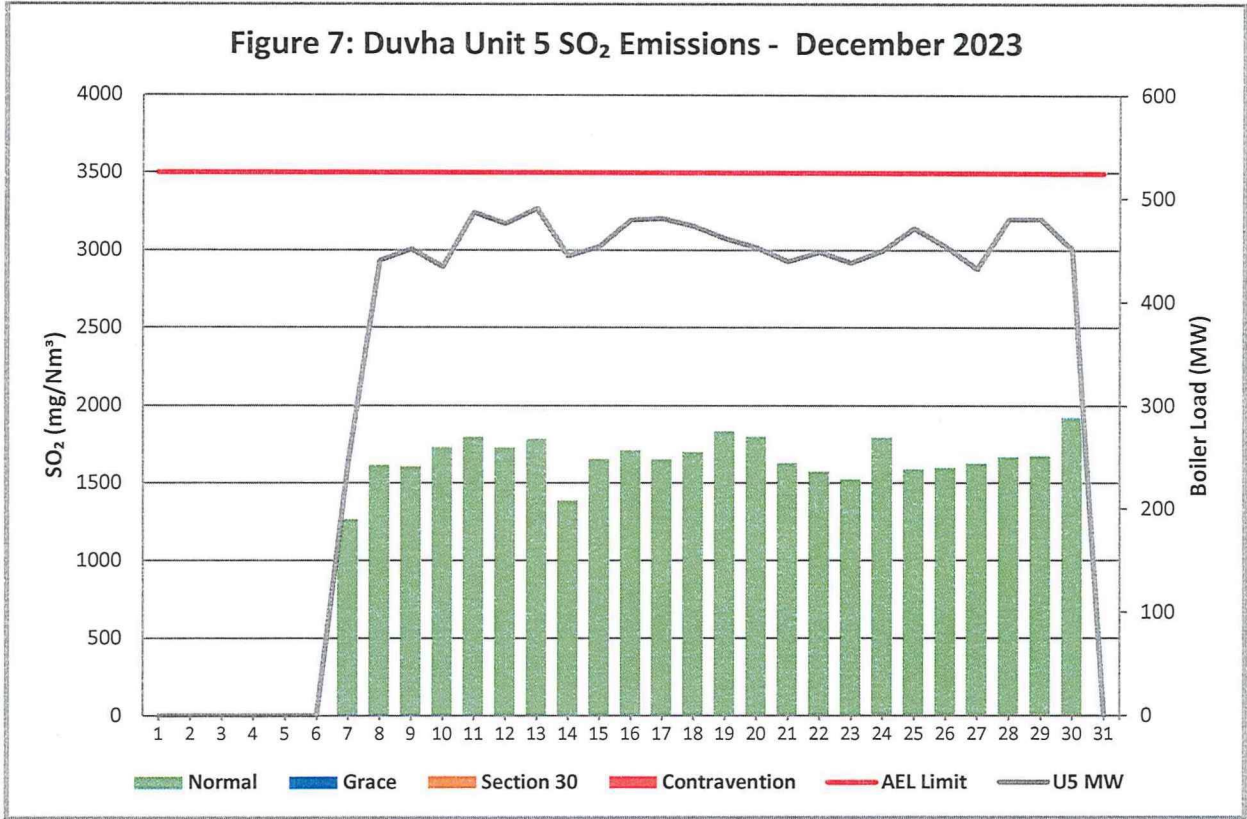


Figure 8: Duvha Unit 6 SO₂ Emissions - December 2023

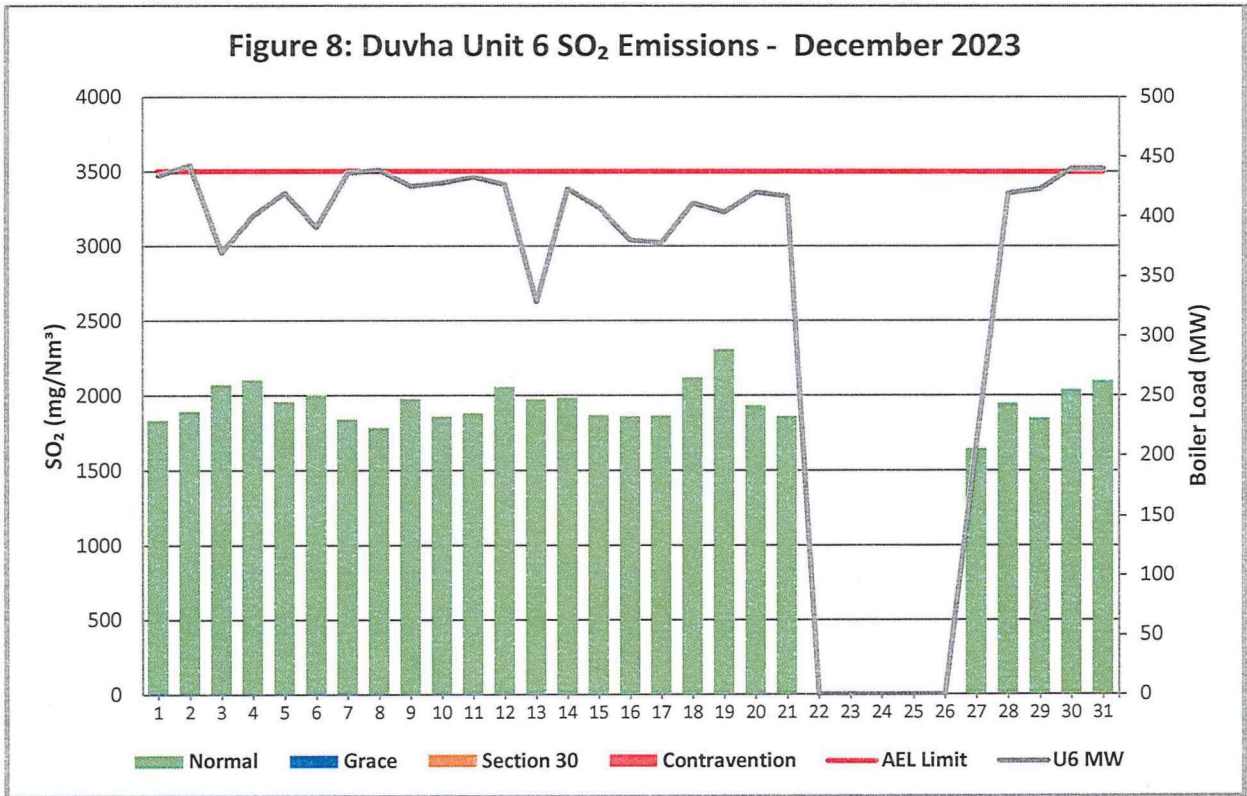


Figure 9: Duvha Unit 2 NOx Emissions - December 2023

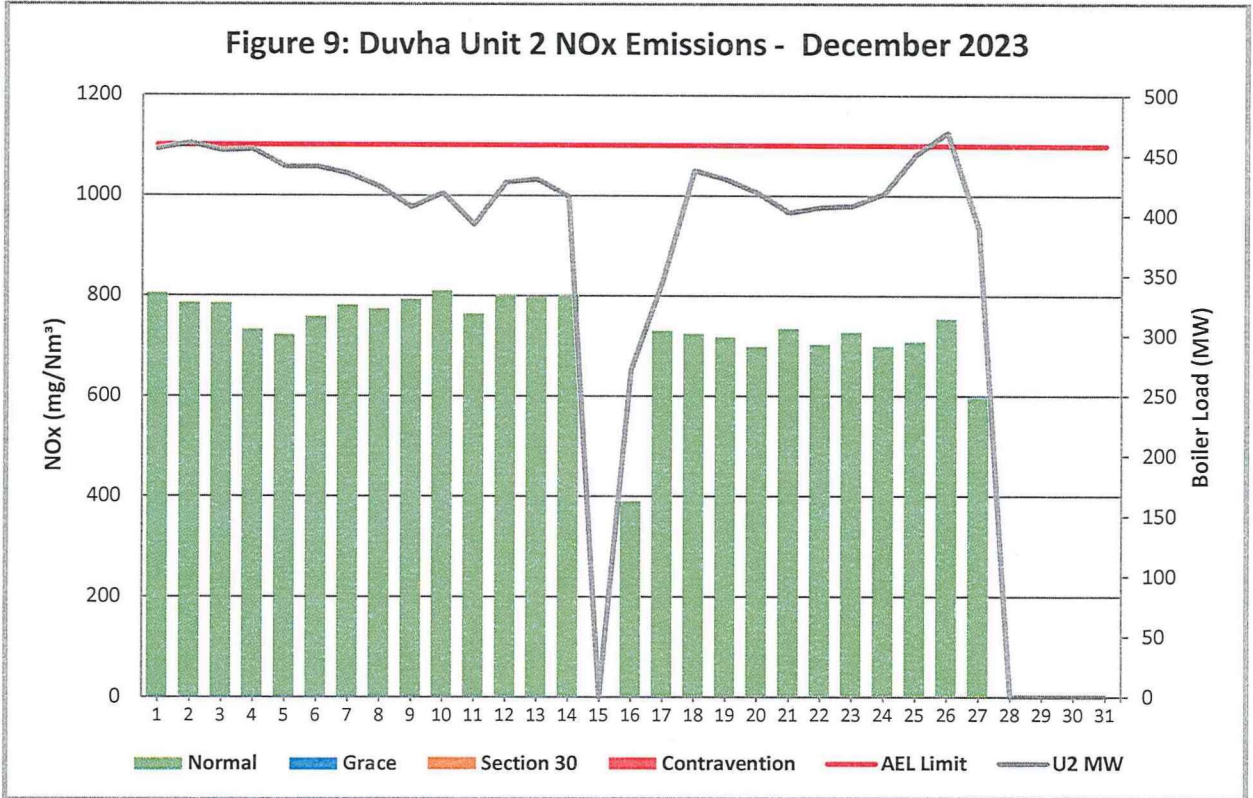


Figure 10: Duvha Unit 4 NOx Emissions - December 2023

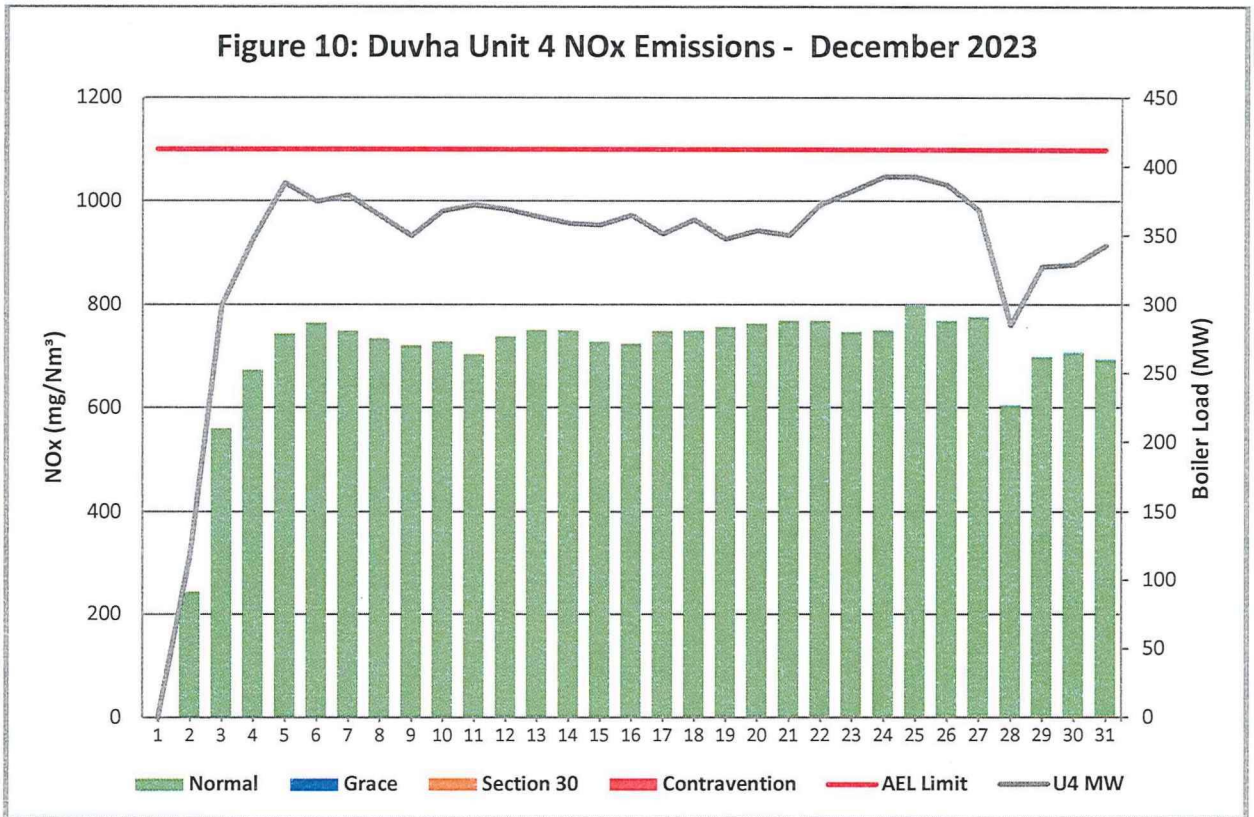


Figure 11: Duvha Unit 5 NOx Emissions - December 2023

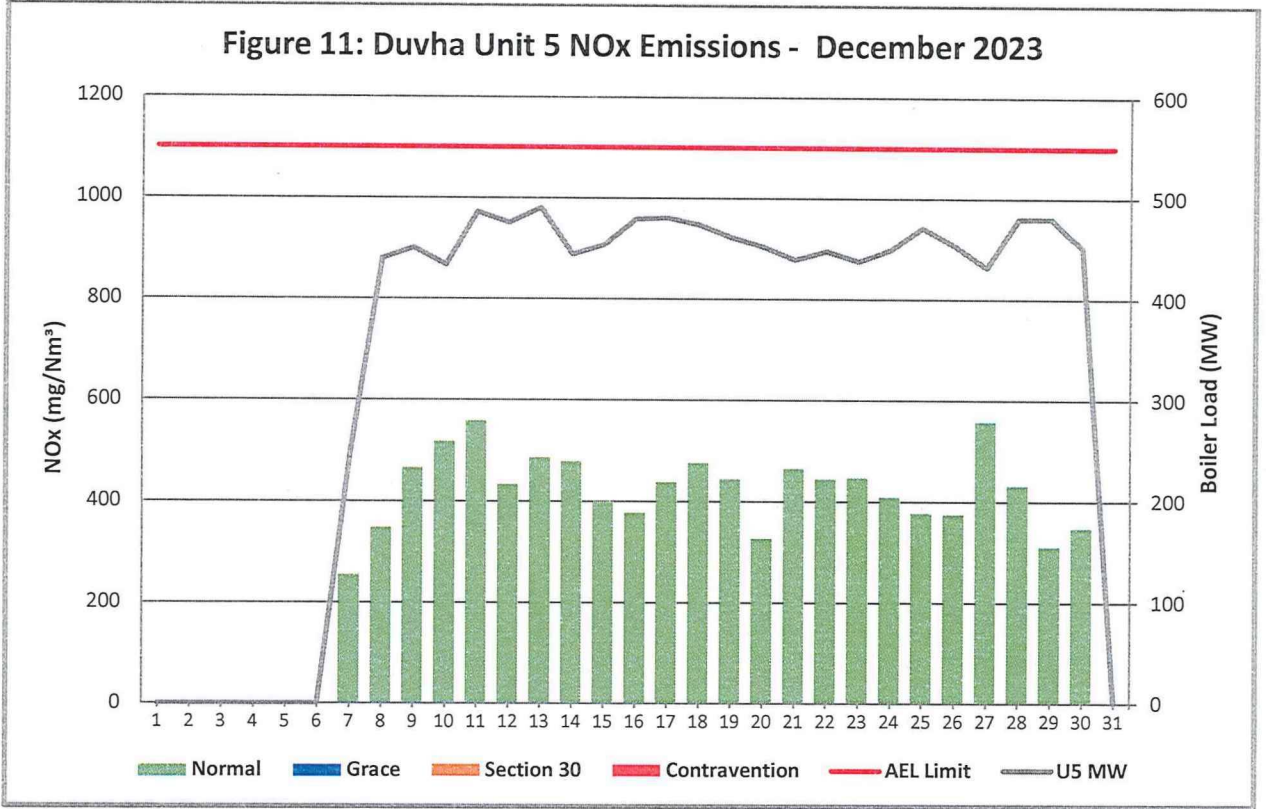
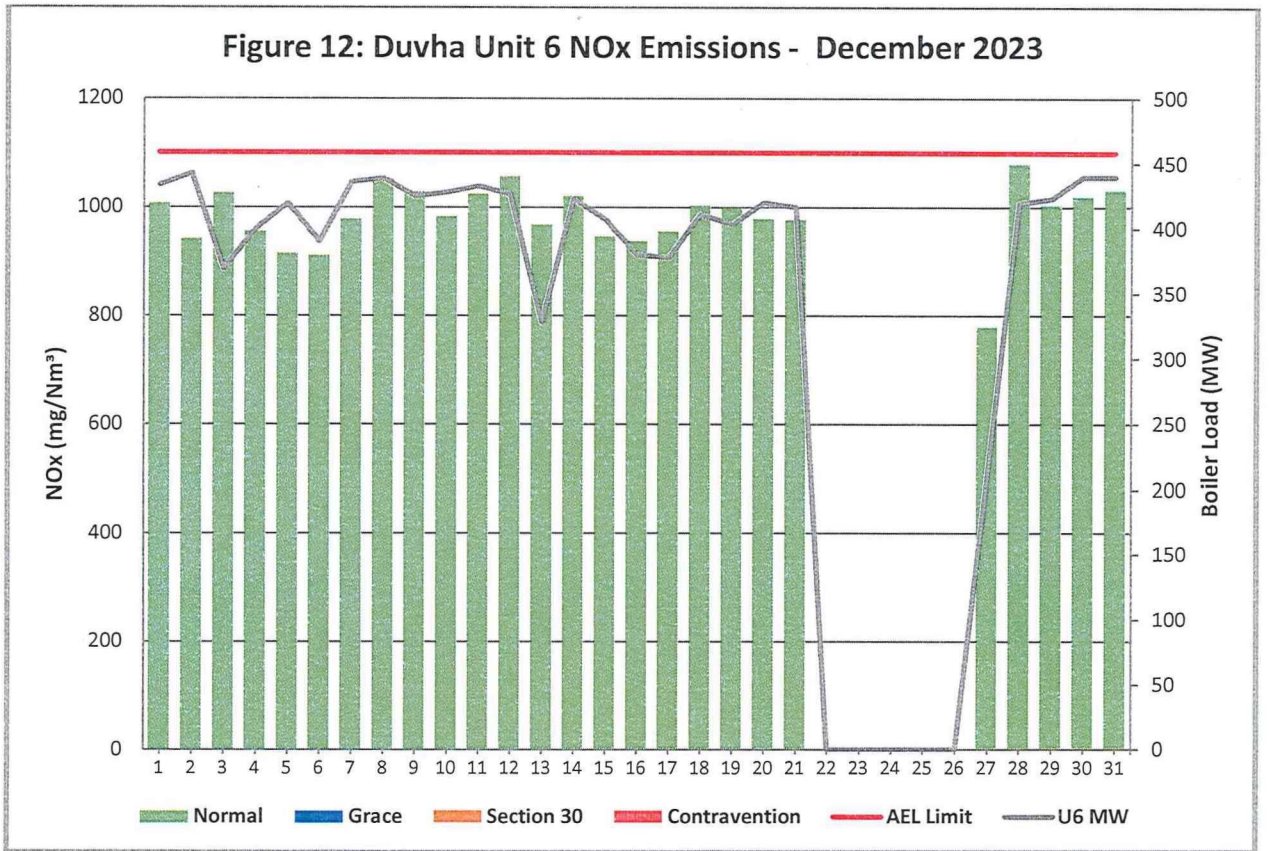


Figure 12: Duvha Unit 6 NOx Emissions - December 2023



7 SHUT DOWN AND LIGHT UP INFORMATION

Tables 7.1: Shut-down and light-up information for the month of December 2023

Unit No.2	Event 1		Event 2		Event 3	
Breaker Open (BO)	1:00 am	2023/12/11	1:05 pm	2023/12/14	4:40 am	2023/12/27
Draught Group (DG) Shut Down (SD)	DG did not trip or SD	DG did not trip or SD	3:35 pm	2023/12/14	9:25 pm	2023/12/27
BO to DG SD (duration)	n/a	DD:HH:MM	00:02:30	DD:HH:MM	00:16:45	DD:HH:MM
Fires in time			7:45 pm	2023/12/15		
Synch. to Grid (or BC)			1:00 am	2023/12/16		
Fires in to BC (duration)		DD:HH:MM	00:05:15	DD:HH:MM		DD:HH:MM
Emissions below limit from BC (end date)			not > limit	not > limit		
Emissions below limit from BC (duration)		DD:HH:MM	n/a	DD:HH:MM		DD:HH:MM

Unit No.4	Event 1		Event 2	
Breaker Open (BO)	BO previously	BO previously	1:55 am	2023/12/28
Draught Group (DG) Shut Down (SD)	n/a	n/a	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
Fires in time	12:35 pm	2023/12/02		
Synch. to Grid (or BC)	10:15 am	2023/12/03		
Fires in to BC (duration)	00:21:40	DD:HH:MM		DD:HH:MM
Emissions below limit from BC (end date)	12:00 am	2023/12/05		
Emissions below limit from BC (duration)	01:13:45	DD:HH:MM		DD:HH:MM

Unit No.5	Event 1		Event 2		Event 3	
Breaker Open (BO)	BO previously	BO previously	12:35 pm	2023/12/24	10:20 pm	2023/12/30
Draught Group (DG) Shut Down (SD)	n/a	n/a	1:45 pm	2023/12/24	12:35 am	2023/12/31
BO to DG SD (duration)	n/a	DD:HH:MM	00:01:10	DD:HH:MM	00:02:15	DD:HH:MM
Fires in time	10:30 am	2023/12/07	2:20 pm	2023/12/24		
Synch. to Grid (or BC)	3:50 pm	2023/12/07	10:10 pm	2023/12/24		
Fires in to BC (duration)	00:05:20	DD:HH:MM	00:07:50	DD:HH:MM		DD:HH:MM
Emissions below limit from BC (end date)	12:00 am	2023/12/10	8:00 am	2023/12/25		
Emissions below limit from BC (duration)	02:08:10	DD:HH:MM	00:09:50	DD:HH:MM		DD:HH:MM

Unit No.6	<i>Event 1</i>		<i>Event 2</i>	
Breaker Open (BO)	<i>1:55 pm</i>	<i>2023/12/12</i>	<i>2:20 pm</i>	<i>2023/12/21</i>
Draught Group (DG) Shut Down (SD)	<i>DG did not trip or SD</i>	<i>DG did not trip or SD</i>	<i>6:20 am</i>	<i>2023/12/23</i>
BO to DG SD (duration)	<i>n/a</i>	DD:HH:MM	<i>01:16:00</i>	DD:HH:MM
Fires in time				
Synch. to Grid (or BC)				
Fires in to BC (duration)		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

8 GENERAL

Unit 1 was not on load for the month of December 2023.

Exceedances:

Unit 5:

08 -09/12/2023

- Cold unit light up.

Unit 6:

05/12/2023

- SO3 plant tripped due to the power supply that was lost.

14-16/12/2023

- Cold unit light up.

The fuel oil usage for the month of December 2023 exceeded the permitted consumption rate. The investigation for the high fuel oil usage is completed and attached as an annexure to this report.

Lastly the averages Oxygen (O2) and Carbon Dioxide (CO2) data from the QAL 2 tests reports were used for reporting for gaseous emissions for Units 2, 4, 5, and 6 due to poor performance of the O2 and CO2 gaseous monitors. These poor performances of the gaseous monitors are due to faulty O2 analysers. The Station is in the process to replace all the faulty analysers by 31 March 2024.

The rest of the information demonstrating compliance with the emission license conditions is supplied in the annual emission report which will be sent to your office.

10 Complaints and S30 Incidents Register

Refer to addendum A


Boiler Plant Engineering
Manager

25/01/2024
Date


Environmental
Manager

2024/01/29
Date


Engineering Manager

2024-01-25
Date

Compiled by: Environmental Officer

For: Nkangala District Municipality Air Quality Officer

Copies: Generation Environmental Management D Herbst
B
Mccourt

Generation Compliance Management R
Rampiar
Generation Asset Management E Patel

Duvha Power Station: Engineering Manager
Operating Manager
Maintenance Manager
Production Manager
Boiler Engineering Manager
System Engineer
Environmental Manager



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Issue ID	100067390	Event Codes	Z02, Z06
Criticality	Level 3	Learner Group	Operating support, Boiler engineering, Environmental
Issue Date	2023/05/31	Reference Objects	03-00PE10 & 03-00PE20
Issue Time	00:01	Lead Investigator	Piet Chauke, 4535454
Investigating Body	Internal	Responsible Department	Process Engineering
Repeat	No	Report Due Date	2023/07/27

Issue Title: Exceedance of Atmospheric Emissions License (AEL) Fuel Oil Limit

1. PROBLEM STATEMENT

Exceedance of Duvha Power Station Atmospheric Emissions License (AEL) Fuel Oil Maximum Permitted Consumption rate (5000 tons per month) in the months of April 2023, May 2023 and June 2023. The Station has exceeded the Atmospheric Emissions License maximum permitted fuel oil consumption rate of 5000 tons per month. It exceeded the rate in April 2023 by 5743.68 tons, in May 2023 by 8511.36 tons and in the month of June 2023 by 7415.63 tons per month. This is non compliance to the Atmospheric Emissions License and it must be investigated to determine the causes and identify the actions that need to be taken to prevent re-occurrence.

2. SCOPE OF INVESTIGATION

The scope of the investigation is to identify the top contributors to the high fuel oil usage from April to June 2023 resulting in the station exceeding the AEL fuel oil maximum consumption rate across the units and put the necessary actions in place to reduce the fuel oil usage to an acceptable level.

3. DESCRIPTION OF THE EVENT

3.1. SEQUENCE OF EVENTS

Plant state before issue : (in bullet format)

- N/A

Chronological sequence of the event: (in bullet format)

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APRIL 2023

- There was a total of 4 unit trips in April 2023 predominantly from the 11 April 2023 to 21 April 2023.
- The total fuel oil usage across the units for April 2023 was 7107 Tons (> AEL of 5000 tons per month).
- Unit 6 is the highest contributor to the fuel oil usage (See table 1 below).

Table 1 below shows the fuel oil usage for the month of April 2023

	U1 fuel oil usage (T)	U2 fuel oil usage (T)	U4 fuel oil usage (T)	U5 fuel oil usage (T)	U6 fuel oil usage (T)
Total fuel oil consumption per month	1240	1199	1353	825	2491

- The mills unavailability and reliability is the highest contributor to the fuel oil usage.
- The recurring issues on the mills across all the units are as follows (See table 2 below):
 - (a) Reject box full. Failure to isolate the mill on load hence the mills must be shut down for reject box cleaning. Reject box inner door defective (burnt by not being rejected on time (lack of enough reject man from operating)
 - (b) Seal air fan vibrations. Bearing replacement and alignment. Poor quality and out of specification bearings used.
 - (c) Hydraulic oil leaks. Steel pipes subject to corrosion (exposed to water, PF, etc.). Pipes have reached end of life (they have never been replaced).
 - (d) Mills feeder stalling. Stone founds during inspection (Coal with high stone content).
 - (e) Constant shutdown for Mill A specifically on unit 6 due to high thermal excursions.
- It was also observed that there was constant oil burner support especially on the bottom mills leading to high fuel oil usage. Pyrometers clinking due to insufficient sootblowing (Poor sootblower availability).

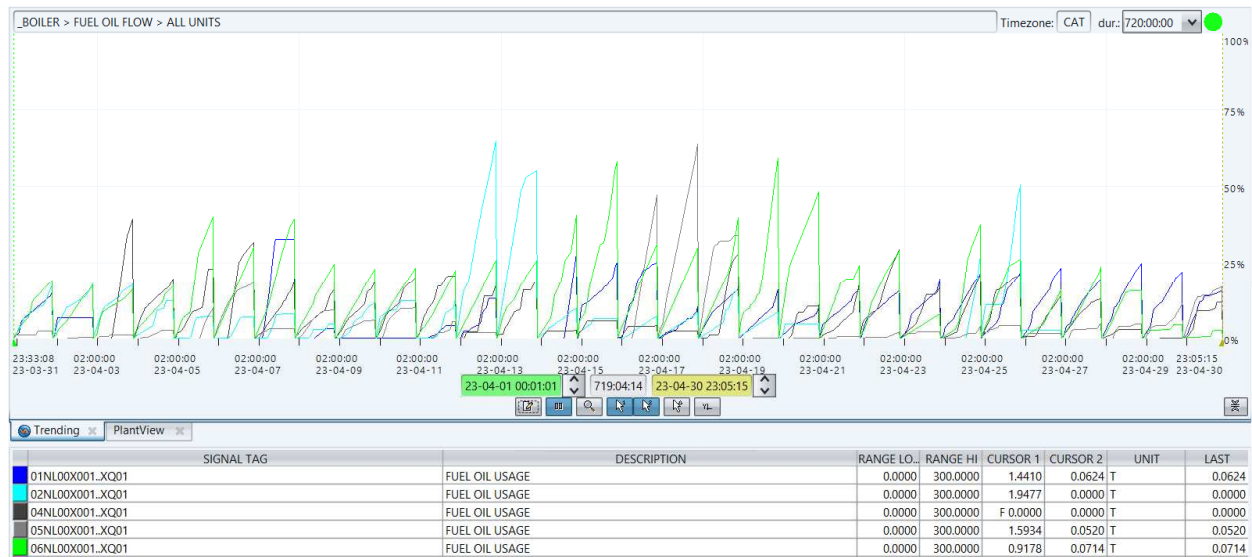


Figure 1: Fuel oil usage trend for the month of April 2023 across all the units

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Table 2: Unitized daily fuel oil usage for the month April 2023



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Time	U1 Fuel oil usage (01NL00X001..XQ01)	U2 Fuel oil usage (02NL00X001..XQ01)	U4 Fuel oil usage (04NL00X001..XQ01)	U5 Fuel oil usage (05NL00X001..XQ01)	U6 Fuel oil usage (06NL00X001..XQ01)	Total Tonnage	Remarks
2023/04/01 22:59	46.349	54.082	0	7.983	58.114	166.528	D MILL SHUT DOWN DUE TO REJECT BOX FULL.
2023/04/02 22:59	20.929	54.865	0	1.364	52.709	129.867	
2023/04/03 22:59	0	56.68	119.644	3.99	49.414	229.728	Unit 4 RTS (cold start) following a boiler tube leak repair
2023/04/04 22:59	0	37.374	59.619	8.235	52.871	158.099	C MILL SHUT DOWN DUE TO REJECT BOX FULL.
2023/04/05 22:59	0	21.887	68.688	31.772	122.625	244.972	6FP 6A tripped on working oil clr temp high capability operated take-out a mill MILL A TRIPPED. 5/H THERMAL EXCURSION COUNT 15HOURS NOT IMPROVING. BREAKER OPENED DUE TO EXCURSION
2023/04/06 22:59	0	21.125	95.237	55.113	91.289	262.764	Unit 4 RTS (Hot start) following a turbine trip on LFO (initiated by the LHID fan tripped on high vibrations).
2023/04/07 22:59	97.928	24.459	57.432	9.967	118.592	308.378	Unit 6B mill supported with oil bnrs bottom pyro not stable. 6b mill reject box full and hydr oil leak. 6B MILL CLINKER REMOVAL FROM OUTSIDE AND REPAIRS.
2023/04/08 22:59	10.196	14.879	49.575	28.59	74.927	178.167	6B MILL SHUT DOWN DUE TO REJECT BOX INNER DOORS NOT FUNCTIONAL & REJECT BOX FULL. 6b mill supported with oil bnrs bottom pyro not stable
2023/04/09 22:59	1.043	39.144	57.252	18.281	69.633	185.353	MILL 6C SHUT DOWN, FOR REJECT BOX CLEANING. 6C mill to weld inner door shaft 6b mill supported with oil bnrs bottom pyro not stable
2023/04/10 22:59	0.976	37.229	60.392	30.607	70.184	199.388	6c mill seal air fan faulty running one side cmp notified. 6C mill to replace innerdoor slide 6b mill supported with oil bnrs bottom pyro not stable. DELOADED FROM 400MW TO 330MW. COAL PRESERVATION
2023/04/11 22:59	13.155	40.692	62.284	16.795	68.689	201.615	support. Fmill tripped (stone in feeder). Lance s/blowing (B&C row fully supported with oil burners). A MILL SHUT DOWN DUE TO EXCURTION /S/H BOLER METAL TEMPS HIGH. 6b mill supported with oil bnrs bottom pyro
2023/04/12 22:59	40.243	196.512	54.006	5.949	78.374	375.084	US As per shift managers instruction - No sootblowing , exceeded stack emission last night:110.8 mg/Nm3 Day avg. 6b mill supported with oil bnrs bottom pyro not stable. 6A MILL IN SERVICE, FOR MILL CHANGE. 6B MILL SHUT DOWN, for reject box cleaning
2023/04/13 22:59	0.167	165.708	56.077	0	77.457	299.409	6B MILL SHUT DOWN. FOR REJECT BOX CLEANING. 6A MILL SHUT DOWN. THERMAL EXCURSION. 6b mill supported with oil bnrs bottom pyro not stable. C MILL SHUT DOWN REJECT BOX FULL
2023/04/14 22:59	88.12	31.203	8.204	0	126.01	253.537	6A MILL SHUT DOWN THERMAL EXCURSION. 6b mill supported with oil bnrs bottom pyro not stable. 6C MILL SHUT DOWN REJECT BOX FULL
2023/04/15 22:59	74.945	20.101	17.438	0	175.862	288.346	6B MILL SHUT DOWN. REJECT BOX FULL. 22 KV breaker closed and loading to block load 120 mw.
2023/04/16 22:59	75.631	22.773	12.768	145.696	95.475	352.343	6C MILL SHUT DOWN. REJECT BOX FULL MILL 6A FEEDER TRIPPED ON FEEDER STALL
2023/04/17 22:59	33.338	25.31	7.924	193.865	90.695	351.132	6b mill supported with oil bnrs bottom pyro not stable. B MILL SHUT DOWN HYDR OIL LEAK. A MILL SHUT DOWN FOR EXCURSION
2023/04/18 22:59	48.959	48.314	83.163	102.088	120.917	403.441	6b mill supported with oil bnrs bottom pyro not stable. UK declare a off risk tripped or possible force shut down unit not stable swiging 3 mill ldg
2023/04/19 22:59	49.318	26.802	0.743	0.752	182.571	260.186	6f mill hydr oil leak cmp attending 6b mill supported with oil bnr bottom pyro not stable.
2023/04/20 22:59	30.742	14.62	33.486	0.845	145.833	225.526	mill 6b reject line. blocked to be checked
2023/04/21 22:59	50.525	0	54.511	2.603	72.767	180.406	
2023/04/22 22:59	48.022	0	89.13	6.959	86.913	231.024	Unit 4 B4&E4 constantly i/s for combustion support. Lance s/blowing with full oil burner support on C,D&F. 6F MILL. TO CHANGE SEAL AIR FAN BEARINGS NUMBER 2 AND 5 AND DO ALIGNMENT
2023/04/23 22:59	60.447	0	50.362	6.806	24.668	142.283	DELOADING. SHUTTING DOWN MILL A FOR PF LEAK
2023/04/24 22:59	64.439	81.989	63.438	12.574	112.862	335.302	6A MILL TO REPAIR COAL GATE CHUTE. 6A MILL. TO CHANGE SEAL AIR FAN BEARINGS NUMBER 1,2 AND 5 AND DO ALIGNMENT. 6E mill to replace lub oil pump motor. 6B MILL SHUT DOWN FOR REJECT BOX FULL
2023/04/25 22:59	65.635	155.252	63.272	12.738	78.892	375.789	6A MILL IN SERVICE AFTER A STONE WAS REMOVED FROM THE FDR. 6b mill to remove dinker inside reject box
2023/04/26 22:59	70.153	8.191	42.379	5.715	48.58	175.018	6b mill to repair pf leak
2023/04/27 22:59	60.345	0	40.035	14.335	73.711	188.426	6b mill supported with oil bnrs bottom pyro not stable. 6D MILL SHUT DOWN FDR STALLED
2023/04/28 22:59	74.943	0	9.412	14.934	47.551	146.84	
2023/04/29 22:59	65.733	0	0.491	34.551	13.884	114.659	
2023/04/30 22:59	47.463	0	35.983	51.426	8.703	143.575	
SUM	1239.744	1199.191	1352.945	824.533	2490.772	7107.185	

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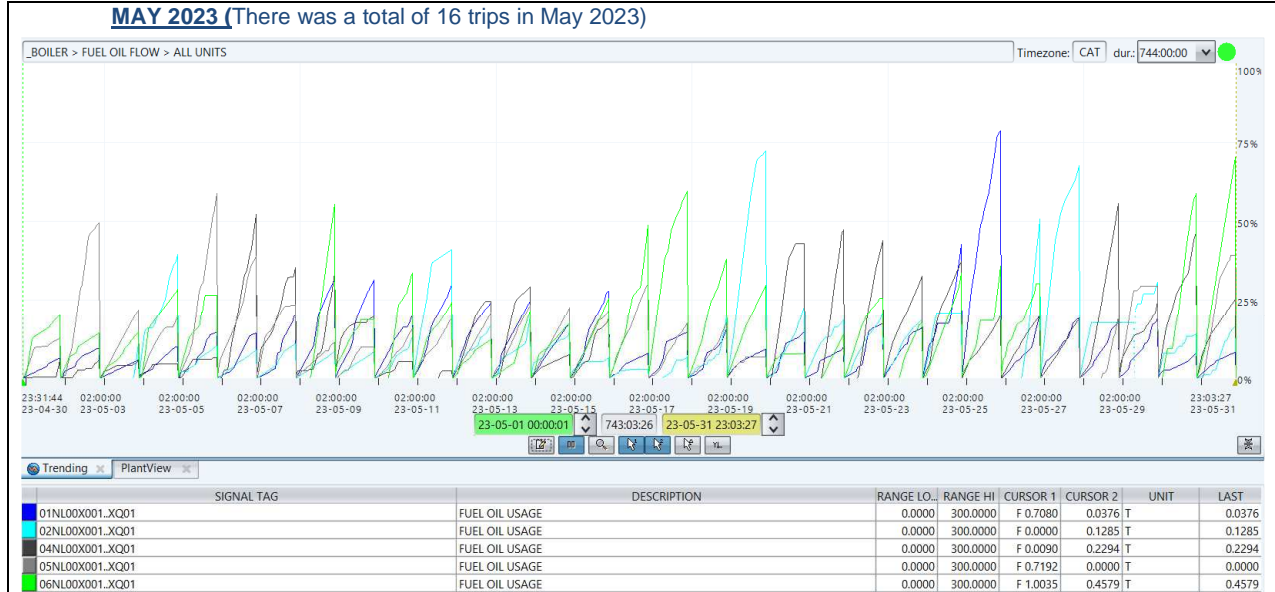


Figure 2: Fuel oil usage trend for the month of May 2023 across all the units

- There was a total of 16 unit trips in May 2023.
- The total fuel oil usage across the units for May 2023 was 9759 Tons (> AEL of 5000 tons per month).
- Unit 6 is the highest contributor to the fuel oil usage followed by unit 4 (See table 3 below).

Table 3 below shows the fuel oil usage for the month of May 2023

	U1 fuel oil usage (T)	U2 fuel oil usage (T)	U4 fuel oil usage (T)	U5 fuel oil usage (T)	U6 fuel oil usage (T)
Total fuel oil consumption per month	1858	1864	2045	1608	2384

- The mills unavailability and reliability is the highest contributor to the fuel oil usage.
- Unit 1 and 2 experiencing wet coal during this period contributing to unit trips and loadlosses (Risk assessment compiled and the actions were assigned to relevant department)
- The recurring issues on the mills across all the units are as follows (See table 4 below):
 - (f) Reject box full. Failure to isolate the mill on load hence the mills must be shut down for reject box cleaning. Reject box inner door defective (burnt by not being rejected on time (lack of enough reject man from operating).
 - (g) Seal air fan vibrations. Bearing replacement and alignment. Poor quality and out of specification bearings used.
 - (h) Hydraulic oil leaks. Steel pipes subject to corrosion (exposed to water, PF, etc.). Pipes have reached end of life (they have never been replaced).
 - (i) Mills feeder stalling. Stone founds during inspection (Coal with high stone content).
 - (j) Constant shutdown for Mill A specifically on unit 6 due to high thermal excursions.
- It was also observed that there was constant oil burner support especially on the bottom mills leading to high fuel oil usage. Pyrometers clinking due to insufficient sootblowing (Low sootblower availability).



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Table 4: Unitized daily fuel oil usage for the month May 2023



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Time	U1 Fuel oil usage (01NL00X001..XQ01)	U2 Fuel oil usage (02NL00X001..XQ01)	U4 Fuel oil usage (04NL00X001..XQ01)	U5 Fuel oil usage (05NL00X001..XQ01)	U6 Fuel oil usage (06NL00X001..XQ01)	Total Tonnage	Remarks
2023/05/01 22:59	19.653	0	18.839	38.537	62.003	139.032	U6 MILL F SHUTDOWN FOR CONDENSE B PASS ISOLATION
2023/05/02 22:59	29.528	0	18.209	149.202	43.907	240.846	U5 RTS following a boiler trip on "no steam flow prot"(2 IP governor valves failing to open). 6F MILL FEEDER, CLEANING, INSPECTION AND REPAIRS
2023/05/03 22:59	19.648	36.78	18.236	66.488	44.457	185.609	Mill 6B tripped via quick close damper due to coal hang up.
2023/05/04 22:59	31.205	119.569	13.914	60.387	86.937	312.012	U6 RTS (hot start) following a turbine trip on LFO (initiated by Mill F shutdown due to high seal air fan vibration). 6F MILL, TO CHANGE SEAL AIR FAN BEARING NUMBER 5 AND CLEAN THE FEEDER. 6B MILL SEAL AIR FAN REPAIRS[CHANGE BEARINGS NUMBER 2 AND 5]
2023/05/05 22:59	44.737	31.259	20.076	179.101	79.644	354.817	U5 RTS (hot start) following a turbine trip on LFO (initiated by LH ID fan trip on inboard brg temp). 6B MILL IN SERVICE AFTER A STONE WAS REMOVED FROM THE FDR. 6F MILL, TO CHANGE SEAL AIR FAN BEARING NUMBER 5 AND CLEAN THE FEEDER
2023/05/06 22:59	43.693	27.034	158.498	117.734	0	346.959	U4 RTS (hot start) following a turbine trip on LFO (initiated by lance sootblowers with no oil support on the top mills). U4 RTS (hot start) for the second time following a turbine trip on CC vacuum.
2023/05/07 22:59	62.701	33.223	107.286	71.284	0	274.494	
2023/05/08 22:59	94.943	25.939	102.263	34.136	167.459	424.74	U4 RTS following a turbine trip on LFO (initiated by RH A/H trip). 6D SAF to replace bearing no 2 & 5 and do alignment. U6 22KV BREAKED CLOSED.
2023/05/09 22:59	94.508	25.654	59.261	30.212	56.777	266.412	
2023/05/10 22:59	62.351	41.029	16.481	49.562	103.213	272.636	U6 RTS following a turbine trip on LFO (initiated by LH ID fan which tripped on earth fault). 6A mills seal air fans shut down as requested by hmd mills (cmp).
2023/05/11 22:59	92.083	123.754	7.603	59.294	74.809	357.543	
2023/05/12 22:59	73.658	50.933	73.741	64.35	37.421	300.103	
2023/05/13 22:59	74.963	62.211	88.316	71.497	66.907	363.894	6B MILL SHUT DOWN REJECT BOX FULL HYDR PRESS LOW CMP NOTIFIED
2023/05/14 22:59	53.737	45.98	23.133	68.651	53.604	245.105	
2023/05/15 22:59	84.229	20.044	59.08	65.904	77.823	307.08	Unit 6 LOAD REDUCED FROM 480MW TO 350MW FOR COAL PERSERVATION.
2023/05/16 22:59	24.144	9.003	0.209	90.218	148.93	272.504	U6 RTS following a boiler trip on att 1.1 temp (initiated by mill B hydraulic pipe burst). 6B MILL SHUT DOWN HYDR OIL PRESS LOW
2023/05/17 22:59	44.38	20.514	0	52.611	179.562	297.067	mill 6B to repair hydraulic oil leak
2023/05/18 22:59	48.004	60.383	0	53.991	115.026	277.404	6E mill supported with oil bnr bottom pyro not stable. MILL 6B . TO REMOVE CLINKER AND REPAIR INNER DOOR
2023/05/19 22:59	27.964	217.119	0	20.758	89.523	355.364	U2 RTS following a boiler trip on eco. Flow (EPP A seal water pump motor failure). 6E mill supported with oil bnr bottom pyro not stable
2023/05/20 22:59	45.047	71.188	128.813	0.305	23.336	268.689	U6 MILL D SHUTDOWN. REJECT BOX FULL, FAULTY INNER DOOR
2023/05/21 22:59	30.904	57.21	142.248	0	44.118	274.48	U4 RTS following a turbine trip on poor vacuum (Defective gov. valve/ faulty moog valve). Mill 6D SAF is pulling high amps after EMD checked it and USS was notified. MILL B HYDRAULIC OIL PRESSURE LOW
2023/05/22 22:59	54.47	65.079	133.664	0	76.791	330.004	U4 RTS following a turbine trip on poor vacuum (Defective gov. valve/ faulty moog valve). Mill 6D SAF is pulling high amps after EMD checked it and USS was notified. MILL B HYDRAULIC OIL PRESSURE LOW. B MILL SHUT DOWN. REJECT BOX FULL
2023/05/23 22:59	50.53	58.049	99.294	0	53.376	261.249	Mill 6B reported to be burning -mill to be taken out but B4 AND E4 oil burners fails to ignite.
2023/05/24 22:59	131.318	63.306	113.3	0	104.477	412.401	U1 RTS following a turbine trip on ROC (Wet coal, low mill outlet temps)
2023/05/25 22:59	236.369	0	61.189	0	110.588	408.146	U1 RTS following a turbine trip on ROC (Wet coal, low mill outlet temps). U6 RTS following a turbine trip on ROC. Mill 6E reject box is burning as per the reject man and preparing to shut it down.
2023/05/26 22:59	62.097	154.99	60.983	0	91.162	369.232	DELOADING TO 350MW. MILL 6B REJECT BOX FULL.
2023/05/27 22:59	58.447	204.176	57.347	0	0	319.97	6B mill supported with oil bnr bottom pyro not stable
2023/05/28 22:59	53.434	53.396	168.359	56.338	0	331.527	
2023/05/29 22:59	58.735	92.43	74.337	88.717	0	314.219	U5 RTS following a boiler trip on eco. Flow (Leak on the feed reg station)
2023/05/30 22:59	25.071	42.79	143.296	0	177.264	388.421	Unit 6 22 kv Breaker closed.
2023/05/31 22:59	25.475	51.232	77.203	118.292	215.278	487.48	U5 RTS following a turbine trip on FRF (Leak on RHT governor valves)
SUM	1858.026	1864.734	2045.178	2687.563	2894.392	9759.439	

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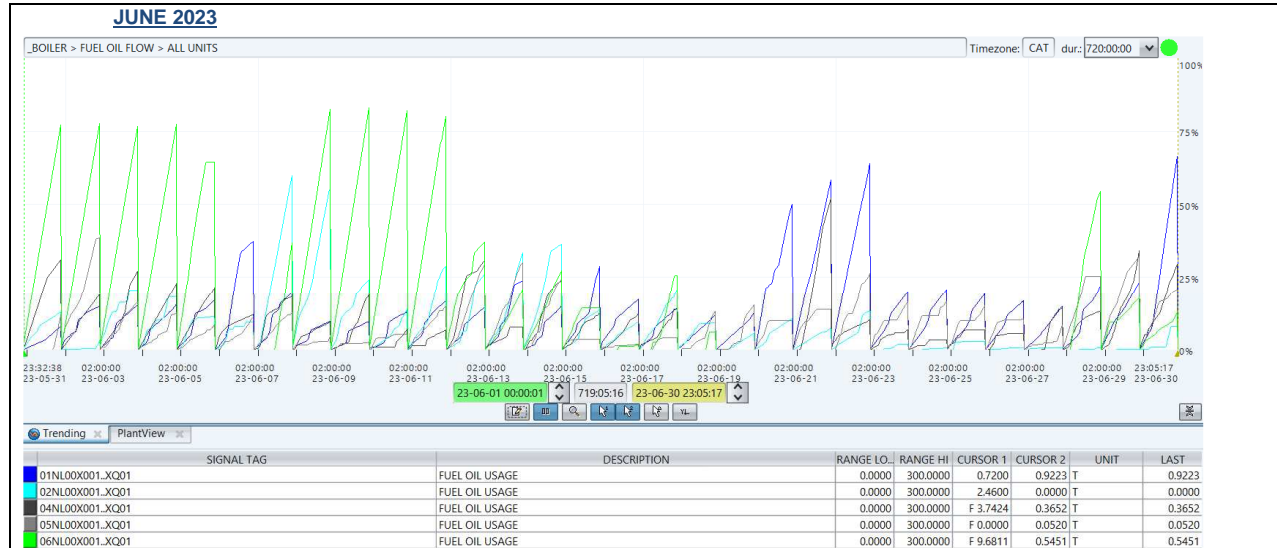



Figure 3: Fuel oil usage trend for the month of June 2023 across all the units

- There was a total of 3 unit trips in June 2023.
- The total fuel oil usage across the units for June 2023 was 9195 Tons (> AEL of 5000 tons per month).
- Unit 6 is the highest contributor to the fuel oil usage followed by unit 1 (See table 5 below).

Table 5 below shows the fuel oil usage for the month of June 2023

	U1 fuel oil usage (T)	U2 fuel oil usage (T)	U4 fuel oil usage (T)	U5 fuel oil usage (T)	U6 fuel oil usage (T)
Total fuel oil consumption per month	2102	1388	1428	1382	2894

- The mills unavailability and reliability is the highest contributor to the fuel oil usage.
- Unit 6 at half load for EFP A oil contamination (Unit on 3 mills loading with oil burner support). BFPT (Boiler feed pump turbine) unavailable.
- Unit 1 and 2 experiencing wet coal during this period contributing to unit trips and loadlosses (Risk assessment compiled and the actions were assigned to relevant department)
- The recurring issues on the mills across all the units are as follows (See table 6 below):
 - (k) Reject box full. Failure to isolate the mill on load hence the mills must be shut down for reject box cleaning. Reject box inner door defective (burnt by not being rejected on time (lack of enough reject man from operating)
 - (l) Seal air fan vibrations. Bearing replacement and alignment. Poor quality and out of specification bearings used.
 - (m) Hydraulic oil leaks. Steel pipes subject to corrosion (exposed to water, PF, etc.). Pipes have reached end of life (they have never been replaced).
 - (n) Mills feeder stalling. Stone founds during inspection (Coal with high stone content).
 - (o) Constant shutdown for Mill A specifically on unit 6 due to high thermal excursions.

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- It was also observed that there was constant oil burner support especially on the bottom mills leading to high fuel oil usage. Pyrometers clinkering due to insufficient sootblowing (Low sootblower availability).

Table 6: Unitized daily fuel oil usage for the month June 2023



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Time	U1 Fuel oil usage (01NL00X001..XQ01)	U2 Fuel oil usage (02NL00X001..XQ01)	U4 Fuel oil usage (04NL00X001..XQ01)	U5 Fuel oil usage (05NL00X001..XQ01)	U6 Fuel oil usage (06NL00X001..XQ01)	Total Tonnage	Remarks
2023/06/01 22:59	24.452	39.171	93.734	37.932	233.674	428.963	Rotek (cond and mon) notified to take mill 6C seal air fan vibrations. Mill 6B SAF to do repairs
2023/06/02 22:59	44.826	9.429	57.262	115.96	233.499	460.976	6C MILL REFURBISHMENT
2023/06/03 22:59	46.755	61.918	82.558	49.267	233.331	473.829	mill 6A , 6f and 6e mill supported with oil bnrns (Unit at half load, EFP A cooler cleaning)
2023/06/04 22:59	47.063	55.159	69.108	38.054	233.174	442.558	
2023/06/05 22:59	51.618	34.159	65.905	25.431	193.368	370.481	6A MILL SHUT DOWN FDR STALLED. 6D MILL SHUT DOWN REJECT BOX FULL. DECLARE TRIPPED RISK OR POSSIBLE FORCE SHUT DOWN TWO MILL LOADING.
2023/06/06 22:59	112.66	28.783	36.473	34.542	0	212.458	UNIT OFFLOAD
2023/06/07 22:59	59.08	179.512	55.102	38.264	110.667	442.625	Mill 6C feeder stone removed. As per shift managers instruction - unit 6 light up to be aborted since ash plant is not available for approximately 10 hours.
2023/06/08 22:59	29.656	166.569	28.442	13.011	251.216	488.894	
2023/06/09 22:59	29.339	72.474	57.626	7.822	250.483	417.744	Gen load 300 mw & 300 mw load loss due to Efp A on ptw.
2023/06/10 22:59	43.531	42.694	20.968	16.316	250.647	374.156	
2023/06/11 22:59	50.749	87.123	20.408	44.687	241.909	444.876	Gen load 310mw,290mw loadloss id fan @ max,both hp htr bank o/c, EFP 6A o/c oil contamination. 6D MILL SHUT DOWN. HYDRAULIC OIL PRESSURE LOW
2023/06/12 22:59	44.045	78.662	92.929	88.263	111.748	415.647	6F MILL SHUT DOWN. FEEDER STALL
2023/06/13 22:59	71.658	101.604	23.589	90.8	63.979	351.63	U2 RTS turbine tripped on LFO (Stone on Mill B feeder, Wet coal). 6D MILL FEEDER STALLED & MILL SHUT DOWN. 6D MILL IN SERVICE AFTER A LARGE STONE REMOVED FROM THE FEEDER.
2023/06/14 22:59	45.584	109.461	71.768	73.663	82.506	382.982	6C mill shut down reject box full. 6D MILL SHUT DOWN FDR STALLED. 6D MILL IN SERVICE AFTER A STONE WAS REMOVED FROM THE FDR
2023/06/15 22:59	88.975	41.785	38.226	11.802	43.435	224.223	
2023/06/16 22:59	52.377	29.158	37.019	4.971	5.863	129.388	6A MILL SHUT DOWN
2023/06/17 22:59	43.423	62.56	41.865	12.486	77.382	237.716	Unit 6 LH top pyrometers started swinging and D & F row i/s. 6D MILL SHUT DOWN DUE TO A FULL REJECT BOX. U6 TUBE LEAK DETECTORS NO.1,2,4,6,7,8 AND 22 ALL IN THE RED.USS AND SHIFT MANAGER NOTIFIED.
2023/06/18 22:59	35.941	27.99	0	40.255	18.123	122.309	Unit 6 22 KV BREAKER OPENED.
2023/06/19 22:59	38.232	17.169	0	46.823	0	102.224	U4&U6 UNIT OFFLOAD
2023/06/20 22:59	152.488	32.397	0	30.214	0	215.099	6C MILL SEAL AIR FAN REPAIRS
2023/06/21 22:59	176.781	22.572	157.776	41.553	0	398.682	U4 RTS following a boiler trip on pyro protection (BTL 16-33ml). U4 tripped on LFO during RTS (oil burner fall out)
2023/06/22 22:59	192.222	39.773	30.888	79.155	0	342.038	
2023/06/23 22:59	60.887	6.09	20.941	50.052	0	137.97	
2023/06/24 22:59	62.86	1.846	10.404	50.313	0	125.423	
2023/06/25 22:59	58.875	8.483	20.392	46.436	0	134.186	
2023/06/26 22:59	51.13	1.855	17.002	31.263	0	101.25	
2023/06/27 22:59	45.089	2.232	43.12	25.591	0	116.032	
2023/06/28 22:59	67.902	2.22	40.41	77.313	165.016	352.861	Unit 6 22 Kv breaker closed & loading to 115 mw (block load). 6D MILL SHUT DOWN DUE TO REJECT BOX FULL AND START TO BURN. Unit 6 as soon as we start a mill seal air fan lh a/h tripped,c mill fdr tripped,a crusher tripped,fuel oil booster p/p 6b tripped
2023/06/29 22:59	70.507	0.53	103.87	97.105	54.091	326.103	6D MILL SHUT DOWN REJECT BOX FULL AND BURNING
2023/06/30 22:59	203.654	24.273	90.713	62.746	40.196	421.582	
SUM	2102.359	1387.651	1428.498	1382.09	2894.307	9194.905	

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Plant state after issue: (in bullet format)

- N/A

4. INDIVIDUALS INTERVIEWED

Department	Name(Print)	Unique number	Date Interviewed
Boiler Engineering	Langelihle Nhlabathi	4126652	24/07/2023
Operating support	Bongi Gowa	3916937	20/07/2023
Environmental	Simthandile Nhlapo	1310151	19/07/2023
Environmental	Maqhawe Nkambule	4387969	19/07/2023
Milling Plant	Mzwakhe Simelane	4033064	19/07/2023

5. INVESTIGATION FINDINGS

Finding Number	Finding Details
5.1	High number of unit trips (16 trips in May 2023) leading to high fuel oil usage because of multiple unit light-ups
5.2	Frequent mill start-ups and shutdowns for maintenance (Reject box full)
5.3	Frequent mill start-ups and shutdowns for maintenance (Seal air fan vibrations)
5.4	Frequent mill start-ups and shutdowns for maintenance (Mill feeders stalling)
5.5	Frequent mill start-ups and shutdowns for maintenance (Hydraulic oil leaks)

6. CAUSES

6.1. Direct Cause

Cause Number	Description	Supporting Facts	Finding Number
6.1.1	N/A		

6.2. Contributory Causes

Cause Number	Description	Supporting Facts	Finding Number	IBI Codes
6.2.1	High number of overdue actions from the trip reduction strategy or investigations	SAP QIM actions status + Recovery action tracker	5.1	M8-01 Corrective actions not effectively implemented or adequate to prevent reoccurrence timeously.

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6.2.2	Lack of enough reject man from operating to reject the mills timeously	Interviews	5.2	F5-02 Staffing levels not optimised to support on-going work activities and unplanned activities, or plant events. M1-02 Personnel resource needs are not properly identified and / or not integrated into business, strategic or project plans.
6.2.3	Poor quality coal (coal with high stone content) leading to abnormal mill rejection	Interviews	5.2 +5.4	E1-03 Equipment operated outside of design specifications.
6.2.4	Poor quality and out of specifications bearings used on the seal air fans	Interviews	5.3	E3-02 Quality Assurance requirements not used or met during procurement process.
6.2.5	Mills hydraulic oil pipes overdue for replacement (Hence, the recurring pipe burst)	Interviews	5.5	E1-05 Failure caused as a result of component operated beyond expected lifetime.

7. IMMEDIATE ACTIONS TAKEN

Action Description	Taken By	Current Status
7.1 N/A		

8. CORRECTIVE ACTIONS (CA)

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Action	Cause Number Addressed	Priority	Due Date	Responsible Person (Name & Signature)	Effectiveness Review Date
8.1. Investigate and address the source of the coal with particle size out of specification (large stone content and the fines)	6.2.3&6.2.2	High	31/12/2023	Jeremia Malatjie p.p.	31/03/2024
8.2. Expedite the recommissioning of hammer sampler	6.2.3&6.2.1	High	30/11/2023	Jeremia Malatjie p.p.	28/02/2024
8.3. Inspect and determine the effectiveness of the grizzly bars at the staithes/bunkers and put measures in place to correct if necessary	6.2.3	High	31/12/2023	Jeremia Malatjie p.p.	31/03/2024
8.4. Verify that the stock description specifies the correct type of bearings to be used (Seal air fans)	6.2.4	High	26/08/2022 (Completed)	Ndwelani Tshiyhase 	
8.5. Generate the scope of work (for the mill hydraulic oil pipes) and provide to maintenance for execution during the refurbishment opportunity	6.2.5	Medium	30/09/2023	Ndwelani Tshiyhase 	31/12/2023

9. PREVENTATIVE ACTIONS (PA)

Action	Cause Number Addressed	Priority	Due Date	Responsible Person (Name & Signature)	Effectiveness Review Date

10. ADDITIONAL COMMENTS

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11. ATTACHMENTS

11.1. Figure 1: Fuel oil usage trend for the month of April 2023 across all the units

11.2. Figure 2: Fuel oil usage trend for the month of May 2023 across all the units

11.3. Figure 3: Fuel oil usage trend for the month of June 2023 across all the units

11.4. Table 1 below shows the fuel oil usage for the month of April 2023

11.5. Table 2: Unitized daily fuel oil usage for the month April 2023

11.6. Table 3 below shows the fuel oil usage for the month of May 2023

11.7. Table 4: Unitized daily fuel oil usage for the month May 2023

11.8. Table 5 below shows the fuel oil usage for the month of June 2023

11.9. Table 6: Unitized daily fuel oil usage for the month June 2023

11.10. Figure 4: North units mills seal air fan action plan

11.11. Figure 5: Coal particle size distribution

11.12. Figure 6: Stone removed from mill 2E and very fine coal

11.13. Figure 7: Risk assessment for wet coal


11.14. Figure 8: The fuel oil maximum permitted consumption rate

11.15. Additional information on non-compliance to the AEL license

12. APPROVAL

	Name(Print)	Unique number	Signature	Date
Compiler (s)	Piet Chauke	4535454		2023/08/17
Reviewer(s)				
GIR Chairperson	Maila Mamoleka	4198077		2023/08/23

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Fan Bearings		Eskom			
Risk to BU:		Low risk	High Risk	No immediate risk	
		Complete	Not started/On hold	On Track	Delayed/behind
Component	Risk status	Issues/Key focus	Actions	Resp. person	Due date
Fan Bearings	High Risk	Type of bearings used	Confirm that we are using the correct bearings	Mzwakhe Simelane	Completed
			Verify that the stock description specifies the correct type of bearings to be used if not to be corrected	Ndweleni Tshivhase	26/08/2022 Completed (description verified)
		Quality of Assembly at Works	Review QCPs (shaft, bearing/Plummer block) – ensure correct size reflected and review the intervention points	Sanny Masombuka	31/08/2022 QCP reviewed from the supplier; refer to FATIGUE FAILURE FEEDBACK below under my name.
			Quality of Installation and Assembly Onsite	Review Procedure and Parameters/QCPs (shaft, bearing/Plummer block) – ensure correct sizes and specification reflected • The procedure to clearly state that with every installation of a fan an Eskom personnel (Supervisor or Technician) must be present	Mzwakhe Simelane
		Review of contractor currently performing the seal air fan maintenance on sit to be done (e.g. Qualifications, correct tools etc.	Mzwakhe Simelane	30/09/2022 Qualifications for the guys doing the seal air fans received and they are using the correct tools	
		Relook at the frequency, grease quantity and	Mzwakhe	24/08/2022	

Figure 4: North units mills seal air fan action plan

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Specification for particle coal size distribution 

TABLE 2: INDICATOR VALUES

Parameter	Range	Value
Volatile Content		21.7%
Heat Involatiles		32%
Dry Ash Free Volatiles		30%
Ash Initial Deformation Temperature		1350°C
Hardgrove Index		55
Sulphur Content		0.87%
Size Distribution	+25mm	10%
	-25mm +12mm	20%
	-12mm +6mm	20%
	-6 mm +3mm	25%
	-3mm	25%

The Indicator Values will be reported on a daily basis.

The Indicator Values are to be applied in accordance with the provisions of the Agreement and are specifically applicable to clause 7 of the Agreement.

Figure 5: Coal particle size distribution

Findings 



- Stone removed from Mill E feeder which is >>60mm which is out of spec



- U1 and U2 Coaling from Staithe 1 and OTS
- Very fine

Figure 6: Stone removed from mill E and very fine coal

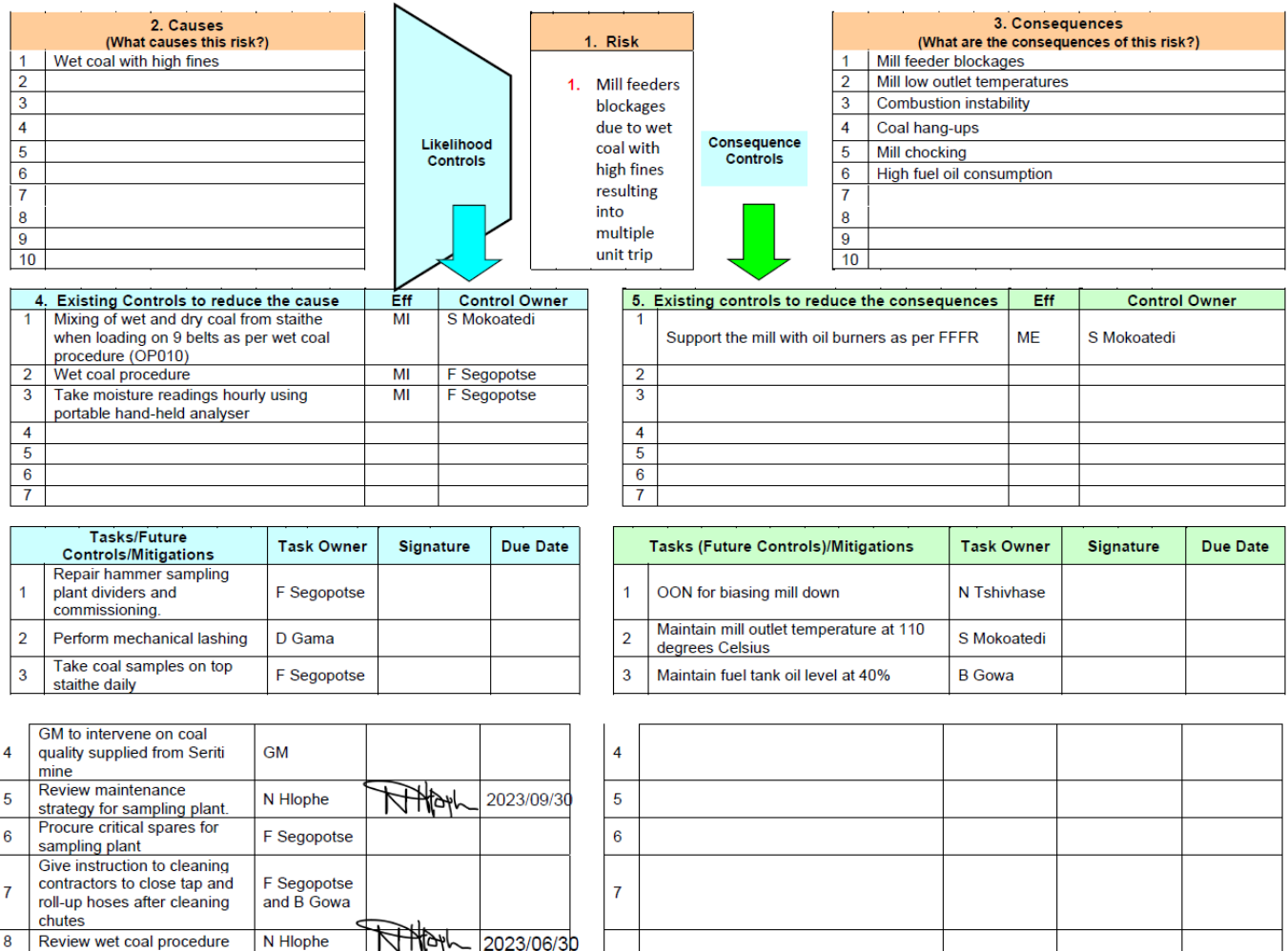



Figure 7: Risk assessment for wet coal

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Regulated Raw Materials		
Raw Material Type	Maximum Permitted Consumption Rate (Quantity)	Units (quantity/period)
Coal	1,400,000	Tons/month
Fuel oil	5000	Tons/month

Figure 8: The fuel oil maximum permitted consumption rate

Additional information on non-compliance to the AEL license

9 PENALTIES FOR NON-COMPLIANCE WITH LICENSE AND STATUTORY CONDITIONS OR REQUIREMENTS

Failure to comply with any of the license and relevant statutory conditions and/ or requirements is an offence, and the Licence Holder, if convicted, will be subjected to those penalties set out in section 52 of the Air Quality Act, 39 of 2004.

Penalties

52. (1) A person convicted of an offence referred to in section 51 is liable to a fine, or to imprisonment for a period not exceeding ten years, or to both a fine and such imprisonment.

(2) A fine contemplated in subsection (1)—

(a) may not exceed an amount prescribed in terms of legislation regulating maximum fines for criminal offences; and

(b) must be determined with due consideration of—

(i) the severity of the offence in terms of its impact, or potential impact, on health, well-being, safety and the environment;

(ii) the monetary or other benefits which accrued to the convicted person through the commission of the offence; and

(iii) the extent of the convicted person's contribution to the overall pollution load of the area under normal working conditions.

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