
EXTERNAL SAMPLING REPORT
ESKOM LETHABO POWER STATION DUSTFALL MONITORING
RESULTS FOR DECEMBER 2023

GONDWANA IS A SANAS ACCREDITED TESTING LABORATORY



T0803



GONDWANA

ENVIRONMENTAL SOLUTIONS



DOCUMENT CONTROL	
Client	Eskom Holdings SOC Limited, Private Bag: 9001, Vereeniging; 079 380 6416
Site	Lethabo Power Station
Test Items Received	Buckets
Date Test Items Received	2024-01-02
Analysis Location	562 Ontdekkers Road, Florida, P.O Box 158, Florida Hills, 1716
Laboratory Details	Gondwana Environmental Solutions International (Pty) Ltd 562 Ontdekkers Road, Florida, P.O Box 158, Florida Hills, 1716 Tel: +27 11 472 3112; E-mail: info@gesza.co.za Web: www.gondwanagroup.co.za
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Analysis Method	ASTM D1739
Laboratory Uncertainty	±11.69% (entire method) (Gondwana Environmental Solutions 2016)
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1 INTRODUCTION

Particulate matter (PM) is a broad term used to describe the particles found in the atmosphere, including soil dust, dirt, soot, smoke, pollen, ash, aerosols and liquid droplets. Distinguishing characteristics of PM are the particle size and the chemical composition. Particle size significantly influences the behaviour of PM in the atmosphere and the potential adverse effects of PM. PM range in size from 1 μm to 1 mm. The smaller size fraction, below 50 μm are referred to as suspended dust/PM, remain suspended for extended periods and can be dispersed kilometres from the source. Generally, larger particles are deposited near the source and this type of dust is referred to as depositional dust (UK Environment Agency 2013), referred to hereafter as dustfall. The terms dust and particulate matter are largely interchangeable.

Dustfall emissions are entrained into the atmosphere through mechanical disturbance of open sources (US-EPA 1995) that includes; agricultural activities, unpaved areas, aggregate storage piles, heavy construction operations and vehicle entrainment to name a few (US-EPA 2006).

The effects of dustfall are dependent on the quantity and composition of PM and the proximity to sensitive receptors. High quantities of dustfall can be a nuisance due to its soiling potential (UK Environment Agency 2013), reduction in visibility (World Health Organization 2006), and affect the social conditions of people (e.g. soiling of cars, laundry, buildings, etc.), vegetation (including agricultural practices) and invertebrates (UK Environment Agency 2013). The chemical composition of dust may further impact the above-mentioned nuisance factors, and also, result in health impacts from direct (oral ingestion) or indirect (eating of contaminated foods) ingestion, and from dermal reactions (absorption of chemicals through the skin) (UK Environment Agency 2013).

Dustfall emissions have the potential to reduce the overall air quality of an area in the short term with negative socio-economic consequences. The South African government has implemented legislation to monitor activities that result in dust emissions through the National Dust Control Regulations (NDCR) of 2013 (South Africa 2013b).

Eskom Holdings SOE Limited appointed Gondwana Environmental Solutions (Gondwana) to manage the existing dustfall network at Lethabo Power Station (Lethabo PS), Free State.



2 ISO/IEC 17025:2017 QUALITY MANAGEMENT SYSTEM

Gondwana is a South African National Accreditation System (SANAS) Accredited Testing Laboratory (No. T0803) under the ISO/IEC 17025:2017 for Environmental Analysis for the 1970 American Society for Testing and Materials (ASTM) D1739-70 (ASTM 1970) method. Gondwana has implemented a Quality Management System (QMS) to comply with the SANAS requirements. The items included and excluded from the Gondwana QMS/SANAS Accreditation are detailed hereafter.

1) Inclusions:

- a) The dustfall sampler design complies with the ASTM D1739-70, except for the addition of a windshield, which is excluded.
- b) Gondwana prepares dustfall collectors (commonly referred to as buckets) following the ASTM D1739-70.
- c) Gondwana delivers and collects the dustfall collectors monthly to and from the site.
- d) Gondwana filters and weighs the dustfall samples following the ASTM D1739-70.
- e) Gondwana calculates the dustfall rate, based on the ASTM D1739-70, to be aligned with the NDCR.
- f) Standard 5-litre 'paint' buckets (collectors) that have a diameter to height ratio of 1:1.34 are the standard, commonly used buckets in South Africa for dustfall monitoring. While the ASTM D1739-70 stipulates a ratio of 1:2, the collectors are not considered as a deviation to the method (ASTM D1739-70) as all the collectors used in this network are the same, which complies with the note stated by the ASTM D1739-70 concerning the ratio and use of collectors:

"Note 1 – No definitive aerodynamic studies have been made of collector design, so the above specifications cannot assure optimum collection. Pending such studies, any network of stations within which comparisons are to be made should use identical collectors." (ASTM 1970, pp. A-1)

2) Exclusions:

- a) Meteorological data (wind and rainfall) are provided by Eskom Lethabo Power Station. While this data is recommended for inclusion by the ASTM D1739 and required by the NDCR, this data can at best, provide indicative environmental conditions that could assist with interpretation of the dustfall results. This is due to the low-resolution monitoring period (30 ±2 days).



- b) The sampling period is required to be a calendar month corrected to 30 days (ASTM 1970). Sampling is conducted monthly (i.e. from one day in a calendar month to the same day in the following calendar month, with the allowance of two days). This is due to logistical, practical and financial reasons that can impact the end-user. The dustfall rate is not corrected to 30 days, based on the requirements of the NDCR that requires the dustfall rate to be per day.
- c) The non-directional dustfall sampler design does not comply with the ASTM D1739-70 as they contain windshields. Gondwana has researched the variation of total dustfall rates between dustfall samplers with windshields versus samplers without windshields. The research indicated that while samplers with windshields had slightly higher values than samplers without windshields, the difference in dustfall was not significant (Lodder et al. 2015). Also, preliminary research using Computation Fluid Dynamics (CFD) indicates that samplers with windshields have a linear surface flow, which results in improved particle retention (Kornelius 2016). This research is supported by the ASTM D1739-98 versions. As such, the use of windshields is preferred.
- d) All opinions, standards and guidelines (other than the ASTM D1739), assumptions, limitations, sample classification, and recommendations.



3 SITE DESCRIPTION AND LOCATION

Lethabo PS is a coal-powered plant operated by Eskom located between Vereeniging and Sasolburg in the Free State. The Lethabo PS dustfall network comprises 20 samplers situated in and around the main areas of the power station, namely; the coal mining area, ash dam, and plant (Figure 1).



Figure 1: Eskom Lethabo PS dustfall network

Dustfall samplers are required to be classified into either Residential or Non-Residential as per the NDCR. All samplers for the Lethabo PS are classified as Non-Residential. The classification of the samplers is based on the land zones adjacent to which they are located (Table 1).



Table 1: Lethabo PS current dustfall network

Site No.	Site Name	Latitude (S)	Longitude (E)	Classification
LET 05	Contractors site	-26.744430	27.980000	Non-Residential
LET 06	Contractors wash bay	-26.743420	27.983110	Non-Residential
LET 10	Vernna Venters offices	-26.735111	27.984722	Non-Residential
LET 11	Babcock offices (cooling tower 4)	-26.736083	27.977861	Non-Residential
LET 12	Solar panel yard	-26.738417	27.972111	Non-Residential
LET 14	Cooling tower 1	-26.743833	27.971056	Non-Residential
LET 22	Ash dump NNE	-26.705694	27.991194	Non-Residential
LET 24	Ash dump ENE	-26.709083	27.996028	Non-Residential
LET 25	Ash dump E corner	-26.714028	27.994000	Non-Residential
LET 28	Power Station Hall	-26.741611	27.957056	Non-Residential
LET 34	Rand Water point 2 (gate 2)	-26.696194	28.007000	Non-Residential
LET 35	Pump house	-26.733528	27.990750	Non-Residential
LET 36	Dust plant SW	-26.746880	27.972480	Non-Residential
LET 37	Emergency Ash dump S	-26.742910	27.985100	Non-Residential
LET 38	Emergency Ash dump E	-26.741230	27.989510	Non-Residential
LET 39	Ash dump S	-26.728510	27.978390	Non-Residential
LET 40	Ash dump SW	-26.729091	27.972742	Non-Residential
LET 41	Emergency Ash dump W	-26.737720	27.982480	Non-Residential
LET 42	Ash dump SE	-26.727740	27.986510	Non-Residential
LET 43	Dust plant NE	-26.737990	27.979520	Non-Residential

The primary land uses in the near vicinity of Lethabo PS are mining (North, West, and North-west), and agriculture (North-east, East, South-east, South, and South-west). The nearest sensitive receptors to Lethabo PS, which for air quality purposes relate primarily to residential areas include:

- Eskom Holdings residential area (approximately 2 km South-west);
- A community centre (approximately 2.5 km East);
- Vereeniging (approximately 6 km North-west); and
- Three Rivers (approximately 8 km North).

There are several water bodies located within the vicinity of the Lethabo PS, most notably the Vaal River, which forms the border of the Lethabo PS.



4 METHODOLOGY

Gondwana uses the ASTM D1739 (ASTM, 1970) as required by the NDCR for the sampling apparatus, preparation, analysis, and dustfall rate calculation.

4.1 Sampling Apparatus

A 5-litre cylindrical collector of which, half (~2.5 litres) is filled with reagent water is used to collect dustfall. A copper sulphate solution, equivalent to at least 75 mg/5 litres, is added to the reagent water to prevent algae growth. Additional algaecide may be added to the collector at the discretion of Gondwana or by request of the Client if algae are identified. Gondwana supplies the collectors to Lethabo PS and prepares the collectors monthly. Gondwana delivers and collects the collectors from the site monthly.

4.2 Sampling Plan

The minimum number of sampling points is four based on the ASTM D1739 (1970). The number of sampling points has been determined by the Client before Gondwana's appointment. The sampling period is 30 ±2 days following the ASTM D1739. The ASTM 1739-70 specifies that the period should be a calendar month; however, this is impractical. The scheduling of the sampling period is the responsibility of Gondwana.

4.3 Sample Analysis

Once the collectors are received, they are rinsed to remove external contaminants from the collector. The content of the collectors is passed through a 1 mm mesh to remove insects and coarse detritus. The sample is then filtered onto a pre-dried and pre-weighed paper filter to capture the insoluble dustfall (the soluble dustfall is passed through the filter and is not analysed unless required). The sides and base of the collector are rinsed with reagent water to ensure that all dust contained in the collector is removed. This secondary sample is placed into the filtering process and the process is repeated until no visible dust remains in the collector. The filter, containing the dustfall, is then dried in an oven for a minimum of 2 hours at 105°C and once dry, the filter is weighed to determine the mass of dustfall. The dustfall rate is calculated as follows:

$$C_u = (M_{fu} - M_{iu})/AT$$

Where:

C_u	=	Insoluble dustfall rate (mg/m ² /day)
M_{fu}	=	Weight of averaged loaded filter mass (mg)
M_{iu}	=	Weight of M1 blank filter (mg)
A	=	Area of the bucket (m ²)
T	=	Sample duration (days)



The ASTM D1739-70 requires the dustfall rate to be calculated as grams per square meter per 30-day month ($\text{g/m}^2\cdot\text{month}$); however, the NDCR requires the dustfall rate to be expressed as milligrams per square meter per day ($\text{mg/m}^2/\text{day}$)¹. The latter is used to calculate the dustfall rate.

4.4 Dustfall Monitoring Standards

The NDCR (South Africa 2013b) provide acceptable dustfall rates for residential and non-residential areas. The classification of residential and non-residential areas is based on the town planning scheme of the sites. The permissible dustfall rate in residential areas is less than $600 \text{ mg/m}^2/\text{day}$ and in non-residential areas is less than $1,200 \text{ mg/m}^2/\text{day}$. For both areas, it is permissible to exceed these values twice a year and/or in non-sequential months (Table 2). Only the Non-Residential Standard applies to Lethabo PS as all samplers are classified as Non-Residential.

Table 2: Acceptable dustfall rates (South Africa 2013b)

Restriction Areas	Dustfall Rate (D) ($\text{mg/m}^2/\text{day}$), 30-day average)	Permitted Frequency of Exceeding Dustfall Rate
Residential Areas	$D < 600$	Two within a year, not sequential months.
Non-Residential Areas	$600 < D < 1,200$	Two within a year, not sequential months.

Gondwana is required to conduct dustfall monitoring and provide reports to Lethabo PS (i.e., the measurement of dustfall). Measures to control dust and report to Authorities is outside the scope of Gondwana. It is the responsibility of the Lethabo PS to ensure that all legislative requirements are adhered to. Lethabo PS is required, following Section 6 of the NDCR, to submit a dustfall report in the event of a non-permitted exceedance to the licensing authority. Thereafter, a dust management plan must be developed and submitted to the Air Quality Officer within three months of submission of the dustfall report. The contents of the dust management plan are provided in Section 6 of the NDCR.

¹ The NDCR further states that the dustfall rate is corrected to a 30-day average; however, this is an incorrect dustfall rate. The rate cannot be simultaneously reported per day AND 30-day average. One or the other can be expressed in a single unit.



5 METEOROLOGICAL CONDITIONS

Lethabo PS provided the meteorological data (wind and rain) for the current calendar month (sourced from Rand Water weather station). Wind roses are calculated using hourly averaged wind data (wind speed and wind direction), while rainfall is calculated as the total cumulative rainfall per month. All winds are discussed as excluding calms (< 0.5 m/s) unless otherwise stated. For the current wind roses, each dotted circle within the wind rose represents a 5% frequency of occurrence during the monitoring period in question. Wind speed classes are based on the Beaufort Scale (World Meteorological Organization 2012) as follows:

1. Calm (> 0 and ≤ 0.5 m/s),
2. Light air (> 0.5 and ≤ 1.5 m/s; dark blue),
3. Light breeze (> 1.5 and ≤ 3.1 m/s; light green),
4. Gentle breeze (> 3.1 and ≤ 5.1 m/s; dark green),
5. Moderate breeze (> 5.1 and ≤ 8.2 m/s; pink),
6. Fresh breeze (> 8.2 and ≤ 10.8 m/s; red),
7. Strong breeze (> 10.8 and ≤ 13.9 m/s; yellow),
8. Near gale (> 13.9 and ≤ 17 m/s; orange),
9. Gale (> 17 and ≤ 20.6 m/s; purple),
10. Strong gale (> 20.6 and ≤ 24.2 m/s; brown),
11. Storm (> 24.2 and ≤ 28.3 m/s; khaki),
12. Violent storm (> 28.3 and ≤ 32.4 m/s; grey), and
13. Hurricane (> 32.4 m/s; black).

Calm conditions occurred 14.4 % of the time during December 2023. The average wind speed was 1.1 m/s. Light air (0.5 – 1.5 m/s) dominated the wind speeds with 62.3 %. Light breezes (3.1 – 5.1 m/s) were the highest category of winds, occurring 1.2 % of the time from the North-north-east, North-east, East-south-east and South-west. The dominant wind direction was from the North-north-east (19.7%), North-east (19.2%), and North (10.7%). Winds from all other directions occurred at less than 10.0% frequency (Figure 2).



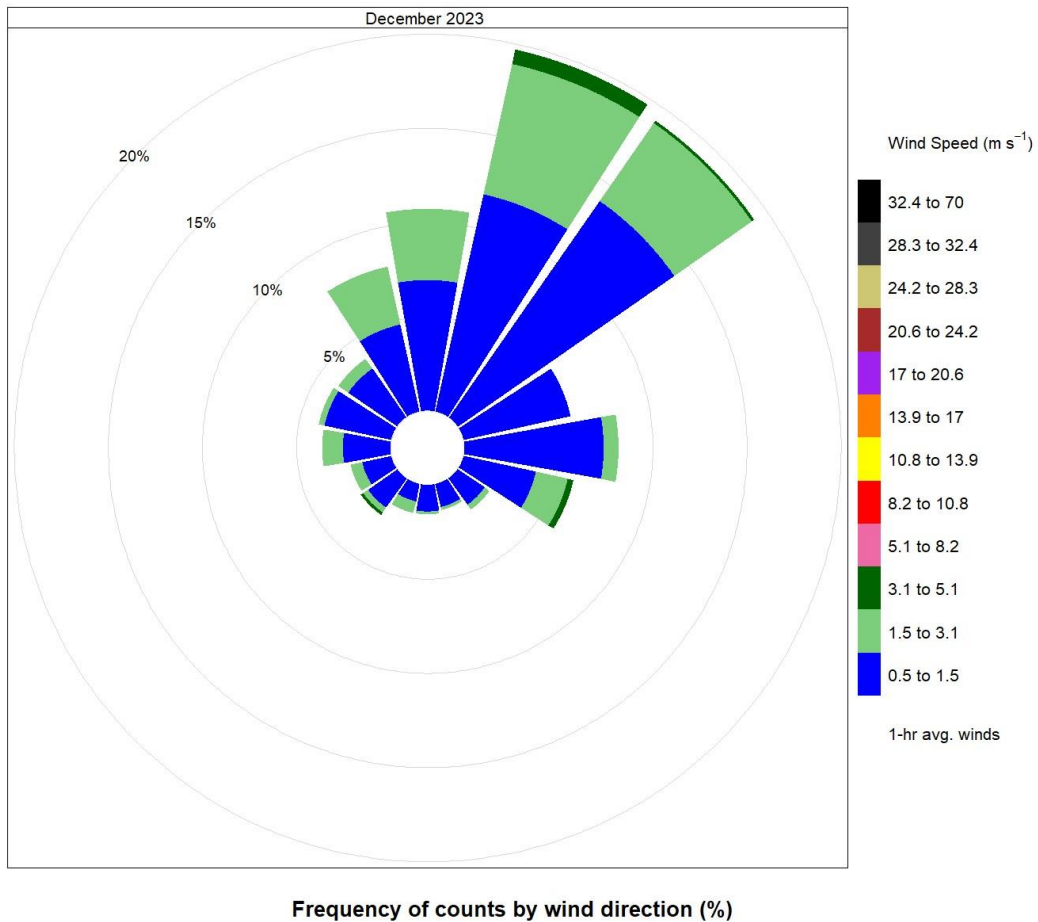


Figure 2: Rand Water 1-hr averaged wind rose

208.5 mm of rainfall occurred during December 2023 (Figure 3). Rainfall can reduce dust entrainment by increasing soil moisture, particle cohesion and thus, resistance to particle entrainment (Wiggs, Baird and Atherton 2004). However, the effectiveness of rainfall to reduce dustfall as measured over 30 days is not well understood. It is likely that the absence of rainfall, combined with increased wind speeds (and other environmental factors), may increase dustfall rates (Lodder et al. 2016).



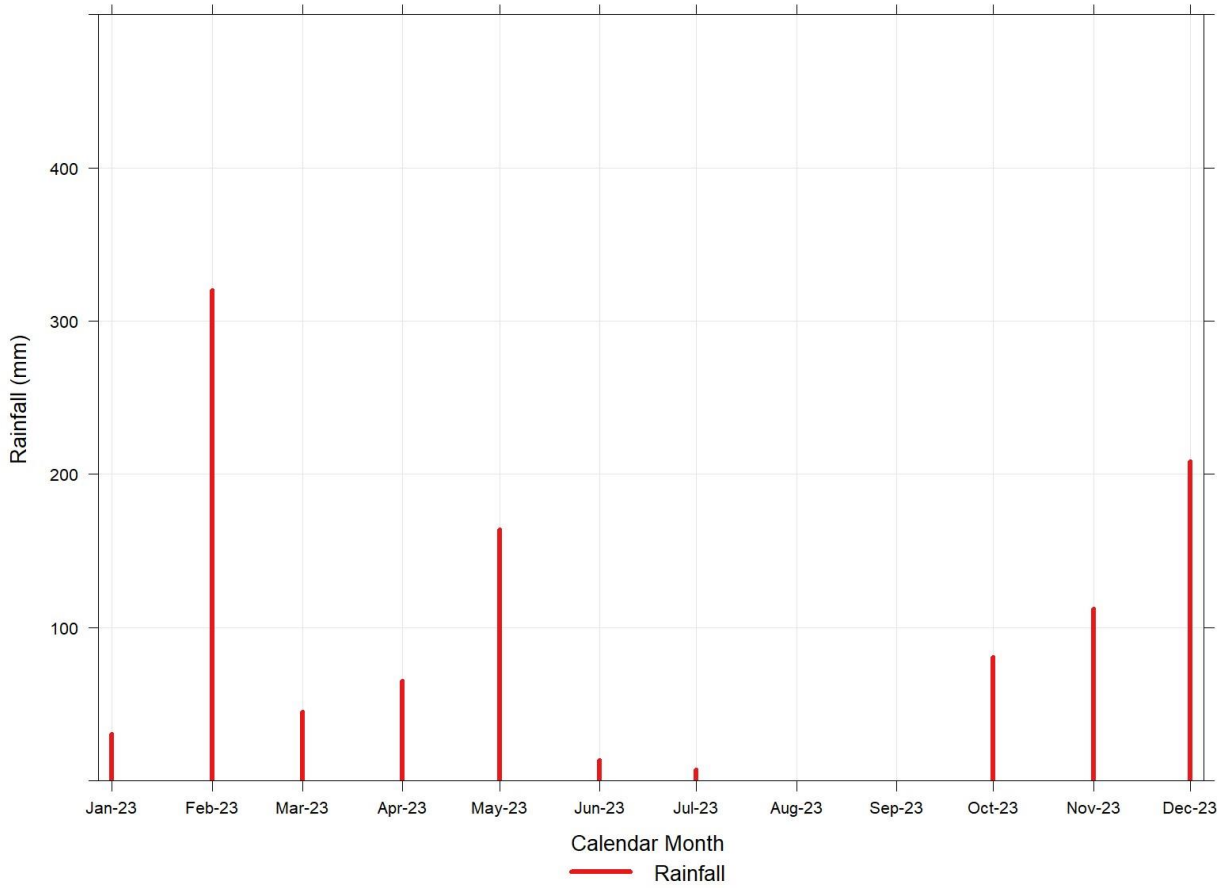


Figure 3: Lethabo PS/Rand Water rainfall for 2023



6 RESULTS

Gondwana analysed the dustfall collectors as a South African National Accredited System (SANAS) accredited Laboratory for analysis of dustfall (Appendix A).

6.1 Assumptions and Limitations

The soluble component is assumed to be negligible to the insoluble content. This assumption is commonly made for most windblown dust sources that comprise primarily insoluble silicates and metallic oxides. This technique of dustfall collection is limited as it is purely quantitative. No elemental analysis is conducted and only the mass of dustfall is measured.

6.2 Decision Rule

The ASTM D1739 method has inherent uncertainty (see Document Control for the Laboratory full method uncertainty). The dustfall rates obtained through this method are compared to South African Legislation. To understand how the method uncertainty may affect conformity to the Legislation, a decision rule is required.

The decision rule applies only to dustfall rates, expressed as $\text{mg/m}^2/\text{day}$, which is compared to the Residential ($600 \text{ mg/m}^2/\text{day}$) and/or Non-Residential Standards ($1,200 \text{ mg/m}^2/\text{day}$) as documented in the NDCR. The actual dustfall rate is compared directly to the standard, without considering the uncertainty error.

Compliance/conformity to the respective Standard is based on the NDCR. Where the dustfall rate is equal to, or greater than the respective standard, then the rate will be indicated as an exceedance. Where the dustfall rate is below the respective Standard, then the rate will be indicated as a non-exceedance.

The risk is based on the method uncertainty, where the dustfall rate is between $530 \text{ mg/m}^2/\text{day}$ and $670 \text{ mg/m}^2/\text{day}$ (for the Residential Standard) and $1,060 \text{ mg/m}^2/\text{day}$ and $1,340 \text{ mg/m}^2/\text{day}$ (Non-Residential Standard) may be a false accept or false reject.

6.3 Current Monitoring Period Dustfall Data

The daily average dustfall rates determined from the current monitoring period are not compared to the NDCR for compliance purposes. The current monitoring period was from 2023-12-01 to 2024-01-02 a period of 32 days, which complies with the ASTM D1739. A 90% valid sample return rate was achieved for the current monitoring period (Table 3) with two samples (LET 39 and LET 40) not analysed due to a fallen tree blocking the road thus no access. Site LET 28 (1, 232



mg/m²/day) and LET 36 (1, 385 mg/m²/day) recorded exceedances of during the current monitoring period. The sample colour at site LET 28 was black which is indicative of possible dust from the coal conveyor belt and possibly from neighbouring activities and LET 36 was grey which is indicative of dust entrainment from nearby ground activities and vehicle entrainment.

Table 3: Dustfall data for the current monitoring period[^]

Site No.	Site Location	Site Classification	Collector Label	Filter ID	Start Date	End Date	Exposure Days	Collector Diameter [m]	Filter Mass M1 [mg]	Average Filter Mass [mg]	Dust Deposition [mg/m ² /day]	Comments
LET 05	Contractors site	Non-Residential	LET 005	GES 23-12 401	2023-12-01	2024-01-02	32	0.152	153.03	743.82	1 017	-
LET 06	Contractors wash bay	Non-Residential	LET 006	GES 23-12 402	2023-12-01	2024-01-02	32	0.152	148.55	469.15	552	-
LET 10	Venna Venters offices	Non-Residential	LET 010	GES 23-12 403	2023-12-01	2024-01-02	32	0.152	158.66	358.81	345	-
LET 11	Babcock offices (cooling tower 4)	Non-Residential	LET 011	GES 23-12 404	2023-12-01	2024-01-02	32	0.152	158.92	528.00	636	-
LET 12	Solar panel yard	Non-Residential	LET 012	GES 23-12 405	2023-12-01	2024-01-02	32	0.152	153.48	625.22	812	-
LET 14	Cooling tower 1	Non-Residential	LET 014	GES 23-12 406	2023-12-01	2024-01-02	32	0.152	154.49	713.48	963	-
LET 22	Ash dump NNE	Non-Residential	LET 065	GES 23-12 407	2023-12-01	2024-01-02	32	0.152	158.27	313.47	267	-
LET 24	Ash dump ENE	Non-Residential	LET 067	GES 23-12 408	2023-12-01	2024-01-02	32	0.152	157.12	304.27	253	-
LET 25	Ash dump E corner	Non-Residential	LET 068	GES 23-12 409	2023-12-01	2024-01-02	32	0.152	156.15	312.58	269	-
LET 28	Power Station Hall	Non-Residential	LET 028	GES 23-12 410	2023-12-01	2024-01-02	32	0.152	158.82	874.18	1 232	-
LET 34	Rand Water point 2 (gate 2)	Non-Residential	LET 034	GES 23-12 411	2023-12-01	2024-01-02	32	0.152	154.12	271.03	201	-
LET 35	Pump house	Non-Residential	LET 035	GES 23-12 412	2023-12-01	2024-01-02	32	0.152	158.26	319.35	277	-
LET 36	Dust plant SW	Non-Residential	LET 036	GES 23-12 413	2023-12-01	2024-01-02	32	0.152	157.86	962.04	1 385	-
LET 37	Emergency Ash dump S	Non-Residential	LET 037	GES 23-12 414	2023-12-01	2024-01-02	32	0.152	154.62	551.55	684	-
LET 38	Emergency Ash dump E	Non-Residential	LET 038	GES 23-12 415	2023-12-01	2024-01-02	32	0.152	156.33	311.01	266	-
LET 39	Ash dump S	Non-Residential										No access-blocked road
LET 40	Ash dump SW	Non-Residential										No access-blocked road
LET 41	Emergency Ash dump W	Non-Residential	LET 041	GES 23-12 416	2023-12-01	2024-01-02	32	0.152	156.99	556.21	688	-
LET 42	Ash dump SE	Non-Residential	LET 042	GES 23-12 417	2023-12-01	2024-01-02	32	0.152	158.63	331.72	298	-
LET 43	Dust plant NE	Non-Residential	LET 043	GES 23-12 418	2023-12-01	2024-01-02	32	0.152	153.38	459.48	527	-

Notes M1 = Pre-weighed filter mass; Average filter mass = average filter mass of final weighed filter that is weighed three times

6.4 Calendar Month Dustfall Results

The current monitoring period results (preceding section) are used to calculate the daily average dustfall rate per calendar month (see Appendix B for the daily dustfall rates used to calculate the calendar month daily dustfall rates), which are compared to the NDCR. A calendar month is based on the definition contained in the SANS 8601:2009 (SANS 2009), which is from the 1st day of a specific month to the last day of that same month. The daily dustfall rates per calendar month can include two or more overlapping monitoring periods.

The NDCR prescribes a permissible number of exceedances that a site can have within a year. The NDCR specifies that a site can exceed the Standard (Residential or Non-Residential, as applicable) twice in a year but not in consecutive months. The term “year” is not specified in the NDCR. A rolling 12-month period to determine exceedances is advocated. Exceedances of the Non-Residential Standard (1,200 mg/m²/day) for each calendar month are represented as orange cells, respectively.

The dustfall rates for December 2023 are based on dustfall rates for the period 2023-12-01/2023-12-31. Sites LET 28 (1, 220 mg/m²/day) and LET 36 (1, 383 mg/m²/day) recorded an exceedance of the Non-Residential Standard (1,200 mg/m²/day) during December 2023. The preceding months’



dustfall rates are provided (Figure 4) to illustrate the current calendar month results relative to the preceding months².

During the last 12 calendar months, seven operational sites have recorded at least one exceedance of the Non-Residential Standard (Table 4).

- LET 05 (2023-06, 2023-08 & 2023-09)
- LET 10 (2023-11)
- LET 14 (2023-08)
- LET 28 (2023-12)
- LET 36 (2023-11 & 2023-12)
- LET 39 (2023-08)
- LET 40 (2022-12, 2023-08 & 2023-09)
- LET 41 (2023-08, 2023-09 & 2023-11)

Sites LET 05, LET 40 and LET 41 have recorded more than two exceedances in the last 12-months, LET 36 exceeded the limit in consecutive months. Overall compliance with the NDCR is 80 % (Table 5) and (Figure 5).

Historical data for the preceding calendar year(s) is provided, where available (Appendix C).

²Historical data is provided by the client.



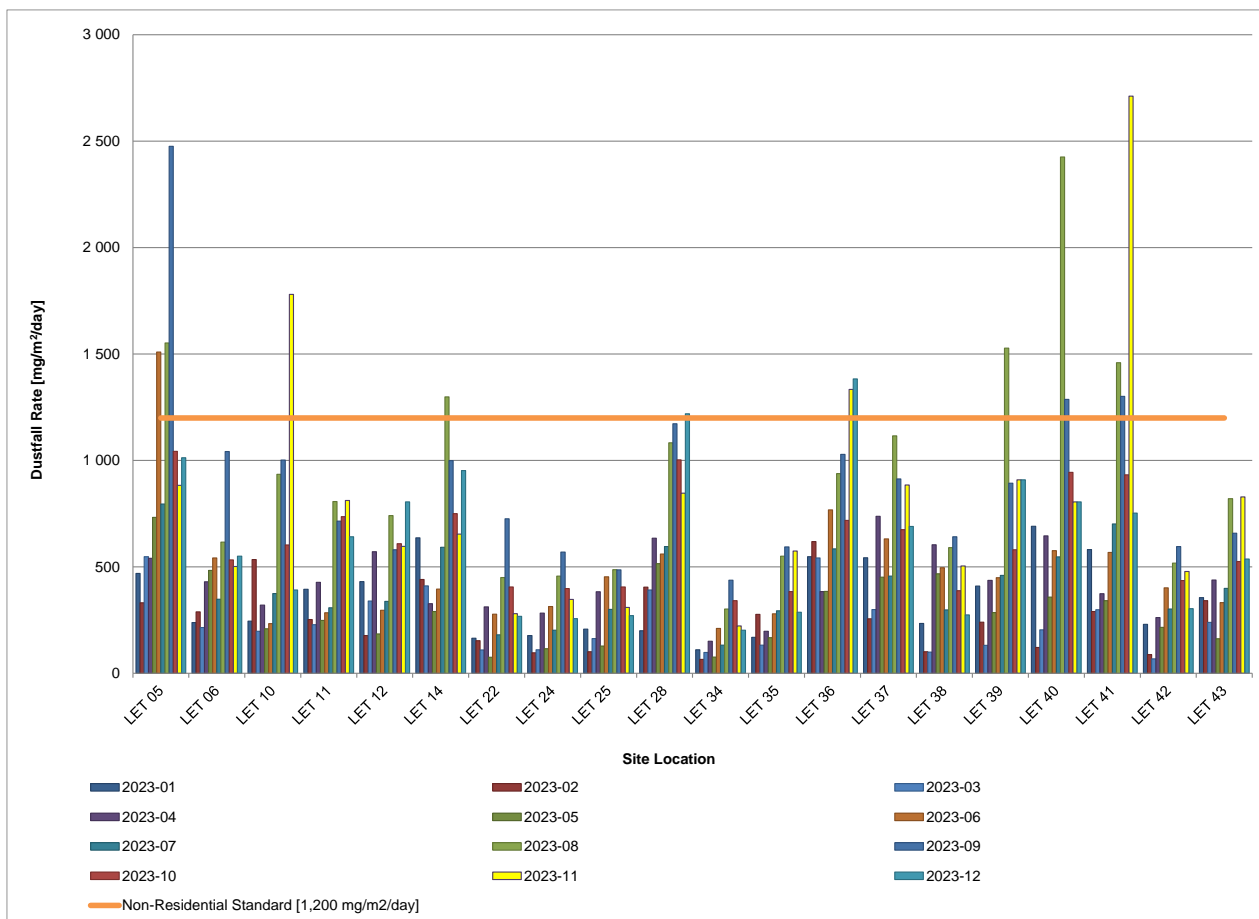


Figure 4: Dustfall rates for the last 12 calendar months relative to the Non-Residential Standard

Table 4: Dustfall rates for the last 12 calendar months

Site ID	Location	Site Classification	Calendar Month Daily Average Dustfall Rates [mg/m ² /day] (Reported Rates)											
			2023-01	2023-02	2023-03	2023-04	2023-05	2023-06	2023-07	2023-08	2023-09	2023-10	2023-11	2023-12
LET 05	Contractors site	Non-Residential	469	331	548	540	732	1 509	796	1 552	2 476	1 043	883	1 013
LET 06	Contractors wash bay	Non-Residential	239	288	215	430	484	542	348	617	1 042	533	501	550
LET 10	Vernna Venters offices	Non-Residential	245	534	197	320	209	233	375	935	1 002	603	1 780	391
LET 11	Babcock offices (cooling tower 4)	Non-Residential	394	252	228	428	249	284	308	807	715	736	812	641
LET 12	Solar panel yard	Non-Residential	431	177	339	571	185	296	338	741	580	609	596	805
LET 14	Cooling tower 1	Non-Residential	636	441	411	327	291	396	592	1 298	1 000	750	654	953
LET 22	Ash dump NNE	Non-Residential	165	153	110	312	75	278	181	450	726	405	280	268
LET 24	Ash dump ENE	Non-Residential	177	96	110	282	115	314	202	457	570	398	347	256
LET 25	Ash dump E corner	Non-Residential	207	101	163	383	128	454	300	487	486	406	310	271
LET 28	Power Station Hall	Non-Residential	200	405	391	635	515	560	596	1 083	1 173	1 003	846	1 220
LET 34	Rand Water point 2 (gate 2)	Non-Residential	110	65	98	151	76	211	132	302	437	341	223	202
LET 35	Pump house	Non-Residential	169	277	132	198	167	280	294	551	594	384	575	287
LET 36	Dust plant SW	Non-Residential	548	619	542	384	385	767	584	938	1 029	719	1 333	1 383
LET 37	Emergency Ash dump S	Non-Residential	542	256	299	738	452	631	457	1 115	913	675	885	690
LET 38	Emergency Ash dump E	Non-Residential	234	102	99	604	467	496	298	590	641	388	504	274
LET 39	Ash dump S	Non-Residential	410	240	131	437	285	449	460	1 528	893	580	909	909
LET 40	Ash dump SW	Non-Residential	691	121	204	645	358	576	547	2 426	1 287	944	805	805
LET 41	Emergency Ash dump W	Non-Residential	581	291	298	374	341	568	701	1 459	1 301	932	2 712	753
LET 42	Ash dump SE	Non-Residential	230	88	68	261	216	401	302	517	596	435	478	304
LET 43	Dust plant NE	Non-Residential	356	341	239	438	162	332	399	820	658	525	829	537

*Exceedances of the Non-Residential Standard are highlighted in orange.
Cells highlighted in grey represent unavailable data for the month.*

Notes
In some instances, the dustfall rate provided for a particular calendar month does not include all days within the calendar month, due to the sampling dates. As such, calendar months are reported with partial data. Corrected dustfall rates for each full calendar month can be requested. The results for LET 39 & 40 are based on one day (2023-12-01)



Table 5: Dustfall exceedances for the last 12 calendar months

Site ID	Location	Site Classification	Report type	Number of Exceedances	Compliance Statement	Non-Compliance Rationale
				2023-01/2023-12		
LET 05	Contractors site	Non-Residential	External	3	No	Exceeded more than twice during the annual reporting period
LET 06	Contractors wash bay	Non-Residential	External	0	Yes	-
LET 10	Vernna Venters offices	Non-Residential	External	1	Yes	-
LET 11	Babcock offices (cooling tower 4)	Non-Residential	External	0	Yes	-
LET 12	Solar panel yard	Non-Residential	External	0	Yes	-
LET 14	Cooling tower 1	Non-Residential	External	1	Yes	-
LET 22	Ash dump NNE	Non-Residential	External	0	Yes	-
LET 24	Ash dump ENE	Non-Residential	External	0	Yes	-
LET 25	Ash dump E corner	Non-Residential	External	0	Yes	-
LET 28	Power Station Hall	Non-Residential	External	1	Yes	-
LET 34	Rand Water point 2 (gate 2)	Non-Residential	External	0	Yes	-
LET 35	Pump house	Non-Residential	External	0	Yes	-
LET 36	Dust plant SW	Non-Residential	External	2	Yes	Exceeded in consecutive months
LET 37	Emergency Ash dump S	Non-Residential	External	0	Yes	-
LET 38	Emergency Ash dump E	Non-Residential	External	0	Yes	-
LET 39	Ash dump S	Non-Residential	External	1	Yes	-
LET 40	Ash dump SW	Non-Residential	External	2	No	Exceeded in consecutive months
LET 41	Emergency Ash dump W	Non-Residential	External	3	No	Exceeded more than twice during the annual reporting period
LET 42	Ash dump SE	Non-Residential	External	0	Yes	-
LET 43	Dust plant NE	Non-Residential	External	0	Yes	-

Notes: Allowable Exceedances: Residential and Non-Residential: Two within a year, not sequential months

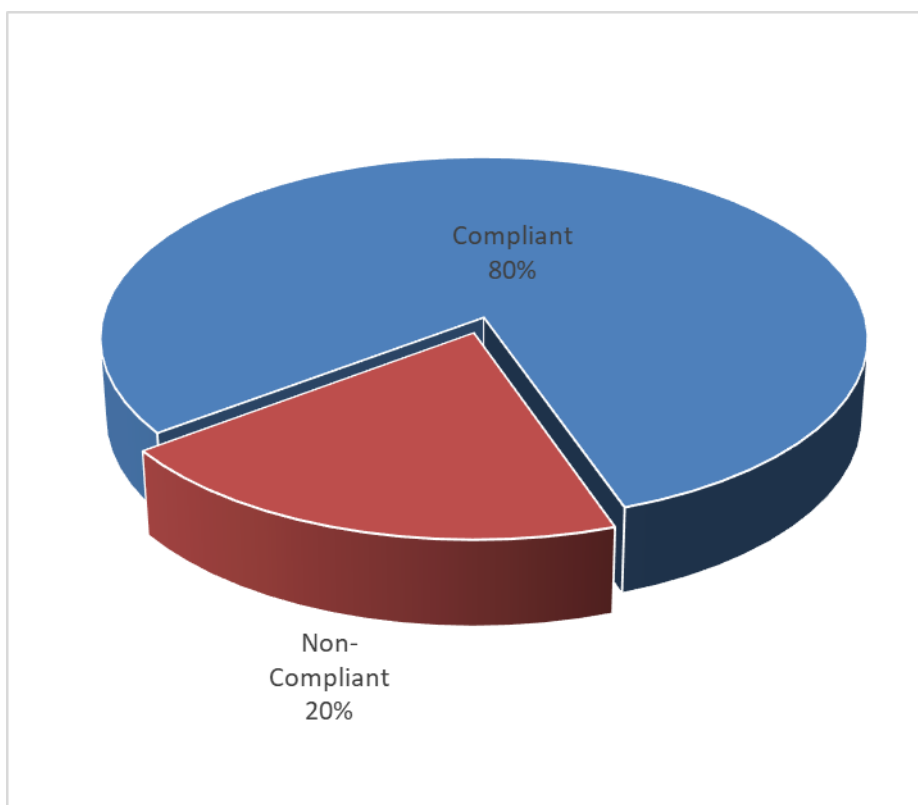


Figure 5: Compliance rating for the last 12-months



7 RECOMMENDATIONS

- All mitigation measures should be considered in terms of suitability and should be guided by the Lethabo PS dust management plan.
- All mitigation measures, when implemented, should be documented in addition to operational and environmental conditions, to determine the effectiveness of the mitigation measures.
- In all instances, the purpose of the sampler at a specific location should be considered. Each sampler should always meet the objective as determined by Lethabo PS.



8 CONCLUSION

All samplers are classified as Non-Residential. Two sites exceeded the Non-Residential Standard in December 2023. A valid sample return of 90 % was achieved for the Lethabo PS dustfall network during the current monitoring period with two samples not analysed. All samples were exposed for 32 days. The dustfall network is currently 80% compliant for the last 12-months based on the NDCR.



REFERENCES

- ASTM. 1970, *Standard Test Method for Collection and Measurement of Dustfall (Settleable Particulate Matter)*, American Standard Test Method. West Conshohocken: ASTM International. (ASTM D1739).
- Lodder, J, van Nierop, MA, van Staden, E and Piketh, SJ 2016, 'Characterising the impact of rainfall on dustfall rates', *The Clean Air Journal*, **26**, 2. 28-33.
- SANS. 2009, *SANS 8601*, Data elements and interchange formats - Information interchange - Representation of dates and times. Pretoria: SABS Standards Division.
- South Africa. 2013, *National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004): National Dust Control Regulations*. (Government Notice No. R. 827). *Government Gazette*, 36974.
- Wiggs, GFS, Baird, AJ and Atherton, RJ 2004, 'The dynamic effects of moisture on the entrainment and transport of sand by wind', *Geomorphology*, **59**, 1–4. 13-30.
- World Meteorological Organization 2012, *Manual on Marine Meteorological Services*, World Meteorological Organization, Switzerland.



TABLE OF REVISIONS

Revision No.	Date	Description
00	2024-01-10	Draft report



APPENDICES

Appendix A: SANAS certificate



Facility Number: T0803

ANNEXURE A
SCHEDULE OF ACCREDITATION

Facility Number: **T0803**

Permanent Address of Laboratory:

Gondwana Environmental Solutions International (Pty) Ltd
562 Ontdekkers Road
Florida Ext 3
Johannesburg
1709

Technical Signatory:

Dr MA van Nierop

Postal Address:

P O Box 158
Florida Hills
1716

Nominated Representative:

Dr MA van Nierop

Tel: 011 472 3112

Fax: 086 650 0581

E-mail: martin@gesza.co.za

Issue No.: 03

Date of Issue: 13 November 2023

Expiry Date: 24 February 2025

Material or Products Tested	Type of Tests / Properties Measured, Range of Measurement	Standard Specifications, Techniques / Equipment Used
Dust Fall	Mass	ASTM D1739

Original Date of Accreditation: 25 February 2015

ISSUED BY THE SOUTH AFRICAN NATIONAL ACCREDITATION SYSTEM



Accreditation Manager



Appendix B: Daily dustfall rates for the current calendar month

Date	Average Dustfall Rate [mg/m ² /day]																			
	LET 05	LET 06	LET 10	LET 11	LET 12	LET 14	LET 22	LET 24	LET 25	LET 28	LET 34	LET 35	LET 36	LET 37	LET 38	LET 39	LET 40	LET 41	LET 42	LET 43
2023-12-01	883	501	1 780	812	596	654	280	347	310	846	223	575	1 333	885	504	909	805	2 712	478	829
2023-12-02	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-03	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-04	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-05	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-06	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-07	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-08	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-09	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-10	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-11	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-12	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-13	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-14	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-15	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-16	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-17	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-18	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-19	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-20	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-21	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-22	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-23	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-24	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-25	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-26	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-27	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-28	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-29	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-30	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
2023-12-31	1 017	552	345	636	812	963	267	253	269	1 232	201	277	1 385	684	266			688	298	527
Average Monthly Dustfall Rate	1 013	550	391	641	805	953	268	256	271	1 220	202	287	1 383	690	274	909	805	753	304	537



Appendix C Historical dustfall data

2019

Site ID	Location	Classification	Calendar Month Dustfall Rates [mg/m ² /day]											
			2019-01	2019-02	2019-03	2019-04	2019-05	2019-06	2019-07	2019-08	2019-09	2019-10	2019-11	2019-12
LET 04	Transport offices	Decommissioned							1,731	1,805	1,031	1,194	912	4,518
LET 05	Contractors site	Non-Residential							1,440	1,277	710	1,190	970	938
LET 06	Contractors wash bay	Non-Residential							510	604	368	496	445	397
LET 10	Vemna Venters offices	Non-Residential							258	642	558	900	662	362
LET 11	Babcock offices (cooling tower 4)	Non-Residential							282	42	694	1,000	945	496
LET 12	Solar panel yard	Non-Residential							282	535	741	608	468	432
LET 13	Corner cooling tower 3	Decommissioned							212	325	504	552	578	382
LET 14	Cooling tower 1	Non-Residential							326	334	1,120	1,178	472	689
LET 17	Ash dump (Roshcon offices)	Decommissioned							461	1,019	1,220	2,873	1,781	937
LET 20	Ash dump NW end	Decommissioned							826	496	886	1,858	0	949
LET 22	Ash dump NNE	Non-Residential							197	170	322	543	429	293
LET 23	Ash dump NE corner	Decommissioned							226	200	273	516	239	243
LET 24	Ash dump ENE	Non-Residential							245	279	282	616	460	296
LET 25	Ash dump E corner	Non-Residential							157	287	298	546	383	265
LET 26	Lethabo substation (close to stockyard)	Decommissioned							952	969	939	1,549	1,157	582
LET 27	Opposite New Vaal corner	Decommissioned							875	1,627	1,083	2,056	1,586	795
LET 28	Power Station Hall	Non-Residential							0	398	607	614	537	348
LET 33	Rand Water point 1 (gate 1)	Decommissioned							206	192	264	728	278	152
LET 34	Rand Water point 2 (gate 2)	Non-Residential							149	163	232	701	307	132
LET 35	Pump house	Non-Residential							163	19	301	528	515	322
LET 36	Dust plant SW	Non-Residential												
LET 37	Emergency Ash dump S	Non-Residential												
LET 38	Emergency Ash dump E	Non-Residential												
LET 39	Ash dump S	Non-Residential												
LET 40	Ash dump SW	Non-Residential												
LET 41	Emergency Ash dump W	Non-Residential												
LET 42	Ash dump SE	Non-Residential												
LET 43	Dust plant NE	Non-Residential												

Note(s): Cells that with no data indicate data unavailable
Exceedances of the Non-Residential Standard are highlighted in orange; Exceedances of the Residential Standard in highlighted in blue.

2020

Site ID	Location	Classification	Calendar Month Dustfall Rates [mg/m ² /day]											
			2020-01	2020-02	2020-03	2020-04	2020-05	2020-06	2020-07	2020-08	2020-09	2020-10	2020-11	2020-12
LET 04	Transport offices	Decommissioned	1,655	1,479	752	759	373	806	1,233	1,790	1,779			
LET 05	Contractors site	Non-Residential	546	604	465	394	365	299	1,072	1,462	1,311	1,284	393	1,068
LET 06	Contractors wash bay	Non-Residential	199	344	337	255	197	157	345	756	619	656	393	603
LET 10	Vemna Venters offices	Non-Residential	234	260	275	170	143	182	354	903	642	605	369	449
LET 11	Babcock offices (cooling tower 4)	Non-Residential	396	608	381	1,199	221	260	375	1,051	780	746	323	385
LET 12	Solar panel yard	Non-Residential	343	716	363	847	265	284	400	698	570	574	338	453
LET 13	Corner cooling tower 3	Decommissioned	216	519	285	529	193	208	391	637	486			
LET 14	Cooling tower 1	Non-Residential	482	638	490	717	286	314	699	738	631	819	425	728
LET 17	Ash dump (Roshcon offices)	Decommissioned	685	698	1,625	429	565	502	943	4,561	2,936			
LET 20	Ash dump NW end	Decommissioned	336	302	2,503	235	597	214	1,157	784	703			
LET 22	Ash dump NNE	Non-Residential	227	234	203	165	168	134	440	327	381	558	249	188
LET 23	Ash dump NE corner	Decommissioned	213	222	164	197	133	111	541	320	392		249	
LET 24	Ash dump ENE	Non-Residential	184	206	164	165	159	104	449	410	461	536	233	175
LET 25	Ash dump E corner	Non-Residential	169	204	168	172	110	115	304	432	408	420	247	133
LET 26	Lethabo substation (close to stockyard)	Decommissioned	700	1,066	252	856	623	898	1,430	1,264	1,017			
LET 27	Opposite New Vaal corner	Decommissioned	776	1,706	753	1,108	1,038	653	1,154	2,074	1,268			
LET 28	Power Station Hall	Non-Residential	269	412	1,174	619	190	174	374	500	447	751	406	606
LET 33	Rand Water point 1 (gate 1)	Decommissioned	137	136	136	136	136	136	136	304	320			
LET 34	Rand Water point 2 (gate 2)	Non-Residential	172	173	109	62	74	93	267	317	275	337	162	366
LET 35	Pump house	Non-Residential	212	196	233	131	149	133	286	299	589	491	291	333
LET 36	Dust plant SW	Non-Residential										902	424	808
LET 37	Emergency Ash dump S	Non-Residential										683	435	507
LET 38	Emergency Ash dump E	Non-Residential										447	349	292
LET 39	Ash dump S	Non-Residential										1,106	684	606
LET 40	Ash dump SW	Non-Residential										2,022	1,603	1,210
LET 41	Emergency Ash dump W	Non-Residential										793	378	630
LET 42	Ash dump SE	Non-Residential										646	327	375
LET 43	Dust plant NE	Non-Residential										609		578

Note(s): Cells that with no data indicate data unavailable
Exceedances of the Non-Residential Standard are highlighted in orange; Exceedances of the Residential Standard in highlighted in blue.



CONFIDENTIAL

2021

Site ID	Location	Classification	Calendar Month Dustfall Rates [mg/m ² /day]														
			2021-01	2021-02	2021-03	2021-04	2021-05	2021-06	2021-07	2021-08	2021-09	2021-10	2021-11	2021-12			
LET 04	Transport offices	Decommissioned															
LET 05	Contractors site	Non-Residential	783	378	260	895	813	1,201	810	1,362	978	724	1,845	697			
LET 06	Contractors wash bay	Non-Residential	664	162	450	313	308	340	308	671	511	495	1,006	267			
LET 10	Vernna Venters offices	Non-Residential	198	103	202	215	306	272	325	847	721	581	701	300			
LET 11	Babcock offices (cooling tower 4)	Non-Residential	273	177	226	353	337	269	331	941	738	698	777	480			
LET 12	Solar panel yard	Non-Residential	378	220	253	325	307	283	326	586	609	570	793	365			
LET 13	Corner cooling tower 3	Decommissioned															
LET 14	Cooling tower 1	Non-Residential	441	305	370	315	343	338	388	1,211	615	843	665	467			
LET 17	Ash dump (Roshcon offices)	Decommissioned															
LET 20	Ash dump NW end	Decommissioned															
LET 22	Ash dump NNE	Non-Residential	118	80	241	0	270	378	260	619	468	434	379	158			
LET 23	Ash dump NE corner	Decommissioned	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
LET 24	Ash dump ENE	Non-Residential	109	62	187	0	161	300	235	598	725	218	339	229			
LET 25	Ash dump E corner	Non-Residential	150	73	161	0	207	292	264	658	547	354	698	305			
LET 26	Lethabo substation (close to stockyard)	Decommissioned															
LET 27	Opposite New Vaal corner	Decommissioned															
LET 28	Power Station Hall	Non-Residential	293	184	263	266	653	351	513	1,205	736	556	647	439			
LET 33	Rand Water point 1 (gate 1)	Decommissioned															
LET 34	Rand Water point 2 (gate 2)	Non-Residential	99	45	112	49	108	136	141	303	310	150	317	124			
LET 35	Pump house	Non-Residential	153	75	236	148	281	214	283	668	530	577	489	142			
LET 36	Dust plant SW	Non-Residential	368	429	432	305	239	475	444	1,011	653	543	660	422			
LET 37	Emergency Ash dump S	Non-Residential	853	232	286	245	370	451	424	898	845	800	922	407			
LET 38	Emergency Ash dump E	Non-Residential	298	103	185	157	218	168	313	638	576	421	723	225			
LET 39	Ash dump S	Non-Residential	281	131	509	389	650	691	463	1,324	1,239	1,074	1,310	281			
LET 40	Ash dump SW	Non-Residential	793	286	368	746	878	679	558	1,508	1,938	1,316	1,460				
LET 41	Emergency Ash dump W	Non-Residential	331	260	359	372	382	445	647	1,057	742	708	661	456			
LET 42	Ash dump SE	Non-Residential	167	158	297	238	421	404	297	1,033	895	879	686	537			
LET 43	Dust plant NE	Non-Residential	265	455	294	353	241	337	387	765	549	657	666	662			

Note(s): Cells that with no data indicate data unavailable
Exceedances of the Non-Residential Standard are highlighted in orange; Exceedances of the Residential Standard in highlighted in blue.

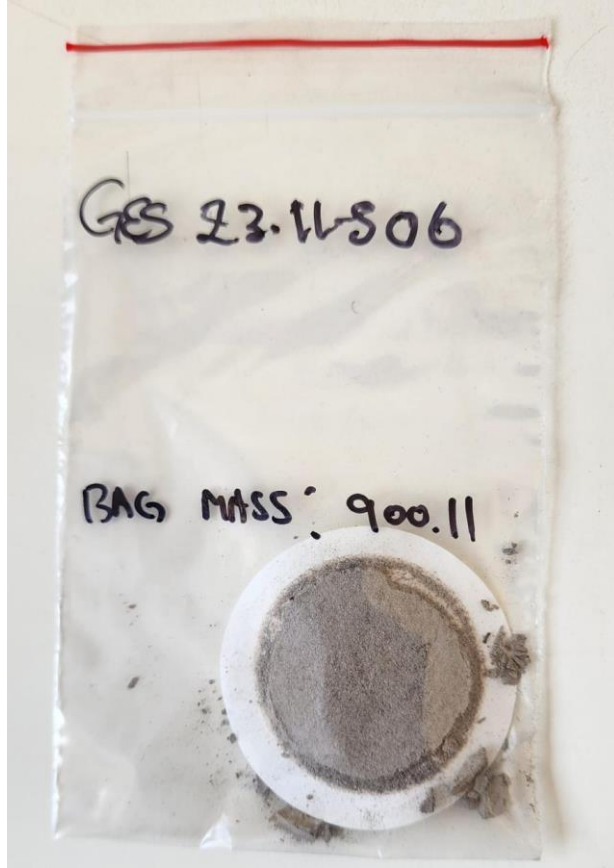
2022

Site ID	Location	Site Classification	Calendar Month Daily Average Dustfall Rates [mg/m ² /day] (Reported Rates)											
			2022-01	2022-02	2022-03	2022-04	2022-05	2022-06	2022-07	2022-08	2022-09	2022-10	2022-11	2022-12
LET 05	Contractors site	Non-Residential	319	328	305	459	554	648	601	1,211	759	773	783	1,050
LET 06	Contractors wash bay	Non-Residential	318	235	171	154	180	221	277	453	390	463	316	376
LET 10	Vernna Venters offices	Non-Residential	138	164	119	157	226	876	189	350	695	333	214	546
LET 11	Babcock offices (cooling tower 4)	Non-Residential	220	287	141	231	224	243	259	347	651	567	321	1,032
LET 12	Solar panel yard	Non-Residential	245	206	234	357	353	281	468	333	465	457	451	922
LET 14	Cooling tower 1	Non-Residential	190	414	292	239	441	252	355	393	421	485	346	352
LET 22	Ash dump NNE	Non-Residential	152	115	115	69	184	143	124	288	230	281	156	300
LET 24	Ash dump ENE	Non-Residential		102	58	83	126	349	141	321	225	210	155	284
LET 25	Ash dump E corner	Non-Residential	148	123	113	83	154	386	169	329	335	370	216	384
LET 28	Power Station Hall	Non-Residential	289	234		276	247	332	469	575	840	659	396	447
LET 34	Rand Water point 2 (gate 2)	Non-Residential	79	131	76	57	53	101	97	156	206	322	98	186
LET 35	Pump house	Non-Residential	138	112	90	234	213		190	370	390	399	184	254
LET 36	Dust plant SW	Non-Residential	277	345	294	313	478	466	425	426	558	593	706	524
LET 37	Emergency Ash dump S	Non-Residential	530	381	224	157	201	362	388	590	863	748	400	436
LET 38	Emergency Ash dump E	Non-Residential	154	94	364	113	239	103	161	314	494	288	205	285
LET 39	Ash dump S	Non-Residential	182	126	136	321	294	148	241	239	1,000	323	367	1,049
LET 40	Ash dump SW	Non-Residential	266	292	266	453	347	244	455	618	1,315	658	421	1,462
LET 41	Emergency Ash dump W	Non-Residential	234	345	370	334	412	1,995	309	590	836	645		745
LET 42	Ash dump SE	Non-Residential	168	144	153	135	200	1,123	241	428	419	360	168	465
LET 43	Dust plant NE	Non-Residential	191	221	175	280	293	762	374	336	390	463	287	997

Notes: Exceedances of the Non-Residential Standard are highlighted in orange.
Blank cells represent unavailable data.
In some instances, the dustfall rate provided for a particular calendar month does not include all days within the calendar month, due to the sampling dates. As such, calendar months are reported with partial data. Corrected dustfall rates for each full calendar month can be requested.

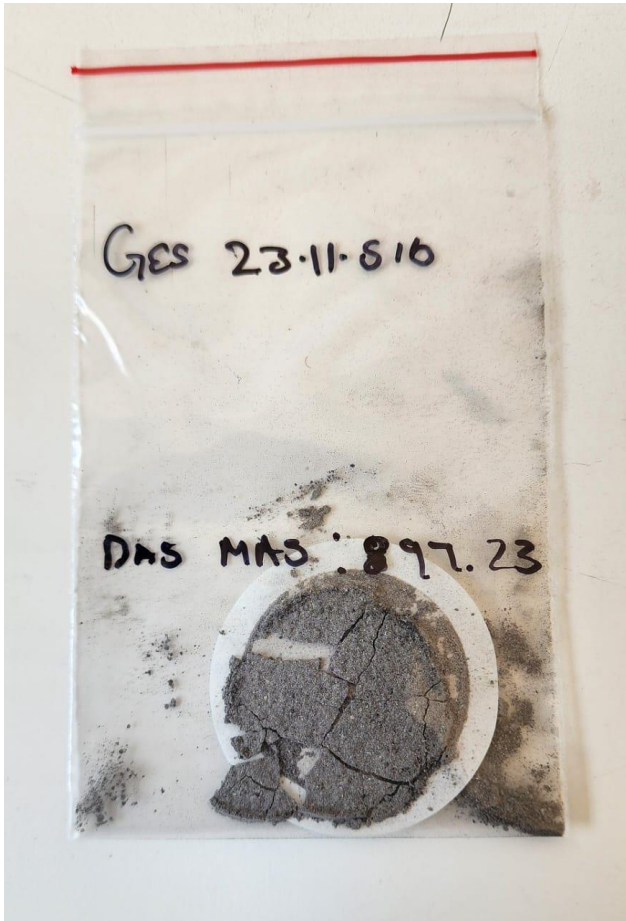


Appendix C: Pictures of exceeded sample



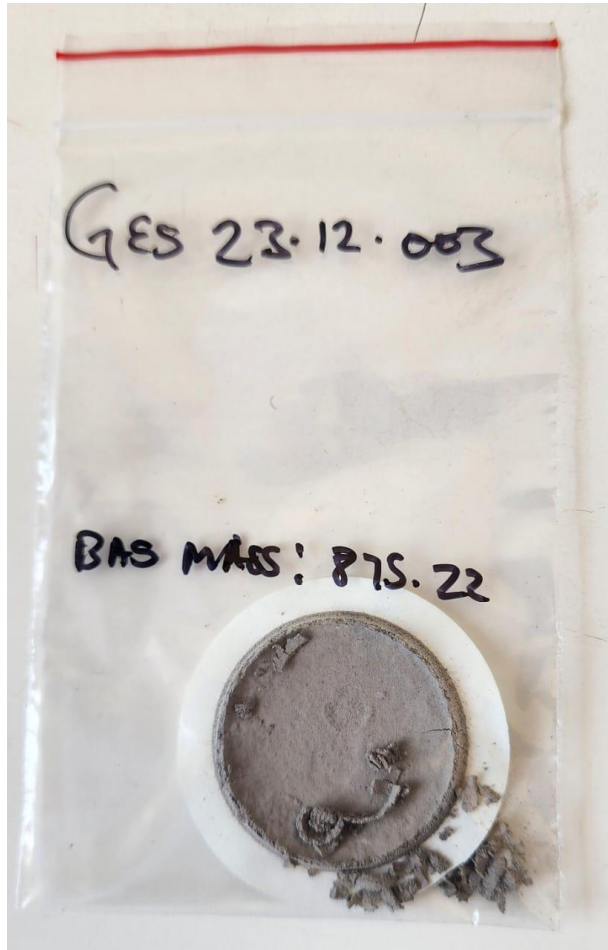
LET 10





LET 36





LET 41

