Rayten
ENGINEERING SOLUTIONS
Environmental and Engineering Consultants

JACANA ENVIRONMENTAL

AMBIENT MONITORING

JUNE 2021 MONTHLY REPORT - #1

04 June 2021 – 05 July 2021

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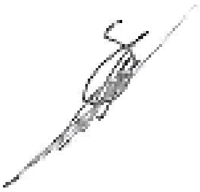
CONFIDENTIALITY

DECLARATION OF INDEPENDENCE

I, the author, Scott Sanders, as the appointed independent consultant, in terms of the 2014 EIA Regulations, hereby declare that:

- I act as an independent consultant within this ambient monitoring report;
- I perform the work relating to the assessment in an objective manner, even if the results are not favourable towards the client;
- I consider the findings and information presented within this report to be true and correct, and do not have and will not have any financial interest in the undertaking of the prescribed activity, other than remuneration for work performed;
- I have no vested interest in the proposed activity proceeding;
- I have not and will not engage in any conflicting interests in the undertaking of the activity; and
- I will ensure that all information containing all relevant facts be included within this report.



Signature of the consultant

Scott Sanders

Rayten Engineering Solutions (Pty) Ltd.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

ASTM	American Society for Testing and Materials
ASTM D1739	The American Society for Testing and Materials standard method for collection and measurement of dust fall (Settleable Particulate Matter)
DEA	Department of Environmental Affairs
DoL	Department of Labour
$mg/m^2/day$	Milligrams per meter squared per day
NDCR	National Dust Control Regulations
NEM: AQA	National Environmental Management: Air Quality Act
OEL	Occupational Exposure Limit
SANAS	South African National Accreditation System
QMS	Quality Management System
PEL	Permissible Exposure Limit
PM	Particulate Matter

1 INTRODUCTION

Rayten Engineering Solutions (Pty) Ltd (hereafter referred to as “Rayten’) was appointed by Jacana Environmental Consultants (Pty) Ltd (hereafter referred to as “Jacana”) to undertake and determine the baseline dustfall and ambient particulate matter levels around the Rietkol area. The area is characterised by both non-residential and residential land use types. The dustfall monitoring programme serving the Rietkol area, which is northwest of Delmas in the Mpumalanga Province, seeks to establish the baseline dustfall and ambient particulate levels, before any construction activities are undertaken.

Rayten follows a strict Quality Management System (QMS), which has been set up to comply with international standards. Rayten is a South African National Accreditation System (SANAS) accredited laboratory (T0894) in accordance with ISO/IEC 17025:2017 international standards. Rayten’s certificate of accreditation for dustfall monitoring can be seen in Appendix B. Calibration certificates for instruments can be provided upon request.

High levels of dust can negatively impact human health and the environment. South Africa has therefore established standards for dustfall and particulate matter (NEM: AQA 39 of 2004, Government Gazette 36974 of 01 November 2013 and Government Gazette 32816 of 24 December 2009, respectively). To establish whether dustfall and particulate concentrations at Rietkol are within the acceptable South African National Standards, air quality monitoring was conducted at the Rietkol site using dustfall buckets and a Beyond Wireless ambient monitoring station. This report serves to establish compliance of dustfall rates and PM_{10} and $PM_{2.5}$ concentrations at Rietkol with the applicable South African National Ambient Air Quality Standards and National Dust Control Regulations, for the **June 2021** monitoring period (**04 June 2021 – 05 July 2021**).

2 DUSTFALL MONITORING METHOD

The American Society for Testing and Materials (ASTM) standard method for collection and analysis of windblown dust deposition (ASTM D1739-98 reapproved 2017) is the preferred method for dustfall monitoring in terms of South African legislation (DEA, 2013). Monitoring is undertaken using a simple device consisting of a 5-l capacity cylindrical bucket, with the height of which is at twice the diameter of the bucket as per ASTM D1739-98 reapproved 2017. It should be noted that the National Dust Control Regulations (NDRC) are currently being reviewed and are in Draft phase (DEA, 2018). A standard test method to be used for measuring dustfall and the guideline for locating sampling points shall be ASTM D1739. The latest version of this method shall be used.

The buckets are left exposed in the field for 30 days (± 2 days) to collect the windblown dust deposition, which is trapped in the distilled water.

Refer to Appendix A for a comprehensive description of the methodology used.

3 SOUTH AFRICAN DUST CONTROL REGULATIONS

Dustfall rates are compared to the South African dustfall standards (Table 3-1). South Africa has National Dust Control Regulations (DEA, 2013). The purpose of these regulations is to prescribe general measures that need to be used to control dust in all areas of South Africa.

Table 3-1. South African acceptable dustfall rates

Restriction Areas	Dustfall Rate (D) 30-Day Average (mg/m^2/day)	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

4 MONITORING SITES

A total of two (2) dustfall monitoring stations (JAE-001 and JAE-002) were installed at two farms, which were identified as sensitive receptors by Jacana, where monitoring was undertaken for a once off period. The dustfall stations are located approximately 860m away from each other with JAE-002 located south-east of JAE-001. The locations of the two dustfall stations can be seen in Figure 4-1 below. Dustfall monitoring stations were installed, and monitoring commenced on 04 June 2021 in order to establish a baseline of dust levels over a set period of time. The location of Rietkol is a mixture between residential and non-residential land use types, with JAE-001 being classified as residential and JAE-002 classified as non-residential. Thus, the dustfall rates that are permitted at the sites must be below 600 mg/m^2/day for JAE-001 and 1 200 mg/m^2/day for JAE-002 as per the South African legislation (DEA, 2013). The site locations were selected based on client specifications (Table 4-1). Further, a site visit was undertaken at the same time.

In addition, a Beyond Wireless ambient monitoring station was installed at the van der Walt Farm and is located in close proximity to the dustfall station at JAE-001 (the approximate location of the ambient station is 26°07'35.55"S; 28°36'11.77"E). The purpose of the ambient station is to monitor the levels of PM_{10} as well as $PM_{2.5}$ during the monitoring period at the Rietkol site.

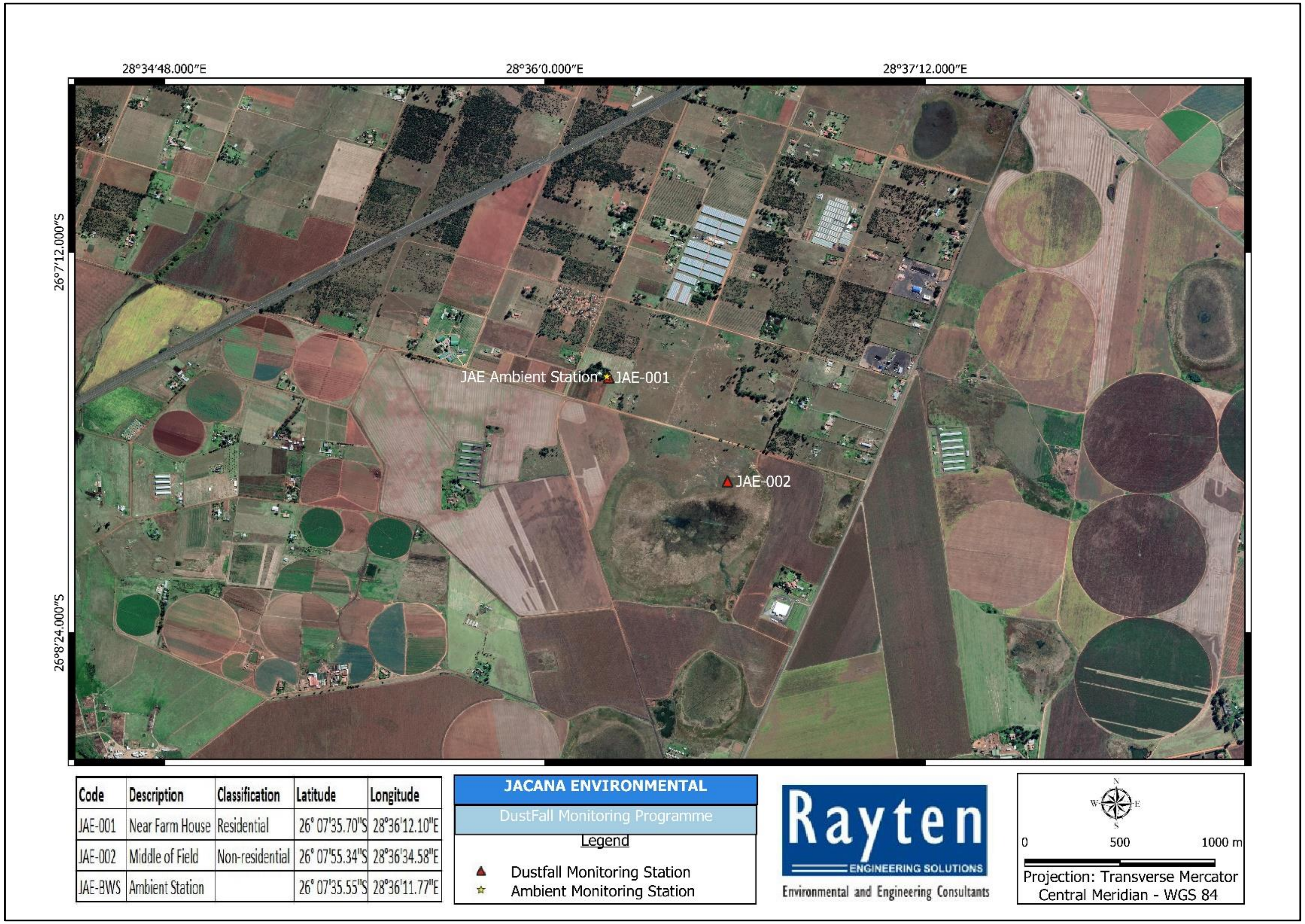


Figure 4-1. Locality of dustfall monitoring sites at Rietkol.

Table 4-1. Assessment of selected sites for dustfall buckets at Rietkol.

SITE CODE	RESIDENTIAL OR NON-RESIDENTIAL	CO-ORDINATES	INSTALLED BY?	SITES SELECTED BY?	REASON FOR SITE SELECTION
DUSTFALL SAMPLING STATIONS					
JAE-001	Residential	26°07'35.70"S 28°36'12.10"E	Installed by Rayten	Client	The dustfall station sites were chosen by the client at locations which were identified as sensitive receptors and at the request of farmers in the area.
JAE-002	Non-Residential	25°07'55.34"S 28°36'34.58"E	Installed by Rayten	Client	

5 RESULTS

5.1. Local Weather

There was no meteorological data provided for the period 04 June 2021 – 05 July 2021, thus representative graphs and wind rose plots could not be generated for inclusion in this report.

NOTE: Rayten is not responsible for providing or acquiring meteorological data. It is the client's responsibility to provide the meteorological data to Rayten.

5.2. Dustfall Monitoring Results

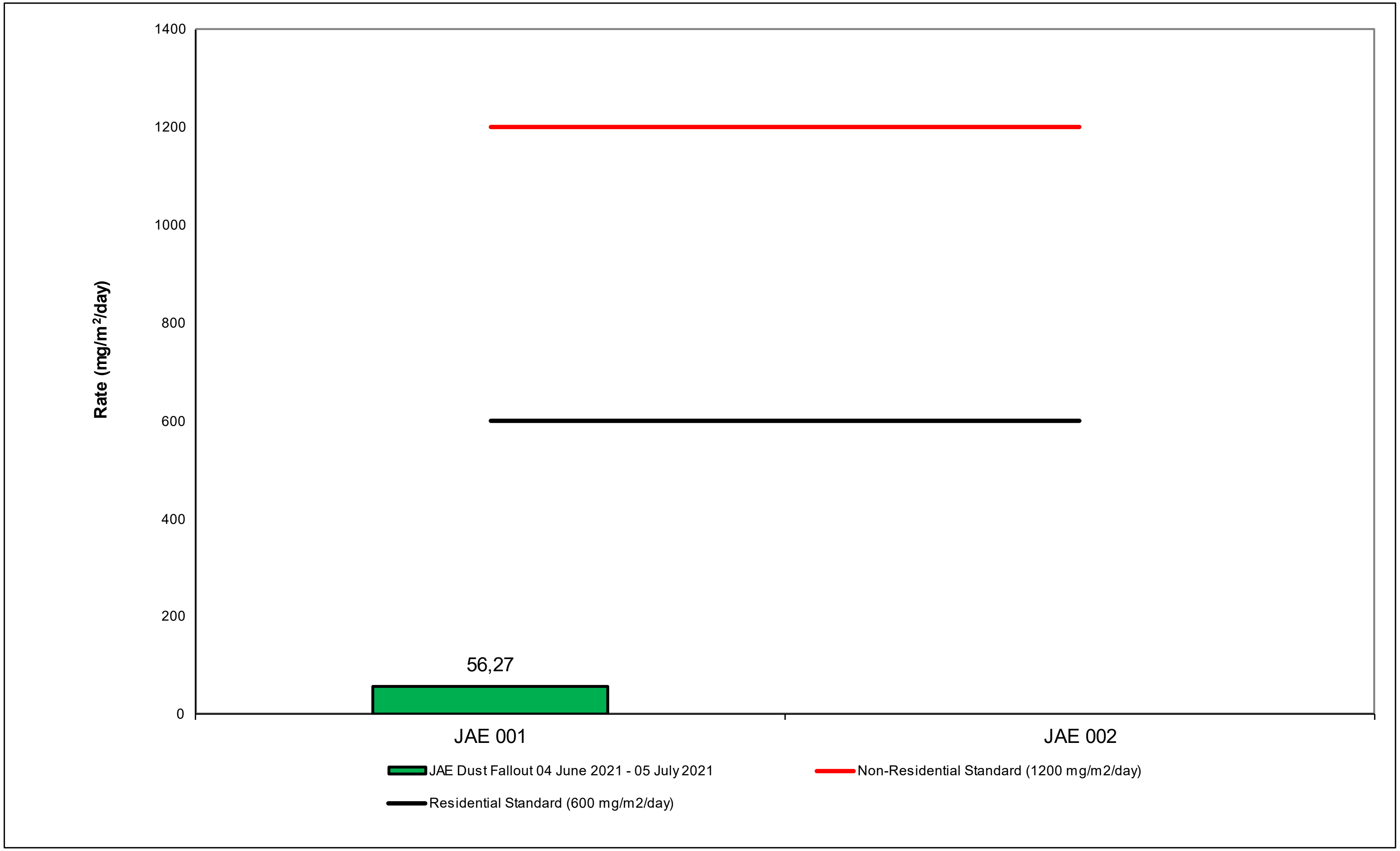
The dustfall monitoring period ran for a total of 31 days. This is within the recommended sampling period of one calendar month (30 days ± 2 days) as per the ASTM D1739-98 (reapproved 2017) standard for dustfall monitoring.

The dustfall rates recorded at Rietkol for the June 2021 monitoring period are provided in Figure 5-1 below. For the June 2021 monitoring period, the dustfall rate at site JAE-001 (Near van der Walt Farmhouse) remained below the residential area standard of 600 $mg/m^2/day$, recording a dustfall rate of **56.27 $mg/m^2/day$**. The dust bucket at site JAE-002 (Near pan in middle of field) was reported stolen and the stand vandalised during the June 2021 monitoring period, as a result a sample could not be obtained for the site.

The dustfall sample obtained from site JAE-001 for the June 2021 monitoring period was sent to an external laboratory for alpha quartz (silica) analysis. Regulations and standards which need to be taken note of with respect to silica are the Department of Labour's (DoL) (2010) Occupational Exposure Limit (OEL) of 0.1 mg/m^3 and the Occupational Health and Safety Administration (OSHA) Permissible Exposure Limit (PEL) of 0.05 mg/m^3 (DoL, 1995; DoL, 2010). The sample fell detectable limits of the instrumentation (which is 0.013 mg), indicating that the levels of silica within the air and recorded during the monitoring period at JAE-001 (Near van der Walt Farmhouse) were extremely low. As such, the silica levels recorded during the monitoring period fell well below the national regulations for silica exposure in South Africa.

The installation and removal of the buckets for the period as mentioned above was conducted by Mr Gift Bhebhe and Mr Jacob Dube from Rayten. Both technicians have been deemed competent and authorised for ASTM D1739 as per ISO/IEC17025:2017 requirements.

Uncertainty of Measurement: ± 4.22 mg with a coverage factor of k = 1,96 at 95% confidence level.



Note: The dustfall station at site JAE-002 was reported vandalised during the June 2021 monitoring period, as a result a sample could not be obtained for the site.

Figure 5-1. Dustfall rates recorded at sites JAE-001 to JAE-002 located at Rietkol [04 June 2021 – 05 July 2021].

Table 5-1. Summary of site exceedance information at sites JAE-001 to JAE-002 for the year 2021 at Rietkol.

SITE ID	SITE CLASSIFICATION	MONTH OF EXCEEDANCE	RATE ($mg/m^2/day$)	STANDARD EXCEEDED
JAE-001	Residential	*	*	*
JAE-002	Non-residential	*	*	*

5.3. Ambient Monitoring Results

A Beyond Wireless Ambient Monitoring Station was used to measure both PM_{10} and $PM_{2.5}$ concentrations at the Rietkol site. The ambient station was installed on the 4th of June 2021 at the farmhouse (26°07'35.55"S; 28°36'11.77"E) in close proximity to dustfall station JAE-001.

PM_{10} concentrations recorded at Rietkol are compared to the South African National Ambient Air Quality Standards (i.e. daily limits) of 75 $\mu g/m^3$ for PM_{10} and 40 $\mu g/m^3$ for $PM_{2.5}$. PM_{10} and $PM_{2.5}$ concentrations for the period 04 June 2021 – 05 July 2021 are presented below.

For the **June 2021** period (**04 June 2021 – 05 July 2021**) there was 96.09% data capture and 96.09% data recovery. There were no exceedances of the South African National Standard of 75 $\mu g/m^3$ (i.e. daily limit) recorded in June 2021 for PM_{10}. However, there were 10 exceedances of the daily limit of 40 $\mu g/m^3$ recorded for $PM_{2.5}$ during the June 2021 monitoring period. A maximum daily average concentration of 51.79 $\mu g/m^3$ for PM_{10} was recorded on the 24th of June 2021, while a maximum daily average concentration of 55.94 $\mu g/m^3$ for $PM_{2.5}$ was recorded on 5th of July 2021 (Figure 5-2). The average daily concentration recorded for the period for PM_{10} was 31.84 $\mu g/m^3$ and 31.44 $\mu g/m^3$ for $PM_{2.5}$. A maximum hourly average concentration of 102.90 $\mu g/m^3$ was recorded for both PM_{10} and $PM_{2.5}$ fractions at least 14 times during the monitoring period (Figure 5-3 and Figure 5-4). The high levels of PM, which can be observed in Figure 5-3 and Figure 5-4, show spikes in PM values in the late evenings (20:00 – 23:00) and early periods of the morning (06:00 – 08:00) at the site. A diurnal graph showing the fluctuations in concentration levels of PM throughout the day can be seen in Figure 5-5, which supports the above.

Such regular spikes could be caused by the cold snap in weather experienced in the area during June 2021, leading to an increased number of fires being lit at the neighbouring squatter camp to the north-west of the site, in attempts to provide warmth at night. In addition, a veld fire was reported to the south of the site during one unspecified night in June 2021, which would also have influenced the PM values recorded.

It can be seen in Figure 5-2 to Figure 5-5 that the levels of $PM_{2.5}$ and PM_{10} are very similar and in some cases the $PM_{2.5}$ levels were higher than the PM_{10} levels. From this one can deduce that there was very little PM_{10} recorded by the ambient monitoring station that was located at the van der Walt Farmhouse, with the $PM_{2.5}$ being included in the PM_{10} concentrations. The reason for this is that the PM_{10} sensor of the ambient monitoring station measures particles which are 10 microns in size or less (which is inclusive of $PM_{2.5}$). When looking at potential sources of $PM_{2.5}$ in the area, sources may include the burning of wood and/or coal (by nearby farmhouses and the squatter camp, which is located north-east of the ambient station) as a means of cooking and as a source of warmth during a reported cold snap in June 2021.

A detailed summary of PM_{10} and $PM_{2.5}$ exceedances at Rietkol is given below in Table 5-2 and Table 5-3, respectively, for 2021 (04 June 2021 – 05 July 2021).

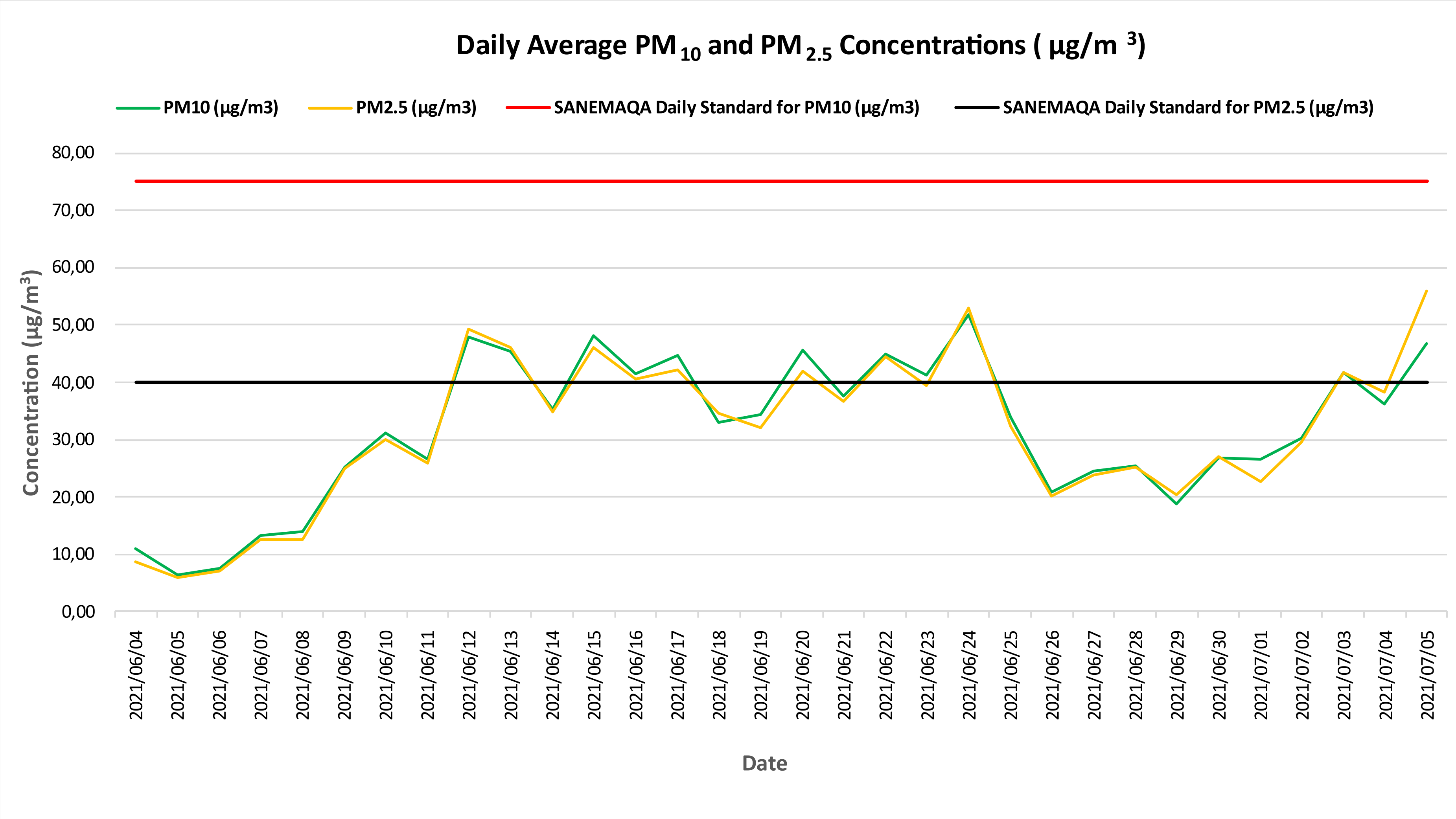


Figure 5-2: Daily average PM_{10} and $PM_{2.5}$ concentrations at Rietkol (04 June 2021 – 05 July 2021).

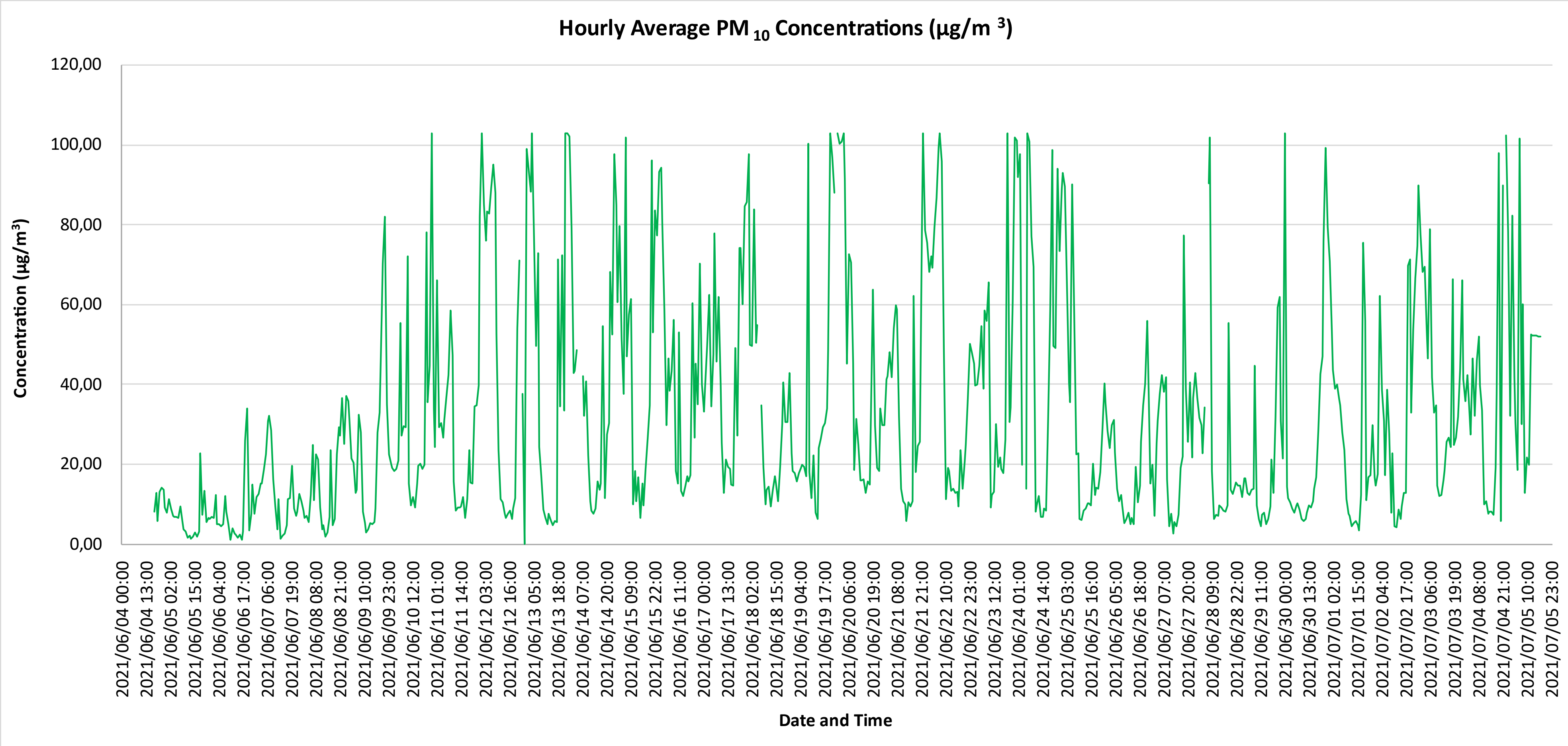


Figure 5-3: Hourly average PM_{10} concentrations at Rietkol (04 June 2021 – 05 July 2021).

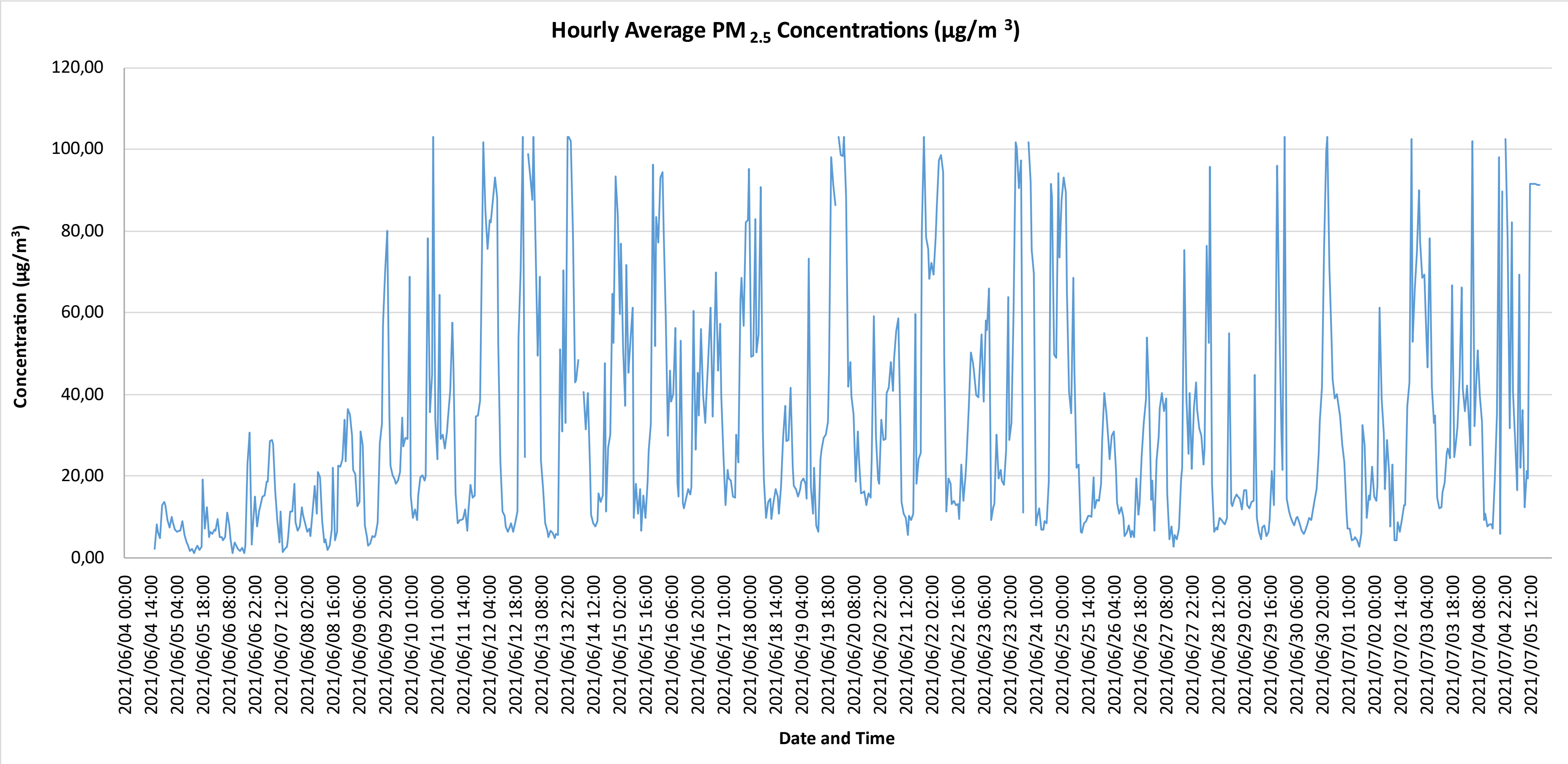


Figure 5-4: Hourly average $PM_{2.5}$ concentrations at Rietkol (04 June 2021 – 05 July 2021).

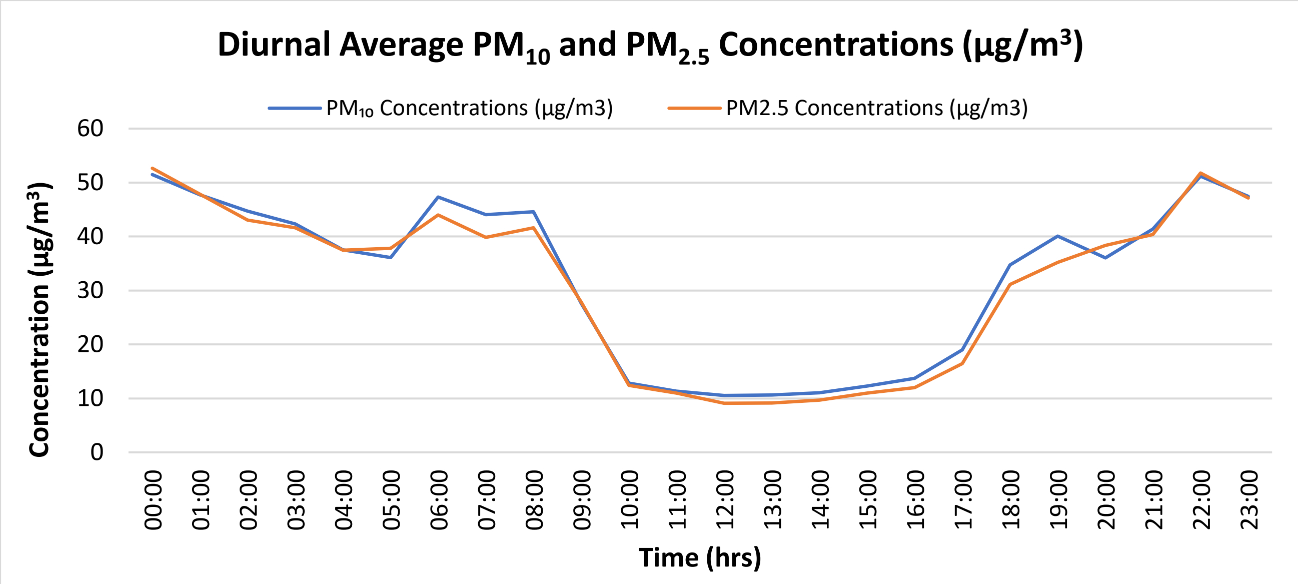


Figure 5-5: Diurnal average PM concentrations at Rietkol (04 June 2021 – 05 July 2021).

Table 5-2: Detailed summary of the number of average PM_{10} daily exceedances (per month) at Rietkol for 2021.

Year	Date	Number of Monthly Average Exceedances in Days
2021	January 2021	-
	February 2021	-
	March 2021	-
	April 2021	-
	May 2021	-
	June 2021	0
	July 2021	*
	August 2021	*
	September 2021	*
	October 2021	*
	November 2021	*
	December 2021	*

* Yet to be determined.

Table 5-3: Detailed summary of the number of average $PM_{2.5}$ daily exceedances (per month) at Rietkol for 2021.

Year	Date	Number of Monthly Average Exceedances in Days
2021	January 2021	-
	February 2021	-
	March 2021	-
	April 2021	-
	May 2021	-
	June 2021	10
	July 2021	*
	August 2021	*
	September 2021	*
	October 2021	*
	November 2021	*
	December 2021	*

* Yet to be determined.

6 CONCLUSION

For the period 04 June 2021 – 05 July 2021, the dustfall rate at site JAE-001 remained below the residential area standard of 600 mg/m^2/day, recording a dustfall rate of **56.27 mg/m^2/day**. The dust bucket at site JAE-002 (Near pan in middle of field) was reported stolen and the stand vandalised during the June 2021 monitoring period, as a result a sample could not be obtained for the site. The dustfall sample obtained from site JAE-001 for the June 2021 monitoring period was sent to an external laboratory for alpha quartz (silica) analysis, which returned results below the limit of reporting range of 0.013 mg, indicating that silica levels during the monitoring period were extremely low or not present at all. The silica levels recorded fell below the DoL (OEL) of 0.1 mg/m^3 as well as the OSHA PEL of 0.05 mg/m^3.

For the **June 2021** period (**04 June 2021 – 05 July 2021**) there was 96.09% data capture and 96.09% data recovery in terms of PM_{10} and $PM_{2.5}$. There were no exceedances of the South African National Standard of 75 µg/m^3 (i.e. daily limit) recorded in June 2021 for PM_{10}. However, there were 10 exceedances of the daily limit of 40 µg/m^3 recorded for $PM_{2.5}$ during the June 2021 monitoring period. A maximum daily average concentration of 51.79 µg/m^3 for PM_{10} was recorded on the 24th of June 2021, while a maximum daily average concentration of 55.94 µg/m^3 for $PM_{2.5}$ was recorded on 5th of July 2021. A maximum hourly average concentration of 102.90 µg/m^3 was recorded for both PM_{10} and $PM_{2.5}$ fractions at least 14 times during the monitoring periods. The regular spikes in PM levels could be caused by the cold snap in weather experienced in the area during June 2021 leading to an increased number of fires being lit at the neighbouring squatter camp to the north-west of the site, in attempts to provide warmth at night. In addition, a veld fire was reported to the south of the site during one unspecified night in June 2021, which would also have influenced the PM values recorded.

Very similar levels of $PM_{2.5}$ and PM_{10} were recorded during the June 2021 monitoring period. From this one can deduce that there was very little PM_{10} recorded by the ambient monitoring station that was located at the van der Walt Farmhouse, with the $PM_{2.5}$ being included in the PM_{10} concentrations. The reason for this is that the PM_{10} sensor of the ambient monitoring station measures particles which are 10 microns in size or less (which is inclusive of $PM_{2.5}$). When looking at potential sources of $PM_{2.5}$ in the area, sources may include the burning of wood and/or coal (by nearby farmhouses as well as the squatter camp, which is located north-west of the ambient station) as a means of cooking and as a source of warmth during a reported cold snap in June 2021.

This report serves to establish a baseline of dustfall rates and particulate matter concentrations at the Rietkol area with the National Dust Control Regulations (DEA, 2013) and the South African Ambient Air Quality Standards (DEA, 2004).

7 RECOMMENDATIONS

1) Any incidences such as heavy rainfall and increased activity on site should be reported for inclusion in any future monthly reports.

8 REFERENCES

American Society for Testing and Materials, 1970: Standard Test Method for Collection and Measurement of Dustfall (Settleable Particulate Matter), ASTM D1739-98.

American Society for Testing and Materials, 2010: Standard Test Method for Collection and Measurement of Dustfall (Settleable Particulate Matter), ASTM D1739-98 (reapproved 2010).

American Society for Testing and Materials, 2017: Standard method for collection and measurement of dustfall, ASTM D1739-98 (reapproved 2017).

Concentra, 2021: What is Silica and Why is it Dangerous? Available from: https://www.concentra.com/resource-center/articles/what-is-silica-and-why-is-it-dangerous/ [Accessed on: 27 July 2021].

Department of Environmental Affairs (DEA) (2013), National Dust Control Regulations in terms of National Environmental Management: Air Quality Act, 2004 (Act No, 39 of 2004) section 53(0), No R. 827.

Department of Environmental Affairs (2018) Draft National Dust Control Regulations, Gazette No. 41650, No. R 517, in terms of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004), Gazette No. 27318.

Department of Labour (DoL), 1995: Occupational Health and Safety Act (Act No 85 of 1993, as amended) - Hazardous Chemical Substances Regulations, GN R1179 in GG 16596.

Department of Labour (DoL), 2010: Occupational Health and Safety (85/1993): Amendment Occupational Exposure Control Limit for Silica in Table 1 of the Hazardous Chemical Substances Regulations. In: Department of Labour (ed.).

Fenger, J., 2002: Urban air quality, In J. Austin, P. Brimblecombe and W. Sturges (eds), Air pollution science for the 21st century, Elsevier, Oxford.

Harrison, R.M. and R.E. van Grieken, 1998: Atmospheric Aerosols. John Wiley: Great Britain.

Mabanga, S.N.K. (2017). Respirable Dust and Quartz Exposure at Coal Fired Power Stations in the Mpumalanga Province during 2012 – 2015. Johannesburg: Faculty of Health Science, University of the Witwatersrand.

Manahan, Stanley. (2000). Environmental Chemistry – Seventh Edition. 10.1201/9781420056716.

Occupational Health Southern Africa (OHSA), 2018: Elimination of silicosis to eliminate which silica? Available from: http://www.occhealth.co.za/?/viewArticle/721 [Accessed on: 27 July 2021].

Terblanche, P., 2009: Basic Assessment for the Amendment of the Air Quality Permit for Iron Ore Handling Facility, Part of Saldanha Health Specialist Study, 5RK399449, SRK Consulting, South Africa.

World Health Organization, WHO Air Quality Guidelines for Europe, 2nd edition, WHO Regional Office for Europe, 2000, Copenhagen, Denmark (WHO Regional Publications, European Series, No 91).

APPENDIX A – GENERAL REPORT

9 AIR QUALITY MONITORING

9.1 Dustfall Monitoring Method

The American Society for Testing and Materials standard method for collection and analysis of windblown dust deposition (ASTM D1739-98 reapproved 2017) is the preferred method for dustfall monitoring in terms of South African legislation (DEA, 2013). Monitoring is undertaken using a simple device consisting of a 5-litre capacity cylindrical bucket, with the height of which is double the diameter as per ASTM D1739-98 reapproved 2017.

The bucket is placed on a stand that comprises of a ring raised supported by four stabilizing bars above the base plate. This serves to prevent contamination of the sample by perching birds. A stainless-steel insect screen is placed over the bucket opening to prevent insects and large pieces of course organic detritus contaminating the sample. A security clamp locks down the stainless-steel insect screen and bucket onto the base plate to prevent theft. The security clamp is locked down with a padlock with a common key for ease of sampling. The base plate is connected to a 2m long steel pole, which is either attached to a pre-existing fence post or to a base plate stand which is buried to a depth of approximately 1m.

The buckets are left exposed in the field for 30 days (± 2 days) to collect the windblown dust deposition, which is trapped in the distilled water. On return to the laboratory, the buckets are rinsed to remove external contaminants which could potentially contaminate the sample. The bucket sample is then filtered through a mesh coarse filter with a pore size of approximately 1 mm to remove insects and course detritus, which passed through the insect screen. The sample is then filtered through a pre-weighed paper filter to remove the dustfall (i.e. the insoluble fraction).

To ensure that all dust collected in the bucket is removed; the sides and base of the bucket are rinsed with distilled water. This secondary sample is also passed through the paper filter. This process is repeated until no dust remains in the bucket. The filter, containing the dustfall is then dried in an oven and once dry, gravimetric analysis is used to determine the insoluble fraction.

The gravimetric analysis is completed with the use of the following equations:

- Calculation of insoluble dust filter

$$Cu = \frac{\mathrm{Mfu} - \mathrm{Miu}}{\mathrm{A\ \ T}}$$

- Calculation of soluble dust filter

$$Cs = \frac{\mathrm{Mfs} - \mathrm{Mis}}{\mathrm{A\ \ T}} \mathrm{X} \frac{\mathrm{V1}}{\mathrm{V2}}$$

- Calculation of total dustfall

$$Ct = Cu + Cs$$

Where:

C_t = Total dustfall (mg/m^2/day)
C_u = Insoluble dustfall (mg/m^2/day)
C_s = Soluble dustfall (mg/m^2/day)
M_{fu} = Weight of loaded filter (mg)
M_{iu} = Weight of blank filter (mg)
M_{fs} = Weight of loaded crucible (mg)
M_{is} = Weight of blank crucible (mg)
A = Area of the bucket (m^2)
T = Sample duration (days)
V1 = Volume of all liquid collected (L)
V2 = Volume of Liquid removed for evaporation (L)

ASTM D1739-98 has been reapproved in 2017 with some changes. These came into effect when the national dust regulations were approved. The changes include the use of a wind shield on the dust bucket stands and the inclusion of the soluble content in the dustfall rate calculations.

Table 9-1. Comparison of ASTM D1739 Methods for Dustfall Monitoring (ASTM D1739-98 – reapproved 2017).

CONDITION	ASTM D1739: 1970	ASTM D1739: 2010	ASTM D1739: 2017
Container	Open topped cylinder with vertical sides and a flat bottom, minimum 15cm diameter with depth of 2 - 3 times diameter	Open topped cylinder with vertical sides and a flat bottom, minimum 15cm diameter with depth of twice diameter	Open topped cylinder with vertical sides and a flat bottom, minimum 15cm diameter with depth of twice diameter.
Stand design	Bird ring design	Design including windshield	Design including windshield.
Water vs no water	Distilled water in the container so that the level is half of the collector's depth as well as algaecide.	No reference to water to be added to the sampler.	No reference to water to be added to the sampler.
Field sampling	No attempt should be made to remove collected particulate sample from the collector at the field site.	No attempt should be made to remove collected particulate sample from the collector at the field site.	No attempt should be made to remove collected particulate sample from the collector at the field site.
Analysis type	Total water insoluble.	Total water insoluble matter as well as total soluble matter.	Total water insoluble matter as well as total soluble matter.

In this report, only the insoluble component is calculated and represented. The soluble component is not calculated.

Table 9-2. Compliance with ASTM D1739 Methods for Dustfall Monitoring (ASTM D1739-98 – reapproved 2017).

SITE CODE	BUCKET TYPE? (SINGLE OR MULTI)	WINDSHIELD?	OBSTRUCTIONS		BUCKET SPECIFICATIONS				REASONS FOR NON-CONFORMANCE, IF ANY.
			Type, if any?	Distance to obstruction (m)	Height from top of bucket off ground (m)	Diameter (mm) of bucket	Height of bucket container (mm)	Water with copper sulphate / No water in bucket?	
DUSTFALL SAMPLING STATIONS									
JAE-001	Single	No	Large tree nearby	17	2.0	170	290	Water with copper sulphate	• Bucket height (length) does not conform to specifications - bucket height is not twice the diameter. • Container does not include a wind shield
JAE-002	Single	No	No		2.0	170	290	Water with copper sulphate	• Bucket height (length) does not conform to specifications - bucket height is not twice the diameter. • Container does not include a wind shield

NOTES: according to ASTM D1739-98 (Reapproved 2017)

1. Container diameter no less than 150 mm
2. Height of container not less than twice its diameter
3. Stand for container must hold the top of the container at a height of 2m above the ground
4. Container must include a windshield.
5. Sampling site must be free of structures higher than 1m within a radius of 20m of the container stand
6. Container and stand must be far away from objects that could affect the settling of PM, such as trees, and air exhausts and intakes.

9.2 Particulate Monitoring Method

The Beyond Wireless Ambient Station is a real-time particulate matter analyser that measures particulates through near-forward light scattering. Air is drawn into a sensing chamber where it passes through the visible laser light. Aerosols in the air scatter light in proportion to the particulate loading in the air. Scattered light is collected and focused on a PIN diode. Electronics measure the intensity of the focused light and output a signal to the CPU. The ambient station measures two particulate matter fractions, namely PM_{10} and $PM_{2.5}$ in real time.

Data is transferred via the cellular network to a database in Johannesburg. The data is available to view online at www.rayten.co.za (a client login and password is required). The ambient station is positioned on top of a steel pole and secured using cable ties in order to prevent theft and vandalism. The instrument is plugged into a secure power supply from the nearby farmhouse and an image of the ambient station at the site can be seen in Figure 9-1.

Figure 9-1: Air quality monitoring station installed at Rietkol.

9.3 Silica and Health Impacts of Exposure

Silica chemically is known as silicon dioxide (SIO_2) and is a common compound found in the Earth's crust and as a result is found commonly within soils around the world. The type of silica of concern for this assessment is alpha quartz - a stable type of quartz at room temperature (below 574° C) (OHSA, 2018). Due to crystalline silica (silica quartz) being found commonly throughout the earth's surface, it is found and allowed to disperse into the atmosphere when materials are extracted from the ground including granite, concrete, rock and coal seams. When these materials are cut, drilled, grinded and cut once extracted from the earth's surface, a large amount of dust may be created through these processes, which contain small crystalline silica particles. Such particles may be easily inhaled by an individual due to their extremely small size and may cause major health implications for those working on a site (e.g. coal mine) or living nearby to coal mines or foundries, to name just two examples (Concentra, 2021). Crystalline silica has been classified as a human lung carcinogen, which may cause serious lung disease and even lung cancer. It has been reported that only a very small concentration of silica dust is needed to create a health hazard. One of the most infamous impacts of prolonged exposure to high levels of silica is a disease called silicosis, which can be contracted after a few months of exposure to the compound. This disease occurs when silica dust enters and settles in the lungs, causing the development of scar tissue and reduces the lungs' ability to take in oxygen. There is currently no cure for silicosis, with the disease being fatal at times (Concentra, 2021). Those that are most exposed to the potential inhalation of silica dust include those working on mines (especially underground where ventilation may be poor), at foundries, quarries, tunnelling and at blasting sites to name just a few examples.

As per Mabanga (2017), the elimination of silicosis has become an important health issue for South Africa, as a result of the link between silicosis and TB in a combination with the HIV epidemic in South Africa. The DoL initiatives to combat and reduce silicosis levels within the country include the introduction of the National Programme for the Elimination of Silicosis in 2004 as well as importantly the reduction in the OEL for silica dust from 0.4 mg/m^3 to 0.1 mg/m^3 during 2008. There have also been numerous research projects commissioned to establish the extent of workers exposure to silica dust in non-mining industries (Mabanga, 2017).

9.4 Health Impacts of Dustfall and Fine Particulate Matter

Dust is made up of solid particles between 1 and 75 microns in size. Whereas dustfall are particles with an aerodynamic diameter greater than 20μm that have been entrained into the air by a physical process such as wind, movement of vehicles, stack emissions and from fugitive dust emissions. People are mainly exposed to dust via inhalation. Larger dust particles tend to deposit in the nasal region while much finer particles can penetrate deeper into the lungs. Chronic exposure to dust particles can cause several respiratory problems such as excessive coughing, throat and lung irritations, tight chest, sinusitis and bronchitis (Terblanch, 2009).

There are many sources of dust and therefore it is one of the major pollutants of concern. Larger dust particles (> 30μm) tend to deposit closer to the source (~100m) while smaller particles (10 – 30 μm) can travel further distances and thus can affect a larger area (~200 - 500m). Dust is a good receptor for other pollutants such as heavy metals. This is because heavy metals are easily absorbed onto the surface area of larger dust particles. Thus, people are also potentially at risk of the effects of heavy metals if exposed to high levels of dust.

While particles can be classified by their aerodynamic properties into coarse particles, PM_{10} (particulate matter with an aerodynamic diameter of less than 10 μm) and fine particles, $PM_{2.5}$ (particulate matter with an aerodynamic diameter of less than 2.5 μm) (Harrison and van Grieken, 1998). The fine particles contain the secondarily formed aerosols such as sulphates and nitrates, combustion particles and re-condensed organic and metal vapours. The coarse particles contain earth crust materials and fugitive dust from roads and industries (Fenger, 2002).

In terms of health impacts, particulate air pollution is associated with effects of the respiratory system (WHO, 2000). Dust particle size is important from a health perspective, as finer particulates are more damaging to human health than coarse particles as larger particles are less respirable in that they do not penetrate deep into the lungs compared to smaller particles (Manahan, 1991). Larger particles are deposited into the extra thoracic part of the respiratory tract while smaller particles are deposited into the smaller airways leading to the respiratory bronchioles (WHO, 2000).

Recent studies suggest that short-term exposure to particulate matter leads to adverse health effects, even at low concentrations of exposure (below 100 µg/m^3). Morbidity effects associated with short-term exposure to particulates include increases in respiratory symptoms in the lower respiratory tract, medication use and small reductions in lung function. Long-term exposure to low concentrations (~10 µg/m^3) of particulates is associated with mortality and other chronic effects such as increased rates of bronchitis and reduced lung function (WHO, 2000). Those most at risk include the elderly, individuals with pre-existing heart or lung disease, asthmatics and children.

APPENDIX B - ACCREDITATION

10 SANAS Accreditation for Rayten Engineering Solutions (PTY) Ltd

sanas
South African National Accreditation System

CERTIFICATE OF ACCREDITATION

In terms of section 22(2) (b) of the Accreditation for Conformity Assessment, Calibration and Good Laboratory Practice Act, 2006 (Act 19 of 2006), read with sections 23(1), (2) and (3) of the said Act, I hereby certify that:-

RAYTEN ENGINEERING SOLUTIONS (PTY) LTD

Co. Reg. No.: 2019/310726/07

Facility Accreditation Number: **T0894**

is a South African National Accreditation System accredited facility provided that all conditions and requirements are complied with

This certificate is valid as per the scope as stated in the accompanying schedule of accreditation, Annexure "A", bearing the above accreditation number for

ENVIRONMENTAL ANALYSIS

The facility is accredited in accordance with the recognised International Standard

ISO/IEC 17025:2017

The accreditation demonstrates technical competency for a defined scope and the operation of a quality management system

While this certificate remains valid, the Accredited Facility named above is authorised to use the relevant accreditation symbol to issue facility reports and/or certificates

Mr M Phaloane
Acting Chief Executive Officer

Effective Date: 13 February 2020
Certificate Expires: 12 February 2025

DUST FALLOUT TEST REPORT

Rayten Engineering Solutions (Pty) Ltd is a SANAS accredited testing laboratory No. T0894

DATE OF REPORT:	13 July 2021
REPORT No.:	JAE-02-106-001-00
CLIENT:	Jacana Environmental
SITE NAME:	Rietkol Farm
CLIENT ADDRESS:	7 Landdros Mare St, Polokwane Central, Polokwane, 0699
CLIENT CONTACT PERSON:	Stuart Thompson
CLIENT TELEPHONE No.:	(015) 291 4015
CLIENT EMAIL ADDRESS:	stuart.thompson.sa@gmail.com
LABORATORY ADDRESS:	43 Kayburne Avenue, Randpark Ridge, Randburg, Gauteng.
ANALYSIS REQUIRED:	Dust
METHOD USED:	ASTM D1739 - 98 (Re-Approved 2017)

SAMPLE DETAILS:

Date of Receipt of Samples:	05 July 2021
Number of samples:	1
Environmental Conditions at time of analysis:	15,9°C / 59.6% RH
Sampling conducted by:	Rayten Engineering Solutions
Date of sampling/change over:	05 July 2021
Sample Matrix	Air

Samples Received at ambient temperature in good condition.

TEST RESULTS:

SITE CODE: 001

Unit of measurement: (mg)	ID:	Avg. pre weight	Avg. post weight	Nett Dust Deposition	Total Dust Deposition	Comments:
Filter (Insoluble)	JAE-DF-001-0001	147,9	187,5	39,6	39,6	
Petri Dish (Soluble)	N/A	N/A	N/A	N/A		

SITE CODE: Blank

Unit of measurement: (mg)	ID:	Avg. pre weight	Avg. post weight	Nett Dust Deposition	Total Dust Deposition	Comments:
Filter (Insoluble)	JAE-DF-OBK-0002	148,5	148,6	0,1	0,1	
Petri Dish (Soluble)	N/A	N/A	N/A	N/A		

Technical Signatory: [signature] **Date:** 14 July 2021

Uncertainty of Measurement: ± 4.22 mg with acoverage factor of k = 1,96 at 95% confidence level.

DISCLAIMER

Note that although every effort has been made by Rayten Engineering Solutions (Pty) Ltd to obtain the correct information and to carry out an appropriate, independent, impartial and competent study, Rayten Engineering Solutions (Pty) Ltd cannot be held liable for any incident which directly or indirectly relates to the work in this document and which may have an effect on the client or on any other third party.

Results contained within this report pertain only to the items tested and as received by the laboratory.

CONFIDENTIALITY

TEST REPORT

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Jacques Le Roux	Laboratory	X-Lab Earth Science
Client	Rayten Engineering Solutions	Address	259 Kent Avenue Ferndale, 2194
Address	Building 2 BOSKRUIN Office Park 835 President fouche drive Bromhof, Johannesburg, 2154	Telephone	+27 (0)11 590 3000
Telephone	011 792 0880	Laboratory Manager	Mrs Tasneem Tagari
Facsimile		Lab Reference	JBX21-9156
Email		Report Number	0000028660
		Date Received	12/07/2021 12:29
Order Number	JACANA AMBIENT MONIT PO101659	Date Started	23/07/2021 16:04
Samples	1	Date Reported	23/07/2021 16:56
Sample matrix	AIR		

Whilst X-Lab Earth Science (Pty) Ltd conforms to ISO/IEC 17025 standards, results of analysis in this report fall outside of the current scope of accreditation.

Samples recieved at ambient temp good condition.

SIGNATORIES

Tasneem Tagari

General Manager/Technical Signatory

Report number 0000028660

Client reference:

JACANA AMBIENT MONIT PO101659

TEST REPORT

Parameter	Units	LOR	Sample Number JBX21-9156.001 Sample Name JAC-DF-001-0001
SUB_Alpha quartz			
Alpha quartz ^	mg	0.013	<0.013

METHOD SUMMARY

METHOD	METHOD SUMMARY

FOOTNOTES

IS	Insufficient sample for analysis.	QFH	QC result is above the upper tolerance
LNR	Sample listed, but not received.	QFL	QC result is below the lower tolerance
^	Performed by outside laboratory.	-	The sample was not analysed for this analyte
LOR	Limit of Reporting	*	Results marked “Not SANAS Accredited” in this report are not included in the SANAS Schedule of Accreditation for this laboratory / certification body / inspection body”.

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Unless otherwise indicated, samples were received in containers fit for purpose.

LAB-QLT-REP-001