AIMS

Report

Monthly AirGradient Monitoring

July 2026

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Note

This report has been finalised with the available information at the time of its compilation.

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The AirGradient screening data contained in this report have undergone the routine quality-control and data-validation procedures applied to the RBCAA secondary screening network. This report, together with the original compilation, presentation and analysis of the data, is the intellectual property of the RBCAA (a non-profit association). It is made available to the public for informational purposes and to relevant authorities for regulatory tracking and compliance. Although this information is accessible, no part of this report or its data compilations may be reproduced, extracted, republished, distributed or incorporated into external works for commercial purposes, private consultancy or financial gain without the prior written consent of the RBCAA. The RBCAA accepts no responsibility or liability for any reliance placed on this information, or for any unauthorised use, misuse, misinterpretation or alteration of the data by third parties.

Acknowledgement

Air Impact Measurement Specialists compiled this report for the Richards Bay Clean Air Association; contributors include Alicia Garnica and François Nel.

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1. INTRODUCTION

This monthly air quality report, prepared for the Richards Bay Clean Air Association (RBCAA), summarises AirGradient monitoring data for July 2026. It assesses particulate matter (PM), total volatile organic compound (TVOC) index values, nitrogen oxides (NO_x) index values and carbon dioxide (CO_2) concentrations measured by the RBCAA AirGradient screening network. The report highlights notable incidents, elevated short-term events and data-quality issues observed during the month. These monthly summaries support the identification of spatial and temporal patterns and help prioritise follow-up investigation where warranted.

RBCAA also publishes annual air quality reports summarising findings and longer-term trends over a complete calendar year. The annual reports provide stakeholders with an integrated view of regional air quality performance and support informed decision-making, policy development and environmental management: consistent monitoring and reporting support transparency, ongoing environmental assessment and community awareness.

The RBCAA monitoring network comprises eleven (11) primary monitoring stations (Figure 1.1 and Table 1.1). Airport, Felixton Met and Meerensee are meteorological stations and do not operate continuous air-quality analysers. The network also includes a secondary screening network comprising 10 AirGradient monitors (Table 1.2).

Figure 1.1: RBCAA monitoring network.

Table 1.1: Primary monitoring network station coordinates.

Station	Latitude	Longitude	Elevation (m)
Airport	-28.738161	32.093332	33.99
Arboretum	-28.752377	32.062791	25.20
Brackenham	-28.731325	32.039059	56.28
CBD	-28.744693	32.054851	32.26
eSikhaleni	-28.865278	31.911679	14.54
Felixton	-28.829255	31.893636	56.59
Meerensee	-28.772104	32.101308	14.89
Felixton Met	-28.836487	31.892513	27.87
Harbour West	-28.787297	32.027133	7.36
Richardia	-28.762769	32.066068	19.96
Scorpio	-28.769694	32.034282	29.39

Table 1.2: Secondary screening network coordinates (AirGradient monitors).

Site	Latitude (°)	Longitude (°)	Elevation (m)	UTM Zone 36S X (m)	UTM Zone 36S Y (m)
Airport	-28.738161	32.093332	33.99	411467	6820686
Brackenham	-28.731325	32.039059	56.28	406161	6821402
CBD	-28.744693	32.054851	32.26	407715	6819933
Empangeni	-28.734970	31.896245	109.85	392217	6820877
eSikhaleni	-28.865278	31.911679	14.54	393857	6806453
Felixton	-28.829255	31.893636	56.59	392060	6810428
Harbour West	-28.787297	32.027133	7.36	405047	6815191
Meerensee	-28.772104	32.101308	14.89	412274	6816931
Mtunzini	-28.959335	31.743905	84.00	377603	6795870
Richardia	-28.762769	32.066068	19.96	408826	6817939

2. AIRGRADIENT MONITORING NETWORK

The AirGradient network was established in late 2023 as a co-location study to evaluate the comparability of particulate measurements against the primary monitoring network. It was subsequently expanded in support of an RBCAA objective to screen additional air-quality parameters. Initially, the network comprised two sites, Harbour West and Richardia, and monitored only particulates (PM_{10}, $PM_{2.5}$ and PM_1). In July 2024, the network was expanded to include Brackenham, CBD, eSikhaleni and Felixton, and all monitors were upgraded to measure total volatile organic compound (TVOC) index, nitrogen oxides (NO_x) index and carbon dioxide (CO_2). A further expansion initiated in August 2025 added Airport, Empangeni, Meerensee and Mtunzini progressively: Meerensee and Mtunzini produced data during 2025, while Airport and Empangeni commenced reporting in 2026. The network now comprises 10 monitors across multiple sites.

AirGradient monitors are designed as accessible, lower-cost air-quality screening instruments. Their data are useful for identifying spatial patterns, short-term events and locations that may warrant follow-up. Still, they are not equivalent to reference-grade or regulatory-equivalent analysers and should be evaluated against a documented monitoring objective, performance basis and QA/QC process (Clements et al., 2022).

- Accuracy and precision: Regulatory reference or equivalent analysers are subject to method approval, routine calibration and quality-assurance requirements for specific pollutants. AirGradient monitors use compact sensors, including optical particle counters for PM and non-dispersive infrared sensors for CO_2. These sensors are useful for indicative screening but are more sensitive to siting, environmental conditions, sensor drift and calibration uncertainty than reference instruments.
- Calibration and certification: Product certifications such as CE, FCC, RoHS and REACH relate primarily to product conformity and market access; they should not be interpreted as certification of equivalence to regulatory reference methods. Where AirGradient data are used for technical assessment, co-location, calibration checks and documented QA/QC procedures are required to define their uncertainty and fitness for use.
- **Data application:** The AirGradient network is therefore treated as a secondary screening network. The TVOC and NO_x outputs are reported as dimensionless index values (Sensirion, 2022a; Sensirion, 2022b) and are interpreted as relative indicators of short-term changes rather than pollutant-specific regulatory concentrations.
- Cost and accessibility: Because the monitors are lower-cost and easier to deploy than reference analysers, they can improve spatial coverage and help identify potential localised events, provided the limitations above are clearly recognised.

In summary, AirGradient monitors provide useful indicative information for non-regulatory screening. Still, the data should not be used as a substitute for approved reference or equivalent-method analyser data when assessing statutory compliance.

Station abbreviations used in figures and tables are Air = Airport, Brk = Brackenham, CBD = CBD, Emp = Empangeni, eSk = eSikhaleni, Flx = Felixton, HW = Harbour West, MS = Meerensee, Mtz = Mtunzini and Rch = Richardia.

Comparison basis: The comments below compare the AirGradient screening results with the July 2026 Monthly Air Quality report (Project 2026001 Report 019) for the RBCAA primary monitoring network. The comparison is qualitative and event/station-based, not a formal method comparison, because instruments, parameters and co-location coverage differ, and the AirGradient TVOC and NO_x outputs are dimensionless indices. The 3σ and 5σ screening thresholds are fixed from pooled valid hourly observations across operational AirGradient stations for calendar year 2025, calculated as the pooled mean plus three or five population standard deviations. Calculations use unrounded thresholds; figures display rounded values. These are statistical screening thresholds, not regulatory or health limits. The thresholds were independently re-derived for this issue from the 2025 pooled hourly datasets and reproduce the published values exactly (TVOC 3σ = 355.6, 5σ = 511.2; NO_x 3σ = 45.1, 5σ = 73.4; CO_2 3σ = 605.2 ppm, 5σ = 706.5 ppm). All July 2026 TVOC, NO_x and CO_2 event counts were recalculated from the source hourly datasets (2026-07_Jul_AirGradient-TVOC / -NOX / -CO2.xlsx, 17 August 2026 issue); Tables 4.2 and 5.2 have been restated where the previous values did not reproduce, and Table 6.2 reproduced without change. Unless otherwise stated, data completeness is calculated as the number of valid 10-minute records divided by the number of scheduled 10-minute records for the reporting month.

3. PARTICULATE MONITORING

3.1. Data Completeness

The July 2026 particulate data completeness results are summarised in Table 3.1.

Table 3.1: Particulate data completeness (%) based on valid 10-minute records.

Month	Air	Brk	CBD	Emp	eSk	Flx	HW	MS	Mtz	Rch
Jan 2026	-	99	***85***	-	97	100	100	100	***90***	100
Feb 2026	***85***	***93***	***85***	***65***	96	98	100	100	98	99
Mar 2026	96	97	99	***90***	***94***	99	99	98	***91***	99
Apr 2026	100	***94***	100	96	96	99	100	100	***90***	100
May 2026	98	99	100	99	***94***	100	100	99	99	100
Jun 2026	99	97	100	99	95	100	100	100	98	99
Jul 2026	100	98	***89***	***94***	***91***	100	100	100	99	100
Aug 2026	-	-	-	-	-	-	-	-	-	-
Sept 2026	-	-	-	-	-	-	-	-	-	-
Oct 2026	-	-	-	-	-	-	-	-	-	-
Nov 2026	-	-	-	-	-	-	-	-	-	-
Dec 2026	-	-	-	-	-	-	-	-	-	-

Missing Data (Particulates)

- *Particulate data completeness ranged from 88.5% to 100% in July 2026. Airport, Harbour West, Meerensee and Richardia recorded 100%, and Felixton (99.7%), Mtunzini (99.0%) and Brackenham (98.4%) met the RBCAA 95% operational target. Empangeni (94.0%) and eSikhaleni (91.3%) met the 90% minimum data capture specified in SANS 1929:2011 (Annex C, Table C.1) but not the 95% target, and CBD (88.5%) met only the 80% statistical-robustness threshold. No July monthly particulate value is withheld. Remaining gaps were intermittent and short.*

3.2. Monthly Concentrations

PM_{10} and $PM_{2.5}$ monthly average concentrations are shown in Figures 3.1 and 3.2. Comparisons to previous months are provided in Figures 3.3 and 3.4.
Regulatory/health-limit interpretation: for PM_{10} and $PM_{2.5}$, the RSA ambient standards are the applicable regulatory reference values, while the WHO air quality guidelines are used as health-based contextual benchmarks. Because these AirGradient measurements are screening-network data, the comparisons identify potential concern and follow-up priorities only; they do not constitute reference-method compliance findings.

- Monthly PM_{10} averages (15.3–36.7 µg/m³) were below the RSA annual standard value of 40 µg/m³ at all ten stations, but above the WHO annual guideline value of 15 µg/m³ at all ten, including CBD (15.3 µg/m³). Annual compliance cannot be assessed from a single monthly average, and AirGradient data remain screening data rather than regulatory-equivalent measurements.
- Monthly $PM_{2.5}$ averages (14.1–22.6 µg/m³) were below the RSA annual standard value of 20 µg/m³ at nine stations; Felixton (22.6 µg/m³) was above it on a single-month basis. All ten stations were above the WHO annual guideline value of 5 µg/m³, shown for context. This is a contextual comparison of screening data only and is not a formal annual exceedance or compliance assessment.
- Station-specific monthly benchmark status: no station exceeded the RSA PM_{10} annual standard value in the July 2026 screening comparison, and only Felixton exceeded the RSA $PM_{2.5}$ annual standard value on a single-month basis. The WHO annual guideline comparison, used as a health-based contextual benchmark only, was exceeded for PM_{10} and for $PM_{2.5}$ at all ten AirGradient stations.

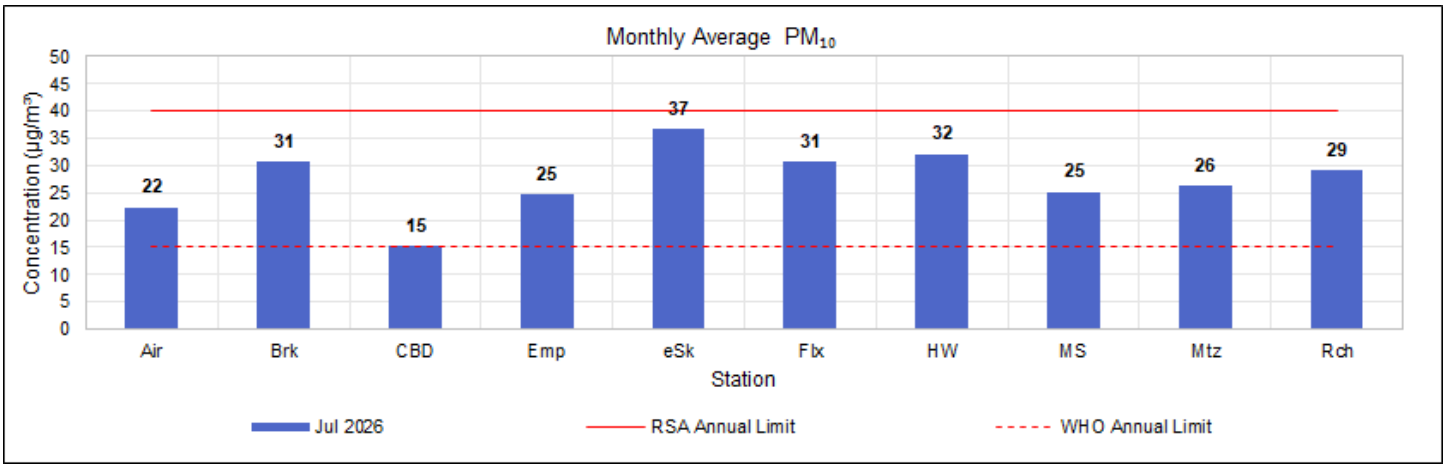

Figure 3.1: PM_{10} monthly concentration.

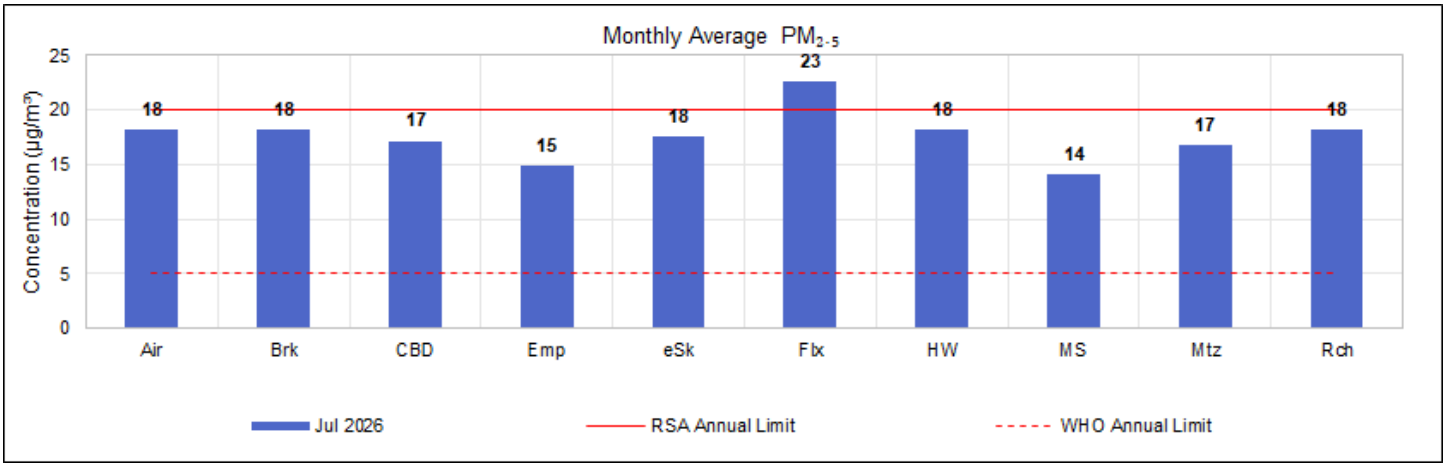

Figure 3.2: $PM_{2.5}$ monthly concentration.

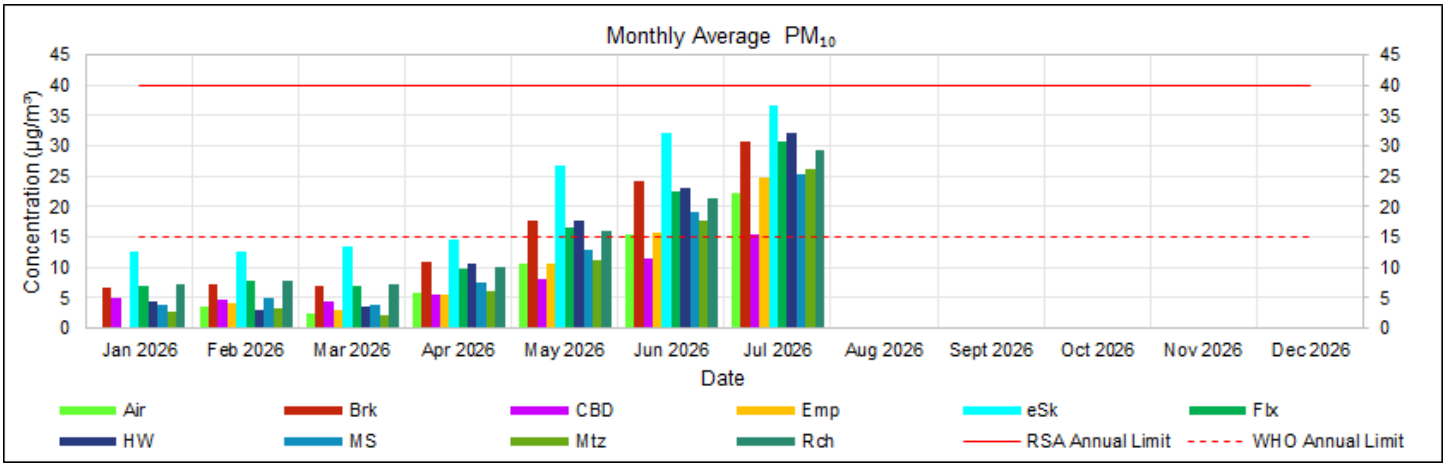

Figure 3.3: PM_{10} monthly comparison.

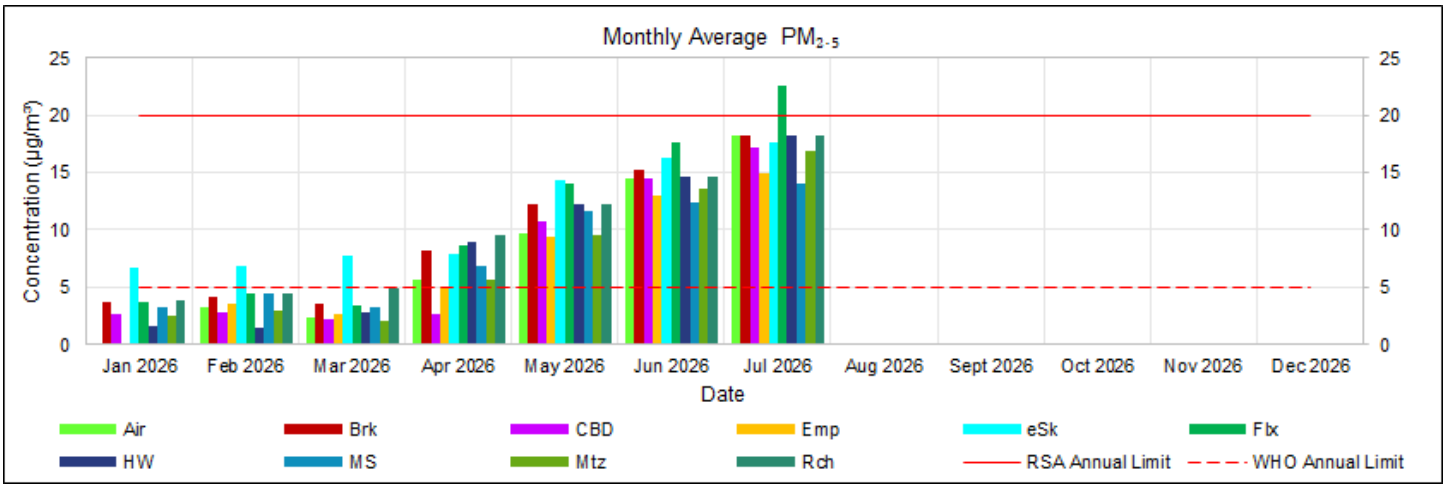

Figure 3.4: $PM_{2.5}$ monthly comparison.

3.3. Diurnal Concentrations

PM diurnal concentrations are shown in Figures 3.5 and 3.6.

- Diurnal PM_{10} and $PM_{2.5}$ averages are presented for temporal-pattern screening only. The July 2026 network-mean diurnal profile peaks at 21:00 (PM_{10} 35.5 µg/m³; $PM_{2.5}$ 21.1 µg/m³) and is lowest at 15:00 (19.3 and 13.8 µg/m³), a pattern consistent with nocturnal boundary-layer suppression and evening domestic combustion rather than with a single continuous industrial source.
- The RSA and WHO particulate criteria used in this report are calendar-day (24-hour) values and should not be applied to hour-of-day averages.
- Benchmark interpretation is therefore based on the calendar-day results in Section 3.4.

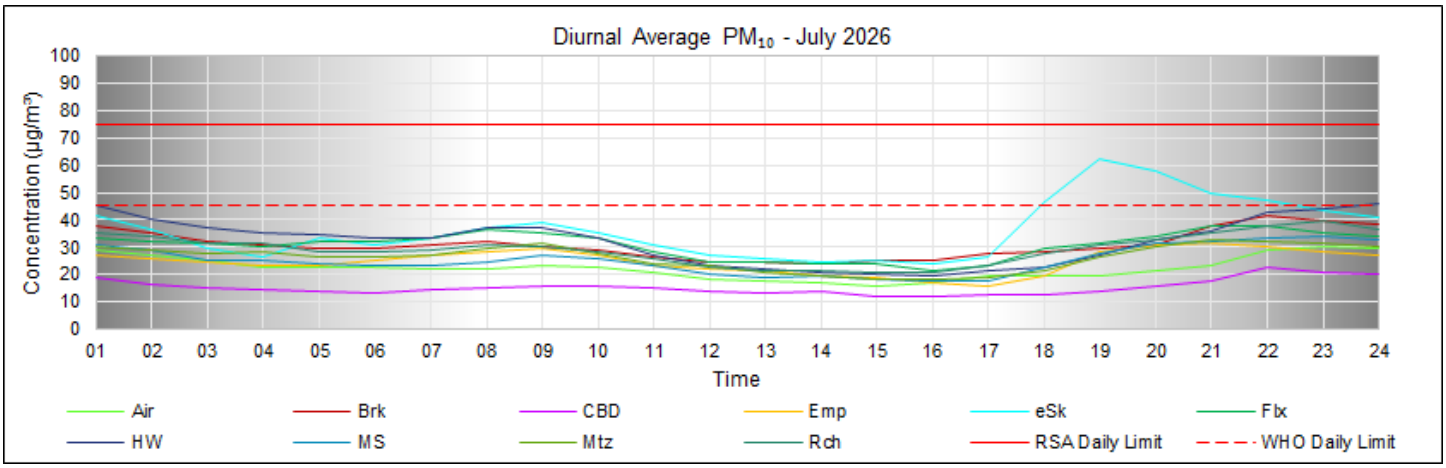

Figure 3.5: PM_{10} diurnal concentrations.

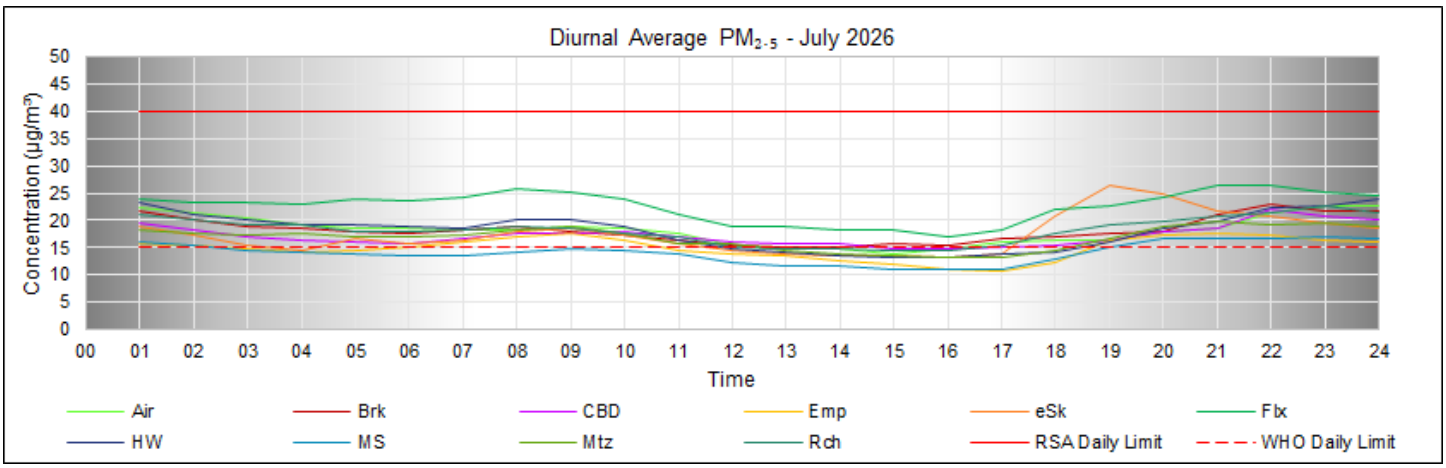

Figure 3.6: $PM_{2.5}$ diurnal concentrations.

3.4. Daily Concentrations

PM daily concentrations are shown in Figures 3.7 and 3.8.

- Daily average PM_{10} exceeded the RSA 24-hour standard value of 75 µg/m³ on four station-days: eSikhaleni (88.7 µg/m³ on 8 July and 75.5 µg/m³ on 19 July), Felixton (76.9 µg/m³ on 8 July) and Mtunzini (75.1 µg/m³ on 8 July). The WHO 24-hour guideline value of 45 µg/m³, shown for context, was exceeded at all stations except CBD, on four to seven days per station.
- Daily average $PM_{2.5}$ exceeded the RSA 24-hour standard value of 40 µg/m³ on five station-days: Felixton (52.4 µg/m³ on 8 July, 48.1 µg/m³ on 18 July and 40.7 µg/m³ on 19 July) and Airport (40.6 µg/m³ on 18 July and 41.9 µg/m³ on 19 July).
  The WHO 24-hour guideline value of 15 µg/m³ for $PM_{2.5}$ was exceeded at all ten stations, on 15 to 21 days per station, with the highest count at Felixton (21 days).
  These are screening-network results and should not be interpreted as reference-method compliance findings.
- Station-specific daily benchmark status: the RSA PM_{10} 24-hour standard value was exceeded at eSikhaleni (two days), Felixton (one day) and Mtunzini (one day); the RSA $PM_{2.5}$ 24-hour standard value was exceeded at Felixton (three days) and Airport (two days). The RSA 24-hour standards permit four exceedances per calendar year; on a screening basis no AirGradient station has reached that count in 2026 to date (PM_{10}: eSikhaleni 2, Felixton 1, Mtunzini 1; $PM_{2.5}$: Felixton 3, Airport 2, Empangeni 2). Felixton is nevertheless at three of the four permitted $PM_{2.5}$ exceedances with five months of the calendar year outstanding, and should be treated as a watch item. This is not a compliance determination, and the AirGradient counts carry the station-specific bias quantified in Section 3.5.

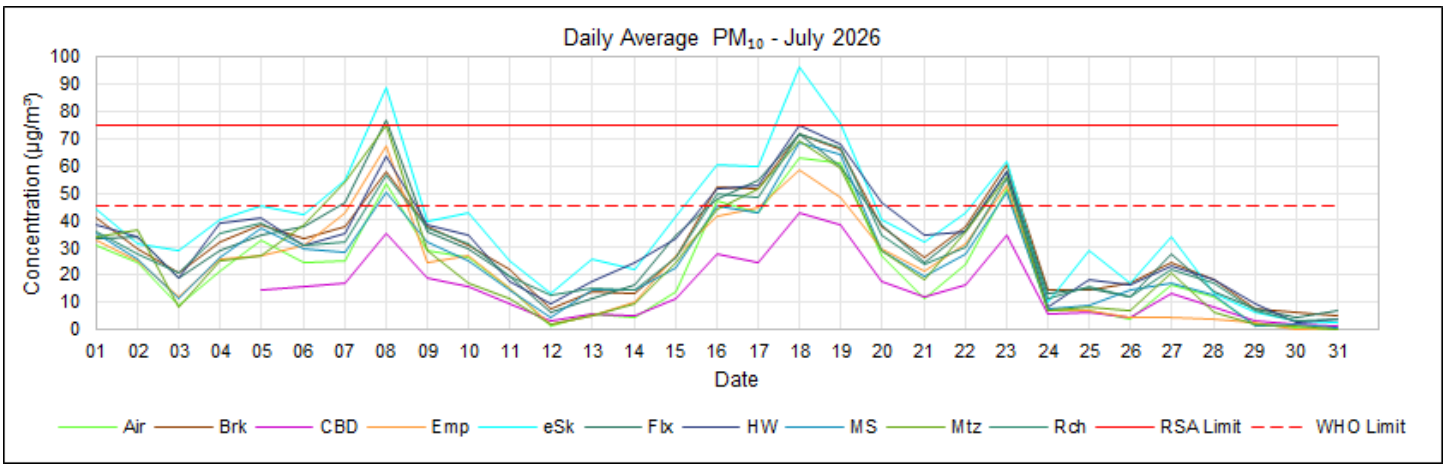

Figure 3.7: PM_{10} daily concentrations.

Missing Data (Particulates): intermittent short communication gaps only. July 2026 particulate data capture ranged from 88.5% (CBD) to 100%; all stations exceeded the 80% statistical-robustness threshold, and only CBD fell below the 90% minimum data capture specified in SANS 1929:2011 (Annex C, Table C.1).

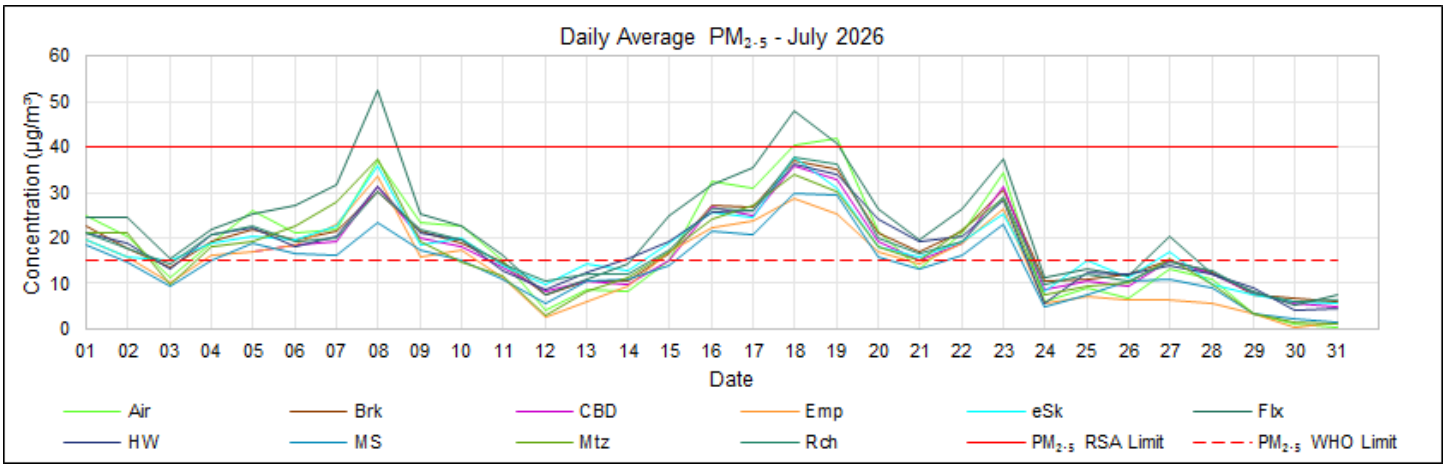

Figure 3.8: $PM_{2.5}$ daily concentrations.

3.5. Conclusion

Particulate concentrations across the AirGradient network increased at every station between June and July 2026, consistent with the seasonal winter maximum and the reduced dispersion associated with stable nocturnal conditions. Concentrations were moderate in absolute terms, with two short regional episodes (8 July and 18–19 July) accounting for all RSA 24-hour standard exceedances.

Monthly PM_{10} averages ranged from 15.3 to 36.7 µg/m³, with the highest value at eSikhaleni (36.7 µg/m³) and the lowest at CBD (15.3 µg/m³); the network mean rose from 20.3 µg/m³ in June to 27.4 µg/m³ in July. Monthly $PM_{2.5}$ averages ranged from 14.1 to 22.6 µg/m³, with the highest value at Felixton (22.6 µg/m³), followed by Airport, Brackenham, Harbour West and Richardia (18.2 µg/m³ each), and the lowest at Meerensee (14.1 µg/m³); the network mean rose from 14.6 to 17.6 µg/m³. Monthly PM_{10} averages were below the RSA annual standard value at all sites; the WHO annual guideline value, shown for context, was exceeded at all ten stations.

Monthly $PM_{2.5}$ averages were below the RSA annual standard value at all sites except Felixton (22.6 µg/m³), and all sites were above the WHO annual guideline value shown for context. These are contextual comparisons of screening data only; annual compliance cannot be concluded from one month of screening data. Daily average PM_{10} exceeded the RSA 24-hour standard value at eSikhaleni (8 and 19 July), Felixton (8 July) and Mtunzini (8 July), and exceeded the WHO 24-hour guideline value at all stations except CBD. Daily average $PM_{2.5}$ exceeded the RSA 24-hour standard value at Felixton (8, 18 and 19 July) and Airport (18 and 19 July), and exceeded the WHO 24-hour guideline value at all ten stations.

Regulatory-limit comment: four AirGradient PM_{10} daily averages (eSikhaleni × 2, Felixton, Mtunzini) and five $PM_{2.5}$ daily averages (Felixton × 3, Airport × 2) exceeded the corresponding RSA 24-hour standard values during July 2026. Because the RSA 24-hour standards permit four exceedances per calendar year, these screening results are not in themselves indicative of non-compliance, and annual regulatory status cannot be concluded from a single month of screening data. Health-limit comment: the WHO guideline comparisons are more conservative and indicate health-relevant particulate levels across the whole network, particularly for $PM_{2.5}$, which exceeded the WHO 24-hour guideline value at every station on 15 to 21 days.

Station-specific conclusion: the July 2026 AirGradient particulate results indicate RSA daily standard exceedances at four stations — eSikhaleni and Mtunzini (PM_{10}), Felixton (PM_{10} and $PM_{2.5}$) and Airport ($PM_{2.5}$). The health-based WHO daily guideline comparison identified PM_{10} exceedances at all stations except CBD, and $PM_{2.5}$ exceedances at all ten stations.

These are screening-network results and should not be interpreted as reference-method compliance findings. July particulate data completeness ranged from 88.5% to 100%: seven stations met the RBCAA 95% operational target, nine met the 90% minimum data capture specified in SANS 1929:2011 (Annex C, Table C.1), and all ten met the 80% statistical-robustness threshold. CBD (88.5%) fell below the SANS 1929:2011 minimum data capture and should be prioritised for maintenance.

Correlation with the July 2026 technical report: temporal agreement between the two networks is strong, but the magnitude agreement is station-specific. Across the paired calendar days of July 2026, the Pearson correlation between the AirGradient daily average and the co-located reference analyser is 0.92 to 0.96 at every co-located pair, confirming that the screening units track the same day-to-day variation. The mean daily bias, however, ranges from −13.5 µg/m³ (CBD, PM_{10}, n = 26) and −13.2 µg/m³ (Brackenham, $PM_{2.5}$, n = 31) to +18.1 µg/m³ (eSikhaleni, PM_{10}, n = 25), while Felixton (+0.5 µg/m³ $PM_{2.5}$, +4.4 µg/m³ PM_{10}), Harbour West (+1.8 µg/m³ $PM_{2.5}$) and Richardia (+1.4 µg/m³ $PM_{2.5}$) agree to within about 2 to 4 µg/m³. The practical consequences follow directly from that bias. At Felixton the two networks recorded $PM_{2.5}$ RSA 24-hour exceedances on identical dates (8, 18 and 19 July). At Brackenham the reference analyser recorded seven $PM_{2.5}$ RSA exceedance days and a peak of 82 µg/m³ on 18 July, whereas the co-located AirGradient unit peaked at 36.8 µg/m³ and recorded none — an underread of more than a factor of two on the worst day of the month. At eSikhaleni the AirGradient unit recorded two PM_{10} RSA exceedances (peak 88.7 µg/m³) where the reference analyser peaked at 36 µg/m³ and recorded none; at CBD the reference analyser recorded five WHO PM_{10} exceedance days (peak 73 µg/m³) where the AirGradient unit recorded none (peak 42.6 µg/m³ on 27 valid days). Because the correlation is high and the bias is stable and station-specific, the divergences are consistent with uncorrected sensor bias rather than with random error, and are in principle correctable by site-specific calibration factors derived from co-location. Until such factors are derived and documented, AirGradient exceedance counts must not be reported as, or compared directly with, reference-method results.

4. TOTAL VOLATILE ORGANIC COMPOUNDS MONITORING

Volatile organic compounds (VOCs) are organic chemicals that can evaporate at ambient temperatures. Outdoor VOCs may originate from industrial activities, combustion sources, vehicle exhaust and the use or storage of solvents and other chemical products. Health and environmental relevance depend strongly on the individual compound, concentration and exposure duration; therefore, a total VOC index should not be interpreted as a compound-specific health-risk metric. The AirGradient TVOC sensor does not identify individual compounds and reports a relative, dimensionless index rather than

an absolute concentration (Sensirion, 2022b). In this report, TVOC index data are used only as screening information to identify temporal changes and potential short-term events requiring follow-up.

4.1. Data Completeness

The July 2026 TVOC data completeness results are summarised in Table 4.1.

Table 4.1: TVOC data completeness (%) based on valid 10-minute records.

Month	Air	Brk	CBD	Emp	eSk	Flx	HW	MS	Mtz	Rch
Jan 2026	-	99	***84***	-	97	100	100	100	***90***	100
Feb 2026	***85***	***93***	***83***	***65***	96	98	100	100	98	99
Mar 2026	96	97	99	***90***	***94***	***92***	99	98	***91***	99
Apr 2026	100	***91***	97	96	96	99	100	100	***90***	100
May 2026	98	99	99	99	***94***	100	100	99	99	100
Jun 2026	99	97	100	99	***76***	100	100	100	98	99
Jul 2026	100	98	***88***	***94***	***91***	***69***	99	100	99	100
Aug 2026	-	-	-	-	-	-	-	-	-	-
Sept 2026	-	-	-	-	-	-	-	-	-	-
Oct 2026	-	-	-	-	-	-	-	-	-	-
Nov 2026	-	-	-	-	-	-	-	-	-	-
Dec 2026	-	-	-	-	-	-	-	-	-	-

Missing Data (TVOC)

- *Felixton – TVOC/NO_x sensor data were unavailable for 227.7 continuous hours, from 12 July 2026 00:10 to 21 July 2026 11:50, with a further 2.2-hour gap on 1 July (July monthly TVOC data completeness: 69.1%, based on valid 10-minute records). The Felixton July monthly TVOC value is therefore withheld. CBD (88.5%), eSikhaleni (91.3%) and Empangeni (94.0%) recorded reduced but usable capture; all remaining stations were at or above 98.4%.*

4.2. Monthly Index Values

TVOC monthly average index values are shown in Figure 4.1. Comparisons to previous months are also provided in Figure 4.2.

Regulatory/health-limit applicability: No South African ambient regulatory limit or generally applicable health-based limit is applied to the AirGradient TVOC index because it is a dimensionless relative index rather than a compound-specific concentration. Elevated TVOC index values are therefore evaluated only as screening indicators using temporal patterns and the 3σ/5σ event flags in Table 4.2.

Station-specific limit/standard status: no AirGradient TVOC station is recorded as exceeding a regulatory or health-based limit or standard in July 2026. Eight of the ten stations recorded one or more 3σ screening flags; eSikhaleni (22) and Richardia (20) recorded the most, while CBD and Empangeni recorded none. No station recorded a 5σ flag. These are screening-event flags only.

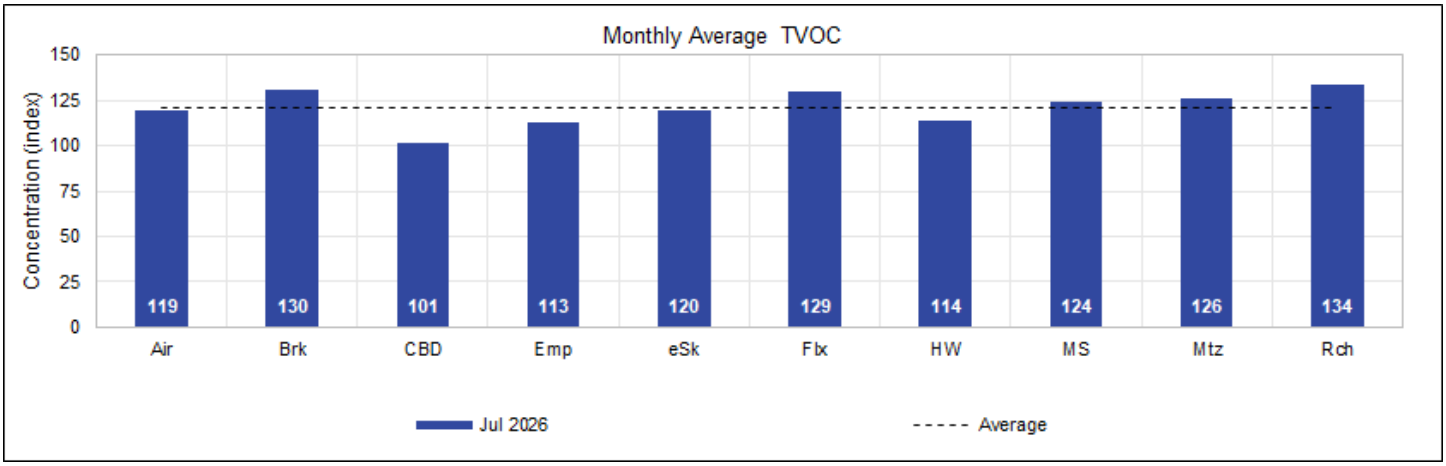

Figure 4.1: TVOC monthly index values.

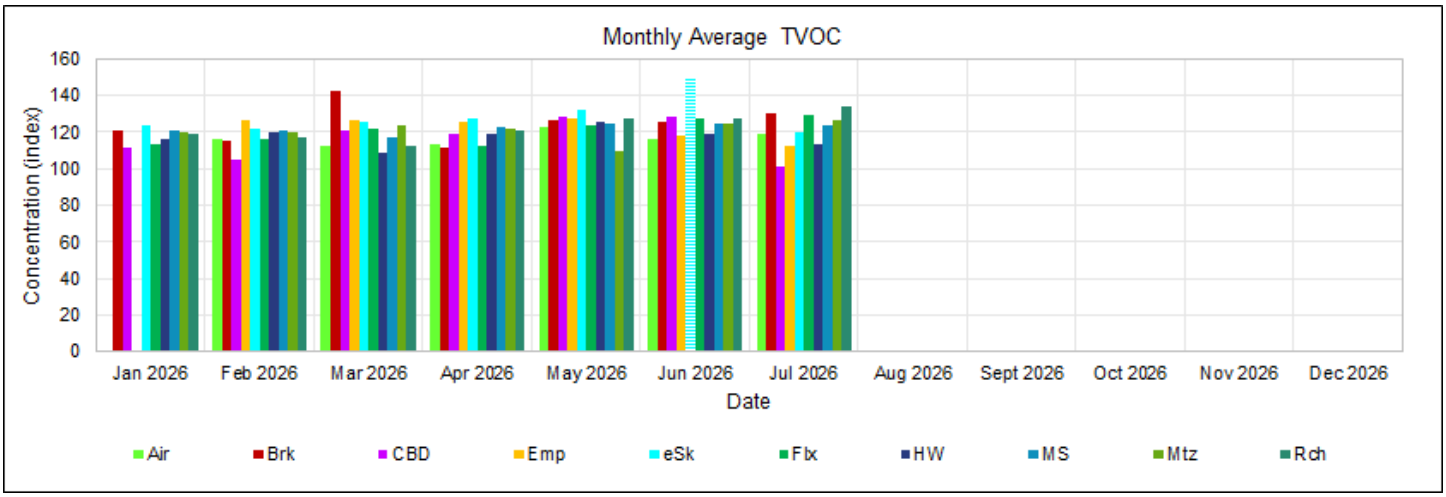

Figure 4.2: TVOC monthly index comparison.

4.3. Diurnal Index Values

TVOC diurnal index values are shown below (Figure 4.3).

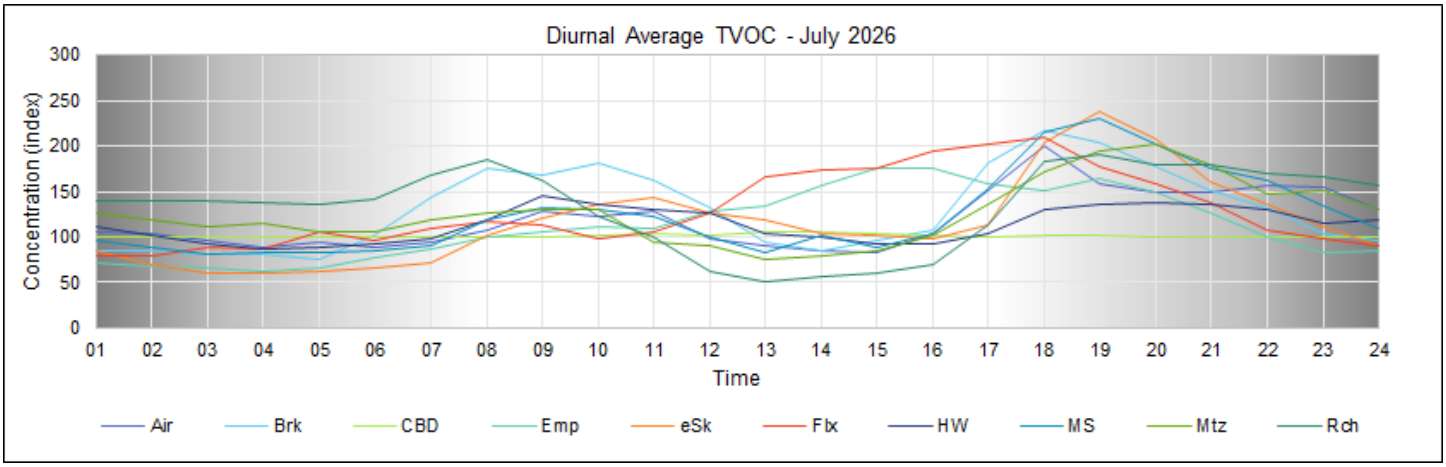

Figure 4.3: TVOC diurnal index values.

4.4. Daily Index Values

TVOC daily index values are shown below (Figure 4.4).

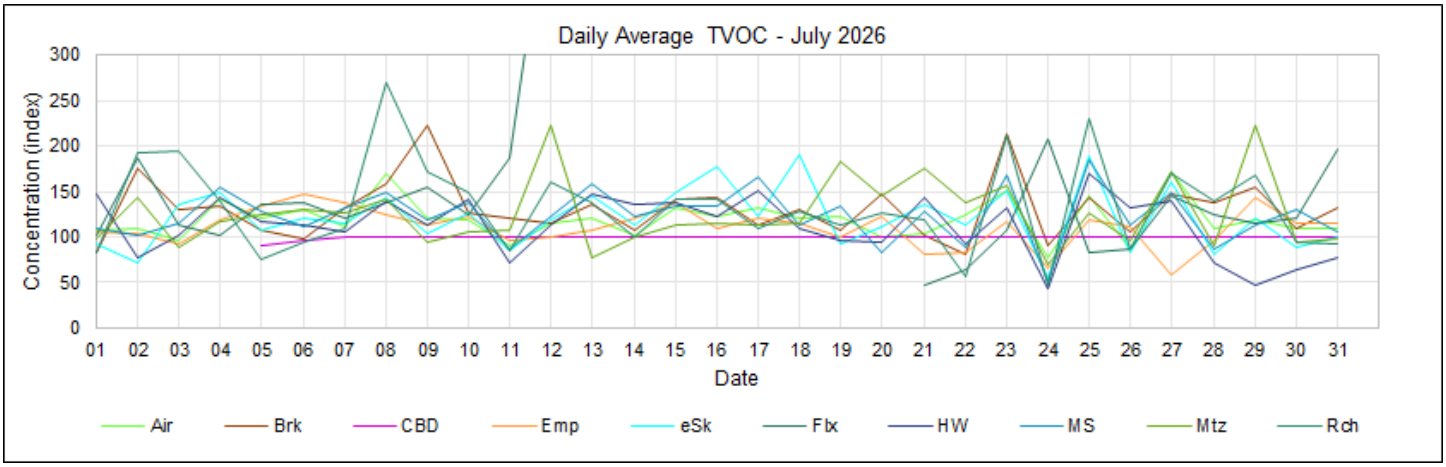

Figure 4.4: TVOC daily index values.

Missing Data (TVOC): Felixton – TVOC sensor data were unavailable from 12 to 21 July 2026 (69.1% capture; monthly value withheld); other stations recorded only intermittent short gaps.

4.5. Hourly Index Values

TVOC hourly index values are shown below (Figure 4.5).

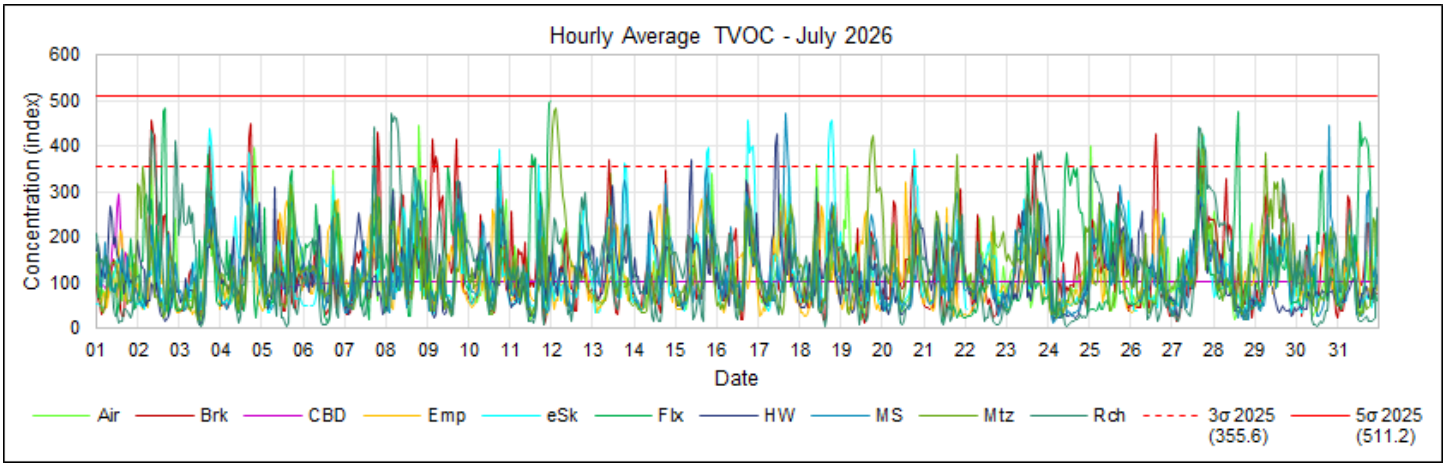

Figure 4.5: TVOC hourly index values.

TVOC hourly observations above the 3σ and 5σ screening thresholds are summarised in Table 4.2.

Table 4.2: TVOC hourly observations above the 3σ and 5σ screening thresholds.

Limit	Air	Brk	CBD	Emp	eSk	Flx	HW	MS	Mtz	Rch	Total
3σ	8	17	0	0	22	19	3	4	15	20	108
5σ	0	0	0	0	0	0	0	0	0	0	0

4.6. Conclusion

July 2026 TVOC monthly average index values ranged from 101.2 to 133.8. Richardia recorded the highest monthly average index value (133.8), followed by Brackenham (130.5), Mtunzini (126.1) and Meerensee (123.7); CBD recorded the lowest (101.2). The Felixton monthly value was withheld because July data completeness (69.1%) was below the 80% completeness threshold. Diurnal and hourly data indicate intermittent short-term elevated index events rather than persistently elevated conditions, with a network-wide diurnal maximum between 17:00 and 19:00 and a minimum between 02:00 and 05:00. Using the exact unrounded hourly thresholds (3σ = 355.6; 5σ = 511.2), 108 hourly observations were above 3σ and none were above 5σ. eSikhaleni (22), Richardia (20), Felixton (19) and Brackenham (17) recorded the most 3σ flags in absolute terms. Expressed as a rate of valid hours, however, Felixton recorded the highest event frequency of the network (19 flags in 514 valid hours, 3.7%), ahead of eSikhaleni (22 in 676 hours, 3.3%), Richardia (20 in 744 hours, 2.7%) and Brackenham (17 in 733 hours, 2.3%); the absolute counts alone therefore understate Felixton, whose record was truncated by the sensor failure of 12 to 21 July. Overall, the results indicate a relatively consistent baseline with isolated short-term events that warrant local-source follow-up only where they coincide with odour observations, complaints or relevant meteorological conditions. Six of the ten stations met the RBCAA 95% operational target for TVOC capture (Airport, Brackenham, Harbour West, Meerensee, Mtunzini and Richardia).

Regulatory and health-limit conclusion: the TVOC findings cannot be assessed against an ambient compliance limit or a health-based concentration threshold in this report. The reported events should be treated as screening triggers for source-pattern review, targeted field observations or compound-specific monitoring where persistent or recurrent elevations are observed.

Station-specific conclusion: no TVOC station exceeded an applicable regulatory or health limit or standard; all named TVOC stations with 3σ flags should therefore be described as screening-event locations rather than exceedance locations.

Correlation with the July 2026 technical report: there is no direct TVOC comparator. The only overlap is contextual. Thirty air quality complaints were logged in July 2026 (June 2026: 45), and the reference network recorded TRS exceedances of the OME 10-minute limit at Felixton (55), Brackenham (4) and eSikhaleni (3), and of the WHO 30-minute H_2S guideline at Felixton (54), eSikhaleni (16), Brackenham (11), CBD (2) and Richardia (1). TVOC 3σ flags occurred at eSikhaleni, Richardia, Felixton, Brackenham, Mtunzini, Airport, Harbour West and Meerensee. The co-occurrence at Felixton, eSikhaleni and Brackenham is a follow-up trigger only, not attribution; the TVOC index responds to a broad and unspecified range of compounds and cannot be equated with reduced sulphur species.

5. NITROGEN OXIDES MONITORING

Nitrogen oxides (NO_x) are a group of reactive gases that primarily include nitric oxide (NO) and nitrogen dioxide (NO_2), generated mainly by high-temperature combustion from vehicles, power generation and industrial activities. NO_x contributes to the formation of ozone and secondary particulate matter and can affect respiratory health, particularly in susceptible populations. The AirGradient NO_x sensor reports a relative, dimensionless index rather than pollutant-specific NO or NO_2 concentrations (Sensirion, 2022a). In this report, NO_x index data are used as screening information to identify short-term changes and potential events, not to assess compliance with ambient NO_2 standards.

5.1. Data Completeness

The July 2026 NO_x data completeness results are summarised in Table 5.1.

Table 5.1: NO_x data completeness (%) based on valid 10-minute records.

Month	Air	Brk	CBD	Emp	eSk	Flx	HW	MS	Mtz	Rch
Jan 2026	-	99	***84***	-	97	100	100	100	***90***	100
Feb 2026	***85***	***93***	***83***	***65***	96	98	100	100	98	99
Mar 2026	96	97	99	***90***	***94***	***92***	99	98	***91***	99
Apr 2026	100	***91***	97	96	96	99	100	100	***90***	100
May 2026	98	99	99	99	***94***	100	100	99	99	100
Jun 2026	99	97	100	99	***76***	100	100	100	98	99
Jul 2026	100	98	***88***	***94***	***91***	***69***	99	100	99	100
Aug 2026	-	-	-	-	-	-	-	-	-	-
Sept 2026	-	-	-	-	-	-	-	-	-	-
Oct 2026	-	-	-	-	-	-	-	-	-	-
Nov 2026	-	-	-	-	-	-	-	-	-	-
Dec 2026	-	-	-	-	-	-	-	-	-	-

Missing Data (NO_x)

- *Felixton – TVOC/NO_x sensor data were unavailable for 227.7 continuous hours, from 12 July 2026 00:10 to 21 July 2026 11:50, with a further 2.2-hour gap on 1 July (July monthly NO_x data completeness: 69.1%, based on valid 10-minute records). The Felixton July monthly NO_x value is therefore withheld. The failure was parameter-specific: Felixton CO_2 and particulate capture was unaffected over the same window.*

5.2. Monthly Index Values

NO_x monthly average index values are shown in Figure 5.1; comparisons to previous months are also provided in Figure 5.2.

Regulatory/health-limit applicability: the AirGradient NO_x output is reported as a dimensionless index and is not equivalent to an NO_2 or NO_x concentration in µg/m³. South African NO_2 ambient standards and WHO NO_2 health-based guidelines are therefore not applied to these index data; interpretation is limited to relative screening and 3σ/5σ event identification.

Station-specific limit/standard status: no AirGradient NO_x station is recorded as exceeding a regulatory or health-based limit or standard in July 2026, because the NO_x output is an index and not an NO_2 concentration. eSikhaleni was the only station with screening flags, recording three hourly observations above the 3σ threshold (maximum hourly index 57.5) and none above 5σ. Meerensee recorded a July maximum of 42.8, below the 3σ threshold. These are screening flags only and not regulatory or health-standard exceedances.

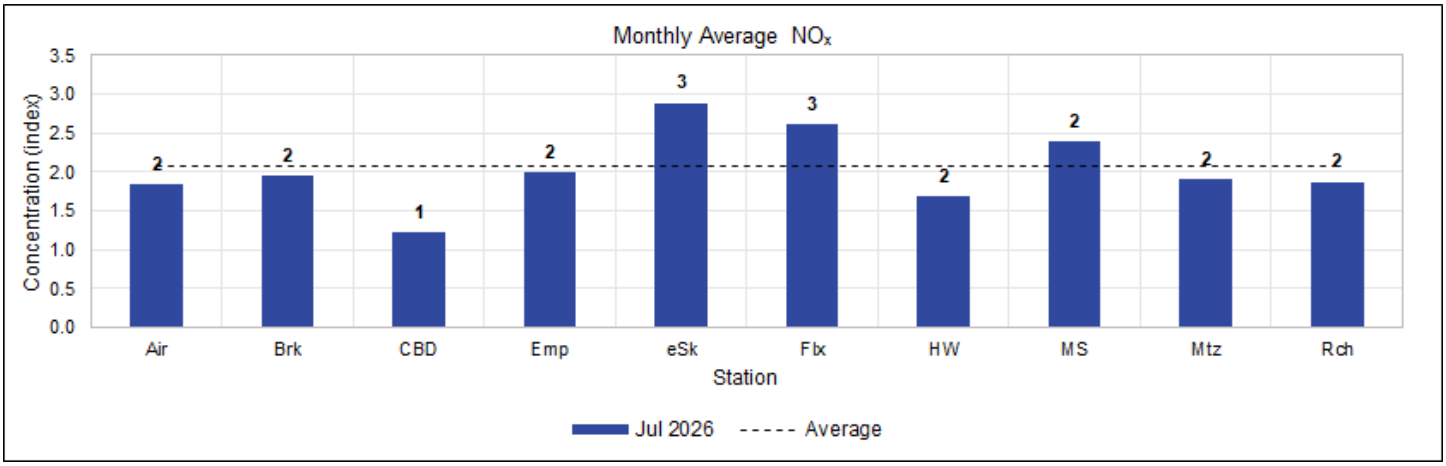

Figure 5.1: NO_x monthly index values.

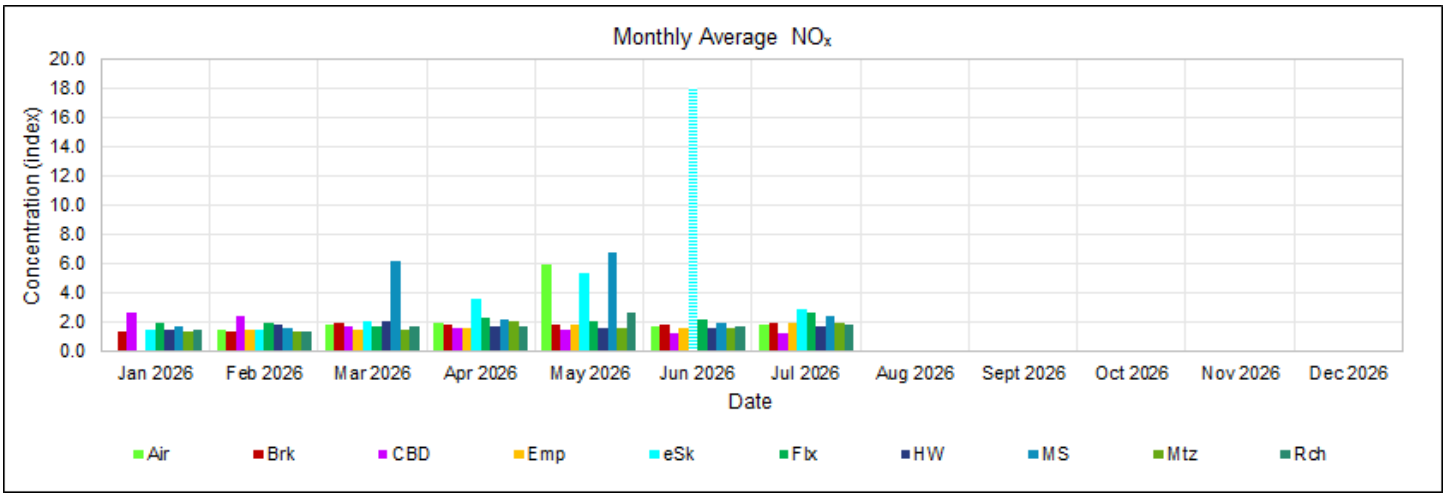

Figure 5.2: NO_x monthly comparison.

5.3. Diurnal Index Values

NO_x diurnal index values are shown below (Figure 5.3).

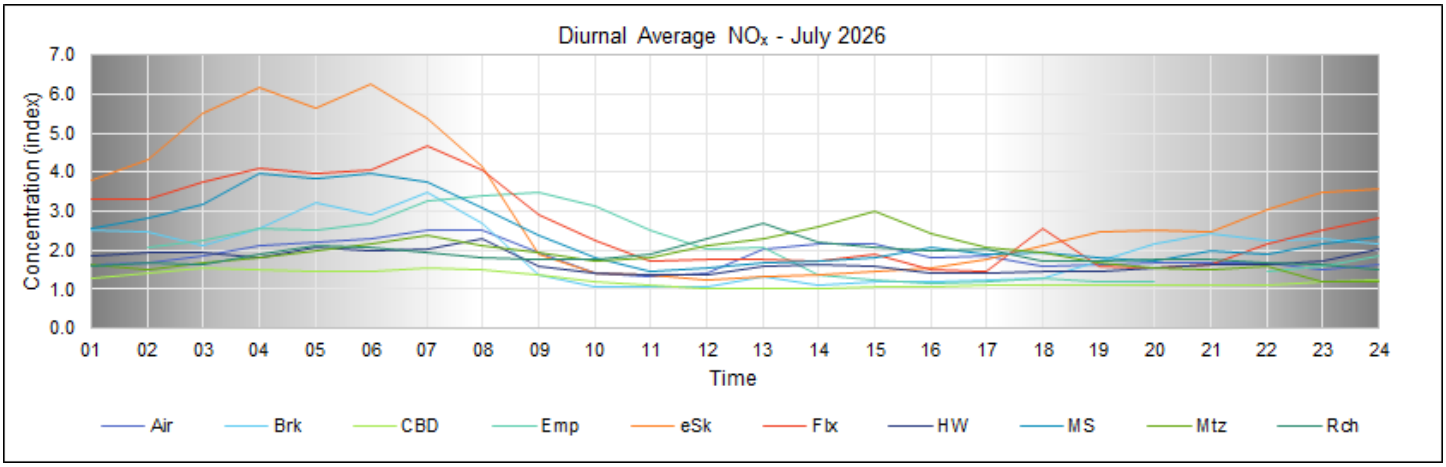

Figure 5.3: NO_x diurnal index values.

5.4. Daily Index Values

NO_x daily index values are shown below (Figure 5.4).

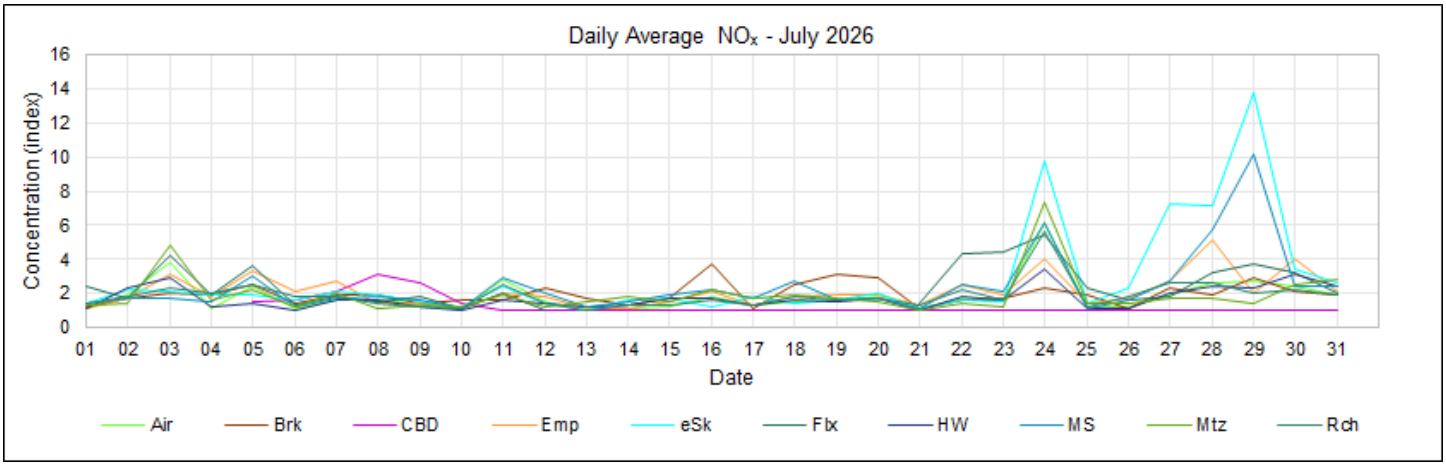

Figure 5.4: NO_x daily index values.

Missing Data (NO_x): Felixton – NO_x sensor data were unavailable from 12 to 21 July 2026 (69.1% capture; monthly value withheld); other stations recorded only intermittent short gaps.

5.5. Hourly Index Values

NO_x hourly index values are shown below (Figure 5.5).

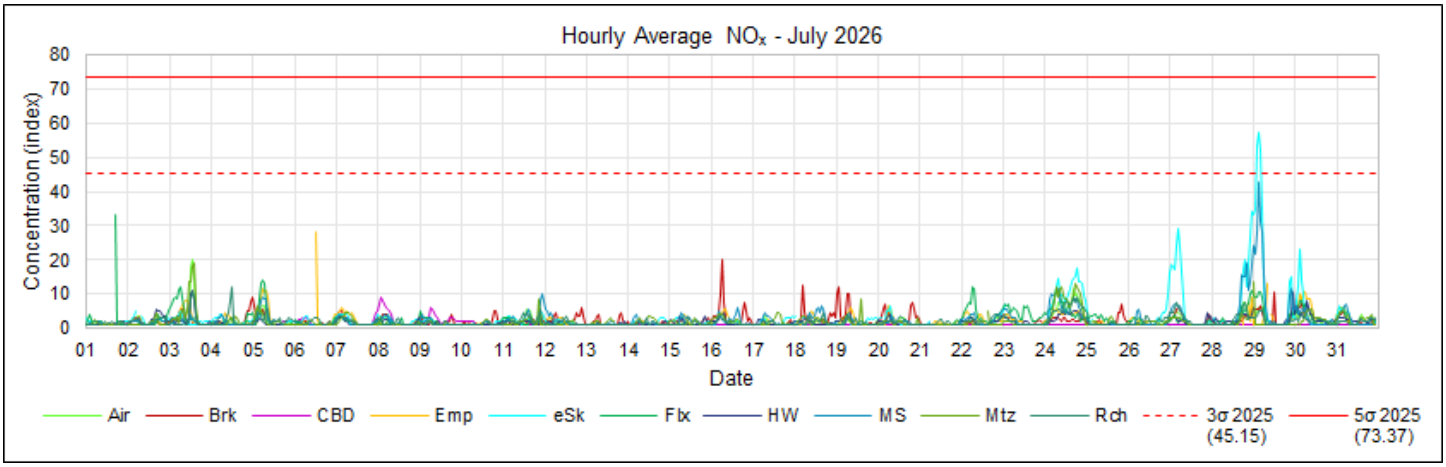

Figure 5.5: NO_x hourly index values.

NO_x hourly observations above the 3σ and 5σ screening thresholds are summarised in Table 5.2.

Table 5.2: NO_x hourly observations above the 3σ and 5σ screening thresholds.

Limit	Air	Brk	CBD	Emp	eSk	Flx	HW	MS	Mtz	Rch	Total
3σ	0	0	0	0	3	0	0	0	0	0	3
5σ	0	0	0	0	0	0	0	0	0	0	0

5.6. Conclusion

July 2026 NO_x monthly average index values remained low at all sites meeting the completeness criterion, ranging from 1.2 to 2.9. eSikhaleni recorded the highest monthly average index value (2.9), followed by Meerensee (2.4) and Empangeni (2.0); CBD recorded the lowest (1.2). The Felixton monthly value was withheld because July data completeness (69.1%) was below the 80% completeness threshold. Using the exact unrounded hourly thresholds (3σ = 45.1; 5σ = 73.4), eSikhaleni was the only station with screening flags: three hourly observations above 3σ and none above 5σ. This is a marked reduction on June 2026, when eSikhaleni recorded 57 observations above 3σ and 37 above 5σ, and the July data therefore no longer support a recurrent elevated-index characterisation of that site. The network diurnal profile peaks between 04:00 and 07:00 and is lowest between 10:00 and 12:00, consistent with overnight accumulation under stable conditions rather than with a specific source. Because the AirGradient NO_x output is a dimensionless index rather than a pollutant-specific NO or NO_2 concentration, the results are screening indicators only and do not demonstrate compliance or non-compliance with ambient NO_2 standards.

Regulatory and health-limit conclusion: no regulatory or health-limit exceedance is concluded from the NO_x index results. Recurrent elevated index events should be treated as screening evidence requiring corroboration with reference/equivalent NO_2 or NO_x measurements before any compliance or health-risk interpretation is made.

Station-specific conclusion: no NO_x station exceeded an applicable regulatory or health limit or standard. eSikhaleni recorded the only 3σ screening flags (three hours) and should be noted as a low-frequency screening-event location; on the July 2026 data no station warrants a recurrent-event designation.

Correlation with the July 2026 technical report: there is no direct NO_2 or NO_x comparator, because the RBCAA primary network measures PM_{10}, $PM_{2.5}$, SO_2 and TRS only. The three elevated NO_x index flags occurred at eSikhaleni, which also recorded reference-network TRS exceedances in July 2026 (three above the OME 10-minute limit and 16 above the WHO 30-minute H_2S guideline). This overlap is contextual only and cannot establish pollutant equivalence, compliance status or source attribution without reference or equivalent NO_2/NO_x measurements.

6. CARBON DIOXIDE MONITORING

Carbon dioxide (CO_2) is reported in parts per million (ppm). In this report, CO_2 data are used as indicative local concentration measurements to identify relative build-up events and spatial differences across the AirGradient network. Because outdoor CO_2 varies with local sources, vegetation, atmospheric mixing, and sensor accuracy, small differences around the background reference line should not be over-interpreted.

6.1. Data Completeness

The July 2026 CO_2 data completeness results are summarised in Table 6.1.

Table 6.1: CO_2 data completeness (%) based on valid 10-minute records.

Month	Air	Brk	CBD	Emp	eSk	Flx	HW	MS	Mtz	Rch
Jan 2026	-	99	***85***	-	97	100	-	100	***90***	100
Feb 2026	***85***	***93***	***85***	***65***	96	98	100	100	98	99
Mar 2026	96	97	99	***90***	***94***	99	99	98	***91***	99
Apr 2026	100	***94***	100	96	96	99	100	100	***90***	100
May 2026	98	99	100	99	***94***	100	100	99	99	100
Jun 2026	99	97	100	99	95	100	100	100	98	99
Jul 2026	100	98	***89***	***94***	***91***	100	100	100	99	100
Aug 2026	-	-	-	-	-	-	-	-	-	-
Sept 2026	-	-	-	-	-	-	-	-	-	-
Oct 2026	-	-	-	-	-	-	-	-	-	-
Nov 2026	-	-	-	-	-	-	-	-	-	-
Dec 2026	-	-	-	-	-	-	-	-	-	-

Missing Data (CO_2)

- *CO_2 data completeness ranged from 88.5% to 100% in July 2026. CBD (88.5%), eSikhaleni (91.3%) and Empangeni (94.0%) fell below the RBCAA 95% operational target, and CBD also fell below the 90% minimum data capture specified in SANS 1929:2011 (Annex C, Table C.1); all ten stations met the 80% statistical-robustness threshold, so no monthly value is withheld. Felixton CO_2 capture was 99.7% despite the concurrent Felixton TVOC/NO_x sensor failure, confirming that the failure was parameter-specific. Remaining gaps were intermittent and short.*

6.2. Monthly Concentrations

CO_2 monthly average concentrations are shown in Figure 6.1; comparisons to previous months are also provided (Figure 6.2).

Regulatory/health-limit applicability: no South African ambient regulatory limit or WHO ambient health-based guideline is applied to outdoor CO_2 in this report. Occupational exposure limits and indoor ventilation thresholds are not appropriate ambient-air compliance criteria; CO_2 is used here only as an indicative tracer for local accumulation, mixing and possible combustion or respiration influences.

Station-specific limit/standard status: no AirGradient CO_2 station is recorded as exceeding an ambient regulatory or health-based limit or standard in July 2026. Felixton (63), Harbour West (36) and eSikhaleni (20) recorded 3σ

screening flags; of these, Felixton (33) and Harbour West (31) also recorded 5σ flags. No other station recorded a flag. These are local accumulation indicators only.

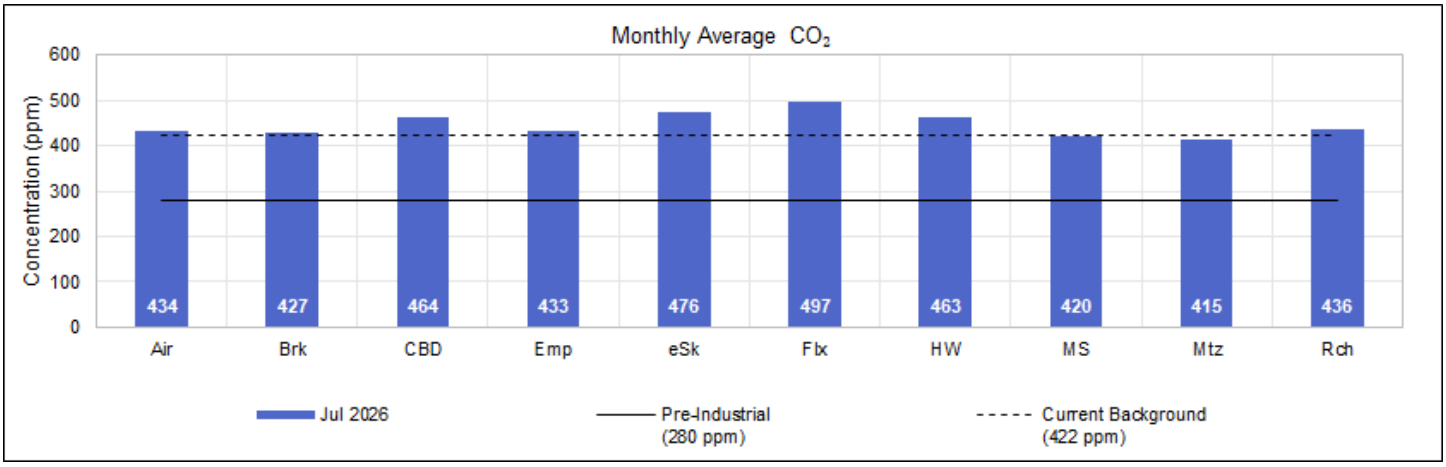

Figure 6.1: CO_2 monthly concentration.

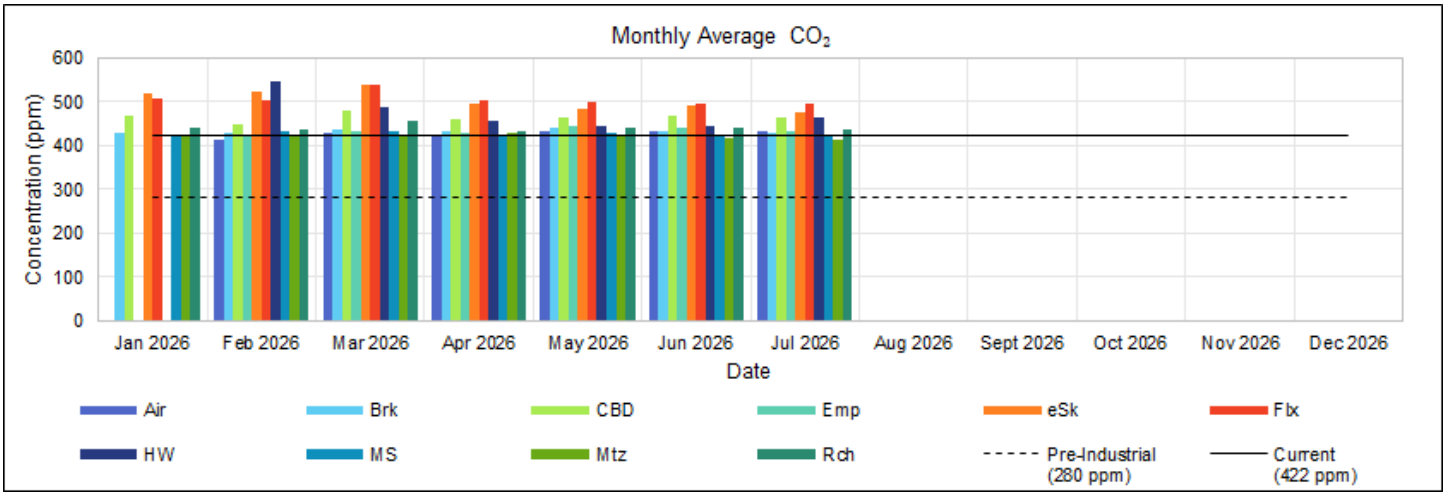

Figure 6.2: CO_2 monthly comparison.

6.3. Diurnal Concentrations

CO_2 diurnal concentrations are shown below (Figure 6.3).

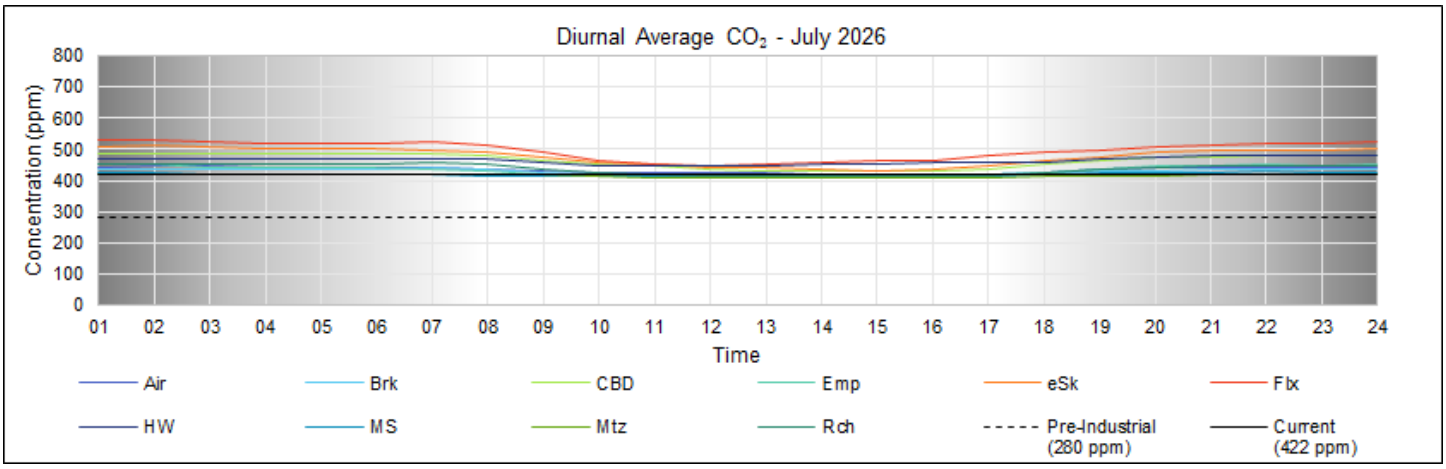

Figure 6.3: CO_2 diurnal concentrations.

6.4. Daily Concentrations

CO_2 daily concentrations are shown below (Figure 6.4).

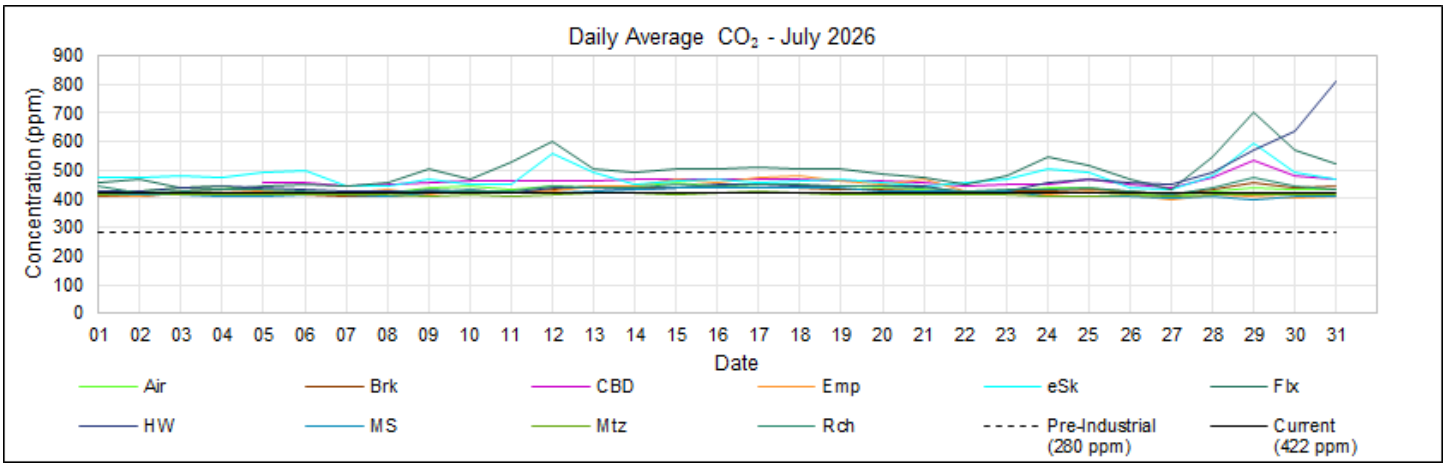

Figure 6.4: CO_2 daily concentrations.

Missing Data (CO_2): intermittent short communication gaps only. July 2026 CO_2 data capture ranged from 88.5% (CBD) to 100%; all stations exceeded the 80% statistical-robustness threshold.

6.5. Hourly Concentrations

CO_2 hourly concentrations are shown below (Figure 6.5).

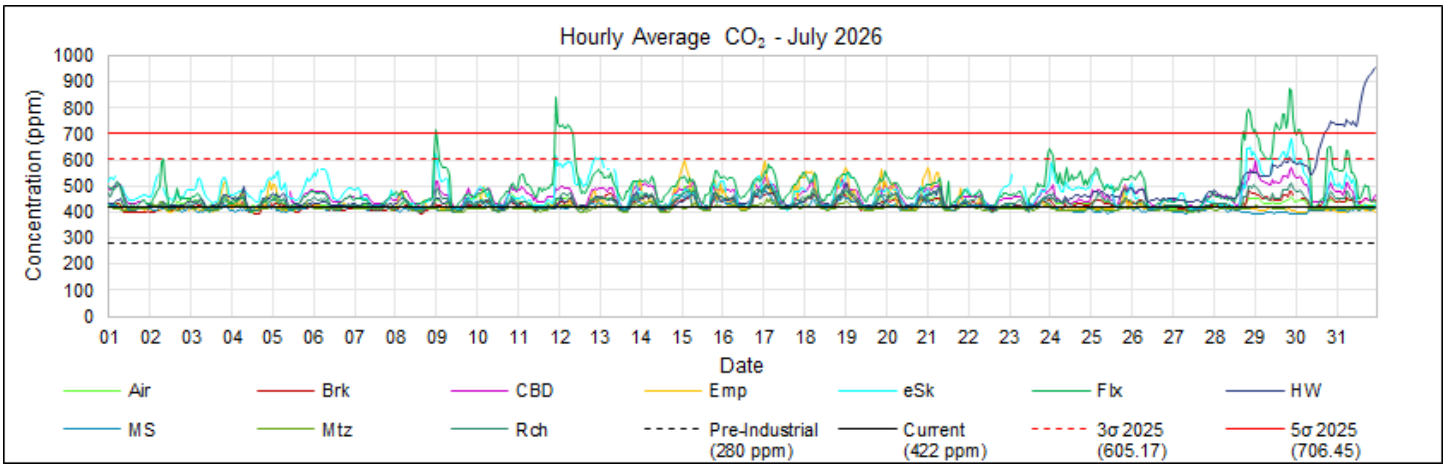

Figure 6.5: CO_2 hourly concentrations.

CO_2 hourly observations above the 3σ and 5σ screening thresholds are summarised in Table 6.2.

Table 6.2: CO_2 hourly observations above the 3σ and 5σ screening thresholds.

Limit	Air	Brk	CBD	Emp	eSk	Flx	HW	MS	Mtz	Rch	Total
3σ	0	0	0	0	**20**	**63**	**36**	0	0	0	119
5σ	0	0	0	0	0	**33**	**31**	0	0	0	64

6.6. Conclusion

July 2026 CO_2 monthly average concentrations ranged from 414.7 to 497.5 ppm. Felixton recorded the highest monthly average (497.5 ppm), followed by eSikhaleni (475.9 ppm), CBD (463.7 ppm) and Harbour West (463.5 ppm). Airport, Brackenham, Empangeni and Richardia were closer to the illustrative 422 ppm background reference line shown in the monthly plot, with Meerensee (419.8 ppm) and Mtunzini (414.7 ppm) marginally below it; small differences around this line should be interpreted in the context of sensor uncertainty. Using the exact unrounded hourly thresholds (3σ = 605.2 ppm; 5σ = 706.5 ppm), 119 hourly observations were above 3σ and 64 were above 5σ. Felixton dominated the events (63 above 3σ, of which 33 were above 5σ), followed by Harbour West (36 and 31) and eSikhaleni (20 and none); no other station recorded a flag. Harbour West recorded the highest single hourly value of the month (956.7 ppm) and a month-on-month rise in monthly average (443.6 to 463.5 ppm) that is not mirrored at neighbouring sites; its calibration record should be checked before the event count is relied upon. The network diurnal profile peaks overnight (maximum at 00:00–01:00, 461.8 ppm) and is lowest in the early afternoon (13:00, 425.2 ppm), consistent with boundary-layer control rather than a continuous local source. The results are indicative screening information for local accumulation and mixing conditions, not a regulatory compliance metric. July CO_2 data completeness ranged from 88.5% to 100%; seven stations met the RBCAA 95% operational target and all ten met the 80% statistical-robustness threshold.

Regulatory and health-limit conclusion: the CO_2 results do not represent regulatory or health-limit exceedances. The elevated short-term flags, particularly at Felixton, identify local accumulation events for follow-up but should not be interpreted as ambient health-limit breaches.

Station-specific conclusion: no CO_2 station exceeded an applicable ambient regulatory or health limit or standard. Felixton and Harbour West should be highlighted only as the dominant short-term CO_2 accumulation locations, not as health-standard exceedance locations.

Correlation with the July 2026 technical report: Felixton is the principal overlap within the reporting period. It recorded the strongest AirGradient CO_2 screening activity (63 hours above 3σ, of which 33 were above 5σ), while the reference network recorded Felixton $PM_{2.5}$ RSA 24-hour exceedances on 8, 18 and 19 July and 55 TRS exceedances of the OME 10-minute limit. Thirty air quality complaints were logged across the RBCAA area in July 2026. This is a month-level co-occurrence only; it establishes neither temporal correlation nor source attribution, and CO_2 is not a marker for the reduced sulphur species that drive the Felixton TRS record.

7. CONSOLIDATED AIRGRADIENT MONITORING CONCLUSION

Overall, the July 2026 AirGradient monitoring results indicate that the secondary screening network provided useful spatial and short-term event context, but the data remain indicative and are not equivalent to reference or regulatory-equivalent analyser data. No AirGradient result should be interpreted as a statutory compliance finding. The only parameter for which regulatory and health-based benchmark comparisons were applied was particulate matter. Across the AirGradient particulate dataset, four PM_{10} daily averages exceeded the RSA 24-hour standard value (eSikhaleni on 8 and 19 July; Felixton and Mtunzini on 8 July) and five $PM_{2.5}$ daily averages exceeded it (Felixton on 8, 18 and 19 July; Airport on 18 and 19 July). Monthly averages were below the applicable RSA annual standard values at all stations except Felixton for $PM_{2.5}$ (22.6 µg/m³); annual compliance cannot be concluded from one month of screening data. The WHO health-based guideline comparisons were more conservative, flagging PM_{10} at all stations except CBD and $PM_{2.5}$ at all ten stations, and indicate health-relevant particulate levels for follow-up.

TVOC and NO_x outputs are dimensionless index values, and CO_2 is used as an ambient screening or tracer parameter; no applicable ambient regulatory or health-based exceedance is concluded for these parameters. TVOC recorded 108 hourly observations above 3σ and none above 5σ, distributed across eight stations, with eSikhaleni (22) and Richardia (20) the most frequent. NO_x screening flags occurred only at eSikhaleni (three observations above 3σ, none above 5σ), a marked reduction on June 2026. CO_2 recorded 119 observations above 3σ and 64 above 5σ, concentrated at Felixton (63 and 33) and Harbour West (36 and 31). These findings are local screening triggers, not compliance or health-limit breaches.

Correlation with the July 2026 technical report is event-based rather than quantitative. The clearest overlap is the 8 July and 18–19 July regional particulate episode, on which the AirGradient and reference networks recorded $PM_{2.5}$ RSA 24-hour exceedances at the co-located Felixton site on identical dates. Agreement is not general: at eSikhaleni the AirGradient unit reported two PM_{10} RSA exceedances where the reference analyser reported none, and at CBD the reference analyser reported five WHO PM_{10} exceedance days where the AirGradient unit reported none. Other overlaps at Felixton (CO_2 screening activity with reference-network TRS exceedances) and eSikhaleni (NO_x index flags with TRS exceedances) indicate follow-up priorities only. These are month-level associations; co-location, reference or equivalent measurements and meteorological and source analysis are required before concluding equivalence or attribution.

July 2026 data completeness was 88.5%–100% for PM and CO_2 and 69.1%–100% for TVOC and NO_x. All ten stations met the 80% statistical-robustness threshold for PM and CO_2, and CBD (88.5%) was the only station below the 90% minimum data capture specified in SANS 1929:2011 (Annex C, Table C.1) for those parameters. Felixton TVOC and NO_x capture was 69.1% because the gas sensor was unavailable from 12 to 21 July 2026; the July monthly TVOC and NO_x statistics for Felixton were therefore withheld. This is the second consecutive month in which an AirGradient gas sensor has failed in isolation from the co-located PM and CO_2 channels (eSikhaleni, 23–29 June 2026), which indicates a recurring fault mode in the gas-sensor module that should be raised with the supplier.

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