COMPREHENSIVE AIR QUALITY DATA COLLECTION, QA/QC, PROCESSING AND REPORTING PROTOCOLS

Version 1.0: Technical Operations Manual 2025

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1.0 PURPOSE, SCOPE AND OBJECTIVE

Effective air-quality management relies on the availability of reliable, continuous, and quality-assured environmental data. For rapidly urbanizing cities such as Nairobi. low-cost sensor networks have become critical tools for understanding fine-scale pollution exposure, supporting policy development, and informing public communication. This document establishes a comprehensive, standardised protocol for the collection, quality assurance, analysis, reporting, and long-term sustainability of particulate-matter ($PM_{2.5}$ and PM_{10}) measurements obtained from the AirQo Binos Generation 5 monitors, deployed in a monitoring network of 50 sensors under the Breathe Nairobi Initiative.

These protocols are grounded in globally recognised air-quality monitoring guidance, including:

1. ***World Health Organization (WHO) Global Air Quality Guidelines (2021)*** – best-practice exposure thresholds and reporting recommendations.
2. ***United States Environmental Protection Agency (US EPA) PM2.5 NAAQS Monitoring Requirements*** – reference thresholds and QA/QC models for PM monitoring.
3. ***European Environment Agency (EEA) Air Quality e-Reporting Specifications*** – standardised structure for reporting, data completeness, metadata, and uncertainty.
4. ***Low-Cost Sensor Performance Evaluation Guidance*** *f*rom USEPA, South Coast AQMD, and the AirQo Research Group ,best practices for calibration, drift correction, outlier management, and network performance.

***Purpose*.** To provide standardised procedures that ensure monthly (and other periodic) air-quality reporting is accurate, consistent, reliable and auditable. These protocols govern data collection, QA/QC, processing, analysis, reporting, dashboard requirements, and handover procedures for Cenex (current operator) and the City (successor).

Scope. Applies to the AirQo binos/Gen5 network (50–80 monitors), backend data pipelines, the public dashboard / API, and field operations teams maintaining hardware. Covers PM2.5 and PM10 (and on-board environmental sensors such as temperature and relative humidity where present).

Audience. Data engineers, dashboard developers, QA/QC officers, field technicians, data analysts, project managers, and municipal stakeholders.

2.0 DATA COLLECTION AND MONITORING

Data collection processes encompass the systematic acquisition of particulate matter measurements from the distributed network of AirQo monitors, ensuring that all devices operate within defined environmental and operational tolerances. Each monitor continuously samples ambient $PM_{2.5}$ and PM_{10} concentrations at 60–90-second intervals, records ancillary variables such as temperature, humidity, altitude, and device health metrics, and transmits these observations through GSM/GPRS to the central data infrastructure. This stage also includes adherence to validated siting criteria, clear sky exposure, optimal height, minimal obstruction, to reduce artefacts caused by shading, dust accumulation, or interference.

Metadata such as deployment location, device type, power status, and maintenance logs are integrated to support traceability and long-term sensor performance tracking. Effective data collection is the foundation of the monitoring program, ensuring representativeness, operational reliability, and the availability of high-resolution datasets required for regulatory comparison, public communication, and scientific analysis.

2.1 Sensor Description and Measurement Capabilities

Table 1. AirQo Binos Technical Specifications (PM performance, power, communication)

Parameter	**specification**
PM size fractions	*0.3–1.0 µm, 1.0–2.5 µm, 2.5–10 µm*
$PM_{2.5}$ effective range	*0–500 µg/m³*
$PM_{2.5}$ maximum detection	*<1000 µg/m³*
Accuracy	*±10% @ 100–500 µg/m³; ±10 µg/m³ @ 0–100 µg/m³*
Data resolution	*60–90 seconds*
Response time	*<1 second*
Power	*5–12 V; 3.7 V LiPo/ Li-ion battery; 1.1 W use*
Solar panel	*6 W, 1.2 A*
Communication	*GSM/GPRS 2G (850, 900, 1800, 1900 MHz)*
Operating temperature	*0–45°C*
Deployment	*Outdoor ambient monitoring*

2.2 Pollutants Measured

The network monitors:

1. $PM_{2.5}$ (primary pollutant of concern)
2. PM_{10}
3. Temperature
4. Relative humidity

Table 2. WHO 2021 $PM_{2.5}$ and PM_{10} Exposure Guideline Values

Averaging Period	$PM_{2.5}$ Guideline (µg/m³)	PM_{10} Guideline (µg/m³)
Annual mean	*5*	*15*
24 Hr- Mean	*15*	*45*

Table 3. US EPA $PM_{2.5}$ and PM_{10} NAAQS Standards

Averaging Period	$PM_{2.5}$ Guideline (µg/m³)	PM_{10} Guideline (µg/m³)
Annual mean	*12*	-
24 Hr- Mean	*35*	*150*

2.3 Siting and Installation Requirements

1. Sensors must be installed 3–5 metres above ground level.
2. Avoid placement near direct emission sources (chimneys, generators, roadsides), unless intentionally measuring hotspots.
3. Solar panels must face the equator-ward direction with no shading.
4. Mounting structures must be stable and vibration-free.
5. Each device must be labelled with unique ID, installation date, coordinates, and metadata recorded.

Table 4: Pollutants and Parameters Measured

Parameter	Method	Range	Resolution	Notes

$PM_{1.0}$, $PM_{2.5}$, PM_{10}	Optical laser scattering	0–500 µg/m³ effective; <1000 max	0.1–1 µg/m³	Requires calibration; humidity-influenced
Temperature	Thermistor	0–45°C	±0.5°C	Used for correction
Relative Humidity	Capacitive	0–100%	±3%	RH>85% affects PM optical signal
Battery Voltage	ADC	0–5 V	±0.01 V	<3.3 V triggers replacement
GSM Signal Strength	RSSI	-	-	Determines uptime
GPS / Location	GSM triangulation	-	-	Used for mapping, drift detection

Table 5: Expected Sensor Performance

Metric	Target	Minimum Acceptable	Action Trigger
Telemetry frequency	1 sample/min	1 sample/10 min	Check GSM
Daily data completeness	≥95%	≥85%	<70% triggers field visit
Monthly data completeness	≥90%	≥75%	<75% = failed site
Uptime	≥95%	≥90%	<85% = investigate
Battery voltage	3.7–4.2 V	≥3.3 V	<3.3 V = replace
Solar charging	5–6 V	≥4 V	Shading identified
Temperature validity	0–45°C	0–50°C	Out-of-range flagged

3.0 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

Quality assurance and quality control procedures are set up/developed to ensure the integrity, accuracy, and reliability of sensor-derived air-quality data by systematically identifying, correcting, and documenting all sources of measurement uncertainty. QA/QC encompasses automated checks such as signal plausibility screening, range enforcement, missing-data detection, flatline identification, and cross-sensor coherence analysis, as well as manual expert review of suspicious temporal or spatial patterns. Routine maintenance, sensor cleaning, battery evaluation, solar shading assessment, component replacement—and periodic calibration or drift correction using reference-grade instruments or established machine-learning correction models are integral to maintaining measurement fidelity. All processed data are annotated with validity flags, uncertainty indicators, and corrective-action metadata, ensuring that only scientifically defensible information progresses to reporting stages. These QA/QC frameworks align with established guidelines from WHO, US EPA, and leading low-cost sensor research bodies, enabling transparent and high-confidence use of the monitoring network's outputs.

3.1 Sensor Performance Evaluation

3.1.1 Daily and Weekly Performance Checks

1. Compare each sensor to its cluster neighbours (z-score, Pearson correlation).
2. Flag devices showing uncharacteristic deviations exceeding ±3σ of neighbourhood trends.
3. Check device uptime, voltage status, and GSM connectivity.
4. Inspect PM trends for stagnation, noise spikes, or flatlining.

Automated Level QA/QC (System-Level)

Performed continuously by the AirQo cloud.

3.2.1 Value Range Checks

Invalid if:

1. PM > 1000 µg/m³
2. Temperature < -10°C or > 60°C
3. RH < 0% or > 100%
4. Battery > 5 V
5. Location movement > 500 m (for fixed monitors)

Spike and Step-Change Detection

Table 6: Spike Rules

Condition	Flag
Sudden >100 µg/m³ jump in 1 minute	Spike
$PM_{2.5}$ > PM_{10}	Invalid
$PM_{2.5}/PM_{10}$ ratio > 0.95	Possible drift
|S1 $PM_{2.5}$ - S2 $PM_{2.5}$|>5 µg/m³	Possible drift

Step-Change Rules

1. Sudden baseline shift >25 µg/m³ for >3 hours
2. Often indicates dust buildup or inlet blockage

Table 7. Automated and Manual Fault Detection Indicators

Activity	Frequency	Description
Remote debugging and inspection	Biweekly	Check for device health metrics i.e battery, sensor and GSM communication
Visual inspection	Quarterly	Check mounting, solar panel, enclosure
Sensor inlet cleaning	Quarterly	Remove dust accumulation
Battery health test	Quarterly	Replace if capacity <70%
Firmware check	Quarterly	Update if required
Full hardware inspection	Annual	Replace worn parts

3.3 Calibration and Drift Correction

1. AirQo uses machine-learning calibration models validated against reference-grade instruments that have been collocated against the existing networks.
2. Drift is evaluated using:
    a. *Intrasensor correlation comparison*
    b. *Neighbourhood comparison*
    c. *Rolling mean deviation analysis*
    d. *Residual error behaviour*
3. Devices undergoing drift beyond thresholds are flagged and corrected using updated calibration models.

Drift is flagged if:

A. Calibration error increases >25% over previous month
B. High residuals vs colocation reference
C. Persistent bias (e.g., always higher than cluster average)
D. $PM_{2.5}$–PM_{10} divergence pattern changes significantly
E. High humidity false inflation patterns re-emerge

Table 8: Flag categories

Flag	Meaning	Action
Green	Healthy	None
Yellow	Possible drift	Monitor
Orange	Drift likely	Collocation
Red	Drift confirmed	Replace optical sensor

Weekly QA/QC Checklist	Monthly QA/QC Checklist
1. Missing data periods reviewed 2. Voltage trends checked for aging batteries 3. Solar charging curve examined 4. Location change detection 5. Compare with neighbouring sensors 6. Diurnal cycle sanity check 7. Weather-normalisation observations 8. Identify outlier sensors vs cluster median	1. Compute calibration performance metrics (MAE, RMSE, R^2) 2. Verify calibration model version applied 3. Thorough review of flagged sensors 4. Require collocation for sensors with >2 consecutive months of drift 5. Validate daily and hourly aggregations 6. Confirm no systematic bias introduced

Table 10. Automated and Manual Fault Detection Indicators

Fault Type	Indicator	Corrective Action
Battery degradation	Voltage <3.6 V or repeated power cycling	Replace battery
Solar shading	Daytime voltage drop	Clear obstruction
PM sensor clogging	Suppressed values in dusty conditions	Clean inlet
Drift	Progressive intrasensor deviation	Apply calibration correction
Communication failure	>3 hours offline	Inspect GSM module
Over-spiking	Unrealistic spikes	Apply filtering rules

4.0. DATA PROCESSING AND ANALYSIS PROTOCOLS

This section defines exact procedures used to transform raw data into usable monthly reporting data. Data processing and analysis protocols describe the full transformation pathway from raw sensor outputs to validated, interpretable air-quality indicators used for monthly reporting. This includes automated ingestion of device data streams, time-synchronization, unit standardization, and structured application of QA/QC procedures such as noise filtering, humidity correction, outlier detection, and drift adjustments. The cleaned datasets are then aggregated into minute-level, hourly, daily, and monthly averages using statistically robust methods that ensure completeness and representativeness while preserving temporal patterns. Spatial analysis incorporates sensor-to-sensor comparisons, neighbourhood coherence checks, and geostatistical smoothing to identify anomalies or hotspots. Final datasets are assigned validity flags, converted into reporting formats (e.g., µg/m³, AQI categories), and prepared with accompanying metadata so that all published values are traceable, reproducible, and aligned with WHO and US EPA reporting standards.

4.1 Data ingestion

1. All raw telemetry is stored in AirQo's primary cloud repository.
2. Timestamps normalised to **UTC+3**.
3. Duplicate packets removed.
4. Values stored to 1 decimal resolution.

Table 11: Data Validation Protocols

Rule	**Description**
Physical range	*$PM_{2.5}$ and PM_{10} must be <1000 µg/m³*
Sensor saturation	*Constant maxed values = invalid*
Humidity correction	*Applied above 85% RH*
Consistency	*$PM_{2.5} \leq PM_{10}$*
Temporal continuity	*No >4 hr unexplained gap*

Table 12: Data Aggregation Methods

Level	**Method**	**Completeness Requirement**

Minute	*Raw*	*N/A*
Hourly	*Median of all valid minute readings*	*≥45 min valid*
Daily	*Mean of valid hourly values*	*≥18 hrs valid*
Monthly	*Mean of valid daily values*	*≥22 days valid*

4.2 Data Storage

1. Data arrives every 60–90 seconds via GSM from the AirQo cloud.
2. Raw data retained with timestamps, device ID, lat/long, $PM_{2.5}$, PM_{10}, RH, temperature.
3. All data stored with ISO 8601 timestamp formatting.

4.3 Data Cleaning

1. Negative values removed.
2. Extreme spikes outside sensor physical limits removed.
3. Missing data gaps identified and logged (no imputation allowed for regulatory comparison).
4. Completeness threshold: ≥75% hourly coverage required for valid daily values.

5.0 REPORTING AND COMMUNICATION

Reporting and communication are the bridge between the data we collect and the people who need to understand what it means. This section explains how the air-quality information from our monitoring network is translated into clear, consistent updates that help the public, policymakers, and project partners make informed decisions. By organizing validated data into monthly reports, dashboard visuals, and easy-to-interpret health messages, we ensure that everyone, from technical teams to everyday residents, can see the bigger picture: how air quality is changing, where the challenges are, and what actions might be needed. These communication guidelines help maintain transparency, build trust, and make sure the science behind the Breathe Nairobi Initiative supports real-world improvements in people's lives.

Table 13. $PM_{2.5}$ AQI Breakpoints (US EPA AQI Standard)

AQI Category	$PM_{2.5}$ Range (µg/m³)	Health Meaning
0–50 Good	0–12	Air quality satisfactory
51–100 Moderate	12.1–35.4	Acceptable, some concern
101–150 Unhealthy for Sensitive Groups	35.5–55.4	Health effects for vulnerable groups
151–200 Unhealthy	55.5–150.4	Everyone may feel effects
201–300 Very Unhealthy	150.5–250.4	Emergency conditions
301–500 Hazardous	>250.5	Serious health impact

Table 14: Network Health Metrics

Metric	Target	Actual	Status
Network uptime	≥90%		Pass/Fail
Sensor completeness	≥90%		Pass/Fail

Sensors offline >72 hrs	0		Investigate
Calibration model	Verified		OK
Maintenance actions	Logged		Completed/Delayed

5.1 AQI- Air Quality Index

The Air Quality Index (AQI) is a standardized scale that converts pollutant concentrations, particularly $PM_{2.5}$ and PM_{10}—into a single value that communicates health risk in a simple, intuitive manner. Instead of requiring the public to interpret raw µg/m³ values, the AQI expresses air quality on a scale from 0 to 500, divided into colour-coded categories ranging from "Good" to "Hazardous." This helps residents, policymakers, and health agencies understand when air pollution poses elevated risks, especially for vulnerable groups such as children, the elderly, and individuals with heart or respiratory conditions. The AQI is calculated using a linear interpolation formula that maps the measured pollutant concentration (C) to the corresponding AQI category defined by breakpoints:

AQI formula:

$$AQI = \frac{I_{high} - I_{low}}{C_{high} - C_{low}}(C - C_{low}) + I_{low}$$

Where:

- C = pollutant concentration
- I_low, I_high = AQI bounds
- C_low, C_high = concentration bounds

Table12: $PM_{2.5}$ AQI Categories, Breakpoints, and Health Implications

AQI Category	AQI Range	$PM_{2.5}$ Concentration (µg/m³)	Colour Band	General Health Implications

Good	0–50	0.0–12.0	Green	Air quality is satisfactory; little or no risk to health.
Moderate	51–100	12.1–35.4	Yellow	Acceptable air quality; however, very sensitive individuals may experience minor respiratory symptoms.
Unhealthy for Sensitive Groups (USG)	101–150	35.5–55.4	Orange	Sensitive groups (children, elderly, heart/lung patients) may experience health effects; general public is less likely to be affected.
Unhealthy	151–200	55.5–150.4	Red	Everyone may begin to experience adverse health effects; sensitive groups may experience more serious impacts.
Very Unhealthy	201–300	150.5–250.4	Purple	Health warnings of emergency conditions; the entire population is likely to be affected.
Hazardous	301–500	250.5–500.4	Maroon	Health alert: everyone may experience severe health effects; outdoor activity should be minimized.

5.2 Public Dashboard Requirements

1. Display hourly and daily $PM_{2.5}$ values.
2. Provide AQI conversion with colour-coded categories.
3. Indicate data confidence or data completeness.
4. Show network health status.
5. Provide downloadable CSV datasets.

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ANNEX 1: DATA FLAGGING AND VALIDATION RULES

Defines the rules used to automatically and manually flag data as valid, suspect, or invalid. These rules ensure consistency with international standards for low-cost sensor QA/QC (USEPA, EEA, AirQo calibration protocols, and South Coast AQMD evaluation guidance).

1.0 FLAG TYPES AND DEFINITIONS

1.1 Valid Data Flag (Flag = 0)

A data point is considered valid when all the following conditions are met:

1. The PM value is within the physical measurable range (0–1000 µg/m³).
2. The sensor is online, transmitting normally, and voltage levels are ≥3.7 V.
3. Temperature and RH values fall within plausible ranges (0–45°C; 5–100% RH).
4. No sudden uncorrelated spikes compared to neighbouring sensors.

1.2 Suspect Data Flag (Flag = 1)

A data point is suspect when:

1. PM readings deviate by >3σ from neighbourhood median for >30 minutes.
2. RH >90% for prolonged periods (known interference region).
3. Device voltage is <3.6 V (possible power instability).
4. Temperature readings are flatlined or unrealistic.
5. GSM signals are intermittent but data still arrives.

1.3 Invalid Data Flag (Flag = 2)

Data is invalid when:

1. PM < 0 or PM > 1000 µg/m³.
2. Sensor flatlines for >60 minutes with PM = constant.
3. Sensor reports PM = 0 during observed pollution events.
4. The device is offline or voltage <3.4 V.
5. Calibration residual is beyond acceptable thresholds.

FLAGGING RULES TABLE

Condition	Flag	Interpretation	Action
PM < 0 µg/m³	2	Physically impossible	Remove
PM >1000 µg/m³	2	Exceeds sensor capability	Remove
Flatline >60 minutes	2	Sensor failure or clogging	Remove + maintenance
Spike >500% in <2 min	1	Likely noise	Smooth or remove
RH >90%	1	High humidity interference	Apply RH correction
Temp <0°C or >50°C	2	Out of operating range	Remove
Voltage <3.4 V	2	Fault	Flag for battery/solar issue
>3σ deviation from neighbors	1	Drift/outlier	Investigate
Missing timestamp	2	Invalid	Remove

ANNEX 2: Proposed Monthly report Template

1.0 Executive Summary

1. Overview of air-quality conditions for the month.
2. Key messages, exceedance events, and public health implications.
3. Network uptime and data completeness summary.

2.0 Network Performance Overview

2.1 Sensor Uptime Table

Sensor ID	Uptime (%)	Data Completeness (%)	Major Issues	Corrective Action

2.2 Network-Wide KPIs

1. Total network uptime (%)
2. Sensors below threshold (<85%)
3. Communication failures
4. Battery/Solar issues
5. Drift-flagged sensors

3.0 Air Quality Exposure Analysis

3.1 Monthly $PM_{2.5}$ and PM_{10} Summary Table

Metric	**$PM_{2.5}$ (µg/m³)**	**PM_{10} (µg/m³)**
Monthly mean		
Monthly max		
Monthly min		
WHO exceedance days		

3.2 Daily Trends (Graph)

Line plot: Daily $PM_{2.5}$ averages with WHO 24-hr guideline.

3.3 Hourly Patterns (Graph)

Diurnal patterns aggregated across the network.

3.4 Spatial Distribution Map

Heatmap of sensor locations and monthly $PM_{2.5}$ averages.

4.0 AQI Assessment

4.1 AQI Category Distribution

AQI Category	Number of Hours	Percentage

4.2 Population Exposure Summary

Narrative on periods of high AQI.

5.0 Sensor Performance and QA/QC Summary

5.1 Drift Analysis Table

Sensor ID	Drift Detected (Y/N)	Method	Correction Applied

5.2 Fault Events Summary

Description of key issues:

1. Redundant sensors
2. High noise sensors
3. Under-reporting or suppressed PM sensors
4. Power degradation
5. Communication instability

6.0 Maintenance and Interventions

6.1 Field Actions Table

Sensor ID	Issue Identified	Action Taken	Date	Technician

7.0 Recommendations

1. Suggested relocations (if applicable).
2. Required hardware replacements.
3. Dashboard/communication improvements.
4. Policy-level considerations.

ANNEX 3: AMBIENT AIR QUALITY TOLERANCE LIMITS (1st Schedule, EMCA AQ Regulations, 2024)

This annex represents the ambient air quality tolerance limits from the first schedule of the environmental management and coordination (Air Quality)Regulations, 2024.

These limits form Kenya's official national standards for key pollutants and provide the legal benchmarks that are used to assess compliance and interpret monitors air quality levels.

Table 1: Ambient Air Quality Tolerance Limits

		Pollutant	Time weighted Average			
				Industrial area	Residential, Rural and Other area	Controlled areas***
1.		Sulphur Dioxide (SO_2);	Annual Average*	80 µg/m^3	60 µg/m^3	15 µg/m^3
			24 hours**	125 µg/m^3	80 µg/m^3	30 µg/m^3
			Annual Average		0.019 ppm/50µg/m^3	
			Month Average			
			24 Hours		0.048ppm /125µg/m^3	
			One Hour			
			Instant Peak		500 µg/m^3	
			Instant Peak (10 min)		0.191 ppm	
2.		Oxides of Nitrogen (NOx);	Annual Average*	80 µg/m^3	60 µg/m^3	15 µg/m^3
			24 hours**	150 µg/m^3	80 µg/m^3	30 µg/m^3
			8 hours			
			Annual Average		0.2 ppm	
			Month Average		0.3 ppm	
			24 Hours		0.4 ppm	
			One Hour		0.8 ppm	
			Instant Peak		1.4 ppm	
3.		Nitrogen Dioxide	Annual Average	150 µg/m^3	0.05 ppm	
			Month Average		0.08 ppm	
			24 Hours	100 µg/m^3	0.1 ppm	
			One Hour		0.2 ppm	
			Instant Peak		0.5 ppm	
4.		Suspended particulate matter (SPM)	Annual Average*	360 µg/m^3	140 µg/m^3	70 µg/m^3
			24 hours**	500 µg/m^3	200 µg/m^3	100 µg/m^3
				Industrial area	Residential, Rural and Other area	Controlled areas***

			mg/Kg			

	Pollutant	Time weighted Average			
		Annual Average****		100 µg/m^3	
		24 hours***		180 µg/m^3	
5.	Respirable particulate matter (<10µm) (RPM)	Annual Average*	70 µg/m^3	50 µg/m^3	50 µg/m^3
		24 hours**	150 µg/Nm^3	100 µg/Nm^3	75 µg/Nm^3
6.	$PM_{2.5}$	Annual Average	35 µg/m^3		
		24 hours	75 µg/m^3		
7.	Lead (Pb)	Annual Average*	1.0 µg/Nm^3	0.75 µg/Nm^3	0.50 µg/m^3
		24 hours**	1.5 µg/m^3	1.00 µg/m^3	0.75 µg/m^3
		Month Average		2.5	
8.	Carbon monoxide (CO)/ carbon dioxide (CO_2)	8 hours**	5.0 mg/m^3	2.0 mg/m^3	1.0 mg/m^3
		1 hour	10.0 mg/m^3	4.0 mg/m^3	2.0 mg/m^3
		mg/Kg			
		24 hours**			
9.	Hydrogen Sulphide	24 hours**	150µg/m^3		
10.	Non-methane hydrocarbons				
		instant Peak	700ppb		
11.	Total VOC	24 hours**	600 µg/m^3		
12.	Ozone	1-Hour	200 µg/m^3	0.12 ppm	
		8 hour (instant Peak)	120 µg/m^3	1.25 ppm	
13.	Odour				

Legend

a) *µg- microgram*

b) m^3 – cubic metre

c) ppm – parts per million

d) ppb – parts per billion

e) Values at Standard Temperature and Pressure (STP)

f) Conversion factors from ppm to mg/m^3 and mg/m^3 to ppm are stipulated under the Eleventh Schedule

g) * [Annual Arithmetic mean of minimum *104* measurements in a year taken twice a week 24 hourly at uniform interval.]

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h) [** 24 hourly/8 hourly values should be met 98% of the time in a year.

However, 2% of the time, it may exceed but not on two consecutive days.]

i) Whenever and wherever two consecutive values exceeds the limit specified above for the respective category, it would be considered adequate reason to institute regular/continuous monitoring and further investigations.

j) * the 24-hour limit may not be exceeded more than three times in one year;

k) ** 24-hour limit may not be exceeded more than three times in one year micrograms/m3

l) *** Not to be exceeded more than once per year average concentration

m) ***In conversion of units from ppm to mg/m^3 and vice versa shall use guidelines set out under Part II of the Fifth Schedule.

Table 2: Ambient Air Quality at Property Boundary for General Pollutants

	Pollutant	Time weighted Average	Property Boundary
1	Particulate matter (PM)	Annual Average*	50 µg/m^3
		24 hours**	70 µg/m^3
2.	Oxides of Nitrogen (NOx);	Annual Average*	80 µg/m^3
		24 hours**	150 µg/m^3
3.	Sulphur oxides (SOx);	Annual Average*	50 µg/m^3
		24 hours**	125 µg/m^3
4.	Hydrogen Sulphide	24 hours**	50 µg/m^3
5.	Ammonia	24 hours**	100 µg/m^3

Note.

a) For residential premises in designated industrial areas, the above standards do not apply.

b) For industries in designated residential areas, standards for residential areas shall apply