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## Environmental Report LAGOS AUGUST 2024

# RUNNING FOR CLEAN AIR

# DISCLAIMER

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This report contains data from the Air Quality monitoring station installed at National stadium complex, Lagos, Nigeria, operating since February 8th, 2024.

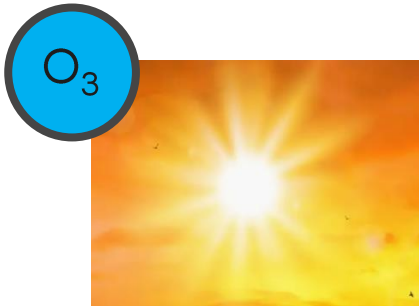
The data presented in this report is collected with sensor technologies which are not regulatory-grade instrumentation following Directive 2008/50/EC. Therefore, the results presented should be considered as informative and not be used for regulatory compliance checking purposes. Any communication of the data should include this statement. After deployment, the monitors are not routinely inter-compared with reference instruments at each destination.

# MAIN POLLUTANTS MEASURED



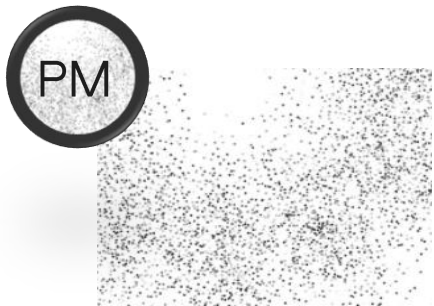
## Nitrogen Dioxide

Primarily gets in the air from the burning of fuel by cars, trucks and buses, power plants



## Ozone

Created by chemical reactions between (NOx) and (VOC) in the presence of sunlight



## Particulate matter

Mixture of solid particles and liquid droplets found in the air. Some are emitted directly from a source, such as heating in residential, construction sites, unpaved roads, fields, smokestacks, fires or transported by the wind

# TO BUILD A SIMPLIFIED AIR QUALITY INDEX (AQI)

## Gaseous pollutants



## Particulate Matter



# EUROPEAN AQI INDEX

Help us understand data measured by the stations

|                                  |   |
|----------------------------------|---|
| <b>EXTREMELY POOR</b><br>126-200 | May cause respiratory issues in healthy people, and serious health issues in people with lung/heart disease.  |
| <b>VERY POOR</b><br>101-125      | The pollution level has reached a critical level. Even healthy people may show symptoms for short exposures.  |
| <b>POOR</b><br>75-100            | Effects can be immediately felt by individuals at risk. Everybody feels the effects of prolonged exposure.    |
| <b>MODERATE</b><br>51-75         | The air has reached a high level of pollution. Higher than the maximum limit for 24 hours established by WHO. |
| <b>FAIR</b><br>26-50             | The air is moderately polluted. A long-term exposure constitutes a health risk.                               |
| <b>GOOD</b><br>0-25              | The air is pure, ideal for outdoor activities.  |

# EUROPEAN AQI LEVELS



Measurements of up to five key pollutants (O<sub>3</sub>, NO<sub>2</sub>, SO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>) determine the index level that describes the current air quality situation at the location of each Kunak device. The index corresponds to the poorest level for any of the five pollutants based on the following scheme:

| Pollutant               | Level index<br>(based on pollutant concentrations in µg/m <sup>3</sup> ) |         |          |          |           |                |
|-------------------------|--|---------|----------|----------|-----------|----------------|
|                         | Good   | Fair    | Moderate | Poor     | Very poor | Extremely poor |
|                         | (0-25)   | (26-50) | (51-75)  | (76-100) | (101-125) | (126-200)      |
| PM <sub>2.5</sub> (24h) | 0-10   | 10-20   | 20-25    | 25-50    | 50-75     | 75-800         |
| PM <sub>10</sub> (24h)  | 0-20   | 20-35   | 35-50    | 50-100   | 100-150   | 150-1200       |
| NO <sub>2</sub>         | 0-40   | 40-90   | 90-120   | 120-230  | 230-340   | 340-1000       |
| O <sub>3</sub>          | 0-50   | 50-100  | 100-130  | 130-240  | 240-380   | 380-800        |
| SO <sub>2</sub>         | 0-100  | 100-200 | 200-350  | 350-500  | 500-750   | 750-1250       |

[https://www.kunak.es/doc/O8.Manuals/html/Kunak\\_Cloud\\_UserManual\\_EN.html#\\_Toc102586013](https://www.kunak.es/doc/O8.Manuals/html/Kunak_Cloud_UserManual_EN.html#_Toc102586013)

RECOMMENDED AIR QUALITY GUIDELINES LEVELS & INTERIM TARGETS

| Pollutant                             | Averaging time           | Interim target |     |      |    | AQG level |
|---------------------------------------|--------------------------|----------------|-----|------|----|-----------|
|                                       |                          | 1              | 2   | 3    | 4  |           |
| PM <sub>2.5</sub> , µg/m <sup>3</sup> | Annual                   | 35             | 25  | 15   | 10 | 5         |
|                                       | 24-hour <sup>a</sup>     | 75             | 50  | 37.5 | 25 | 15        |
| PM <sub>10</sub> , µg/m <sup>3</sup>  | Annual                   | 70             | 50  | 30   | 20 | 15        |
|                                       | 24-hour <sup>a</sup>     | 150            | 100 | 75   | 50 | 45        |
| O <sub>3</sub> , µg/m <sup>3</sup>    | Peak season <sup>b</sup> | 100            | 70  | -    | -  | 60        |
|                                       | 8-hour <sup>a</sup>      | 160            | 120 | -    | -  | 100       |
| NO <sub>2</sub> , µg/m <sup>3</sup>   | Annual                   | 40             | 30  | 20   | -  | 10        |
|                                       | 24-hour <sup>a</sup>     | 120            | 50  | -    | -  | 25        |

AIR QUALITY GUIDELINES FOR NITROGEN DIOXIDE (SHORT AVERAGE TIME) REMAIN VALID

| Pollutant                           | Averaging time | Air quality guidelines that remain valid |
|-------------------------------------|----------------|--|
| NO <sub>2</sub> , µg/m <sup>3</sup> | 1-hour         | 200                                      |

Recommended 2021 AQG levels compared to 2005 air quality guidelines

| Pollutant                             | Averaging Time           | 2005 AQGs | 2021 AQGs |
|---------------------------------------|--------------------------|-----------|-----------|
| PM <sub>2.5</sub> , µg/m <sup>3</sup> | Annual                   | 10        | 5         |
|                                       | 24-hour <sup>a</sup>     | 25        | 15        |
| PM <sub>10</sub> , µg/m <sup>3</sup>  | Annual                   | 20        | 15        |
|                                       | 24-hour <sup>a</sup>     | 50        | 45        |
| O <sub>3</sub> , µg/m <sup>3</sup>    | Peak season <sup>b</sup> | -         | 60        |
|                                       | 8-hour <sup>a</sup>      | 100       | 100       |
| NO <sub>2</sub> , µg/m <sup>3</sup>   | Annual                   | 40        | 10        |
|                                       | 24-hour <sup>a</sup>     | -         | 25        |
| SO <sub>2</sub> , µg/m <sup>3</sup>   | 24-hour <sup>a</sup>     | 20        | 40        |
| CO, mg/m <sup>3</sup>                 | 24-hour <sup>a</sup>     | -         | 4         |

<https://apps.who.int/iris/bitstream/handle/10665/345329/9789240034228-eng.pdf?sequence=1&isAllowed=y>



# METHODOLOGY

## Meteo sensors

Temperature

(WBGT) Wet bulb globe temperature

Relative Humidity

## Gas sensors (ug/m3)

NO, NO2, O3

## Particulate Matter sensor (ug/m3)

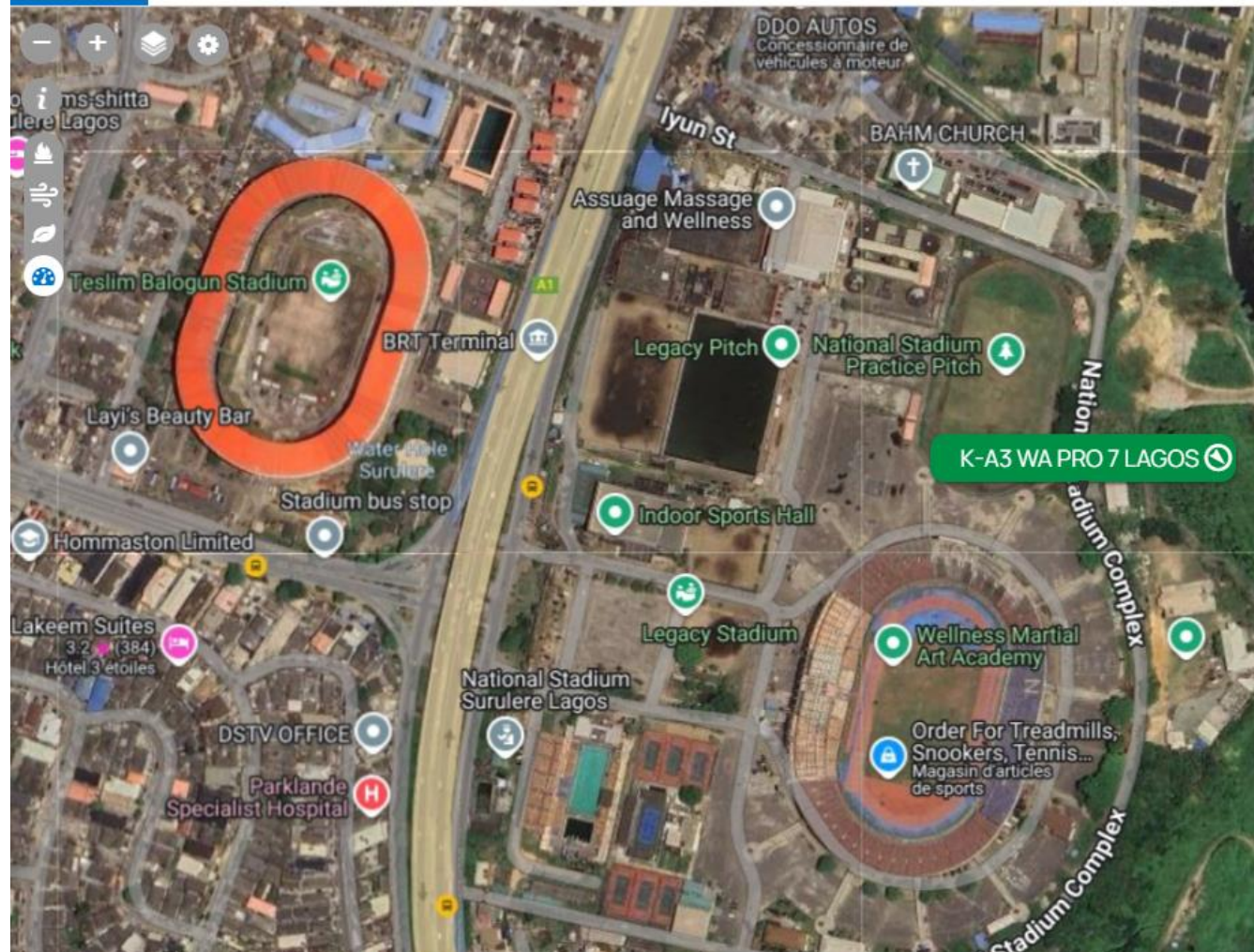
PM2.5, PM10

## Positioning

GPS

## K-A3 WA PRO 7 LAGOS

Summary Data Warnings<sup>0</sup> Configuration Operation<sup>0</sup>





**AGGREGATED DATA August 1<sup>st</sup> to August 31<sup>st</sup>, 2024**

**ENVIRONMENTAL DATA & AIR QUALITY INDEX**

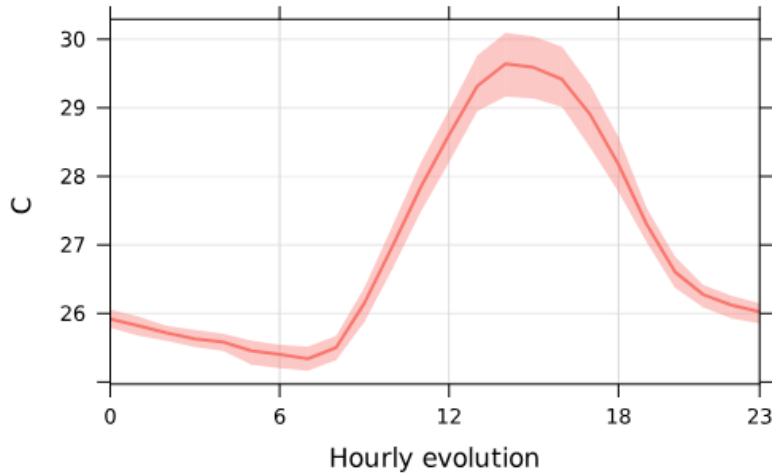
**DEVICE LOCATED AT**

National Stadium Surulele



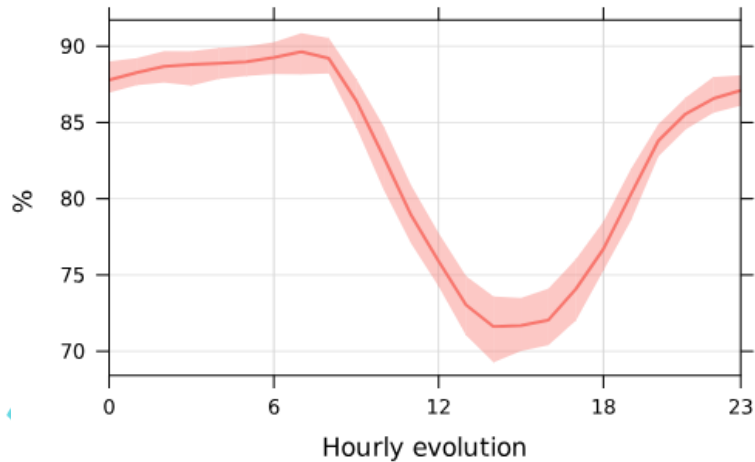
# TEMPERATURE & HUMIDITY – Time variation - August 1st to August 31st

## Air Temperature



Aggregated data of the temperature hourly evolution indicate that the lowest temperature is measured at 07:00 and the highest between 14:00 and 15:00

## Relative Humidity



Aggregated data of the humidity hourly evolution indicate that the lowest humidity is measured at 15:00 and the highest during nights and 08:00

# WET BULB GLOBE TEMPERATURE - Time variation



WBGT is a measure of heat stress in direct sunlight.

It is a comprehensive measure of all the weather-related factors

(i) air temperature;

(ii) humidity;

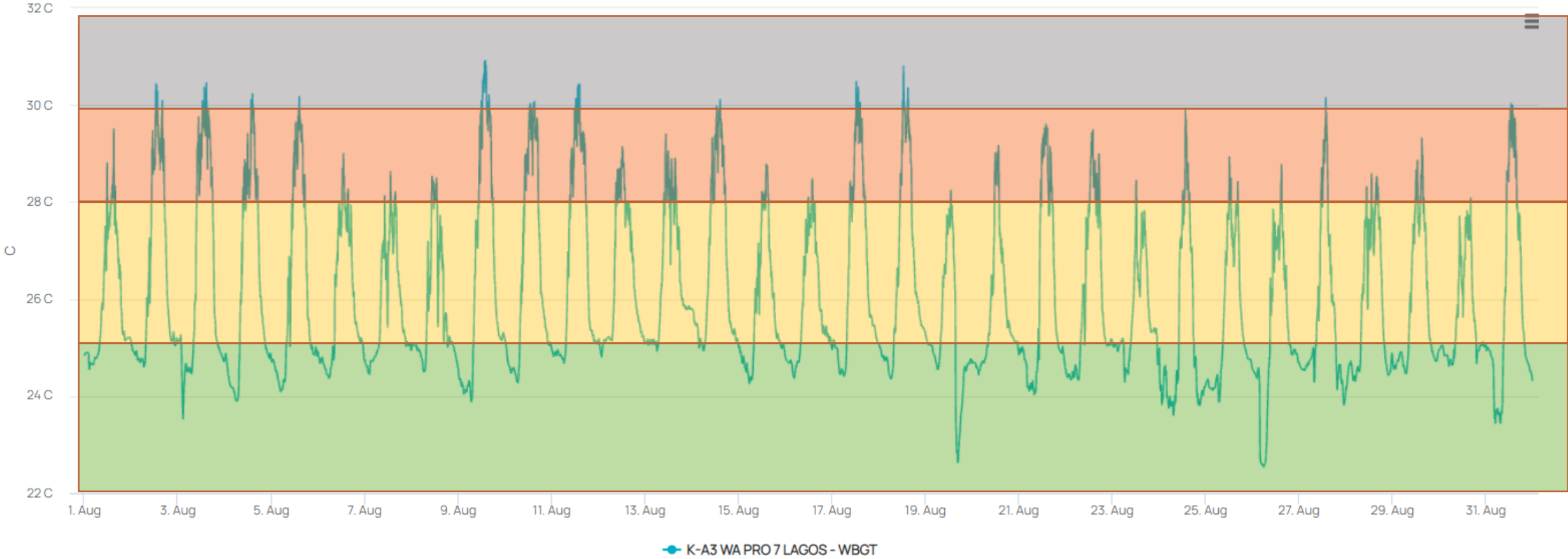
(iii) wind speed;

(iv) solar radiation

that impact the health and performance of athletes.

# WBGT - Time variation August 1st to August 31st

WBGT index during this period was very high and represent a significant level of heat stress for training athletes.



**WBGT**

|                   |                 |                 |                        |               |
|-------------------|-----------------|-----------------|------------------------|---------------|
| Almost safe <21°C | Caution 21-25°C | Warning 25-28°C | Severe warning 28-30°C | Danger > 30°C |
|-------------------|-----------------|-----------------|------------------------|---------------|

# AQI EU - August 1st to August 31st

## AQI EU of K-A3 WA PRO 7 LAGOS in 2024

| August-2024 |    |    |    |    |    |    |
|-------------|----|----|----|----|----|----|
| 28          | 29 | 30 | 31 | 37 | 34 | 34 |
| 33          | 33 | 34 | 41 | 42 | 38 | 39 |
| 40          | 39 | 33 | 36 | 30 | 29 | 35 |
| 41          | 41 | 39 | 37 | 29 | 33 | 33 |
| 31          | 28 | 30 | 27 | 35 | 32 | 31 |
| 1           | 2  | 3  | 4  | 5  | 6  | 7  |
| S           | M  | T  | W  | T  | F  | S  |

EXTREMELY POOR

126-200

VERY POOR

101-125

POOR

75-100

MODERATE

51-75

FAIR

26-50

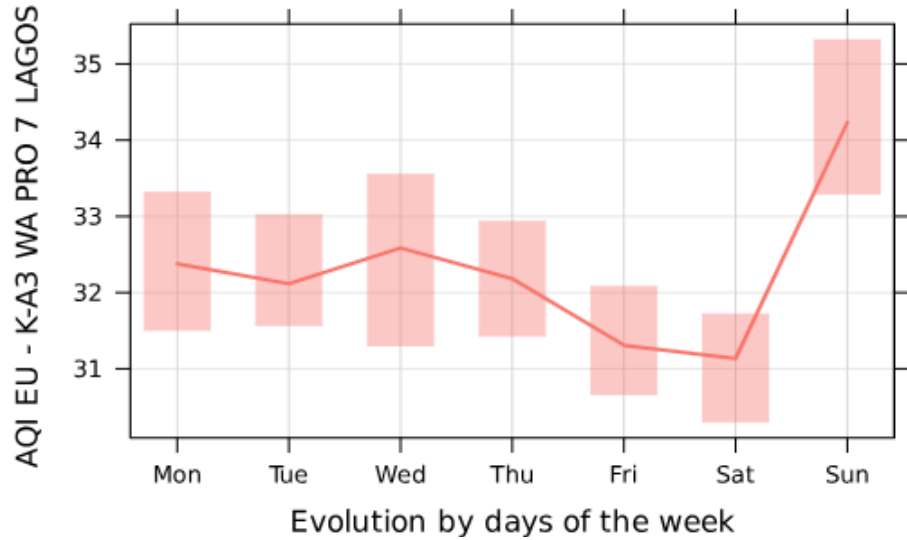
GOOD

0-25

The AQI calendar plot indicates the AQI for each day during the monitoring period. Helping us to have a first glimpse of the conditions for each day. The AQI measured in August shows a fair air quality. The worst and best AQI values reported over the period are (41) and (28) respectively.

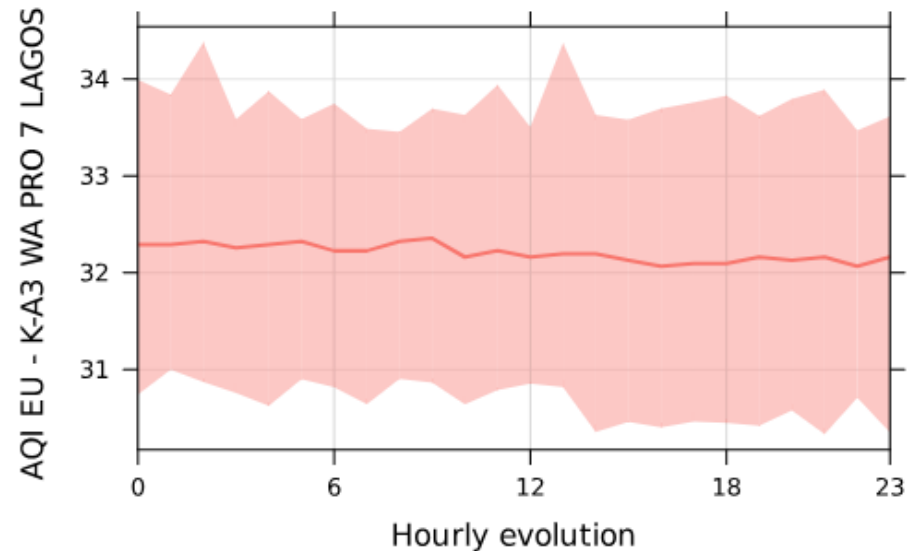


# AQI - Time variation - August 1st to August 31st



Aggregated data of the AQI evolution throughout the monitoring period helps us understand how the AQI changed based on day of the week and time of the day.

Aggregated data of the evolution by days of the week indicates the lowest AQI values were recorded on Tuesday this month.

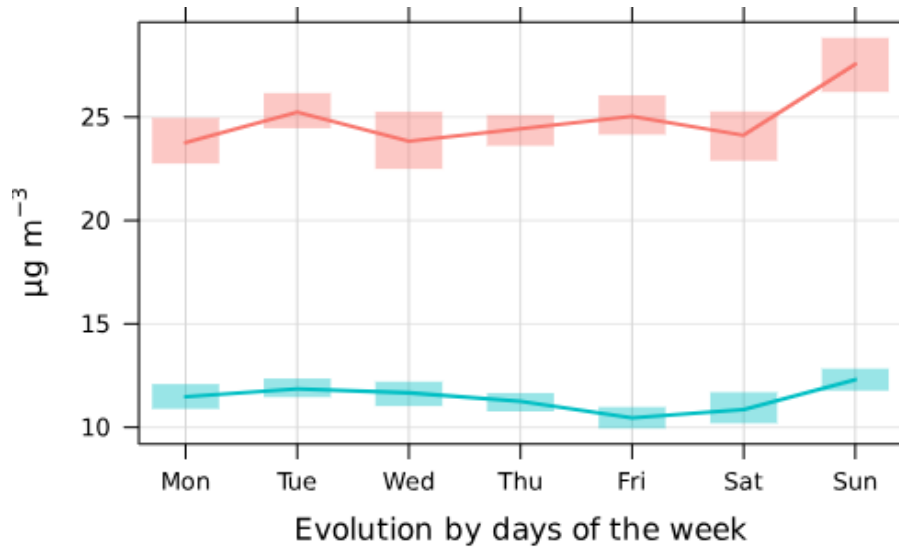


Aggregated data of the AQI hourly evolution indicates very low changes

# PARTICULATE MATTERS - Time variation - August 1st to August 31st

PM<sub>10</sub> - K-A3 WA PRO 7 LAGOS

PM<sub>2.5</sub> - K-A3 WA PRO 7 LAGOS



Aggregated data of the particulates pollutants evolution by days of the week indicates that absolute concentrations were higher on Sunday.

**Guideline values**

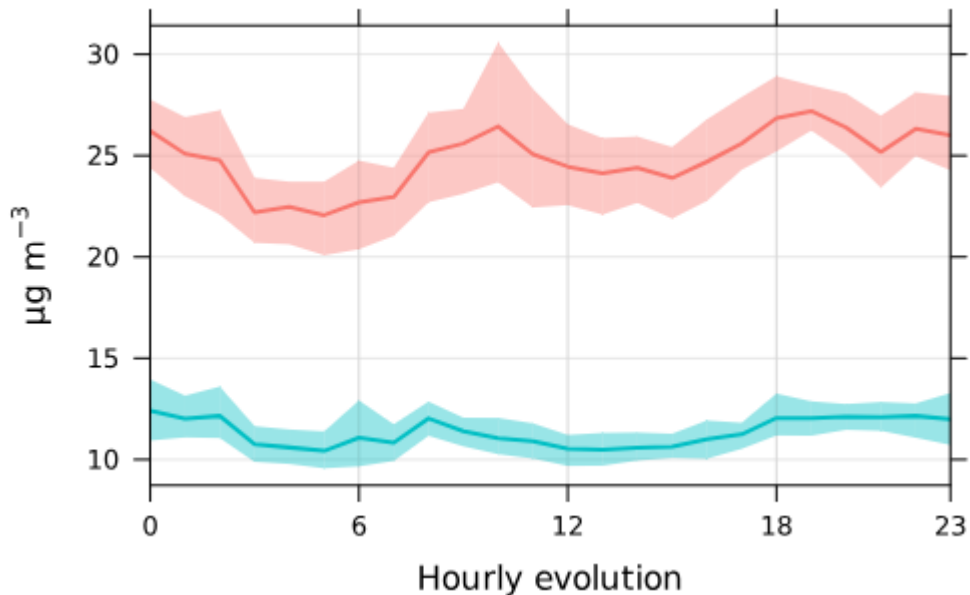
Coarse particulate matter (PM10): 45 µg/ m<sup>3</sup> 24-hour mean

Fine particulate matter (PM2.5): 15 µg/ m<sup>3</sup> 24-hour mean

# PARTICULATE MATTERS - Time variation - August 1st to August 31st

PM<sub>10</sub> - K-A3 WA PRO 7 LAGOS

PM<sub>2.5</sub> - K-A3 WA PRO 7 LAGOS



These organic compounds can be emitted by both natural sources, such as trees and vegetation, as well as from man-made (anthropogenic) sources, such as industrial processes and motor vehicle exhaust.

Aggregated data of the particulates pollutants hourly evolution show a low to moderate levels. PM<sub>2.5</sub> and PM<sub>10</sub> showed no specific pattern.

#### Guideline values

Coarse particulate matter (PM<sub>10</sub>): 45  $\mu\text{g}/\text{m}^3$  24-hour mean

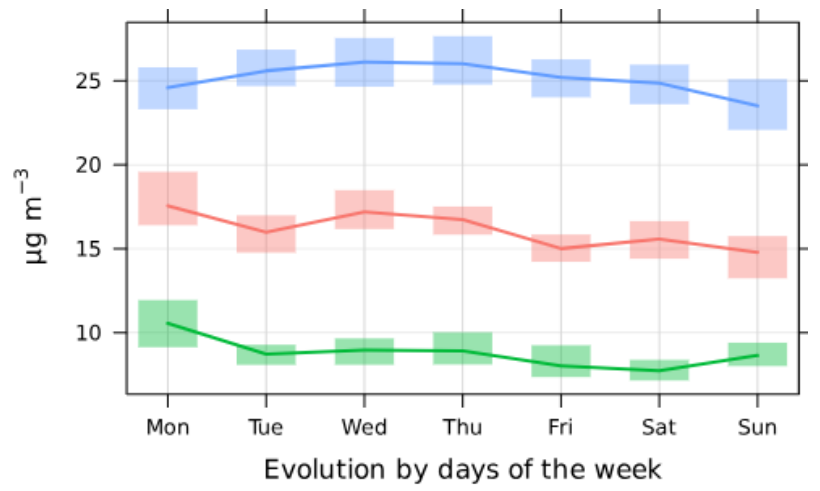
Fine particulate matter (PM<sub>2.5</sub>): 15  $\mu\text{g}/\text{m}^3$  24-hour mean

# GASEOUS POLLUTANTS - Time variation - August 1st to August 31st

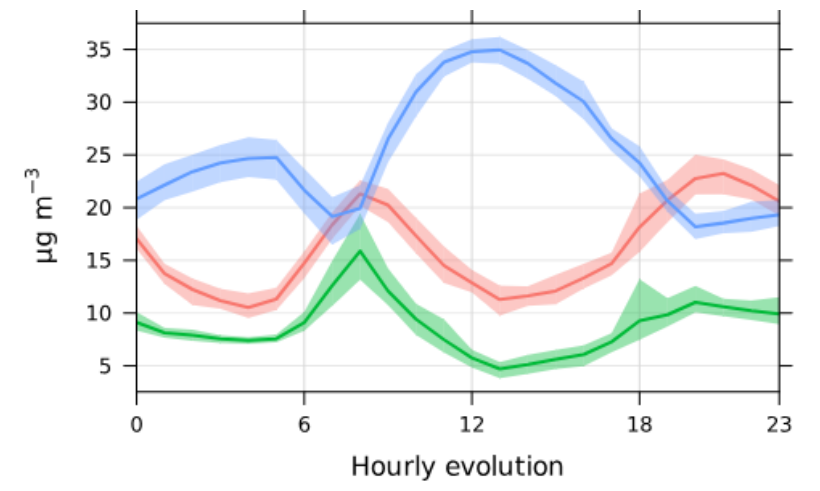
NO<sub>2</sub> GCc - K-A3 WA PRO 7 LAGOS

NO GCc - K-A3 WA PRO 7 LAGOS

O<sub>3</sub> GCc - K-A3 WA PRO 7 LAGOS



Aggregated data of the gaseous pollutants evolution by days of the week indicates that absolute concentrations were relatively low for NO<sub>2</sub>, NO and O<sub>3</sub>.



Aggregated data of the gaseous pollutants hourly evolution show typical trends for NO<sub>2</sub> and NO suggesting the influence of vehicle traffic emissions (morning and evening rush hours, 08:00 and 18:00) in this location. O<sub>3</sub> peaked in the early afternoon between 11:00 and 14:00. Typically, ozone levels reach their peak in mid-afternoon, after exhaust fumes from morning rush hour have had time to react in sunlight.

Guideline values NO<sub>2</sub>  
 25 µg/m<sup>3</sup> (24h)  
 200 µg/m<sup>3</sup> 1-hour mean

Guideline values O<sub>3</sub>  
 100 µg/m<sup>3</sup> 8-hour mean

# CONCLUSIONS

Air Quality Index values recorded during the month of August shows a fair levels of air pollution. AQI index was influenced by particulates matters PM 10 and PM 2.5.

WBGT index during this period was very high and represent a significant level of heat stress for training athletes.

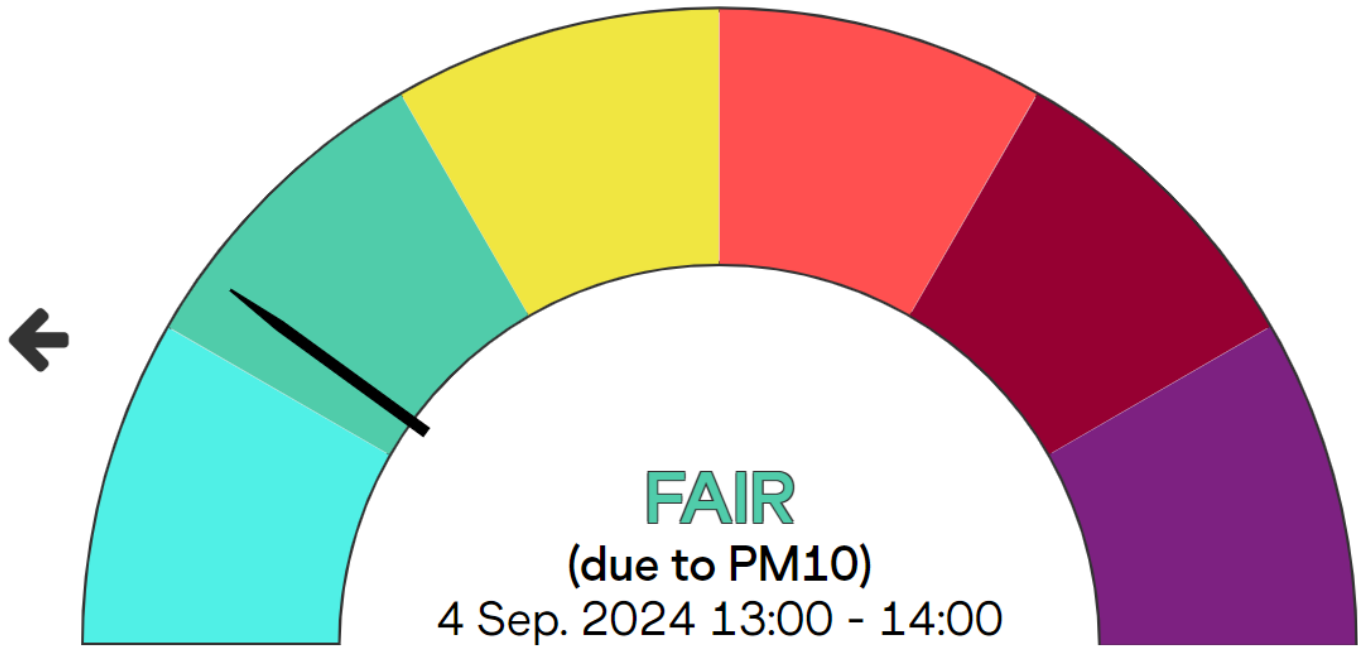
Aggregated data of the gaseous pollutants evolution by days of the week indicates that absolute concentrations were relatively low for NO<sub>2</sub>, NO and O<sub>3</sub>. Aggregated data of the gaseous pollutants hourly evolution show typical trends for NO<sub>2</sub> and NO suggesting the influence of vehicle traffic emissions (morning and evening rush hours, 08:00 and 18:00) in this location. O<sub>3</sub> peaked in the early afternoon between 11:00 and 14:00. Typically, ozone levels reach their peak in mid-afternoon, after exhaust fumes from morning rush hour have had time to react in sunlight.

Aggregated data of the particulates pollutants hourly evolution show a low to moderate levels. PM<sub>2.5</sub> and PM<sub>10</sub> showed no specific pattern.



# Appendix

## AIR QUALITY INDEX (EUROPE)

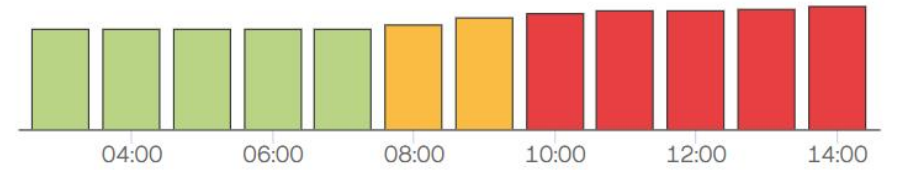
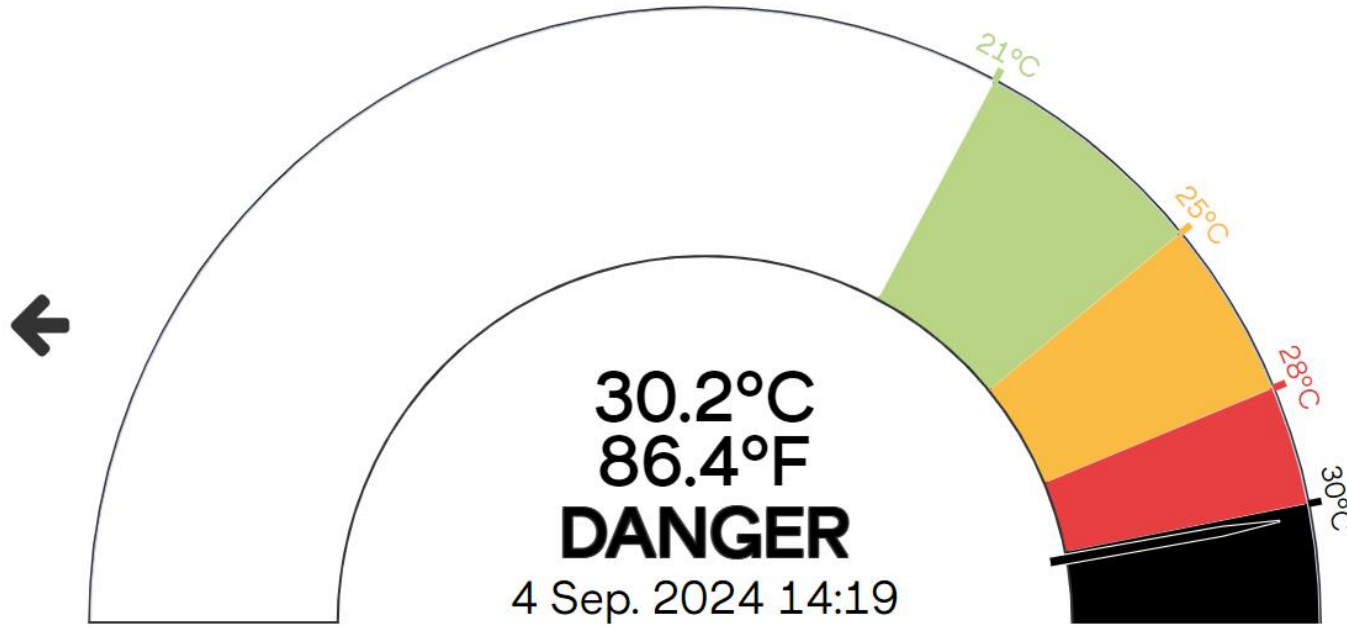


Good Fair Moderate Poor Very Poor Extremely Poor

LAGOS Powered by kunak

# Appendix

## HEAT STRESS INDEX WET BULB GLOBE TEMPERATURE



Hourly WBGT evolution (last 12h)

🌡️ Air Temperature **31.7 °C / 89.0 °F**  
💧 Relative Humidity **63.0 %**

Safe Caution Warning Severe Warning Danger

LAGOS

Powered by **kunak**  
LEGION NETWORK



An abstract graphic on a teal background. In the center is a black silhouette of a hand, palm facing left. From the hand, numerous black lines radiate outwards in various directions, creating a sunburst or starburst effect. The lines vary in length and thickness, some extending towards the edges of the frame.

Contact: [healthandscience@worldathletics.org](mailto:healthandscience@worldathletics.org)