



Environmental Report
LAGOS OCTOBER 2024

RUNNING FOR CLEAN AIR

DISCLAIMER

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

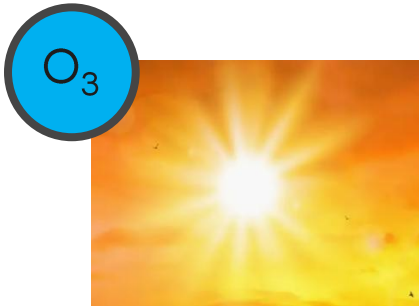
The data presented in this report is collected with sensor technologies which are not regulatory-grade instrumentation following Directive 2008/50/EC. Therefore, the results presented should be considered as informative and not be used for regulatory compliance checking purposes. Any communication of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

MAIN POLLUTANTS MEASURED



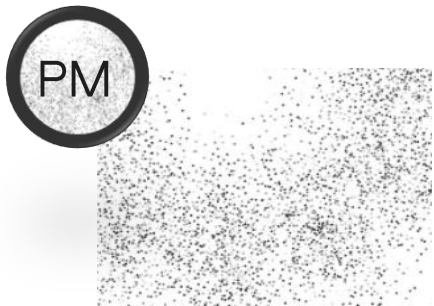
Nitrogen Dioxide

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



Ozone

Created by chemical reactions between (NO_x) 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

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

EUROPEAN AQI LEVELS



Measurements of up to five key pollutants (O₃, NO₂, SO₂, PM₁₀, PM_{2.5}) 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 (based on pollutant concentrations in µg/m ³)					
	Good	Fair	Moderate	Poor	Very poor	Extremely poor
	(0-25)	(26-50)	(51-75)	(76-100)	(101-125)	(126-200)
PM _{2.5} (24h)	0-10	10-20	20-25	25-50	50-75	75-800
PM ₁₀ (24h)	0-20	20-35	35-50	50-100	100-150	150-1200
NO ₂	0-40	40-90	90-120	120-230	230-340	340-1000
O ₃	0-50	50-100	100-130	130-240	240-380	380-800
SO ₂	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

RECOMMENDED AIR QUALITY GUIDELINES LEVELS & INTERIM TARGETS

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

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

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

Recommended 2021 AQG levels compared to 2005 air quality guidelines

Pollutant	Averaging Time	2005 AQGs	2021 AQGs
PM _{2.5} , µg/m ³	Annual	10	5
	24-hour ^a	25	15
PM ₁₀ , µg/m ³	Annual	20	15
	24-hour ^a	50	45
O ₃ , µg/m ³	Peak season ^b	-	60
	8-hour ^a	100	100
NO ₂ , µg/m ³	Annual	40	10
	24-hour ^a	-	25
SO ₂ , µg/m ³	24-hour ^a	20	40
CO, mg/m ³	24-hour ^a	-	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)

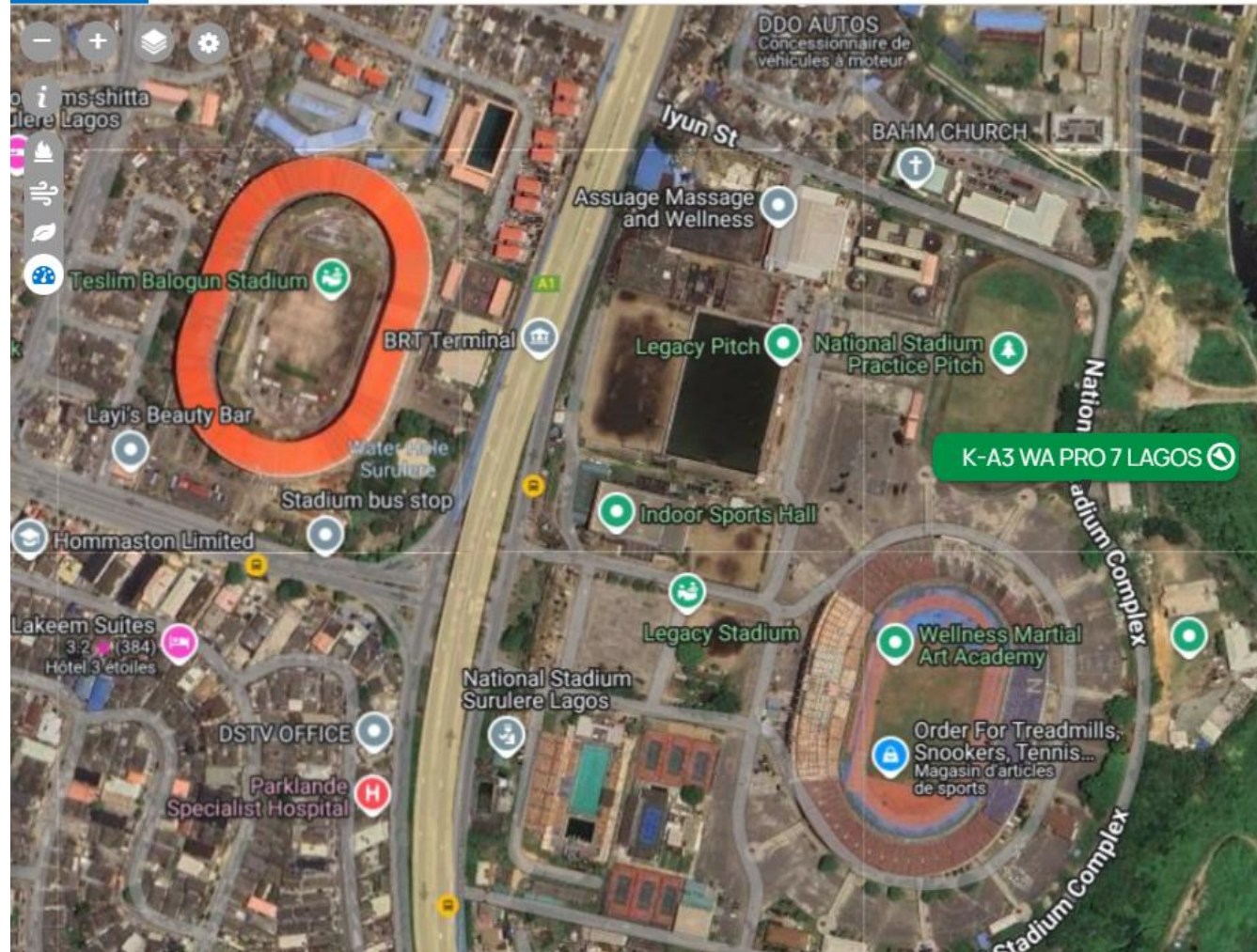
PM2.5, PM10

Positioning

GPS

K-A3 WA PRO 7 LAGOS

Summary Data Warnings⁰ Configuration Operation⁰



AGGREGATED DATA October 1st to October 31st, 2024

ENVIRONMENTAL DATA & AIR QUALITY INDEX

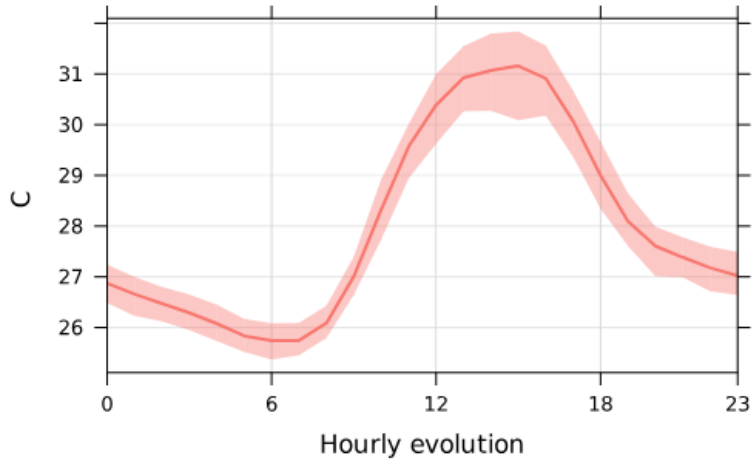
DEVICE LOCATED AT

National Stadium Surulele



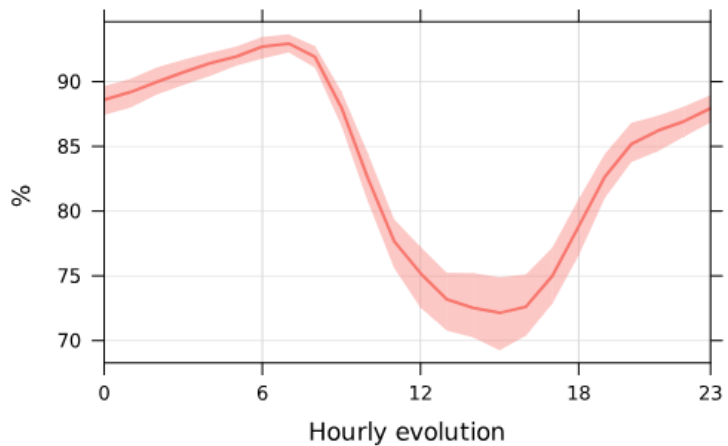
TEMPERATURE & HUMIDITY – Time variation - October 1st to 31st

Air Temperature



Aggregated data of the temperature hourly evolution indicate that the lowest temperature is measured at 07:00 and the highest between 13:00 and 16:00

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;

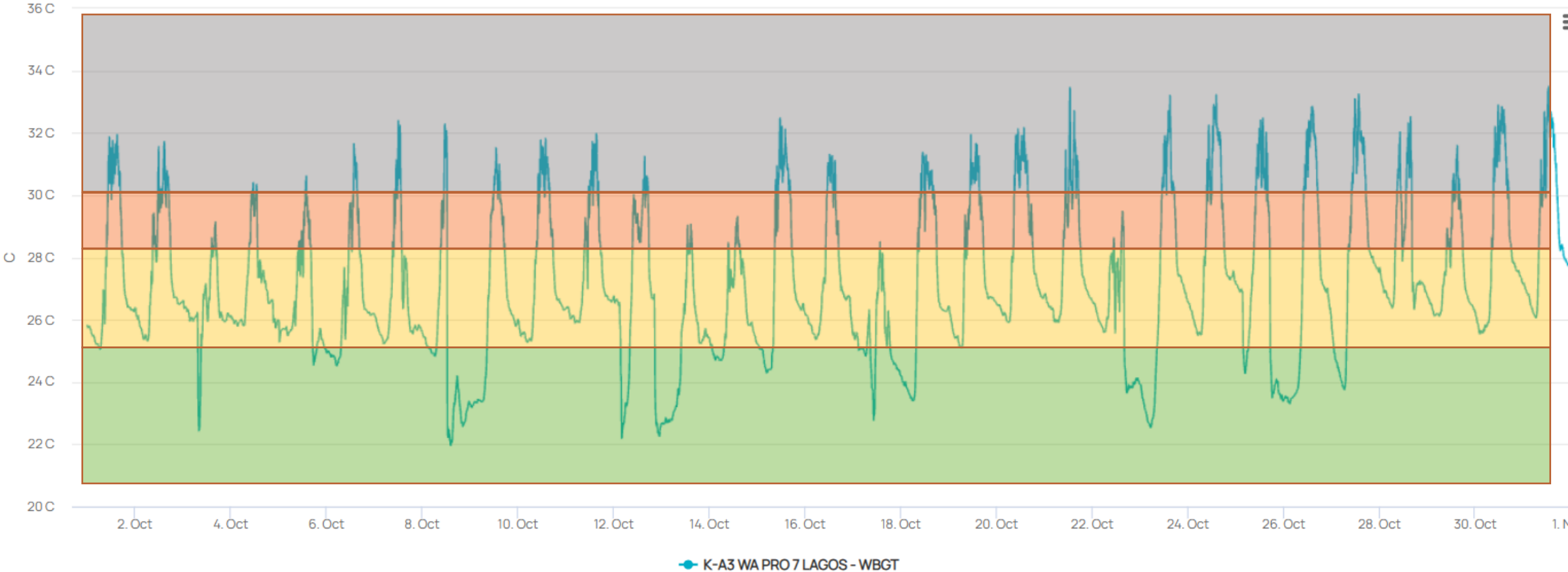
(iii) wind speed;

(iv) solar radiation

that impact the health and performance of athletes.

WBGT - Time variation October 1st to 31st

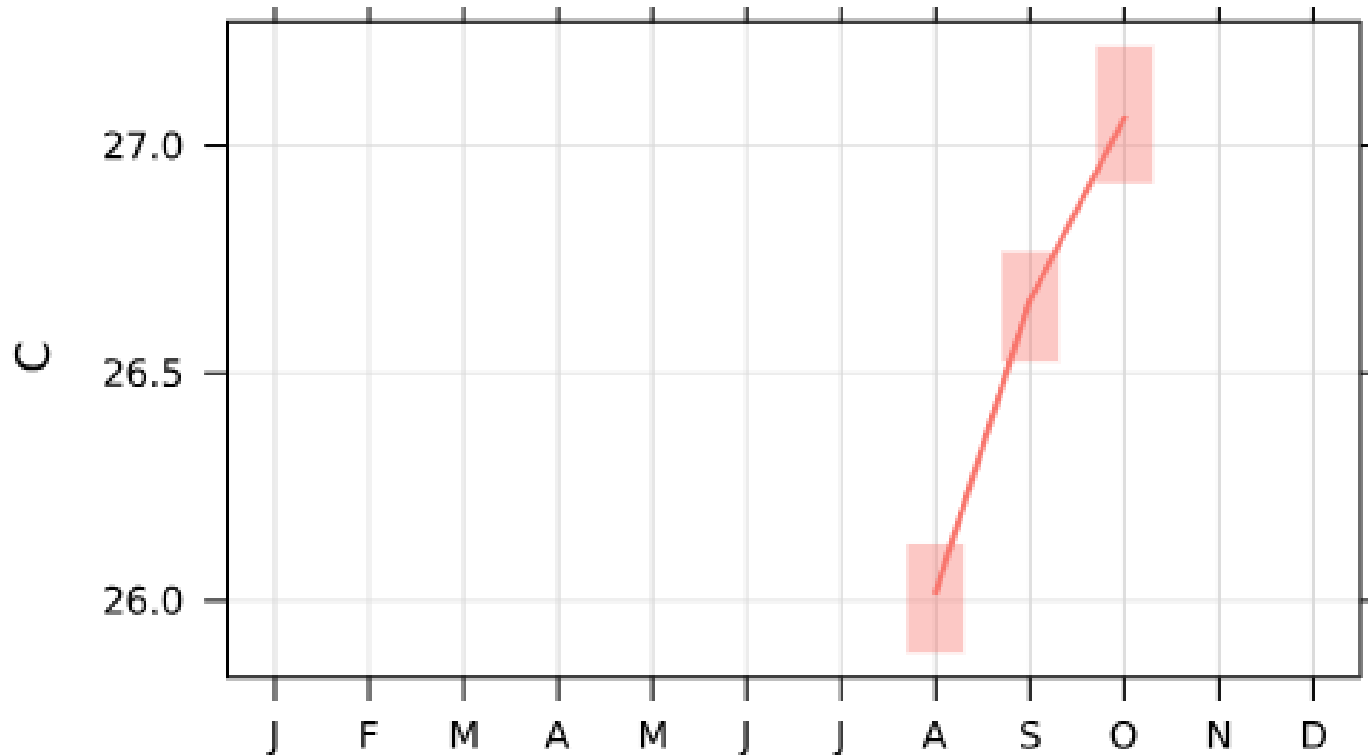
WBGT index during this period was very high and represent a significant level of heat stress for training athletes.



WBGT

Almost safe <21°C	Caution 21-25°C	Warning 25-28°C	Severe warning 28-30°C	Danger > 30°C
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WBGT evolution from August to October

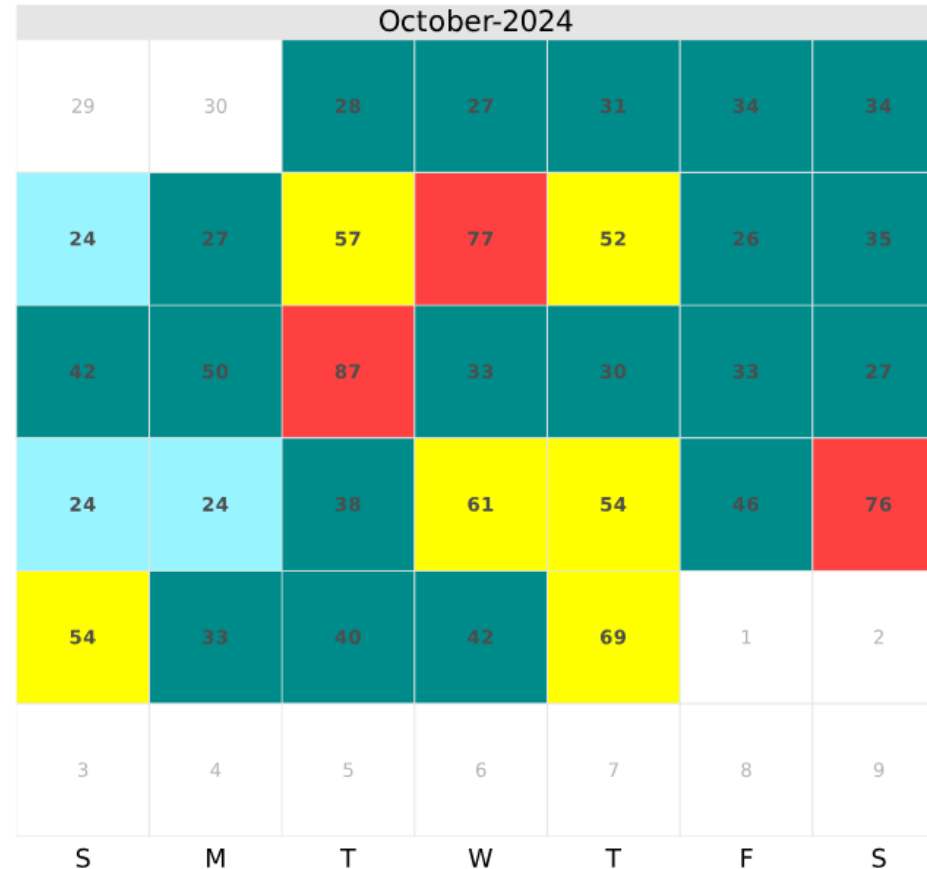


Monthly evolution
Mean and 95% confidence interval in mean

WBGT - K-A3 WA PRO 7 LAGOS

AQI EU - October 1st to 31st

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



EXTREMELY POOR

126-200

VERY POOR

101-125

POOR

75-100

MODERATE

51-75

FAIR

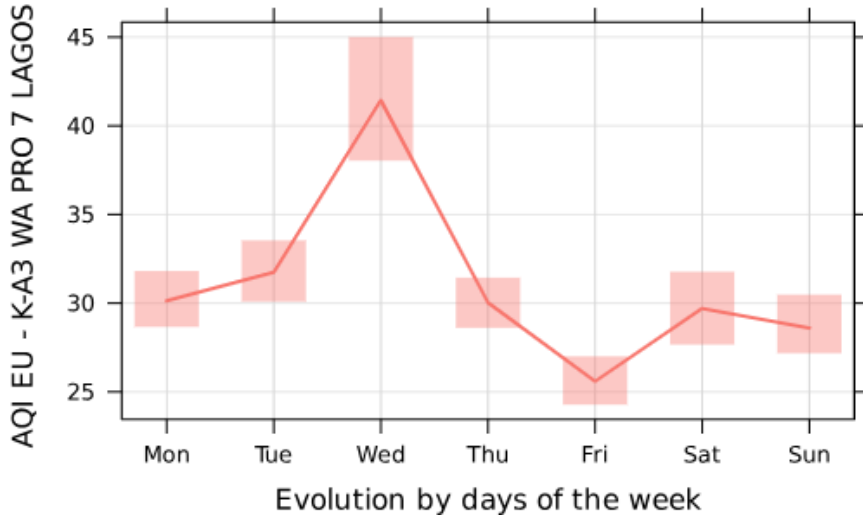
26-50

GOOD

0-25

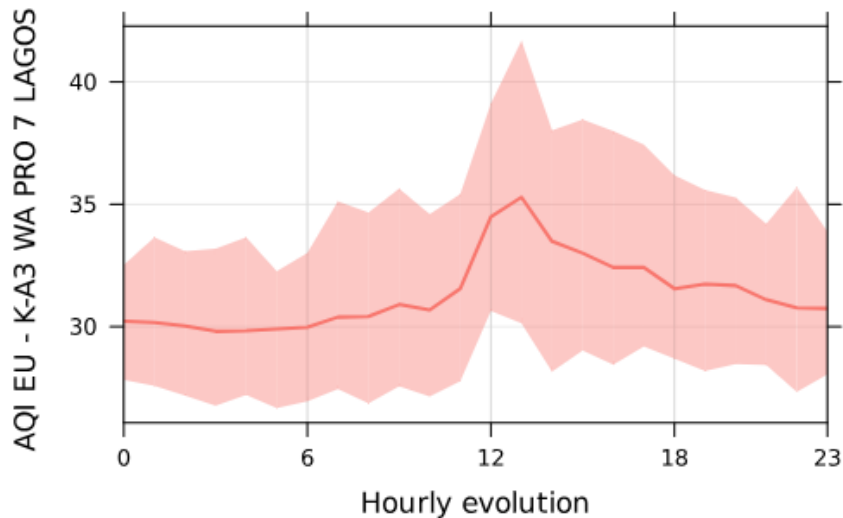
The AQI calendar plot indicates the AQI for each day during the monitoring period. Helping us to have a first glimpse of the conditions for each day. The AQI measured in October shows a fair to poor air quality. The worst and best AQI values reported over the period are (24) and (87) respectively.

AQI - Time variation - October 1st to 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 Friday this month.

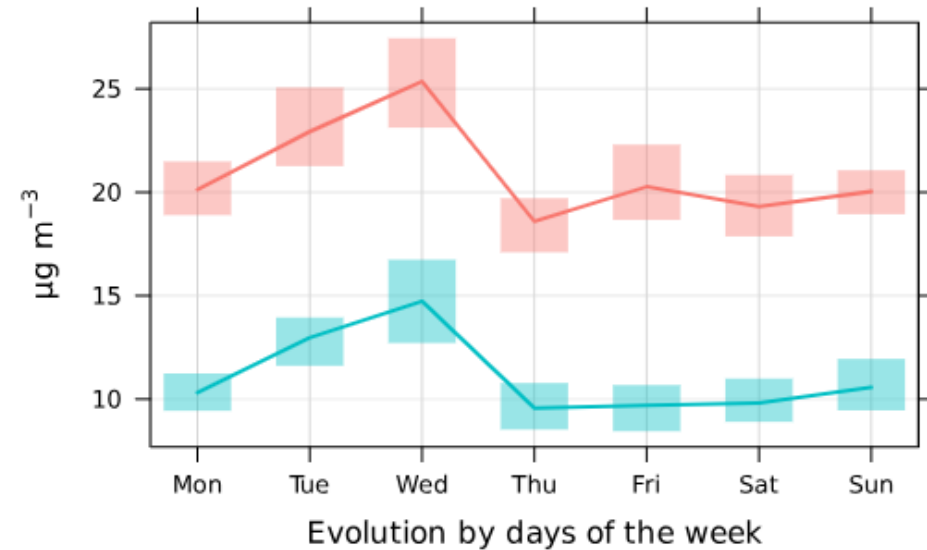


Aggregated data of the AQI hourly evolution indicates low changes. The highest AQI value were recorded in the early afternoon.

PARTICULATE MATTERS - Time variation - October 1st to 31st

PM₁₀ - K-A3 WA PRO 7 LAGOS

PM_{2.5} - 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 Wednesday.

Guideline values

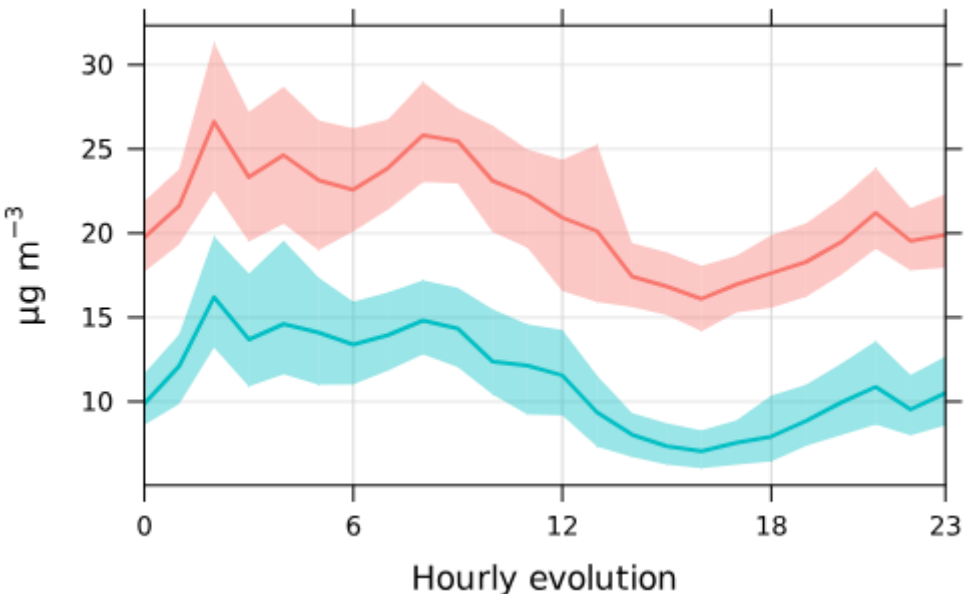
Coarse particulate matter (PM₁₀): 45 $\mu\text{g/ m}^3$ 24-hour mean

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

PARTICULATE MATTERS - Time variation - October 1st to 31st

PM₁₀ - K-A3 WA PRO 7 LAGOS

PM_{2.5} - 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 moderate levels. PM_{2.5} and PM₁₀ do not showed specific traffic influence pattern however higher concentrations are reported during the morning.

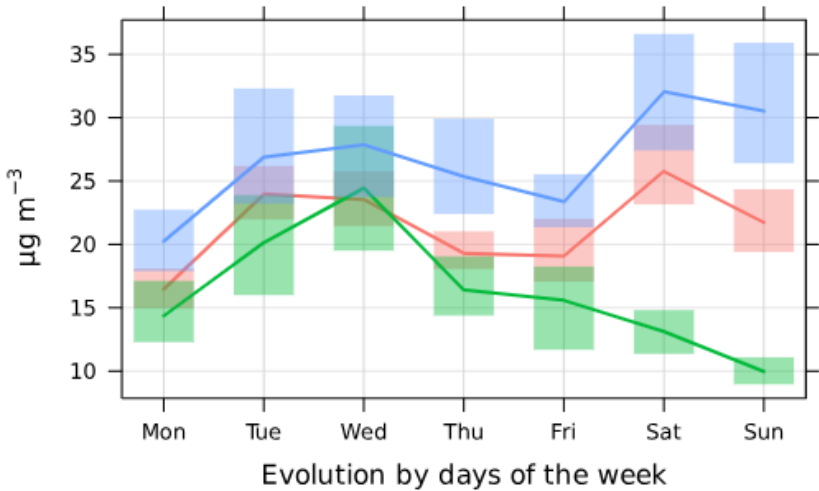
Guideline values
Coarse particulate matter (PM₁₀): 45 µg/ m³ 24-hour mean
Fine particulate matter (PM_{2.5}): 15 µg/ m³ 24-hour mean

GASEOUS POLLUTANTS - Time variation - October 1st to 31st

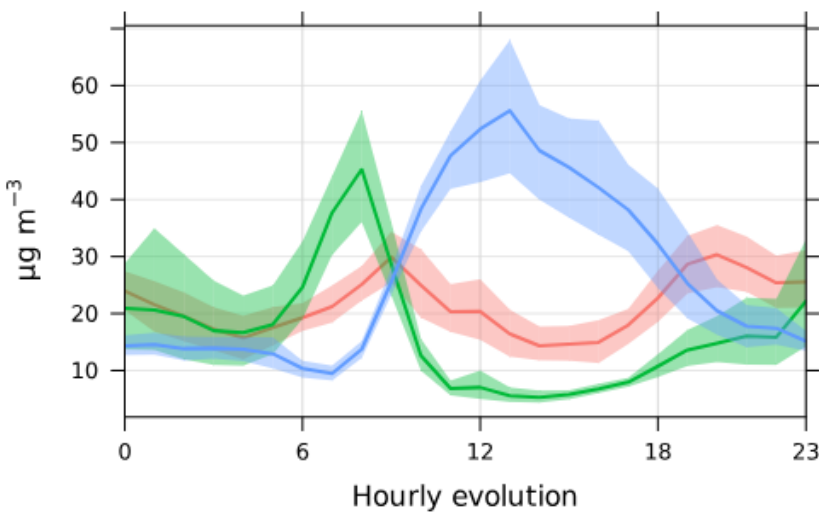
NO₂ GCc - K-A3 WA PRO 7 LAGOS

NO GCc - K-A3 WA PRO 7 LAGOS

O₃ 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 NO₂, NO and O₃.



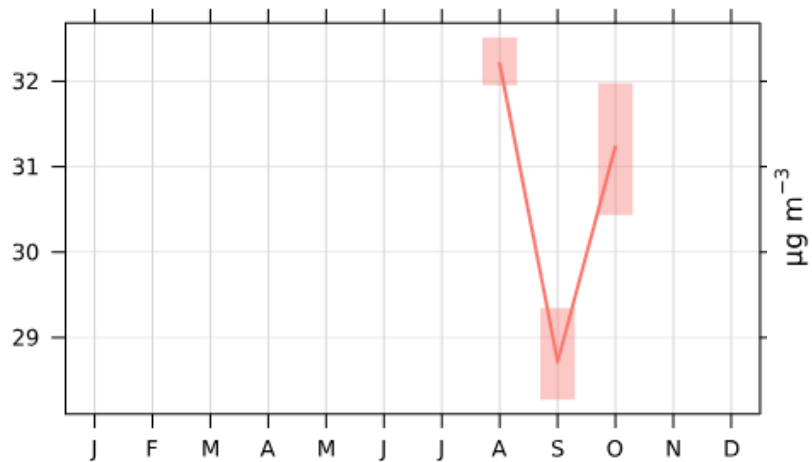
Aggregated data of the gaseous pollutants hourly evolution show typical trends for NO₂ and NO suggesting the influence of vehicle traffic emissions (morning and evening rush hours, 08:00 and 19:00) in this location. O₃ peaked in the early afternoon between 12:00 and 13:00. Typically, ozone levels reach their peak in early-afternoon, after exhaust fumes from morning rush hour have had time to react in sunlight.

Guideline values NO₂
 25 µg/m³ (24h)
 200 µg/m³ 1-hour mean

Guideline values O₃
 100 µg/m³ 8-hour mean

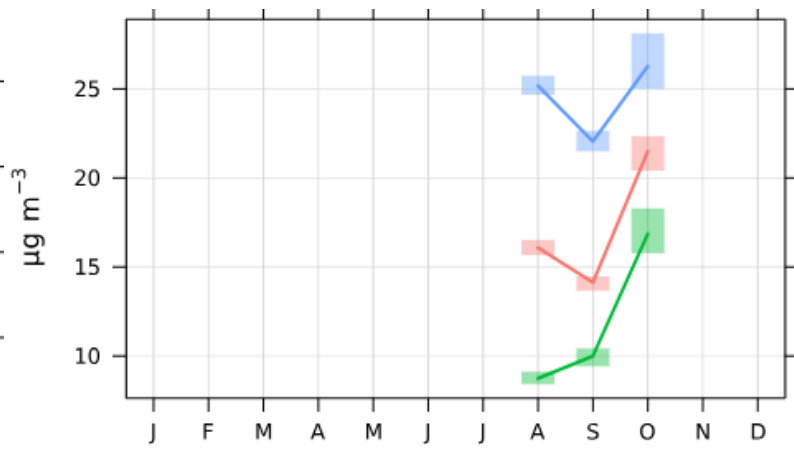
Comparison from August to October

AQI EU - K-A3 WA PRO 7 LAGOS



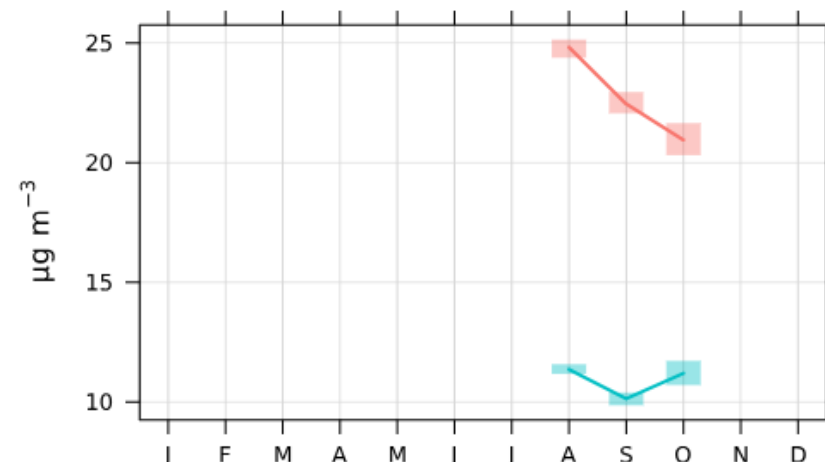
Monthly evolution
Mean and 95% confidence interval in mean

AQI EU



Monthly evolution
Mean and 95% confidence interval in mean

■ NO₂ GcC ·
 ■ NO GcC
 ■ O₃ GcC



Monthly evolution
Mean and 95% confidence interval in mean

■ PM₁₀
■ PM_{2.5}

CONCLUSIONS

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

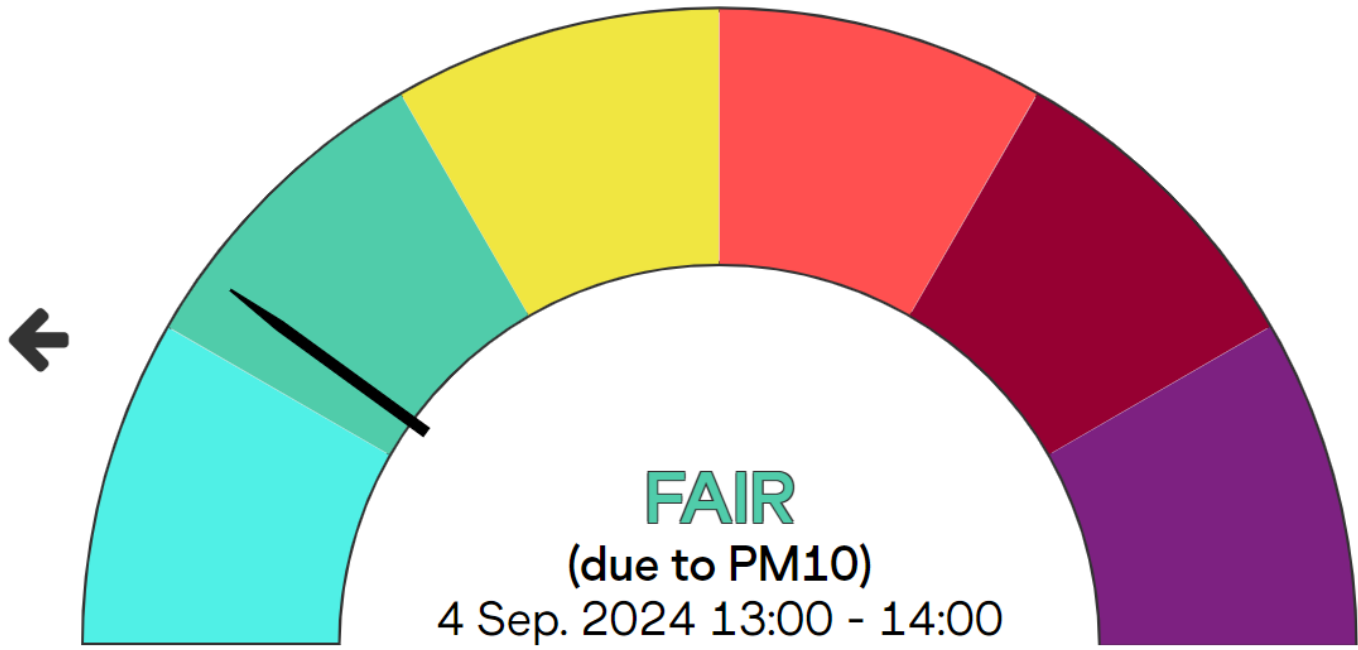
WBGT index during this period was very high (23 days) and represent a significant level of heat stress for training athletes.

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Aggregated data of the particulates pollutants hourly evolution show a moderate levels. PM_{2.5} and PM₁₀ do not showed specific traffic influence pattern.

Appendix

AIR QUALITY INDEX (EUROPE)

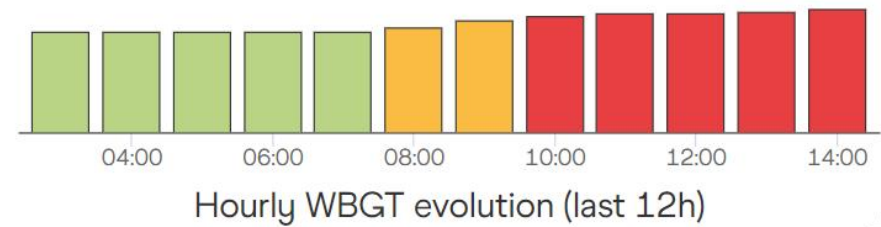
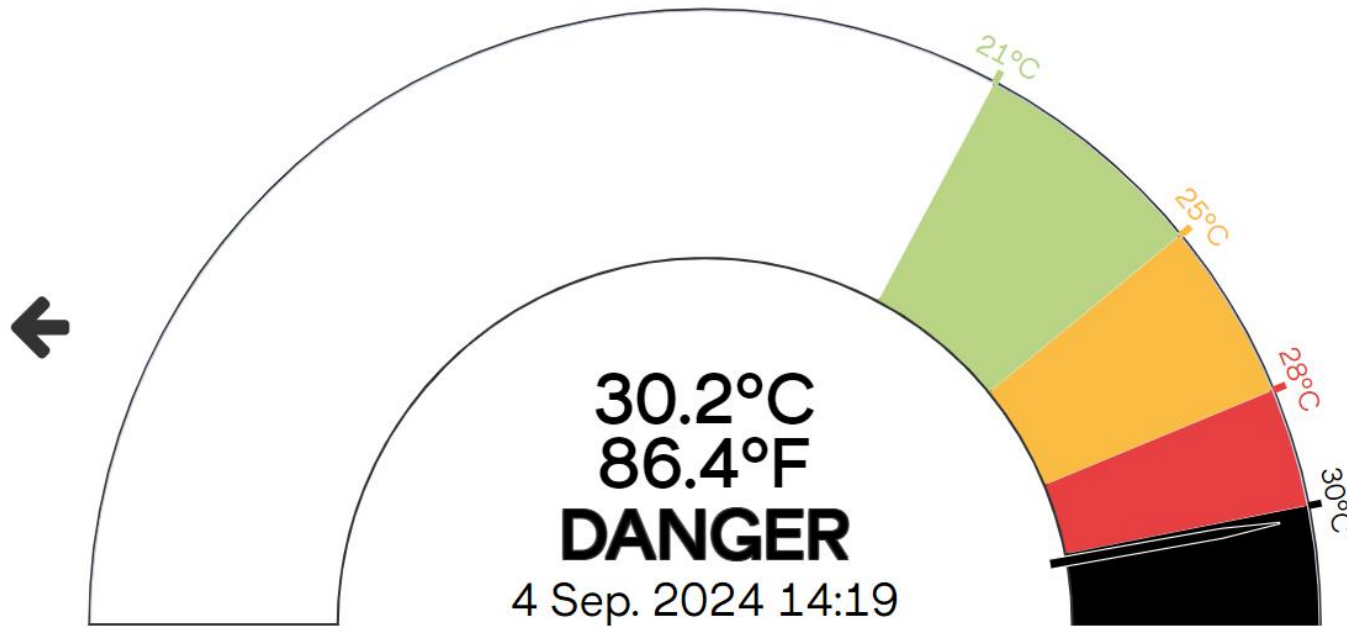


Good Fair Moderate Poor Very Poor Extremely Poor

LAGOS Powered by kunak

Appendix

HEAT STRESS INDEX WET BULB GLOBE TEMPERATURE



🌡️ 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. A central black shape, resembling a stylized letter 'A' or a fan, is surrounded by numerous black lines radiating outwards in all directions, creating a sunburst or starburst effect. The lines vary in length and angle, some pointing towards the top corners and others towards the bottom corners.

Contact: healthandscience@worldathletics.org