



Ministry of Environment



The Hashemite Kingdom of Jordan

Ambient Air Quality Monitoring Report

In (Amman-Irbid-Zarqa)

2017
Year Report





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**National Ambient Air Quality Monitoring Network
Amman - Irbid - Zarqa**

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Abstract

This report summarizes the air quality monitoring that has been carried out for one year starting from 1/1/2017 to 31/12/2017 in the Ministry of Environment air quality monitoring network in **Amman, Irbid and Zarqa**.

Exceedances are obtained by comparing measured values with the Jordanian Standard for ambient air quality **JS 1140 / 2006**.

The Ministry of Environment air quality monitoring network consists of 12 ambient air quality monitoring stations, Distributed as follows:

- 7 stations located in Amman (GAM, KAC, KHG, MAH, TAB, UNI, and YAR).
- 3 stations in Zarqa (HAJ, MAS, and ABK).
- 2 stations in Irbid (HSC, and BAR).

The network reference station was located at the King Hussein Gardens in Amman. The locations of the measurement stations were chosen based on a preliminary mapping of the 3 cities and the monitoring sites were chosen in a way that ensures a fair and comprehensive representation of anthropogenic activities throughout the three cities.

Thus there are fixed stations that continuously monitor air quality in urban areas, traffic dominated sites, and industrial zones.

The criteria air pollutants monitored in the stations included:

- **Particulate matter with aerodynamic diameter ≤ 10 microns (PM_{10})**
- **Carbon monoxide (CO)**
- **Sulfur dioxide (SO_2)**
- **Nitrogen dioxide (NO_2)**
- **Ozone (O_3)**

The operation of the network started on 1st of May 2014 with continuous operation. Pollutant measurements are automatically transmitted to a central server where they are stored, checked, analyzed and reports compiled on a weekly and monthly basis.

Results show that the three main Jordanian cities (**Amman, Irbid, and Zarqa**) enjoy fairly good air quality during most of the year, however particulate matter **PM₁₀** daily averages in all sites exceeded the Jordanian standards in a percentage between 3% to 44.7% as shown below.

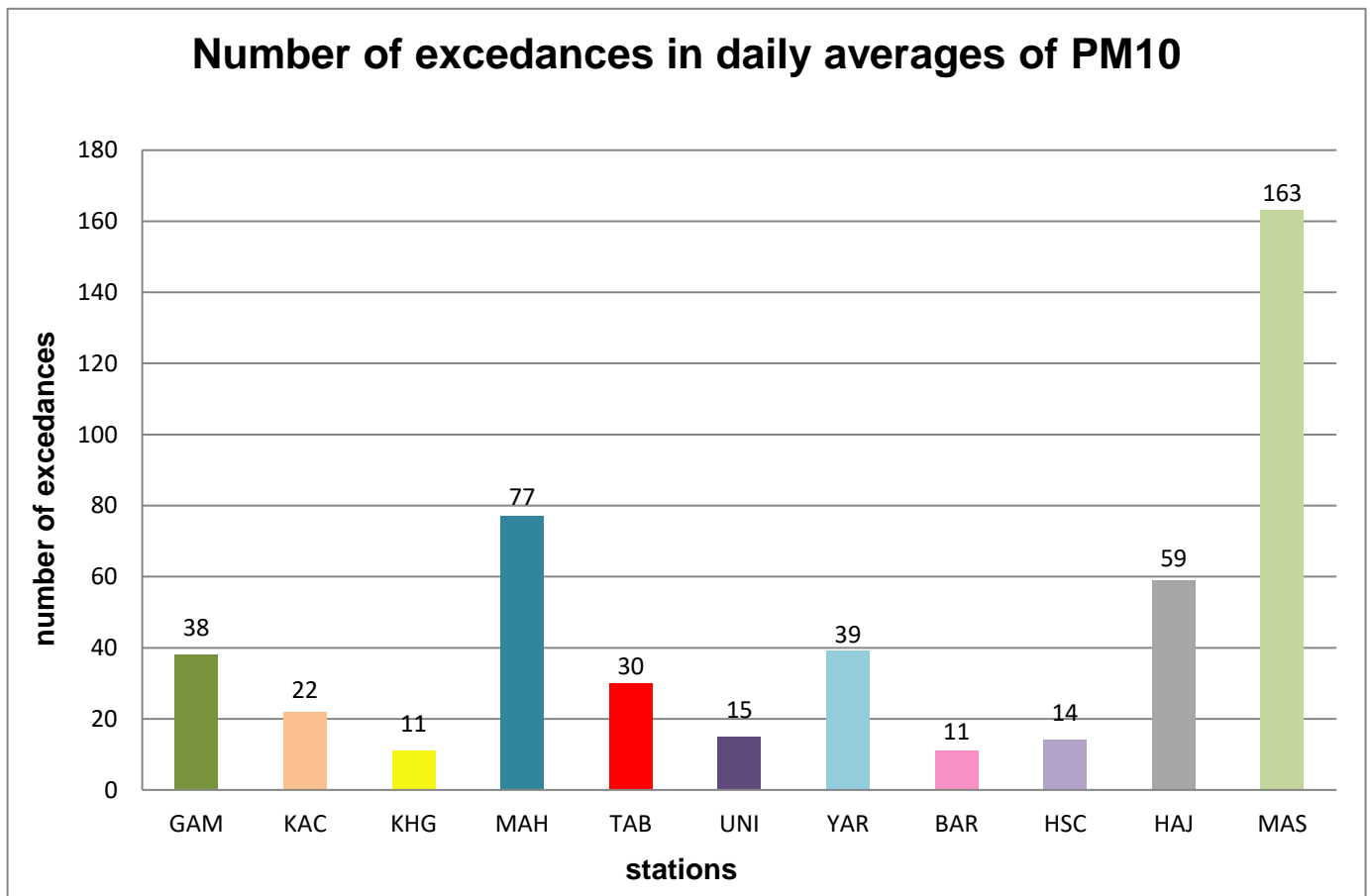


Figure (1): Number of daily average exceedances of PM10 in all stations in comparison with set limits in Jordanian Standard JS 1140/2006 for Ambient Air Quality.

Not all of the pollutants were monitored at every site. The annual mean concentration for each pollutant shows that all pollutants are within the Jordanian standards limits except for the annual **PM₁₀** where it **exceeded** the Jordanian Standard for ambient air quality in five out of the twelve stations.

Percentage of exceedances in daily averages of PM10

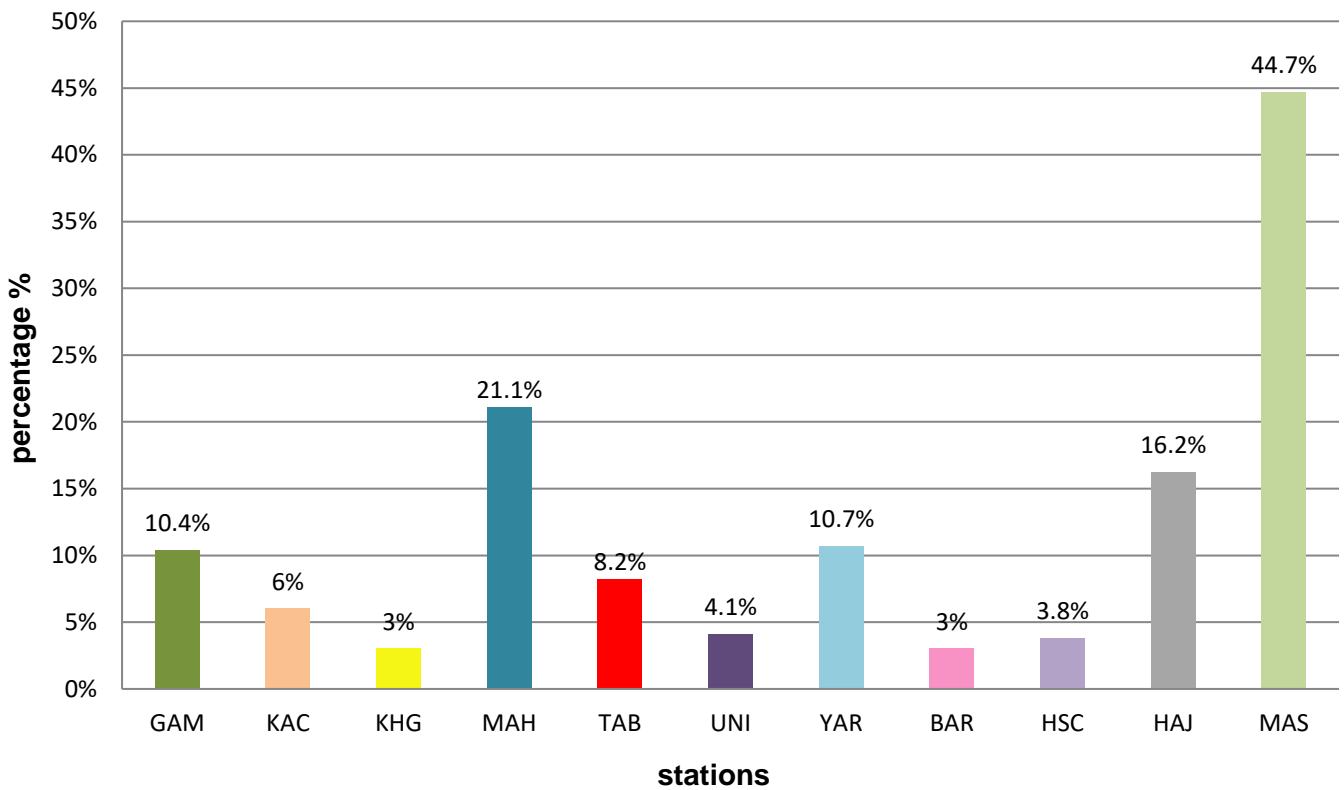


Figure (2): percentage of daily average exceedances of PM10 in all stations in comparison with set limits in Jordanian Standard JS 1140/2006 for Ambient Air Quality.

Percentage of exceedances = (number of exceedances days during the year / number of the year days) * 100 %

In addition, carbon monoxide CO 8 hour averages exceeded the Jordanian standard in Greater Amman Municipality Station (GAM), Tabarbour station (TAB), and Al Hassan Sports city in Irbid station (HSC) as shown below.

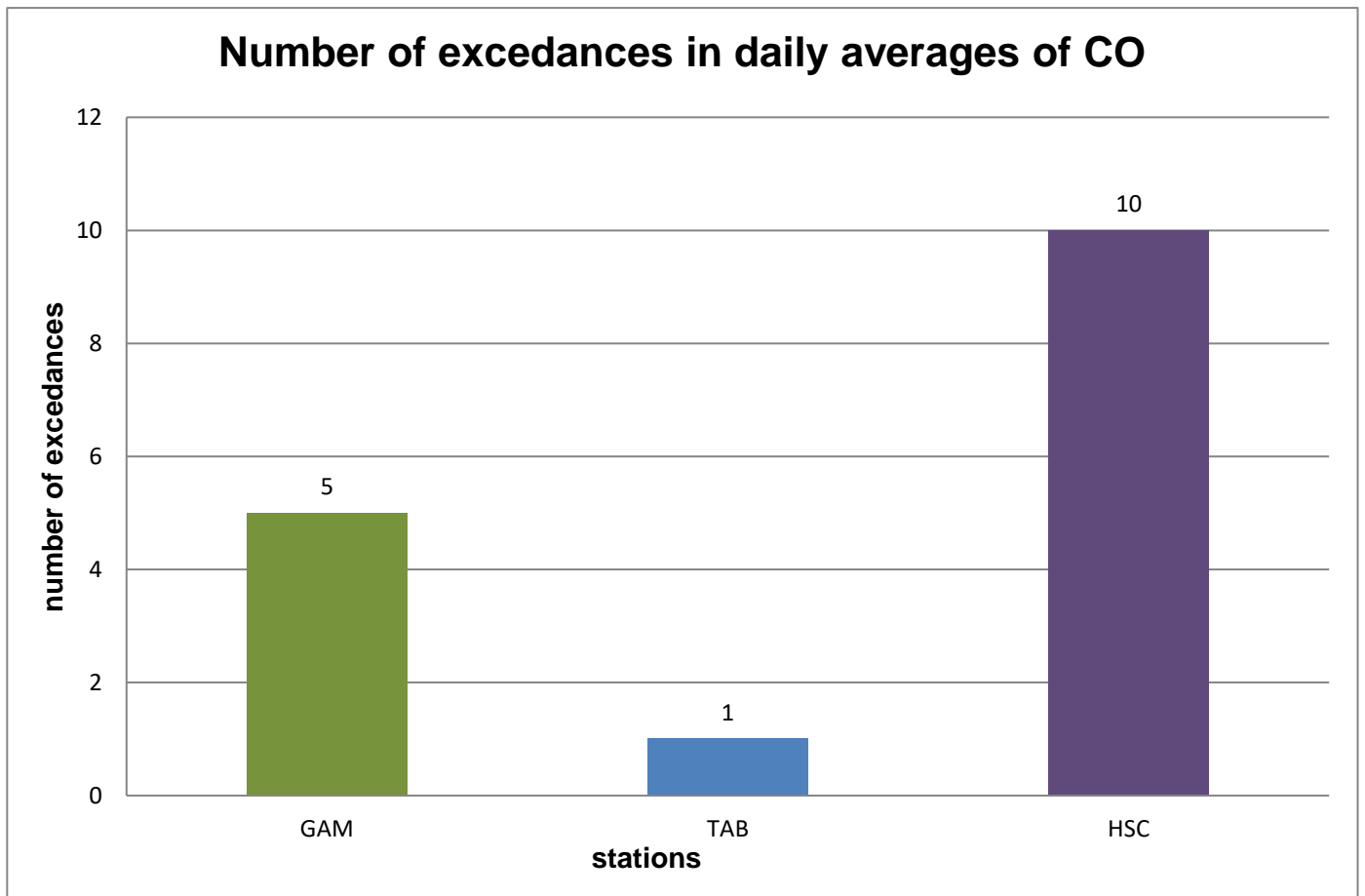


Figure (3): Number of daily average exceedances of CO in all stations in comparison with set limits in Jordanian Standard JS 1140/2006 for Ambient Air Quality.

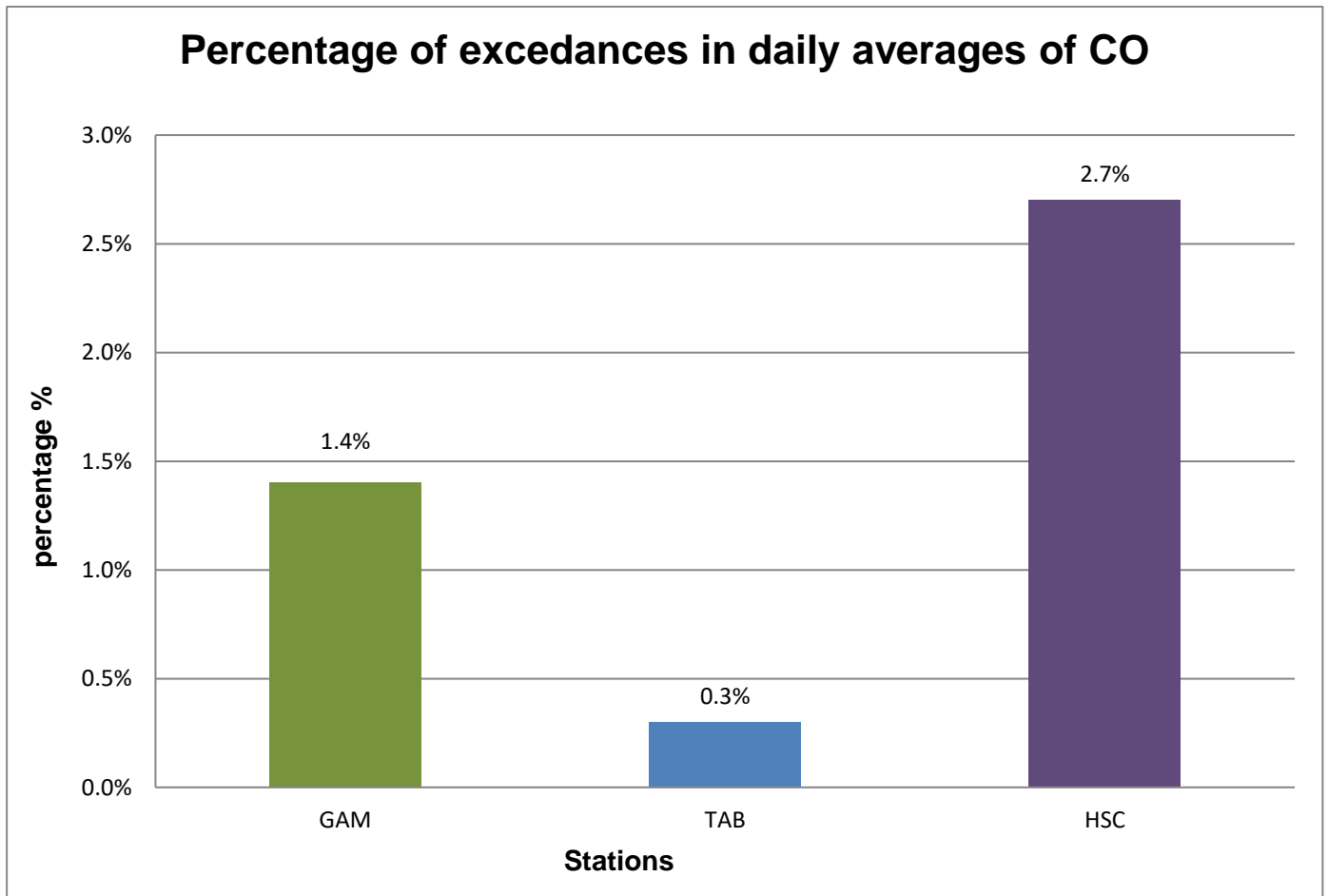


Figure (4): percentage of daily average exceedances of CO in all stations in comparison with set limits in Jordanian Standard JS 1140/2006 for Ambient Air Quality.

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1

INTRODUCTION

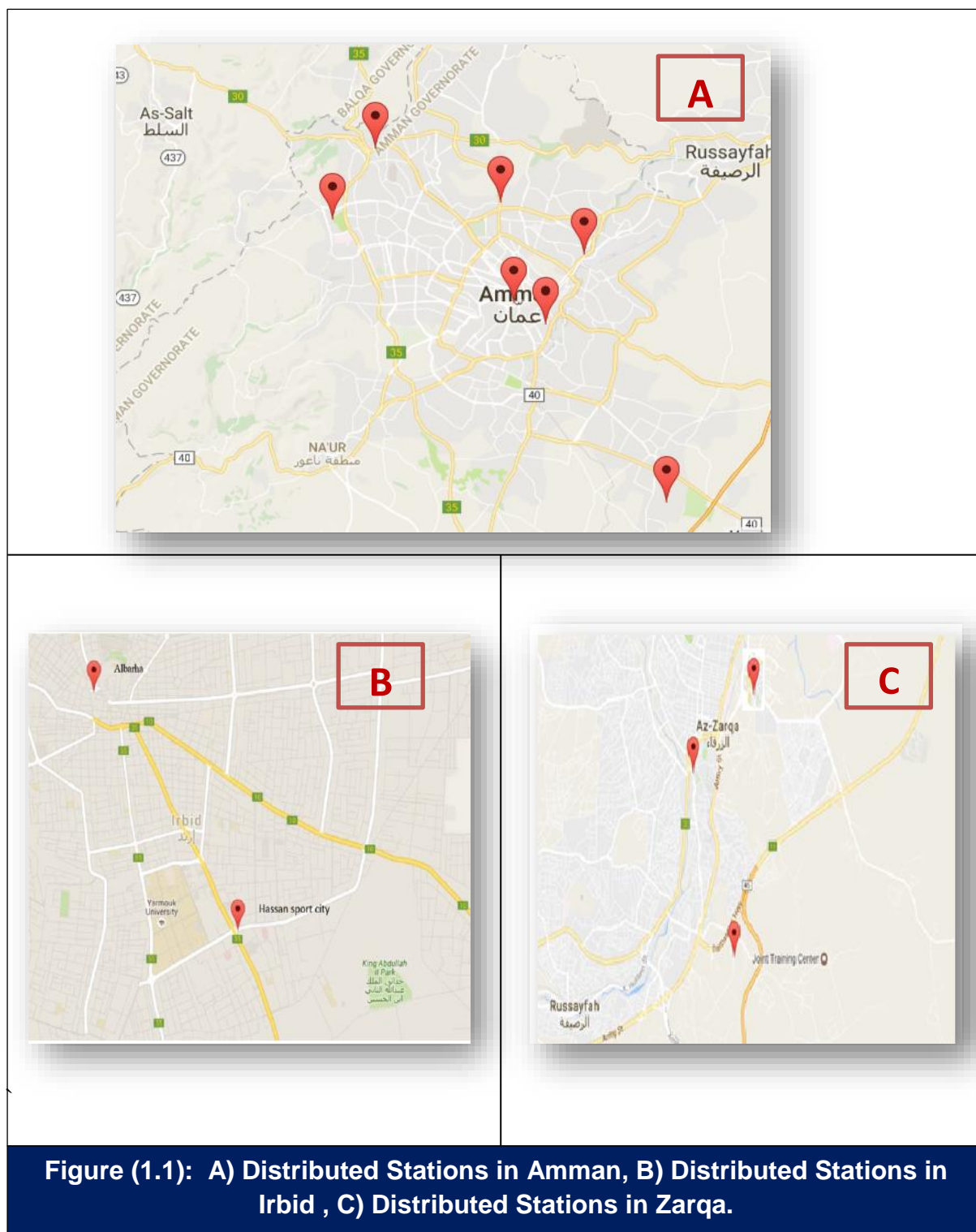
1.1 Monitoring Sites

The ministry's Ambient Air Quality Network consists of 12 continuous monitoring stations, Table (1.1) Refers to types and locations of stations in Amman, Irbid and Zarqa.

Locations of the measurements stations were chosen based on a preliminary mapping of the 3 cities to represent urban, traffic and industrial atmospheric events, in addition to a background reference station located in Amman at the king Hussein gardens in the area of Dabooq in Amman.

Table (1.1): Station's location and abbreviation.

Short Name	Name in Arabic	Type of Station	Name in English
Amman			
KHG	حدائق الملك حسين	Background	King Hussein Gardens
GAM	أمانة عمان الكبرى	Urban	Greater Amman Municipality
TAB	مجمع سفريات الشمال (طبربور)	Traffic	Northern Bus Station Tabarbour
MAH	ماركا – المحطة	Urban	Marka – Mahata
UNI	شارع الجامعة - صويلح	Traffic	University street Sweile
KAC	مدينة الملك عبدالله الثاني الصناعية / سحاب	Industrial	King Abdullah II Industrial City / Sahab
YAR	حديقة اليرموك وادي الرمم	Industrial	Wadi Rimam Yarmuk Garden
Irbid			
HAJ	مركز صحي وادي الحجر	Traffic	Health Center Wadi Hajjar
MAS	المسلخ البلدي منطقة المصانع	Industrial	Main slaughter house Masane' Zone
ABK	حديقة البنك العربي	Urban	Arab Bank Garden
Zarqa'a			
HSC	مدينة الحسن الرياضية	مرور	AL Hassan Sport City
BAR	شارع البارحة	Urban	Al Barha street



1.2 Jordanian Standard for Ambient Air Quality

Air Quality Data presented in this report and exceedances is discussed and compared against Jordanian National Standard for ambient air quality JS 1140/2006 as shown in **Table (1.2)**.

It is worth noting that the limits in the Jordanian standard are higher than the WHO guideline limits.

Table (1.2) Jordanian Standard Specification 1140/2006

Pollutant	Sample Duration	Maximum Allowable Limit	Number of Allowable Exceeded Events
Sulfur dioxide(SO ₂)	One Hour	0.3 part per million (ppm)	3 times in any 12-month period per year
	24 Hours	0.14 part per million (ppm)	Once per Year
	Yearly	0.04 part per million (ppm)	-
Carbon monoxide(CO)	One Hour	26 part per million (ppm)	3 times in any 12-month period per year
	8 Hours	9 part per million (ppm)	3 times in any 12-month period per year
(NO ₂) Nitrogen dioxide	One Hour	0.21 part per million (ppm)	3 times in any 12-month period per year
	24 Hours	0.08 part per million (ppm)	3 times in any 12-month period per year
	Yearly	0.05 part per million (ppm)	-
Ozone (O ₃)	One Hour	0.12 part per million (ppm)	-
	8 Hours	0.08 part per million (ppm)	-
Particulate Matter (PM ₁₀)	24 Hours	120 Microgram (µg/m ³)	3 times in any 12-month period per year
	Yearly	70 Microgram (µg/m ³)	-

1.3 Pollutants

Pollutants Monitored included: Particulate matter with aerodynamic diameter ≤ 10 microns (**PM₁₀**), Carbon monoxide (**CO**), Sulphur dioxide (**SO₂**), Nitrogen dioxide (**NO₂**) and Ozone (**O₃**).

Table (1.3): Pollutants monitored in each station.								
Type of station	Station Name	Short name	CO	NO ₂	SO ₂	O ₃	PM ₁₀	MET
Amman								
Background	King Hussein Gardens	KHG		1	1	1	1	1
Urban	Greater Amman Municipality	GAM	1	1	1		1	
Traffic	Northern Bus Station Tabarbour	TAB	1	1			1	
Urban	Marka – Mahata	MAH		1	1		1	
Traffic	University street Sweileh	UNI		1			1	
Industrial	King Abdullah II Industrial City / Sahab	KAC		1	1	1	1	
Industrial	Wadi Rimam Yarmuk Garden	YAR		1	1		1	
Zarqa'a								
Traffic	مركز صحي وادي الحجر	HAJ	1	1	1		1	1
Industrial	المسلخ البلدي منطقة المصانع	MAS		1	1		1	
Urban	حديقة البنك العربي	ABK		1	1		1	
Irbid								
Traffic	مدينة الحسن الرياضية	HSC	1	1			1	
Urban	شارع البارحة	BAR		1	1	1	1	1

1.4 Measurement Techniques

All monitors and analyzers used in this project are in compliance with the Jordanian standard 1140/2006 and are approved by the American Environmental Protection Agency (**EPA**), in addition to European and other International environmental authorities.

Pollutant	Model	Approval & Certifications
Particulate Matter (PM₁₀)	Thermo 5014i	U.S. EPA Approved PM-10 (EQPM1102-150)
Nitrogen dioxide (NO₂)	Thermo 42i	U.S. EPA Reference Method: RFNA-1289-074; MCerts Certified: MC070093/00; EN14211: 936/21203248/C Report; NF Certificate: 05/01
Sulfur dioxide (SO₂)	Thermo 43i	US EPA Equivalent Method: EQSA-0486-060, MCERTS Certified Sira MC070094/00, EN14212: TÜV 936/21203248/D Report
Carbon monoxide (CO)	Thermo 48i.	US EPA Reference Method: RFCA-0981-054, MCERTS Certified Sira MC070095/00, EN14626: TÜV 936/21203248/A Report
Ozone (O₃)	Thermo 49i	US EPA Equivalent Method: EQOA-0880-047, MCerts Certified MC070096/00, EN14626: 936/21203248/13 Report, NF Certificate: 05/01

1.5 Calibration

All gas analyzers were calibrated using the Thermo Scientific Dynamic Gas Calibrator model 146i with Gas Phase Titration, the Zero Air generator model 111 and calibration Gas bottles. The calibrator produces precise gas levels of nitric oxide, nitrogen dioxide, carbon monoxide, sulfur dioxide and ozone to calibrate the instruments for span and multipoint calibrations. The zero air generator is used to perform zero calibration.

1.6 Meteorology

Three stations (table 1.3) are furnished with ultrasonic wind speed and direction sensors in addition to temperature and humidity sensors. The sensors are mounted at about 10 meters above the ground using retractable mast.

1.7 Communication and Telemetry

All measurements are automatically transmitted to the ministry of environment central server through internet connection.

1.8 Operation and site Performance

All monitoring sites were operated by staff of United Technology Establishment (UniTec). Operation included maintenance of monitoring equipment, site supervision, calibration, telemetry and provision of quality assured data. In addition to issuing of weekly, monthly and yearly reports.

Sites were operated in accordance with manufacturer and International Quality Assurance procedures for ambient air quality monitoring. Part of these procedures state that “site operation and office procedures shall be conducted to minimize data loss”. During this year an average of **98.11%** completeness of data (in 11 stations) was achieved as an average of measured parameters for all the analyzers. This is a high percentage and far exceeded the requirement set by the Ministry of Environment of minimum **85%** data completeness. Percentage completeness is defined as the percentage of annual data available, compared to the total possible number of observations for each parameter at each site.

Reasons for incomplete datasets include: instrument malfunction, communications failure or power loss. Measures to mitigate data loss were implemented with multiple levels of data security in place, detailed remote monitoring of the internal parameters in the analyzers in addition to site follow up procedures.

1.9 Stations

All twelve stations are typical in external architecture and were designed to provide both functionality as well as a nice architecture from the outside. The shelters are fully insulated and the external protection perimeter is made from steel and sandstone blocks which are typical building material used in Jordan. Analyzers were mounted internally in 19" racks and the shelter was fitted with two air conditioning units. A typical station is shown in (figures 1.2 and 1.3).



Figure (1.2) Station from inside



Figure (1.3) Station from outside

2

RESULTS

Table (2.1) shows the results of yearly average for the ambient air quality in all stations, **Red color** indicates that this value exceeded the Jordanian Limits JS1140/2006.

Table (2.1): The yearly average in all stations.

#	Station	Short Name	PM ₁₀ µg/m ³	NO ₂ ppb	SO ₂ ppb	CO ppb	O ₃ ppb	
Average as in Jordanian Limits 1140/2006 Yearly								
			70 µg/m ³	50 ppb	40 ppb	N/A	N/A	
Amman								
1	King Hussein Gardens (Background Station)	KHG	43.8	9.52	3.17	-	41.0	
2	Greater Amman Municipality	GAM	68.0	29.6	7.26	3516	-	
3	Northern Bus Station Tabarbour	TAB	74.5	24.4	-	3842	-	
4	Marka – Mahata	MAH	88.7	27.4	15.4	-	-	
5	University street Sweile	UNI	64.8	9.87	-	-	-	
6	King Abdullah II Industrial City / Sahab	KAC	61.5	13.8	5.08	-	12.3	
7	Wadi Rimam Yarmuk Garden	YAR	76.1	16.1	4.68	-	-	
Zarqa								
8	Health Center Wadi Hajjar	HAJ	82.1	17	6.61	4093	-	
9	Main slaughter house Masane' Zone	MAS	133.0	12.4	3.51	-	-	
10	Health Center Wadi Hajjar	ABK	Stopped					
Irbid								
11	AL Hassan Sport City	HSC	60.0	16.3	-	6813	-	
12	Al Barha street	BAR	45.3	22.2	18.3	-	22.1	

Table (2.2): Number of exceedances in all stations.

			PM ₁₀	NO ₂	NO ₂	SO ₂	SO ₂	CO	CO	O ₃	O ₃
Station			24hr AVG	24hr AVG	1hr MAX/ 24hr	24hr AVG	1hr MAX/ 24hr	8hr AVG MAX/ 24hr	1hr MAX/ 24hr	8hr AVG MAX/ 24hr	1hr MAX/ 24hr
Limits			120 µg/m ³	80 ppb	210 ppb	140 ppb	300 ppb	9000 ppb	26 ppm	80 ppb	120 ppb
Number of allowed exceedances			3	3	3	3	3	3	3	-	-
Amman											
1	King Hussein Gardens	KHG	11	-	-	-	-	-	-	-	-
2	Greater Amman Municipality	GAM	38	-	-	-	-	5	-	-	-
3	Northern Bus Station Tabarbour	TAB	30	-	-	-	-	1	-	-	-
4	Marka – Mahata	MAH	77	1	-	-	-	-	-	-	-
5	University street Sweile	UNI	15	-	-	-	-	-	-	-	-
6	King Abdullah II Industrial City/Sahab	KAC	22	-	-	-	-	-	-	-	-
7	Wadi Rimam Yarmuk Garden	YAR	39	-	-	-	-	-	-	-	-
Zarqa											
8	Health Center Wadi Hajjar	HAJ	59	-	-	-	-	-	-	-	-
9	Main slaughter house Masane' Zone	MAS	163	-	-	-	-	-	-	-	-
10	Arab Bank Garden	ABK	Stopped								
Irbid											
11	AL Hassan Sport City	HSC	14	-	1	-	-	10	-	-	-
12	Al Barha street	BAR	11	-	-	-	-	-	-	-	-

2.1 Particulate Matters (PM₁₀)

PM₁₀ Particulates are inhalable aerosols that are less than 10µm in diameter; the smaller the particle, the further they can penetrate into the lungs which could cause several health problems especially for people with existing respiratory conditions, such as asthma and bronchitis. Particles can also alter immune systems and thus reduce the body's ability to resist and fight infection. Recent epidemiological research have also pointed that inhalable particulates could lead to high blood pressure, strokes, and lung cancer, and thereby increase annual mortality rates.

The Jordanian standard for annual average **PM₁₀** is **70µg/m³**. Table (2.1) shows that five out of the twelve stations exceeded this yearly average limit.

The Jordanian standard for 24hr average **PM₁₀** is **120µg/m³**, which is not to be exceeded for more than three times in a 12-month period.

Figure (2.2) shows that the maximum reading for **PM₁₀** yearly average was **133 µg/m³** in “**MAS**” station, Regional dust events and local soil erosion cause high **PM₁₀** readings and all stations record high dust measurements during regional dust storms. Figure (2.1) shows the highest 24hr **PM₁₀** readings at all stations. The highest 24 hr. **PM₁₀** concentration measured in all twelve stations was around **532 µg/m³** in “**HSC**” station. Daily **PM₁₀** breaches are shown in the Annex. There were other lighter dust storms as well as emissions emanating from local sources including motor vehicles, light industry and domestic heating that led to high **PM₁₀** readings. Events of unstable atmospheric conditions may also lead to elevated **PM₁₀** levels.

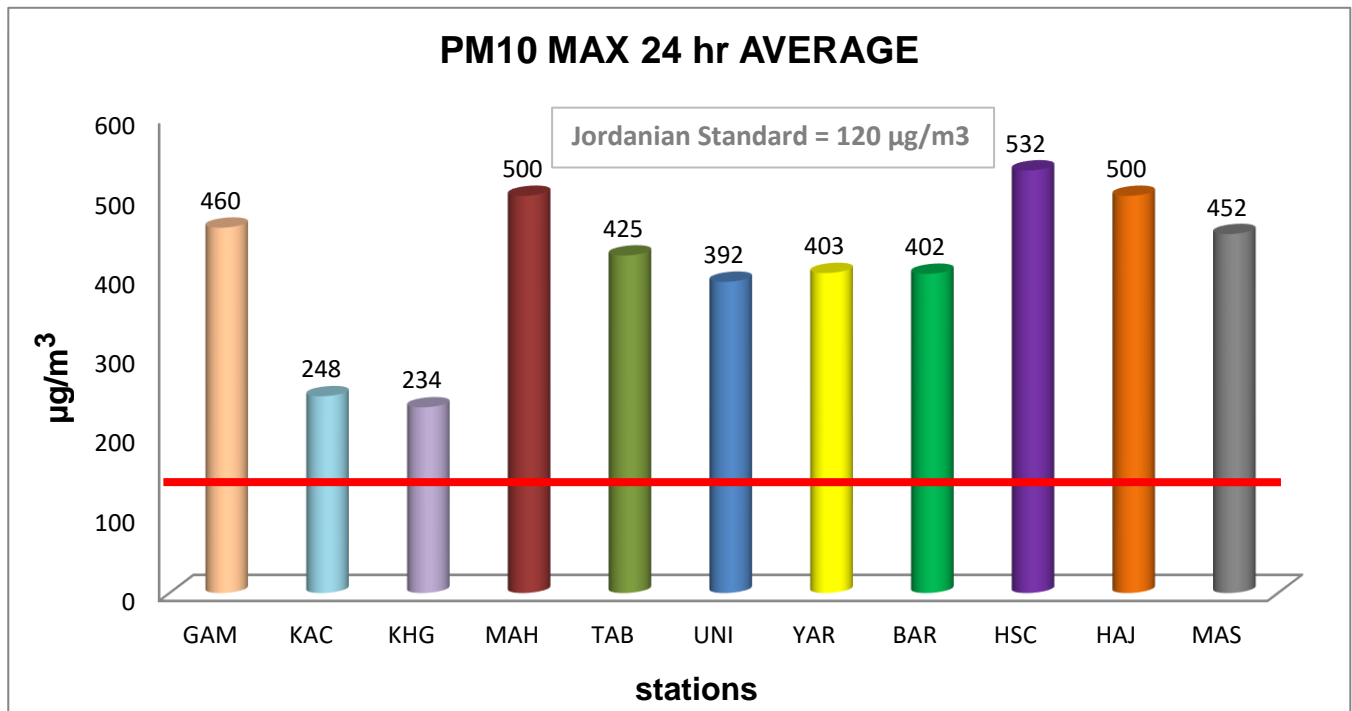


Figure (2.1): the Maximum value of daily averages of the Particulate matter (PM_{10}) in all stations.

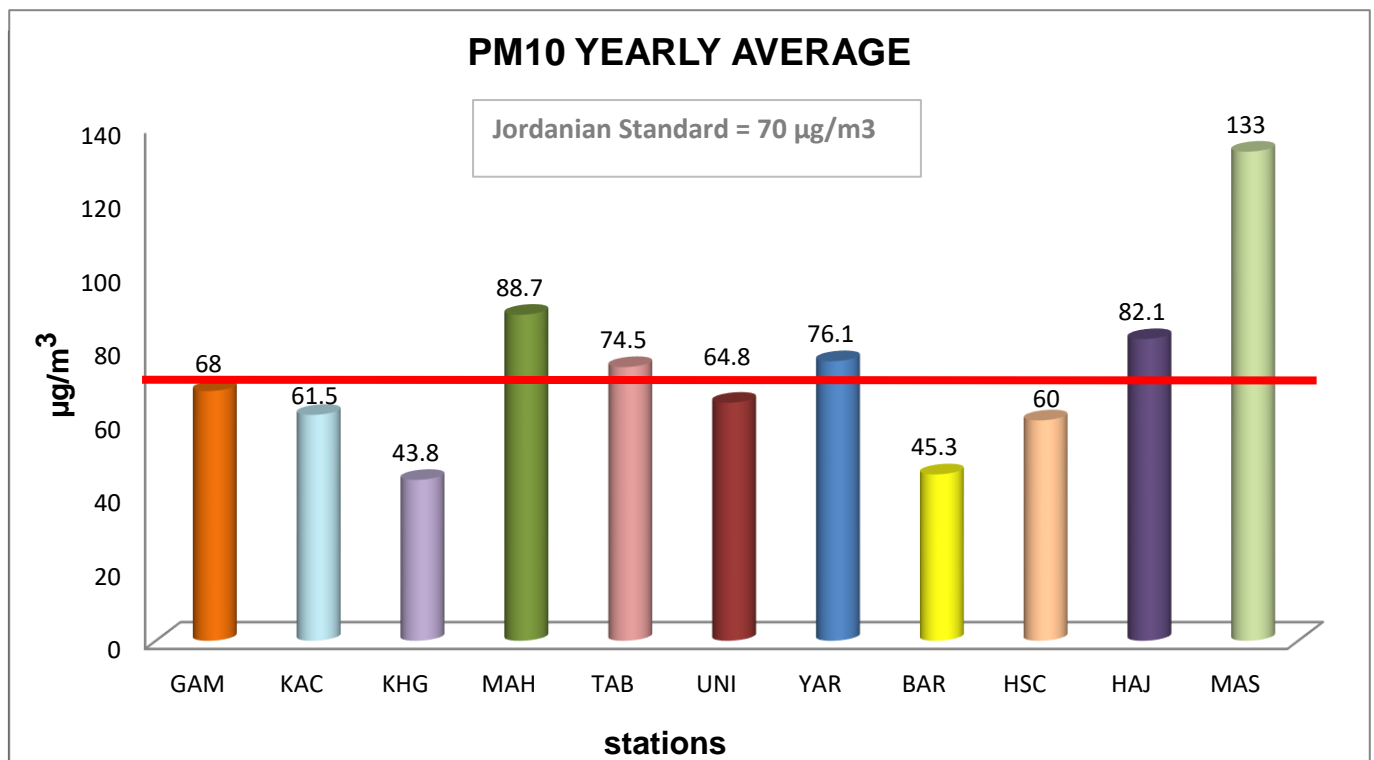


Figure (2.2): The Yearly average value of the Particulate matter (PM_{10}) in all stations.

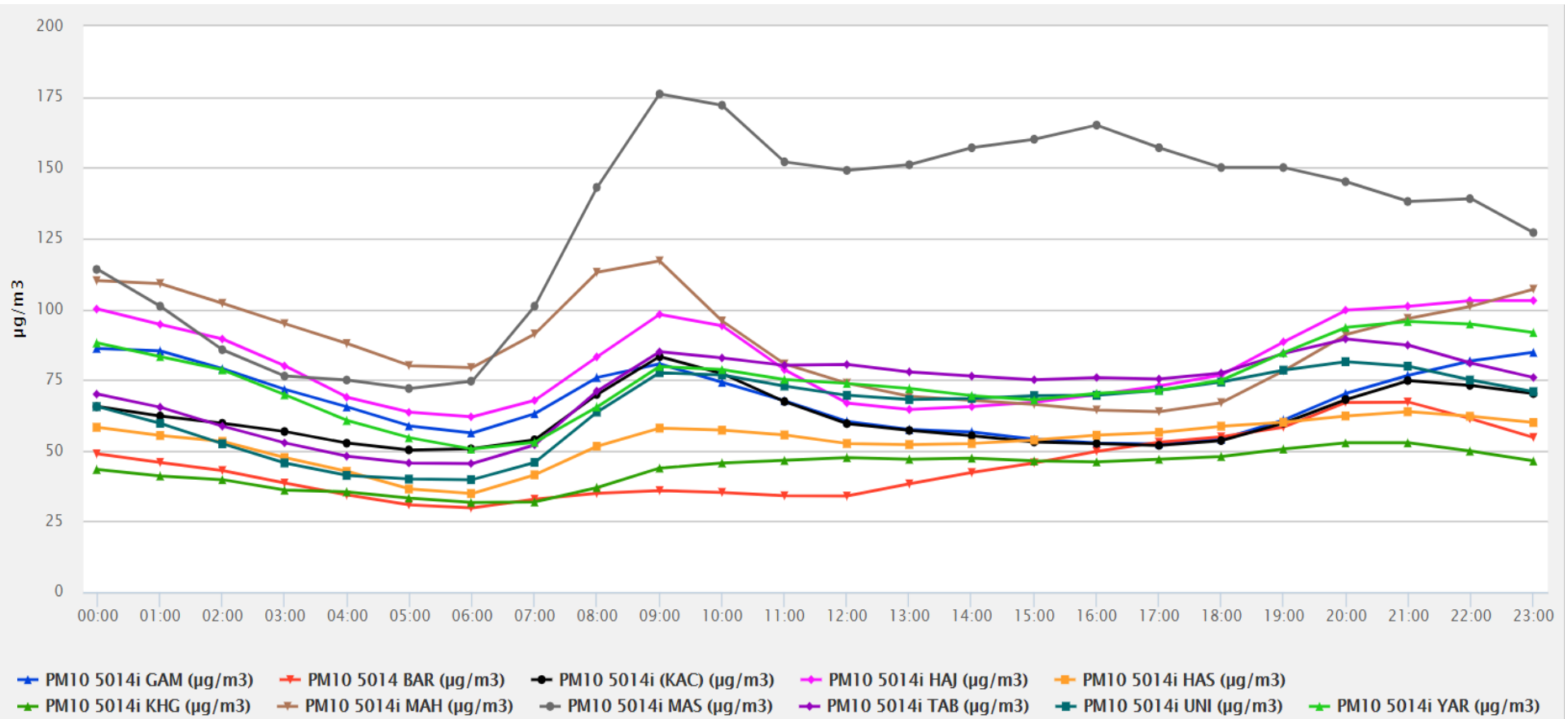


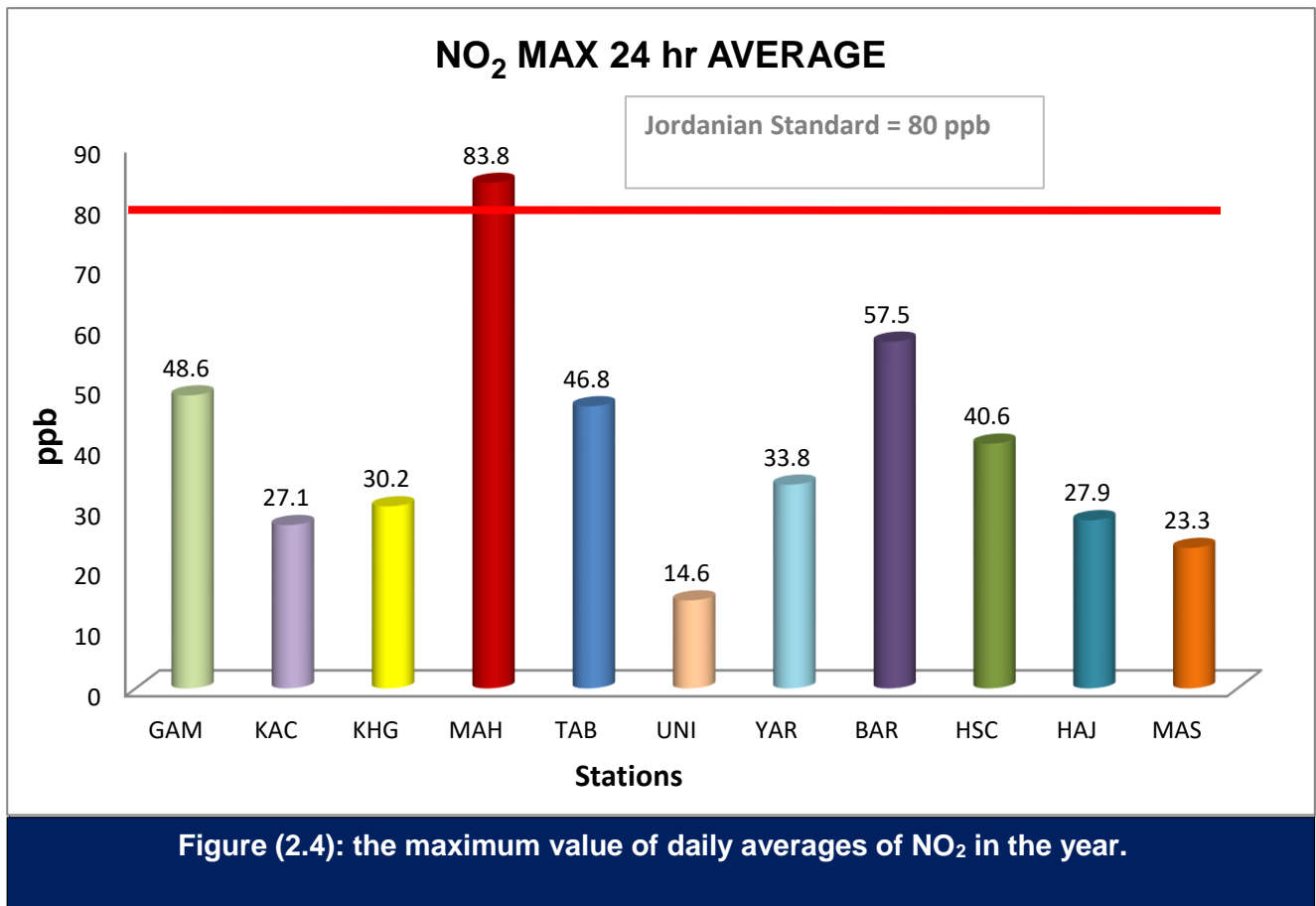
Figure (2.3): the average value in each hour of the day in all stations of the Particulate matter (PM₁₀).

Figure (2.3) illustrates the average yearly PM₁₀ concentration for each hour for all stations. It can be readily seen that the highest daily PM₁₀ readings occur during peak traffic movement around (8-9am) in the morning and (7-8) pm in the evening.

2.2 Nitrogen dioxide (NO₂)

Nitrogen dioxide (NO₂) is a gas that adversely affects the respiratory system. The Jordanian Standard allows three 1-hour average concentrations greater than **210 ppb** a 12-month period.

The 24-hour average Jordanian Standard for ambient air quality is **80 ppb** while the yearly average is **50 ppb**. Almost all stations showed results within Jordanian Standard for ambient Air quality limits as listed in table (1.2).



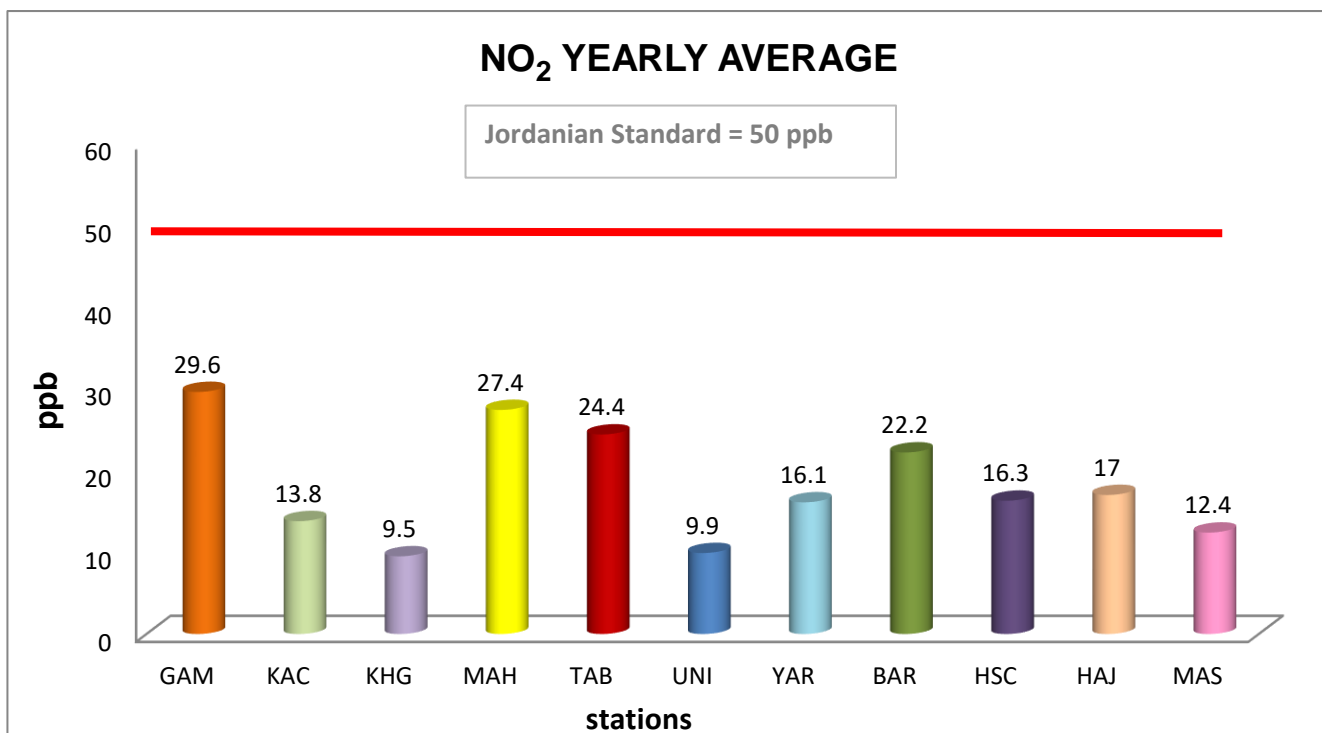


Figure (2.5): the Yearly average value of Nitrogen dioxide (NO₂) in all stations.

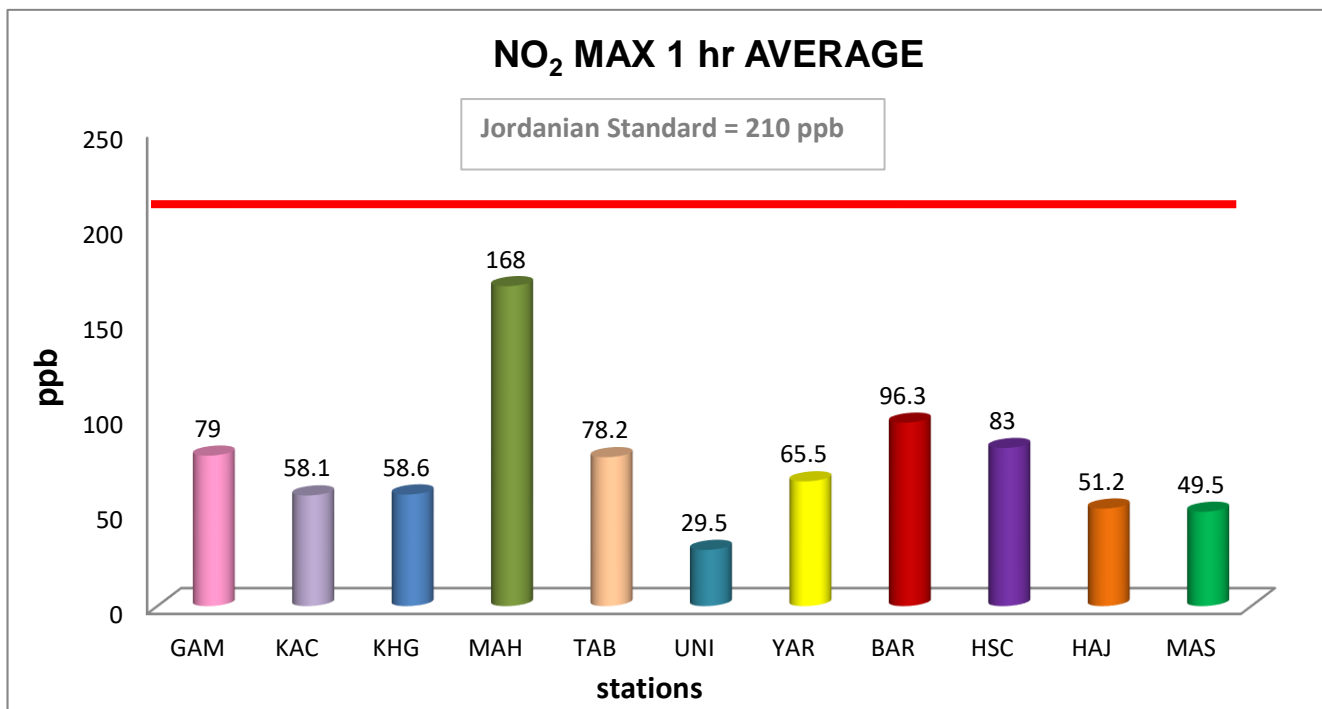


Figure (2.6): maximum one hour average value of NO₂ in all stations.

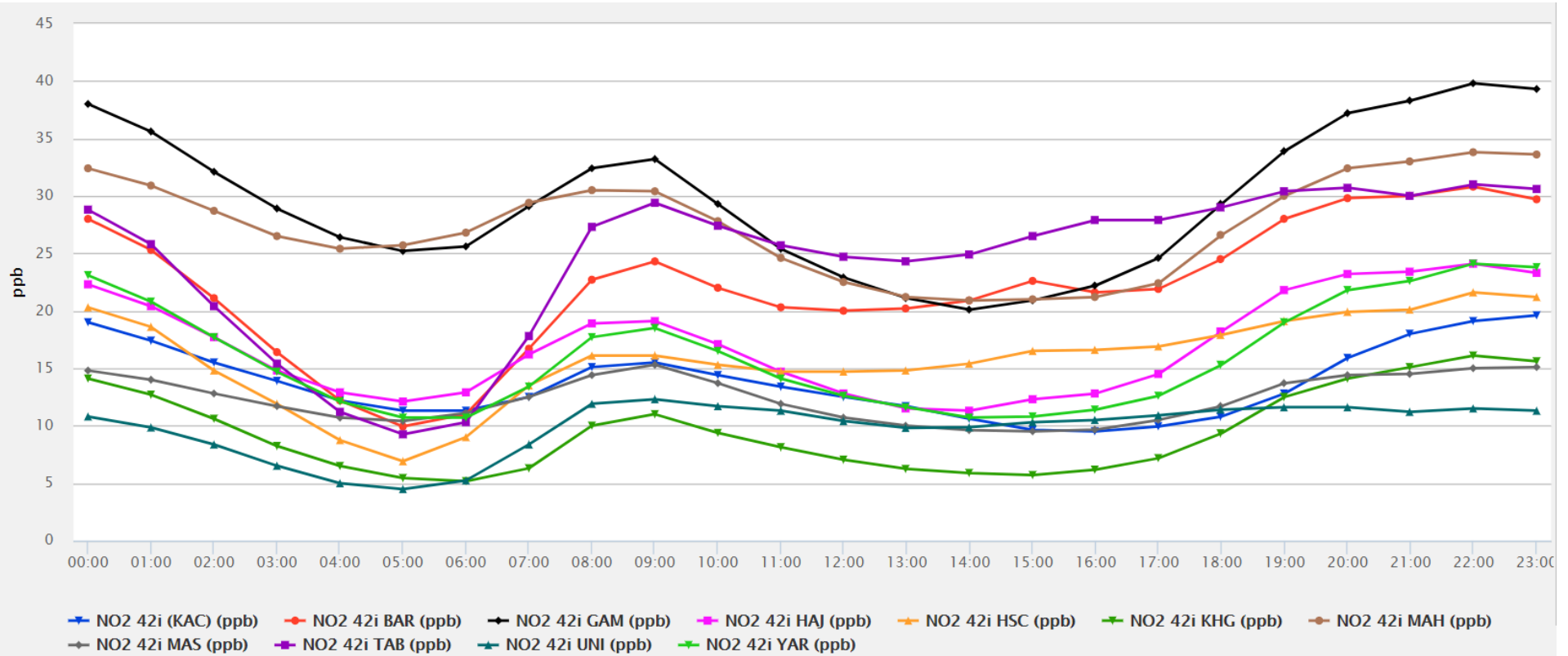


Figure (2.7): the average value in each hour of the day in all stations of Nitrogen Dioxide (NO₂).

The highest daily NO₂ readings appear to be around midnight as shown in figure (2.7).

2.3 Sulfur Dioxide SO₂

Sulphur dioxide (SO₂) is a toxic gas known to have adverse impacts on the respiratory system. It irritates the nose, throat and lungs and it could cause bronchitis. The Jordanian Standard allows three 1-hour average concentrations greater than **300 ppb** in a 12-month period. The 24-hour average Jordanian Standard for ambient air quality is **140 ppb** while the yearly average is **40 ppb**. All stations showed results within the Jordanian Standard for ambient air quality limits and there were no exceedances.

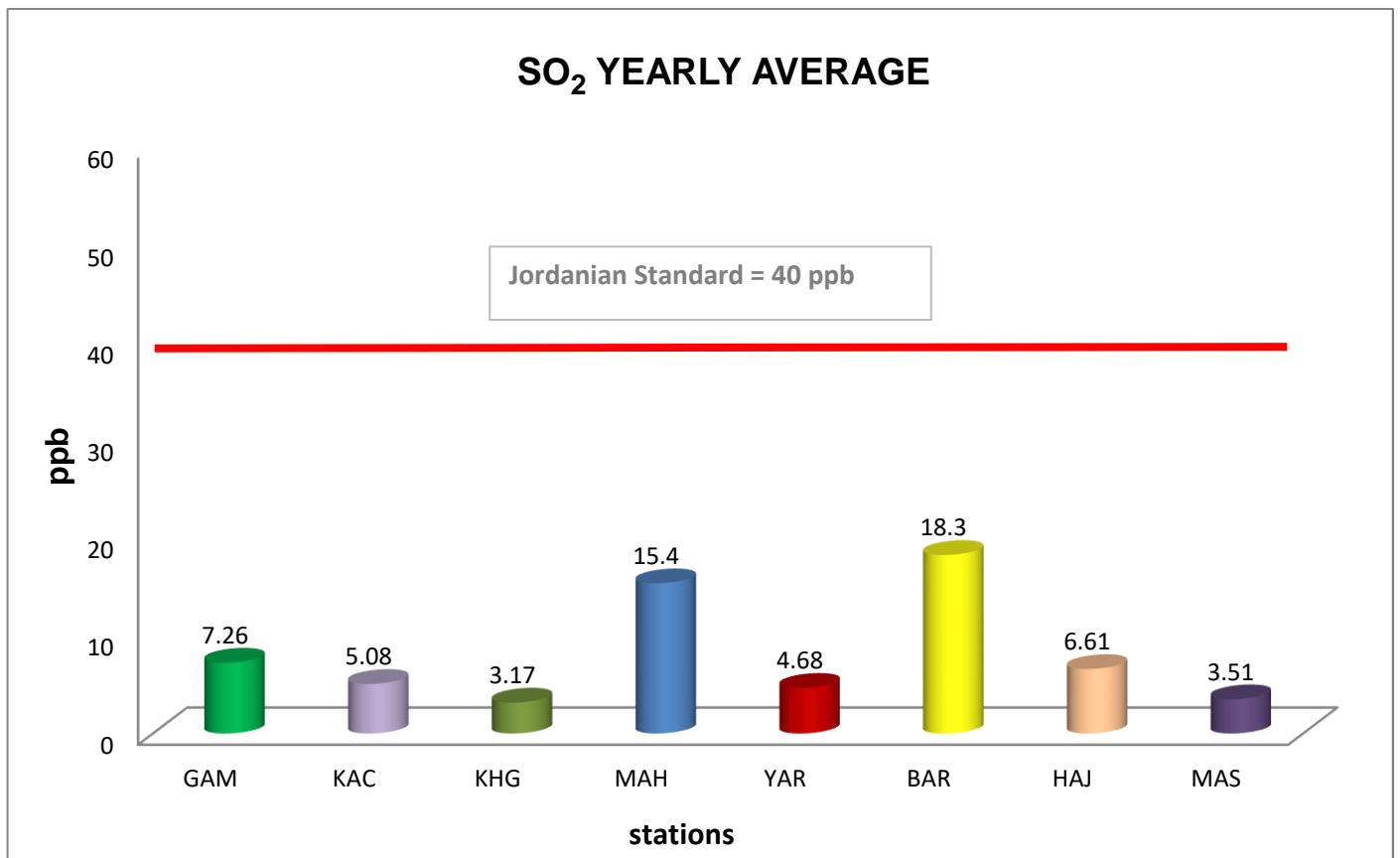


Figure (2.8) yearly average value of sulfur dioxide (SO₂).

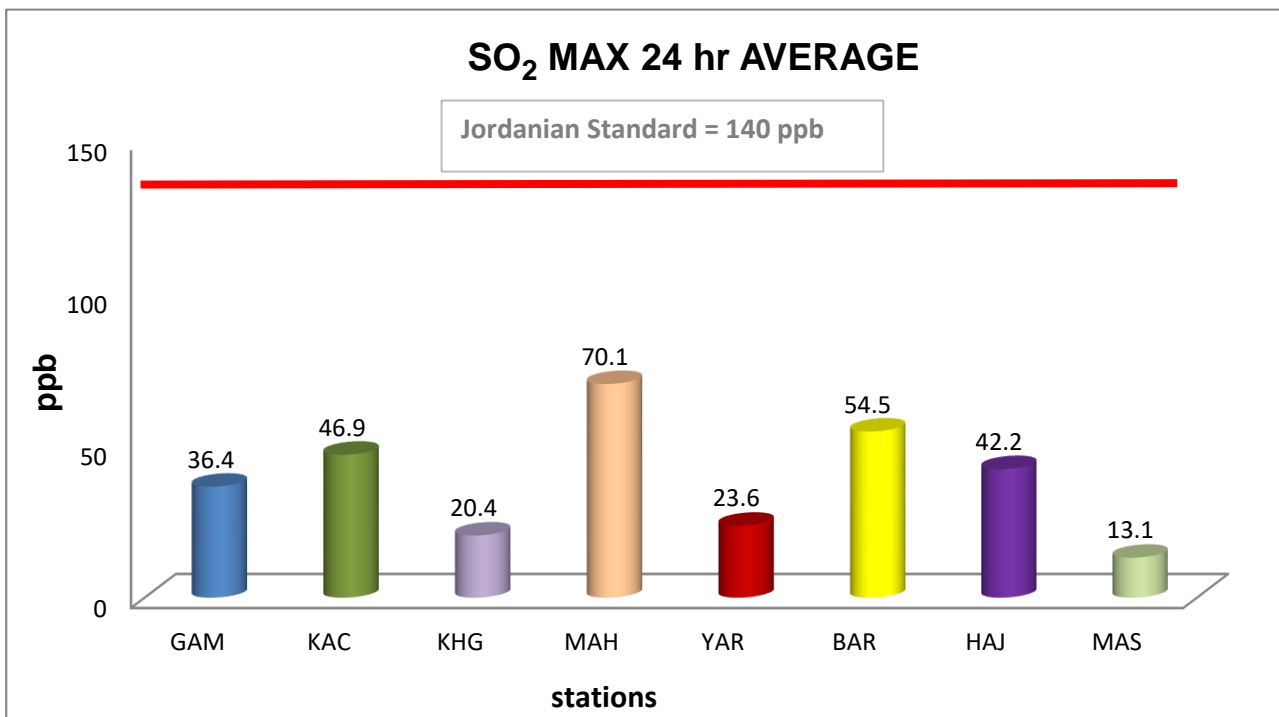


Figure (2.9): the maximum value of daily averages of SO₂ in the year.

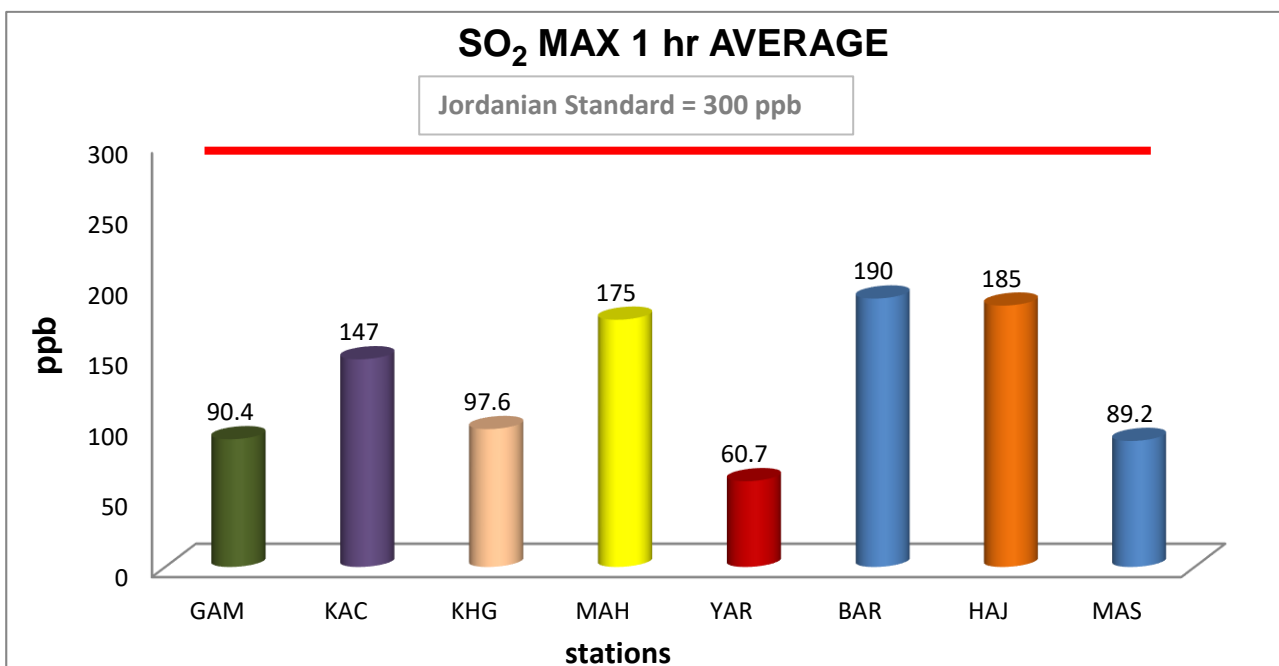
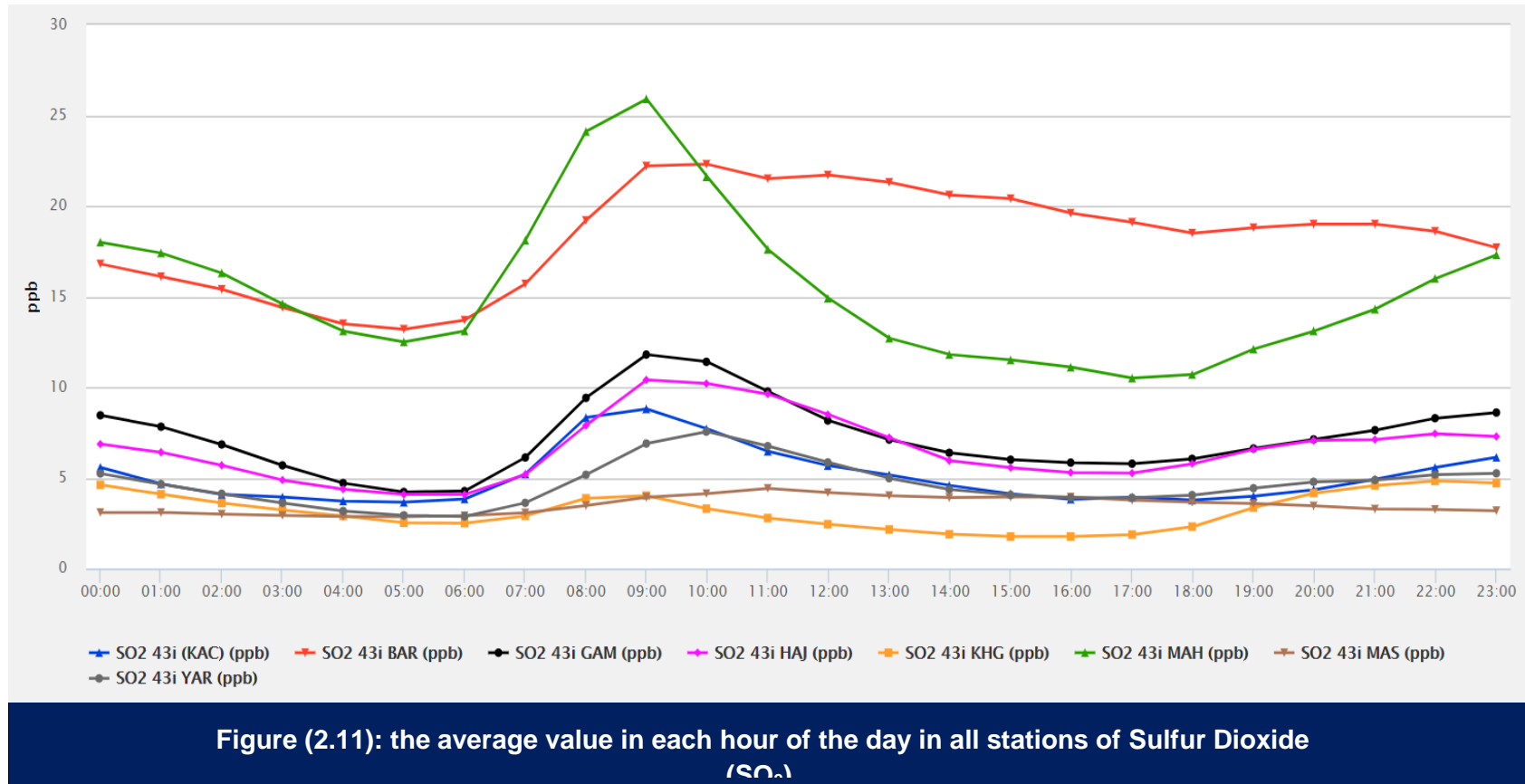


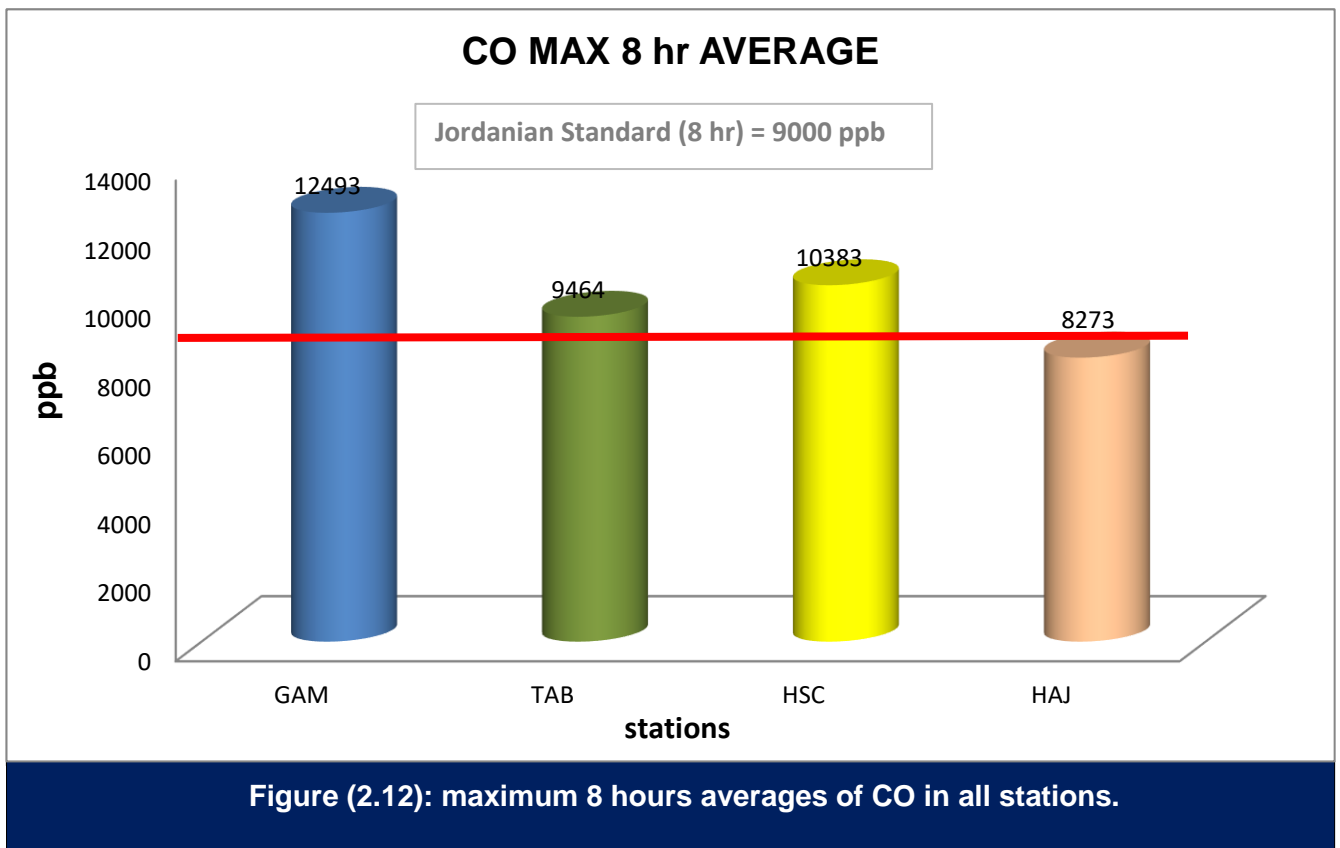
Figure (2.10): maximum one hour average value of SO₂ in all stations.



- Figure (2.11) illustrates the average yearly SO₂ concentration for each hour in all stations. It can be readily seen that the highest daily SO₂ readings occur during peak traffic movement around 8-9 am in the morning.

2.4 Carbon monoxide CO

- Carbon monoxide (CO) is a poisonous colorless gas that restricts the blood's ability to transport oxygen to cells and organs, leading to suffocation at high doses. The Jordanian Standard allows three 1-hour average concentrations greater than 26 ppm a 12-month period.
- The 8-hour average guideline is 9 ppm and there is no yearly average Jordanian Standard for ambient air quality.
- Figure (2.13) illustrates the average yearly CO concentration for each hour of the day for all stations. It can be readily seen that the highest daily CO readings occur during peak traffic movement around 8am in the morning and builds up to peak around 10pm.



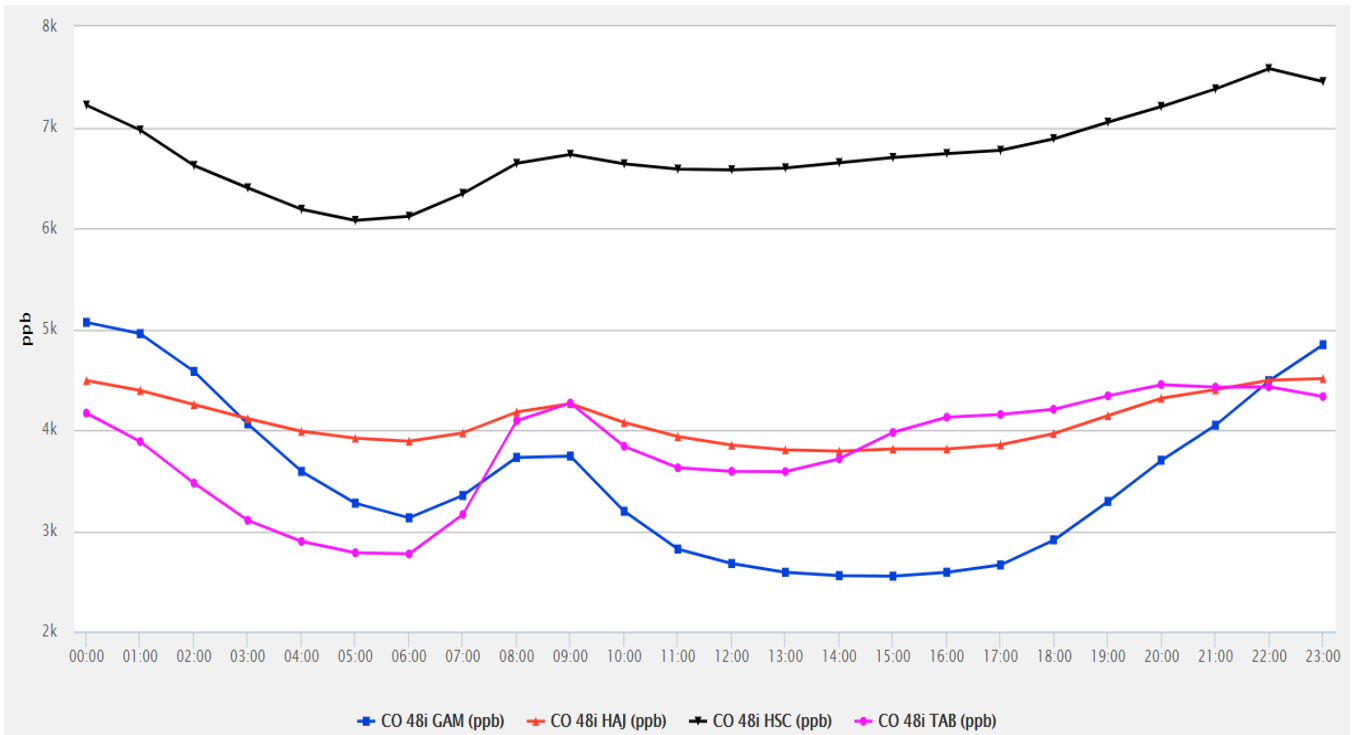


Figure (2.13): the average value in each hour of the day in all stations Carbon monoxide (CO).

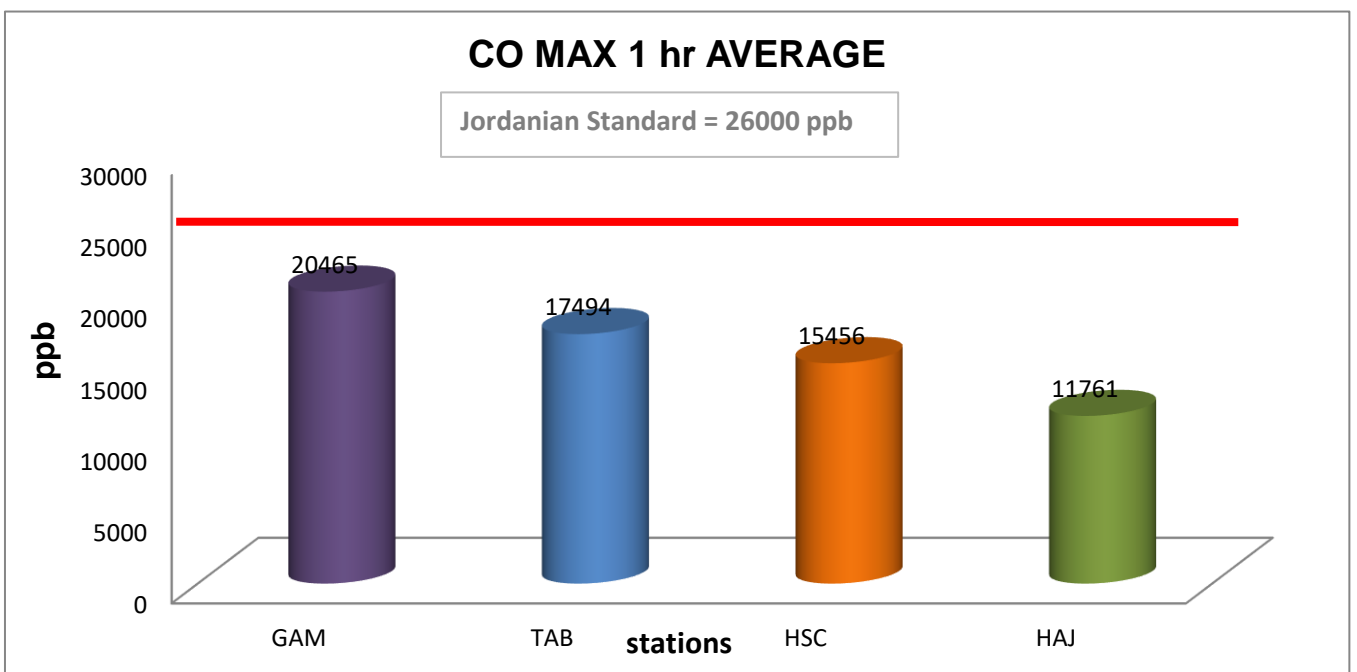


Figure (2.14): maximum one hour average value of CO in all stations.

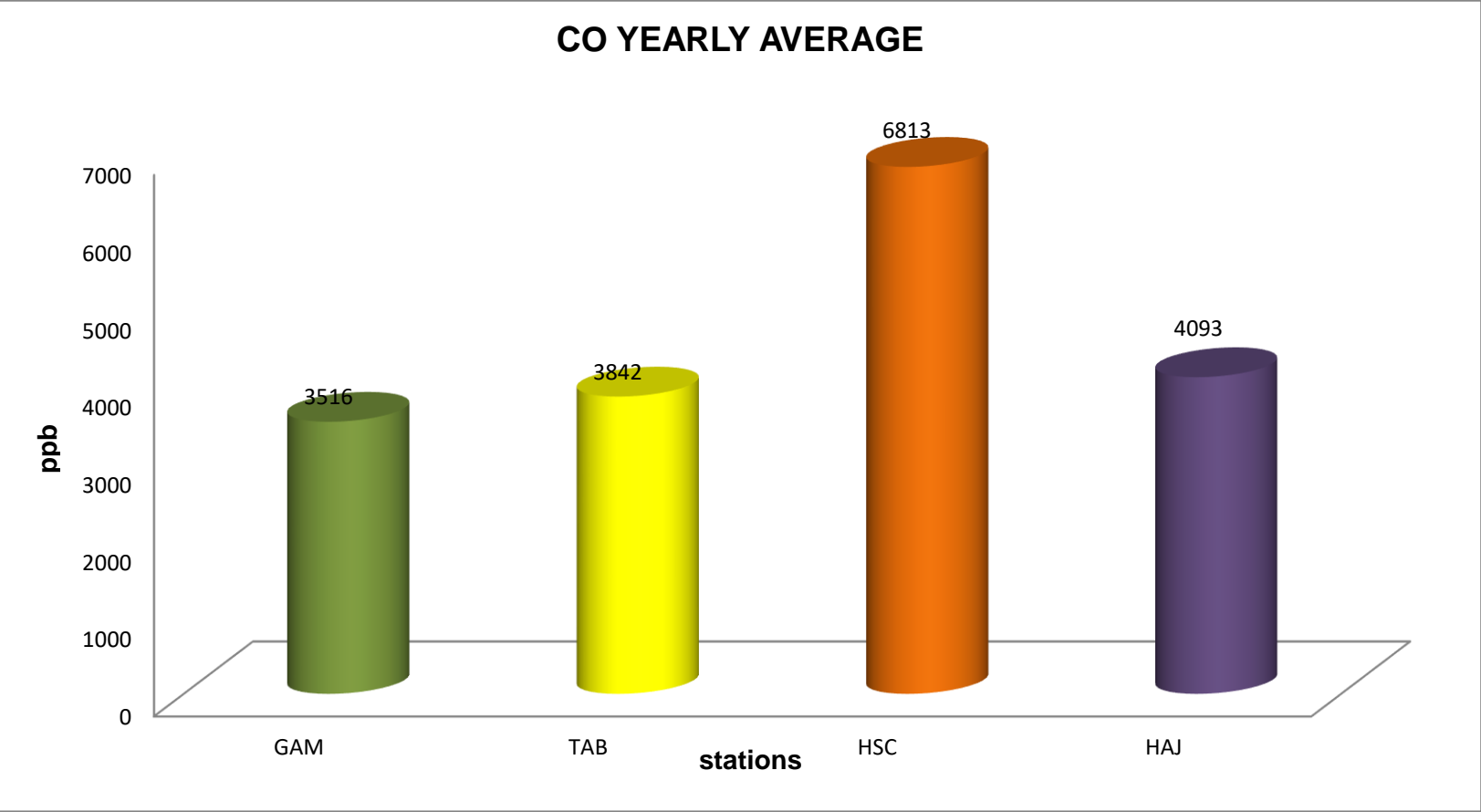


Figure (2.15): Yearly average value of Carbon monoxide (CO).

2.5 Ozone (O₃)

The ozone molecule consists of three oxygen atoms that are bounded together (triatomic oxygen, or O₃). Unlike the form of oxygen that is a major constituent of air (diatomic oxygen, or O₂), Ozone is a powerful oxidizing agent. Ozone reacts with biological membranes, such as those present in the linings of the human lungs and plant leaves, which can damage living cells. Exposure to Ozone has been associated with several adverse health effects, such as aggravation of asthma and decreased lung function.

The majority of tropospheric Ozone is formed when nitrogen dioxide (NO₂), carbon monoxide (CO) and volatile organic compounds (VOC_s), undergo photochemical reactions in air in the presence of sunlight. Thus NO₂, CO, and VOC_s are called Ozone precursors. Motor vehicle exhaust, industrial emissions, and chemical solvents are the major anthropogenic sources of ozone precursors. Although these precursors often originate in urban areas, winds can carry NO₂ hundreds of kilometers, causing ozone formation to occur in less populated regions as well. The Jordanian Standard guidelines for Ozone are **120 ppb** for 1-hour average concentrations and **80 ppb** for 8-hour average concentrations and there is no yearly average guideline. All stations showed results within these limits and there were no exceedances.

Ozone readings are the highest recorded in the King Hussein Gardens station as it is probably picking up pollutants from the west.

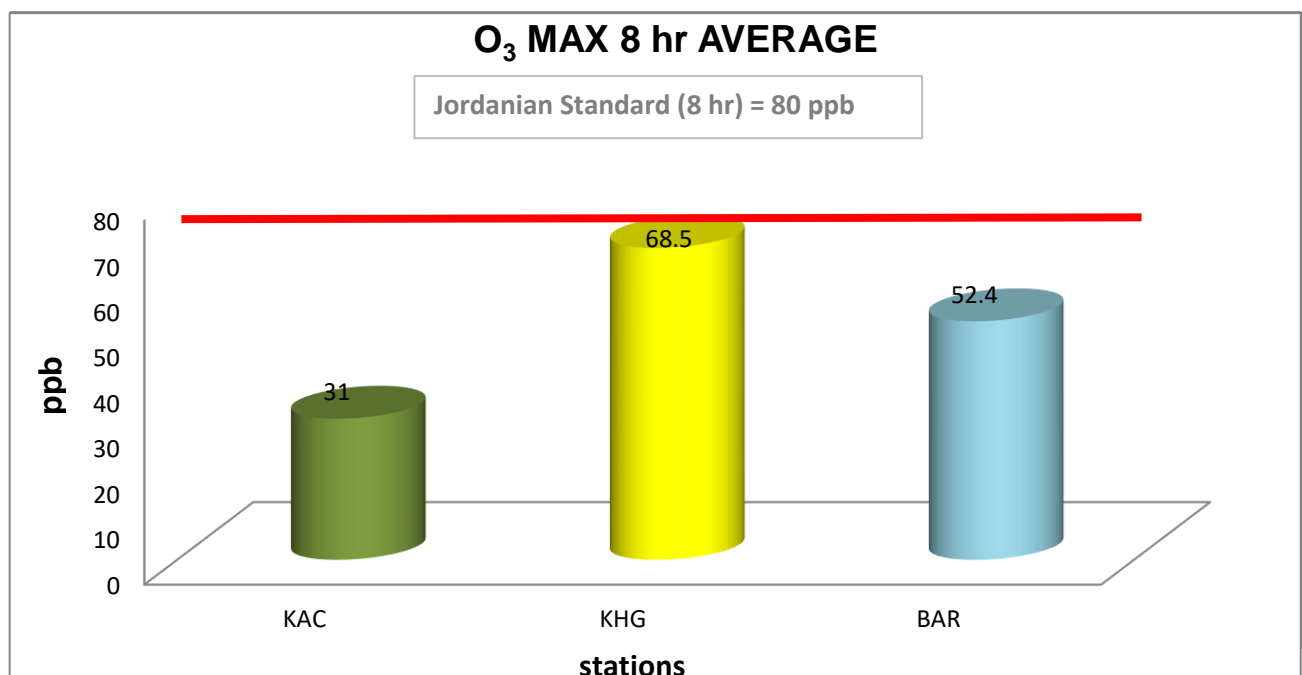
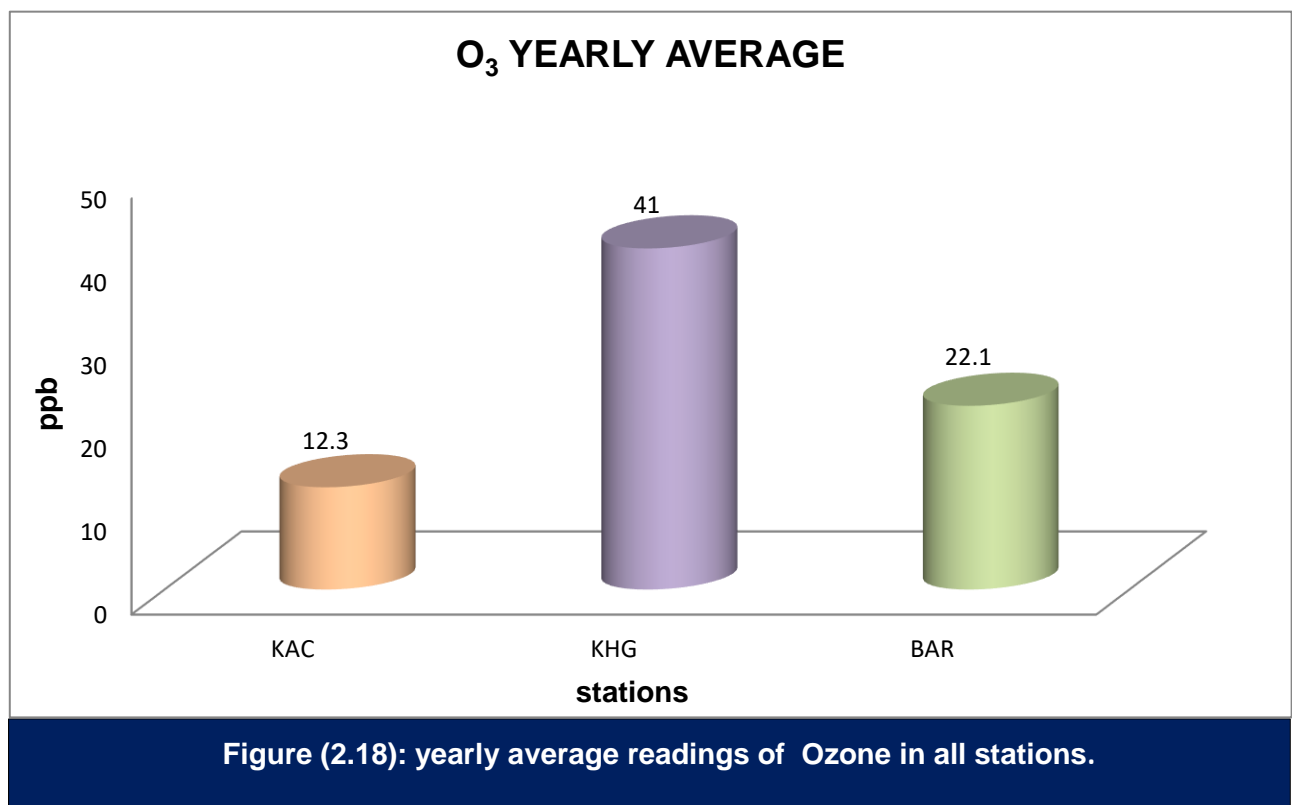
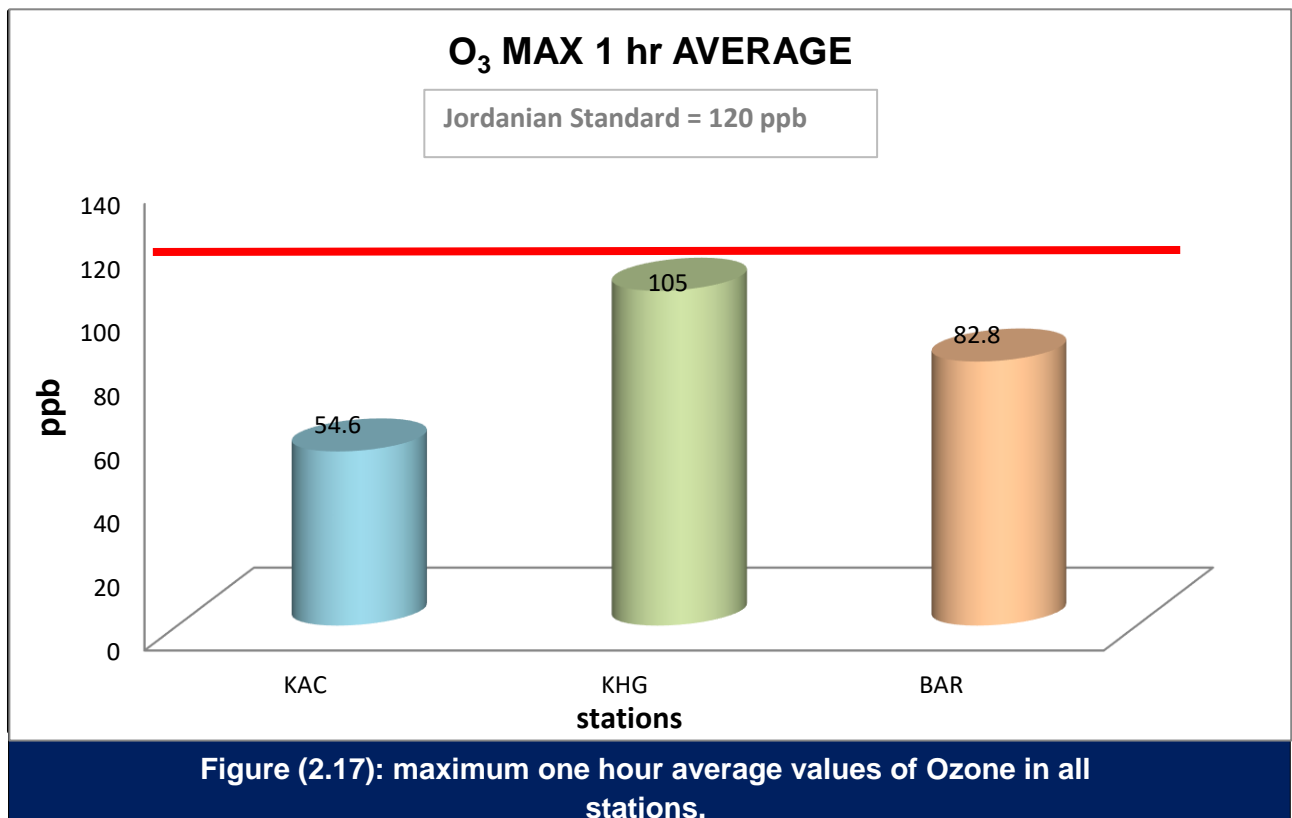


Figure (2.16): maximum 8 hours averages of Ozone in all stations.



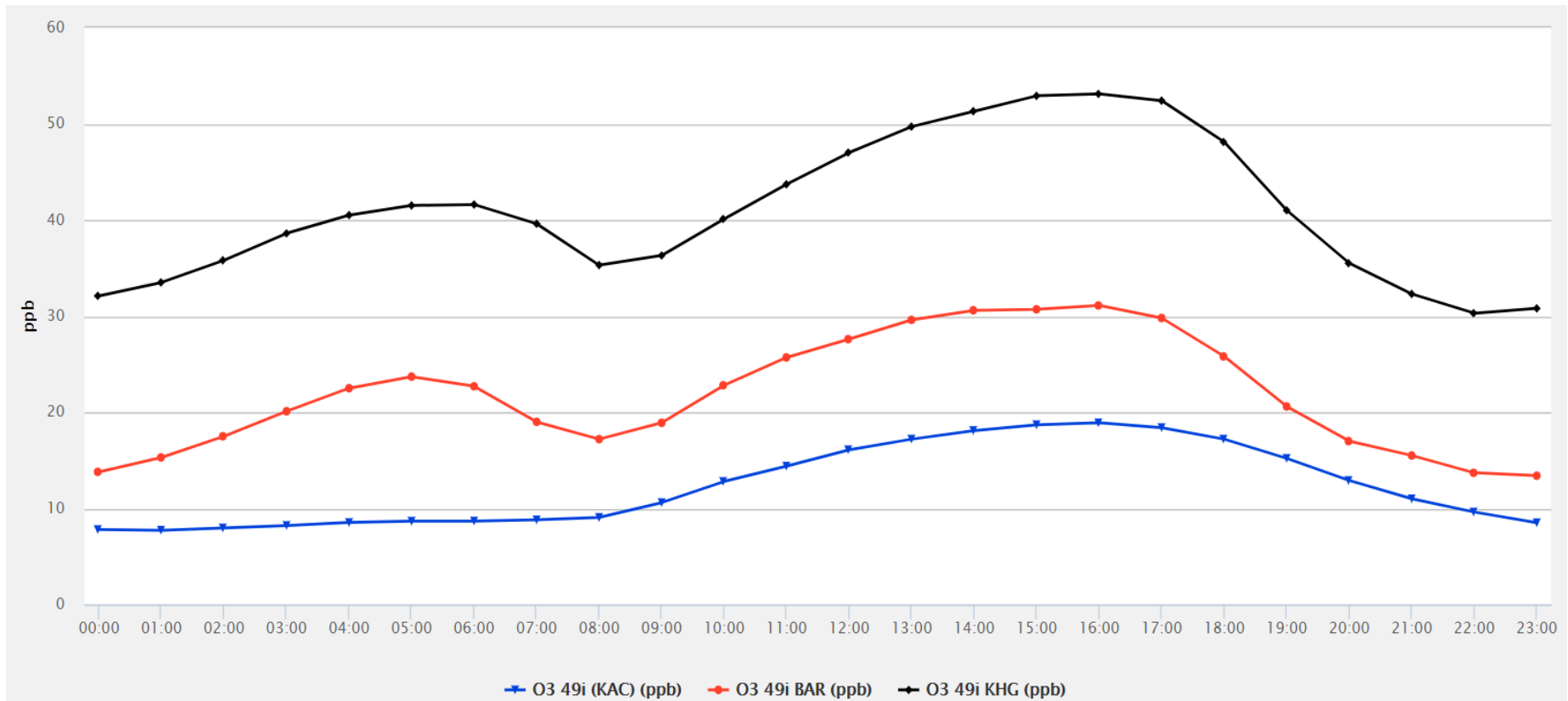


Figure (2.19): the average value of Ozone (O_3) in each hour of the day in all stations

Highest readings are mainly during the afternoon period when ambient temperature is the highest in the day as shown in figure (2.19).

2.6 Meteorology: Wind Speed and Direction, Temperature and King Hussein Gardens

- As shown in **figure (2.20)**, wind direction at the King Hussein Gardens (Reference station) in Amman is mainly from south - west. Wind direction at the Barha street station in Irbid **figure (2.21)** is almost south-east and in the Zarqa – Wadi Al-Hajjar station **figure (2.22)** the wind is mainly from the south - west. Wind speed varies and is shown as a yearly percentage to the right of the wind direction graphs. Yearly minimum and maximum temperature and humidity values are also shown.

Temperature

- Annual Temperature
- Minimum daily temperature: -0.8 °C
- Maximum daily temperature: 29°C
- Minimum hourly temperature: -2.17°C
- Maximum hourly temperature: 34.5 °C
- Average yearly temperature: 15.8°C

Humidity

- Annual Humidity:
- Minimum daily humidity: 25.6 %
- Maximum daily humidity: 100%
- Minimum hourly humidity: 17%
- Maximum hourly humidity: 100%
- Average yearly humidity: 59.9%

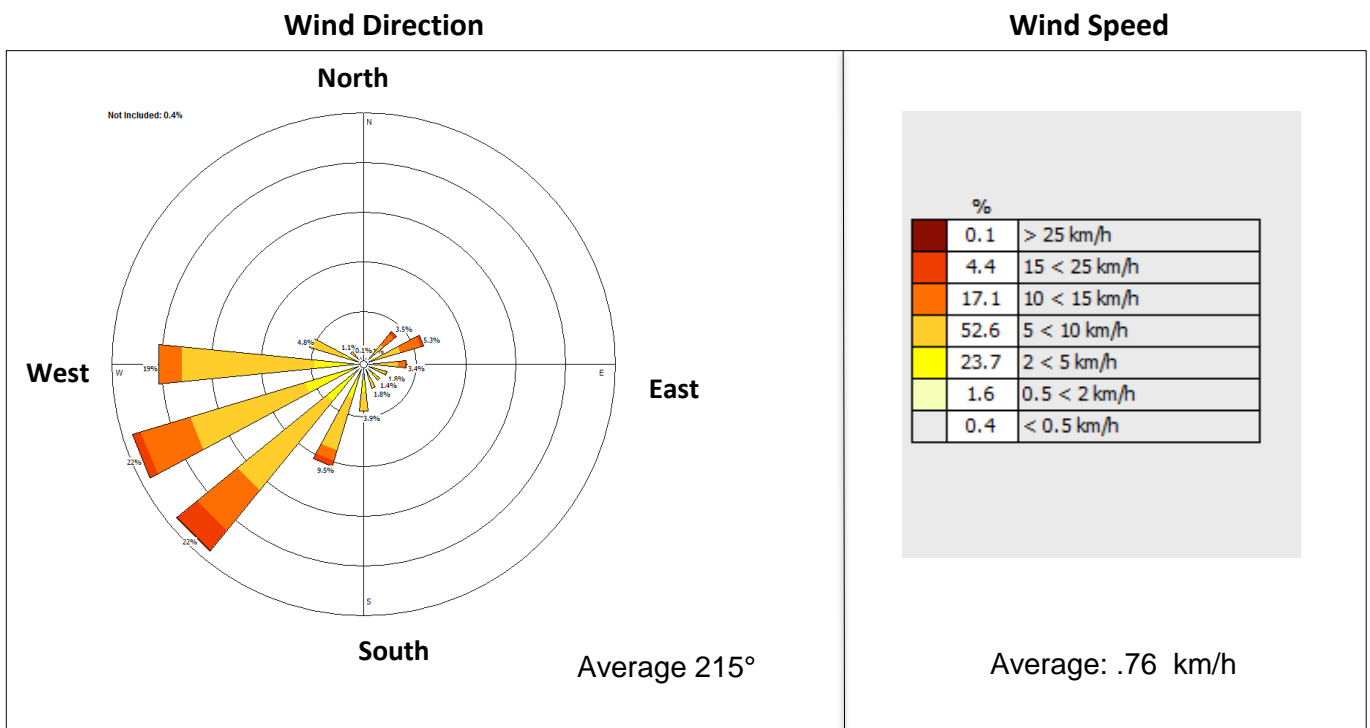


Figure (2.20): Amman - King Hussein Gardens Station Met Data.

Al Barha Street Station

Temperature

- Annual Temperature
- Minimum daily temperature: 5.6°C
- Maximum daily temperature: 31.5°C
- Minimum hourly temperature: 1.37°C
- Maximum hourly temperature: 38.7°C
- Average yearly temperature: 19.2°C

Humidity

- Annual Humidity:
- Minimum daily humidity: 15.3 %
- Maximum daily humidity: 87.7 %
- Minimum hourly humidity: 9%
- Maximum hourly humidity: 96%
- Average yearly humidity: 53.5%

Wind Direction

Wind Speed

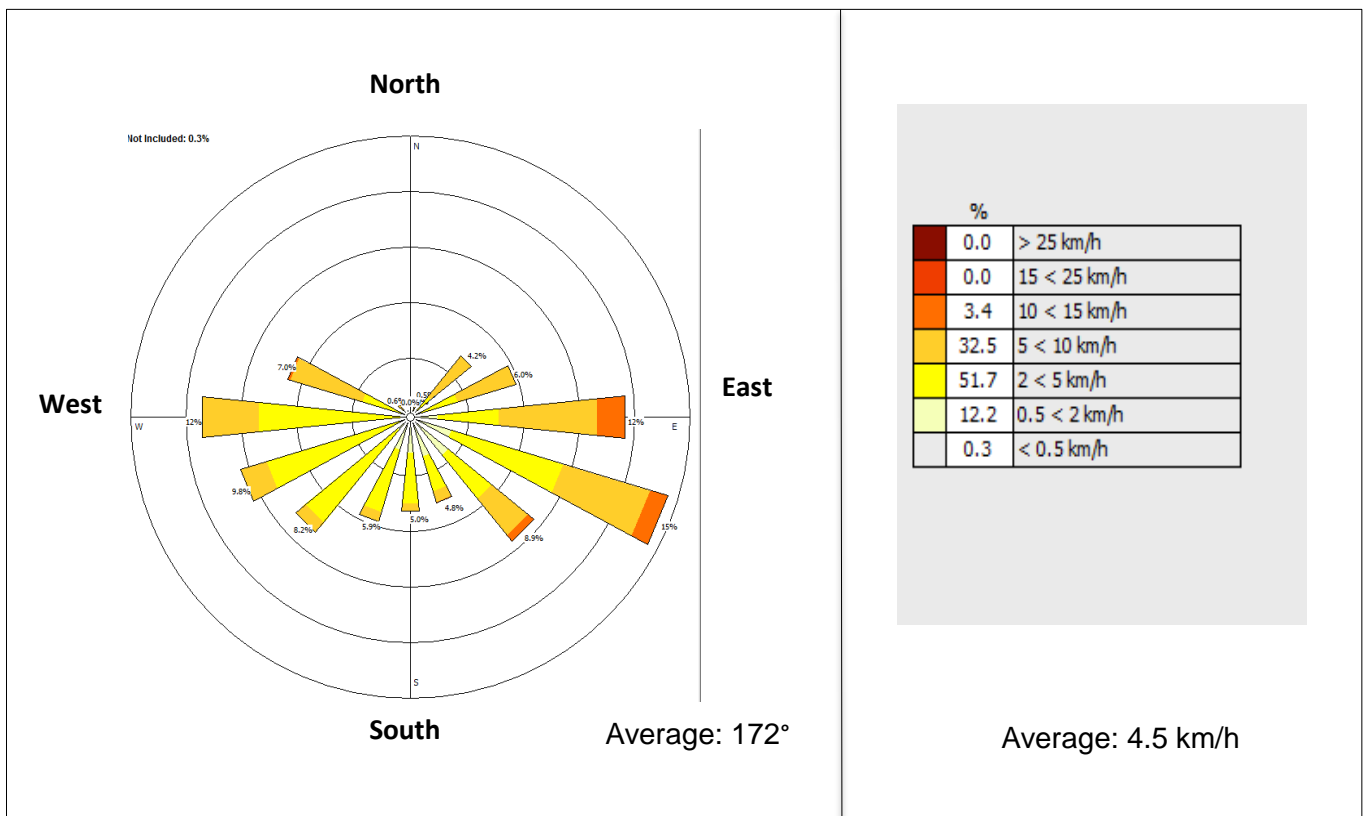


Figure (2.21) Irbid - Al Barha Street Station - Met Data

Wadi El- Hajjar Station (Zarqa)

Temperature

- Annual Temperature
- Minimum daily temperature: 6.56°C
- Maximum daily temperature: 35°C
- Minimum hourly temperature: 2.12°C
- Maximum hourly temperature: 43.5°C
- Average yearly temperature: 21.8°C

Humidity

- Annual Humidity:
- Minimum daily humidity: 22.2%
- Maximum daily humidity: 87.7%
- Minimum hourly humidity: 11%
- Maximum hourly humidity: 100 %
- Average yearly humidity: 50.8%

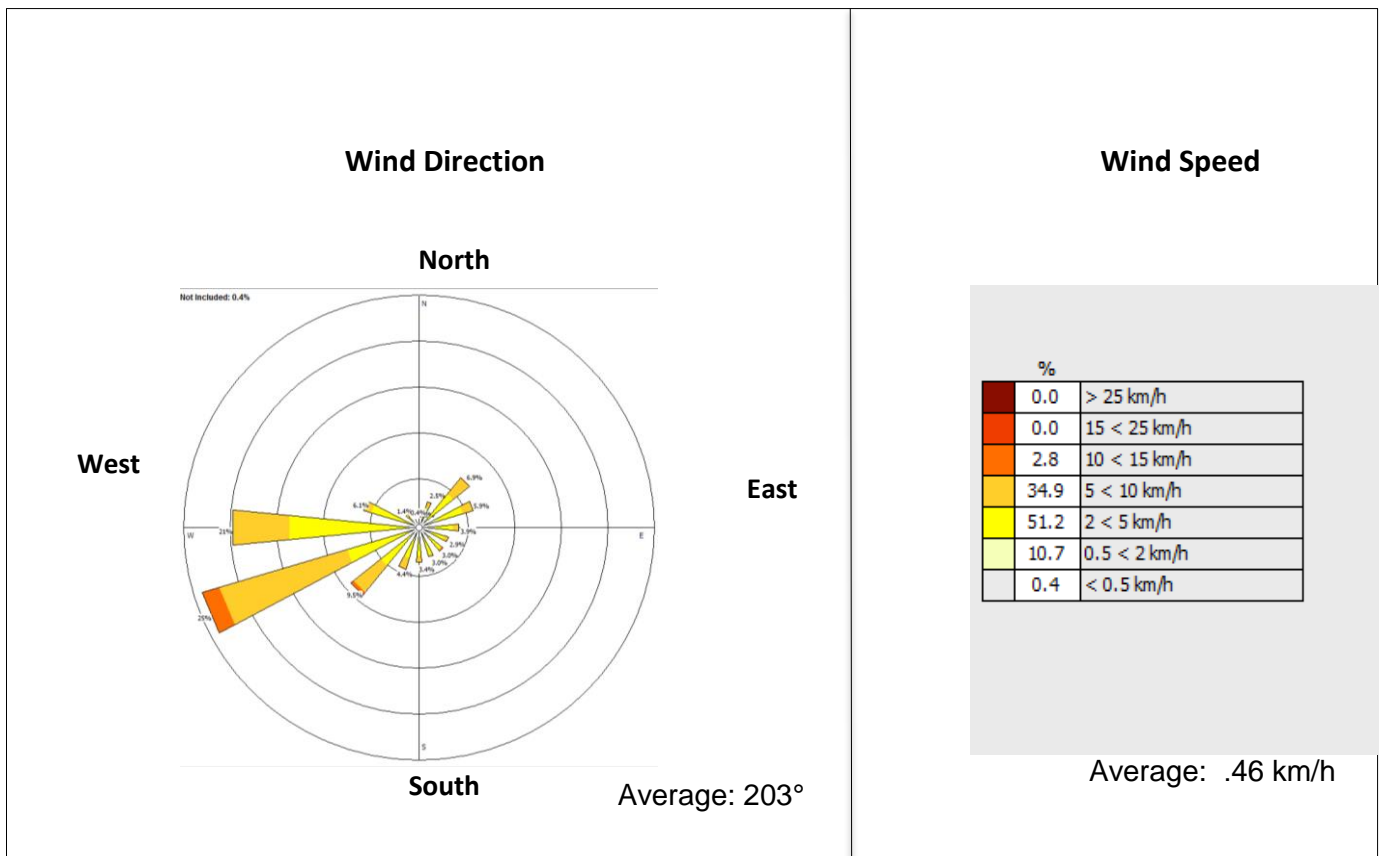


Figure (2.22) Zarqa - Wadi El Hajjar Station - Met Data

3

CONCLUSION

- Results show that the three cities Amman, Zarqa and Irbid have fairly good air quality throughout most of the year in comparison with the Jordanian ambient air quality standard 1140- 2006 (Table 1.2).
- The monitored pollutants: Carbon monoxide (CO), Sulfur dioxide (SO₂), Nitrogen dioxide (NO₂) and Ozone (O₃) were generally within the current Jordanian standard guideline limits, however particulate matter **PM₁₀** concentrations in most sites exceeded the standard.
- Regional dust storms and local soil abrasion contributed to the high **PM₁₀** level. The pollution limits in the Jordanian Standard for ambient air quality are higher than the WHO guideline limits.
- It is realized that pollution levels in measurement stations in the center of Amman and further east in Zarqa are higher as they include air pollution emitted from the various activities in the cities (motor vehicles, industry and domestic heating).

4

RECOMMENDATIONS

- 1) Measure **PM_{2.5}** particulates in all stations in order to quantify inhalable aerosols that are less than 2.5µm in diameter as such a size usually emanates from local sources of vehicle exhaust emissions and industry and has adverse health impacts. This size measurement is included in the WHO guidelines and is done by international environmental authorities.
- 2) Measure criteria gas pollutants that are missing in stations.
- 3) Measure meteorological parameters wind speed and direction in all stations.

5

APPENDIX

5.1 Percentage annual data available-All stations (from 1/1/2017 to 31/12/2017)

Amman - Greater Amman Municipality أمانة عمان الكبرى																	
Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4	Year
CO (GAM)	100%	100%	96.60%	98.50%	99.90%	100%	100%	100%	100%	100%	100%	99.60%	98.80%	99.50%	100%	99.90%	99.50%
NO ₂ (GAM)	100%	100%	96.60%	98.50%	100%	100%	100%	100%	100%	100%	100%	99.60%	98.80%	99.50%	100%	99.90%	99.60%
PM ₁₀ (GAM)	100%	100%	96.60%	98.50%	99.90%	100%	100%	100%	100%	100%	93.80%	99.60%	98.80%	99.50%	100%	97.80%	99.00%
SO ₂ (GAM)	100%	100%	96.60%	98.50%	99.90%	100%	100%	100%	100%	100%	100%	99.60%	98.80%	99.50%	100%	99.90%	99.50%

Amman - King Abdulla II Industrial City مدينة الملك عبدالله الثاني الصناعية سحاب																	
Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4	Year
NO ₂ (KAC)	100%	100%	96.80%	92.60%	100%	100%	100%	100%	100%	100%	100%	100%	98.90%	97.60%	100%	100%	99.10%
O ₃ (KAC)	100%	100%	96.80%	91.50%	100%	100%	100%	100%	100%	100%	100%	100%	98.90%	97.20%	100%	100%	99.00%
PM ₁₀ (KAC)	100%	100%	96.80%	92.60%	100%	100%	100%	100%	100%	100%	100%	99.70%	98.90%	97.60%	100%	99.90%	99.10%
SO ₂ (KAC)	100%	100%	96.80%	92.60%	100%	100%	100%	100%	100%	100%	100%	100%	98.90%	97.60%	100%	100%	99.10%

Amman - King Hussien Gardens حدائق الملك حسين

Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4	Year
NO ₂ (KHG)	100%	100%	96.80%	98.60%	99.60%	100%	100%	100%	100%	100%	99.70%	99.90%	98.90%	99.40%	100%	99.90%	99.50%
O ₃ (KHG)	100%	100%	96.80%	98.60%	100%	100%	99.90%	100%	100%	100%	99.70%	99.90%	98.90%	99.50%	100%	99.90%	99.60%
PM ₁₀ (KHG)	100%	100%	96.80%	98.60%	99.10%	100%	100%	100%	100%	100%	94.90%	99.90%	98.90%	99.20%	100%	98.30%	99.10%
SO ₂ (KHG)	100%	100%	96.80%	98.60%	99.70%	100%	100%	99.90%	100%	100%	99.70%	99.90%	98.90%	99.50%	100%	99.90%	99.50%

Amman - Marka - Mahata ماركا المحطة

Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4	Year
NO ₂ (MAH)	100%	100%	96.80%	99.60%	100%	81.80%	100%	100%	100%	100%	100%	100%	98.90%	93.90%	100%	100%	98.20%
PM ₁₀ (MAH)	100%	100%	96.80%	99.40%	100%	81.80%	100%	100%	100%	94.90%	99.70%	94.50%	98.90%	93.80%	100%	96.30%	97.30%
SO ₂ (MAH)	100%	95.20%	96.80%	99.40%	100%	81.80%	100%	100%	100%	100%	100%	100%	97.40%	93.80%	100%	100%	97.80%



Amman - University Street Sweileh صويلح شارع الجامعة																	
Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4	Year
NO ₂ (UNI)	100%	100%	96.80%	93.50%	99.90%	100%	100%	100%	99.90%	100%	100%	100%	98.90%	97.80%	100%	100%	99.20%
PM ₁₀ (UNI)	100%	100%	96.80%	96.80%	99.90%	100%	100%	100%	99.90%	100%	100%	100%	98.90%	98.90%	100%	100%	99.40%

Amman - Wadi Rimam Yarmuk Garden حديقة اليرموك وادي الرمم																	
Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4	Year
NO ₂ (YAR)	100%	100%	96.80%	92.80%	87.60%	87.90%	64.70%	100%	100%	100%	100%	100%	98.90%	89.40%	88.10%	100%	94.10%
PM ₁₀ (YAR)	100%	100%	96.80%	92.80%	87.60%	87.90%	64.50%	100%	100%	96.80%	100%	84.70%	98.90%	89.40%	88.00%	93.80%	92.50%
SO ₂ (YAR)	100%	100%	96.80%	92.80%	87.60%	87.90%	64.70%	100%	100%	100%	100%	100%	98.90%	89.40%	88.10%	100%	94.10%



Amman -Jabal Hussein Tabarbour مجمع الشمال طبربور

Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4	Year
CO (TAB)	100%	100%	96.80%	92.90%	100%	100%	100%	100%	89.60%	100%	100%	100%	98.90%	97.70%	96.60%	100%	98.30%
NO2 (TAB)	100%	100%	96.80%	92.90%	100%	100%	100%	100%	100%	100%	100%	100%	98.90%	97.70%	100%	100%	99.10%
PM10 (TAB)	100%	100%	91.30%	92.90%	100%	100%	100%	89.10%	100%	78.10%	94.70%	94.40%	97.00%	97.70%	96.30%	89.00%	95.00%

Irbid - Al Barha Street شارع البارحة

Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4	Year
NO ₂ (BAR)	100%	100%	96.80%	96.70%	100%	100%	95.20%	100%	100%	100%	99.90%	100%	98.90%	98.90%	98.40%	100%	99.00%
O ₃ (BAR)	100%	100%	96.80%	96.70%	100%	100%	95.20%	100%	100%	100%	99.90%	90.50%	98.90%	98.90%	98.40%	96.70%	98.20%
PM ₁₀ (BAR)	100%	100%	96.80%	96.70%	100%	100%	81.50%	100%	100%	100%	99.90%	100%	98.90%	98.90%	93.80%	100%	97.90%
SO ₂ (BAR)	100%	100%	96.80%	96.70%	100%	100%	95.20%	100%	100%	100%	99.90%	100%	98.90%	98.90%	98.40%	100%	99.00%



Irbid - Al Hasan Sport City مدينة الحسن الرياضية

Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4	Year
CO (HSC)	90.20%	99.90%	99.90%	98.80%	100%	100%	100%	100%	100%	100%	100%	100%	96.50%	99.60%	100%	100%	99.00%
NO ₂ (HSC)	87.60%	78.30%	99.90%	98.80%	100%	100%	100%	100%	100%	100%	100%	100%	88.90%	99.60%	100%	100%	97.20%
PM ₁₀ (HSC)	81.30%	69.60%	91.70%	98.80%	90.30%	84.00%	49.30%	100%	100%	100%	100%	100%	81.30%	91.00%	82.90%	100%	88.80%

Zarqa - Wadi Hajjar مركز صحي وادي الحجر

Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4	Year
CO (HAJ)	100%	100%	96.60%	98.80%	99.90%	100%	100%	100%	100%	100%	100%	100%	98.80%	99.50%	100%	100%	99.60%
NO ₂ (HAJ)	100%	100%	96.60%	98.80%	99.90%	100%	100%	100%	100%	100%	100%	100%	98.80%	99.50%	100%	100%	99.60%
PM ₁₀ (HAJ)	100%	100%	96.60%	98.80%	93.00%	100%	100%	100%	100%	100%	100%	100%	98.80%	97.20%	100%	100%	99.00%
SO ₂ (HAJ)	100%	100%	96.60%	98.80%	99.70%	100%	100%	100%	100%	100%	100%	100%	98.80%	99.50%	100%	100%	99.60%



Zarqa - Masane المنطقة المصانع المسلخ البلدي

Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4	Year
NO ₂ (MAS)	100%	100%	99.90%	99.90%	100%	99.90%	100%	100%	100%	99.90%	96.30%	100%	100%	99.90%	100%	98.70%	99.60%
PM ₁₀ (MAS)	100%	100%	99.90%	99.90%	100%	99.90%	100%	100%	85.70%	91.40%	96.30%	100%	100%	99.90%	95.30%	95.90%	97.80%
SO ₂ (MAS)	100%	100%	99.90%	99.70%	100%	99.90%	100%	100%	94.30%	99.90%	96.30%	100%	100%	99.90%	98.10%	98.70%	99.20%

Yearly Average All Parameters and All Stations 98.11 %

