

AIR QUALITY ANNUAL SUMMARY REPORT

ABU DHABI

2021



OIL

INTRODUCTION

The objective of EAD's air quality priority is to ensure that ambient air quality in Abu Dhabi protects human health and the environment. EAD will focus on improving the comprehensiveness of ambient air quality monitoring across the emirate, advancing capabilities for analysing, modelling and reporting air quality information, and ensuring that emission standards, regulations and enforcement regimes are in place for the key sectors and pollutants that pose the greatest threats to public health, wildlife, and quality of life in Abu Dhabi.

The Environment Agency – Abu Dhabi (EAD) started monitoring air quality in 2007. Quality Assurance/Quality Control (QA/QC) methods and procedures are implemented with full documentation and are validated through an international certified calibration reference laboratory. Forms and log sheets document every activity in the air monitoring stations and document all maintenance, calibration, operation and other activities such as all visits to the stations.

This annual report provides an overview and analysis of air quality monitoring data in Abu Dhabi for the year 2021, and a short comparison of monitoring results with earlier years. The analysis covers the three regions in Abu Dhabi Al Ain Region (Eastern Region), Al Dhafra Region (Western Region) and Central Region (Greater Abu Dhabi and its surrounding).

The report summarizes the data available at the twenty fixed stations in Abu Dhabi Emirate, in addition two mobile stations. The network monitors up to 17 parameters.



AIR POLLUTION SOURCES AND HEALTH EFFECTS

POLLUTANT



SULFUR
DIOXIDE SO₂

- Traffic pollution
- Fuel Combustion
- Electric Utilities
- Industrial Processes
- Oil and gas activities



CARBON
MONOXIDE CO

- Traffic Pollution
- Fuel Combustion



NITROGEN
DIOXIDE NO₂

- Traffic Pollution
- Fuel Combustion
- Electric Utilities
- Industrial Boilers



PARTICULATE
MATTER PM

- Arid climate
- Regional dust clouds
- Fuel Combustion
- Industrial processes
- Traffic Pollution
- Construction Activities



OZONE
O₃

- Secondary pollutant typically formed by photochemical reaction of volatile organic compounds (VOCs) and NOx in the presence of sunlight.



HYDROGEN
SULFIDE H₂S

- Sewage Network
- Oil and Gas industrial activities
- Waste-water treatment plants



Respiratory diseases

Cardiovascular diseases

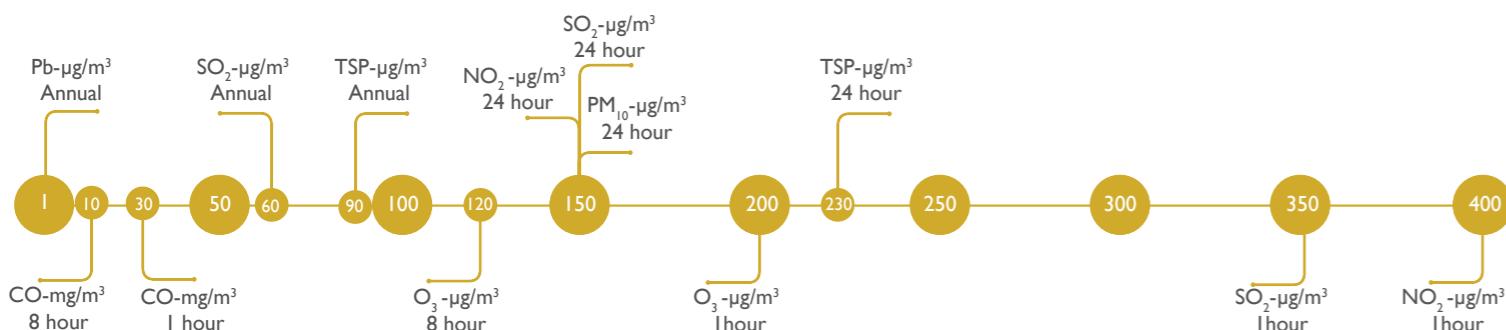
Odor nuisance



03

AMBIENT AIR QUALITY LIMITS (AQL)

The air pollution levels have been compared to the UAE Air Quality Limits defined in the Cabinet of Ministers Decree No. 12 for 2006 concerning Protection of Air from Pollution. A summary of these Ambient Air Quality Limit (AQL) concentration levels is presented below.



04

AIR QUALITY INDEX

This report establishes the Air Quality Index (AQI) to evaluate air pollution. EAD simplifies the Ambient Air Quality State by calculating the AQI Range based on Air Quality National Standards for the major five parameters; Particulate matter, Ground level ozone, Sulfur dioxide, Nitrogen dioxide and Carbon monoxide.

AQI values that are below 100 are compliant with the air quality limits and are therefore considered to be acceptable.

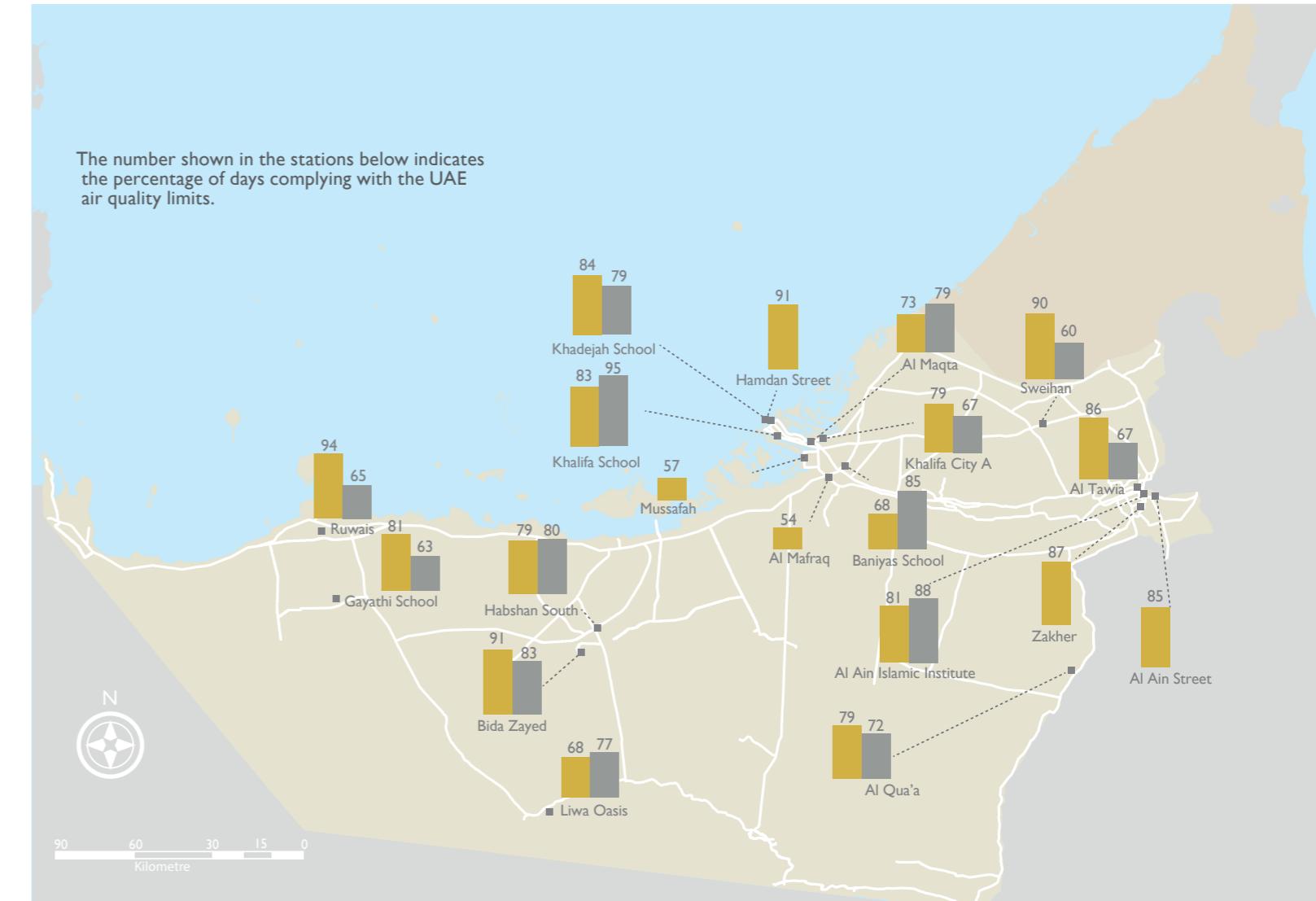
US EPA AQI Classifications		
AQI RANGE	CLASSIFICATIONS	CONDITIONS
0 to 50	Good	Considered satisfactory
51 to 100	Moderate	Air quality is acceptable
101 to 150	Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects
151 to 200	Unhealthy	Everyone may begin to experience health effects
201 to 300	Very Unhealthy	Health alert, meaning everyone may experience more serious health effects.
301 to 500	Hazardous	Health warnings of emergency conditions.

05 AIR QUALITY MONITORING STATIONS

STATION NAME	STATION REPRESENTATIVITY (AREA TYPE)	MAIN PARAMETERS						
		SO ₂	NO ₂	CO	O ₃	PM ₁₀	PM _{2.5}	H ₂ S
CENTRAL ABU DHABI AREA								
HAMDAN STREET	URBAN TRAFFIC	●	●	●		●	●	
KHADEJAH SCHOOL	URBAN BACKGROUND	●	●		●	●	●	●
KHALIFA SCHOOL	SUBURBAN BACKGROUND	●	●		●	●	●	●
AL MAQTA	SUBURBAN BACKGROUND	●	●	●	●	●	●	●
KHALIFA CITY A	SUBURBAN BACKGROUND	●	●		●	●	●	●
BANIYAS SCHOOL	SUBURBAN BACKGROUND	●	●		●	●	●	●
MUSSAFAH	SUBURBAN INDUSTRIAL	●	●		●	●	●	●
AL MAFRAQ	SUBURBAN INDUSTRIAL	●	●		●	●	●	●
AL AIN REGION								
AL AIN STREET	URBAN TRAFFIC	●	●	●		●	●	
AL AIN ISLAMIC INSTITUTE	URBAN BACKGROUND	●	●		●	●	●	●
ALTAWIA	SUBURBAN BACKGROUND	●	●		●	●	●	●
ZAKHER	URBAN BACKGROUND	●	●		●	●	●	●
SWEIHAN	SUBURBAN BACKGROUND	●	●	●	●	●	●	
AL QUA'A	REGIONAL RURAL BACKGROUND	●	●	●	●	●	●	
AL DHAFRA REGION								
EII ROAD	RURAL TRAFFIC	●	●	●		●	●	
BIDA ZAYED	SUBURBAN BACKGROUND	●	●		●	●	●	●
HABSHAN SOUTH	RURAL INDUSTRIAL	●	●		●	●	●	●
RUWAIS	SUBURBAN INDUSTRIAL	●	●	●	●	●	●	●
GAYATHI SCHOOL	SUBURBAN BACKGROUND	●	●		●	●	●	●
LIWA OASIS	REGIONAL RURAL BACKGROUND	●	●		●	●	●	

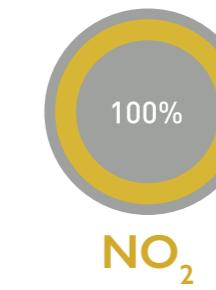
Measured Parameters

06 AIR QUALITY STATUS



The percentage of compliant days present AQI values below 100, which are normally expected to be satisfactory

THE PERCENTAGE OF
COMPLIANT DAYS
WITHIN THE YEAR
IN ABU DHABI
MONITORING STATIONS



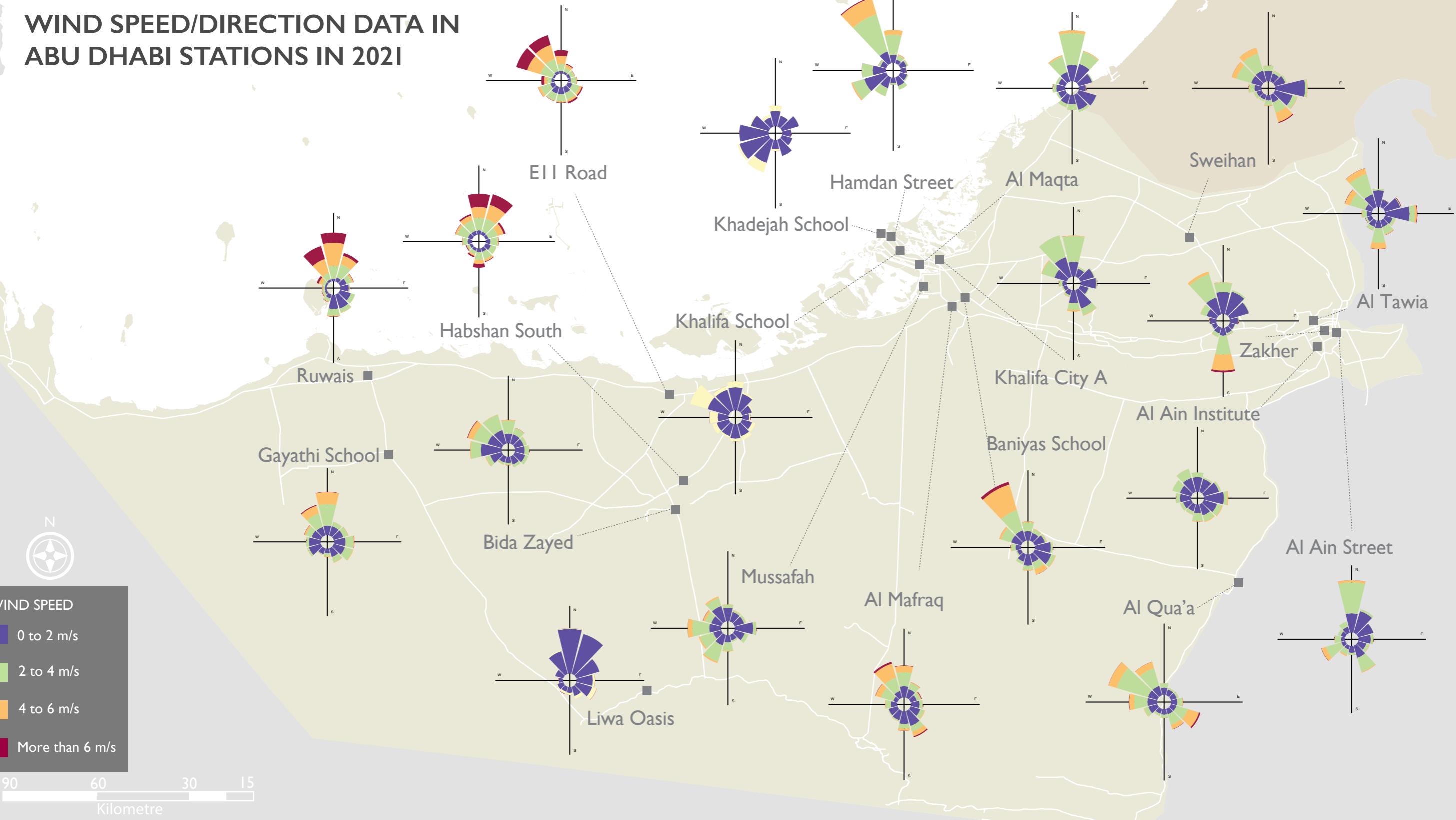
METEOROLOGICAL DATA

All EAD air quality monitoring stations are equipped with sensors to record meteorological parameters, which are essential to understand the ambient air quality patterns and local meteorological conditions. The meteorological parameters measured are: wind speed, wind direction, temperature, relative humidity, net radiation and barometric pressure.

The prevailing winds over Abu Dhabi are northwesterly winds, though differences in wind speed and wind direction may occur in specific locations due to local conditions and patterns. During the night, wind blowing from south-southeast also has a high percentage of occurrence.

The below map shows the wind roses in all of Abu Dhabi stations in 2021, and the wind rose is a graphic tool used to describe the distribution of the wind speed and wind direction in a particular location. The frequency of the winds is plotted by wind direction, with colour bands showing wind speed ranges. The direction of the longest spoke shows the predominant wind direction in that location.

WIND SPEED/DIRECTION DATA IN ABU DHABI STATIONS IN 2021



07

08 PARTICULATE MATTER PM₁₀

Figure 1 shows the annual average PM₁₀ concentrations by region together with the linear regression of PM₁₀ annual means measured at all stations from the beginning of 2007 until the end of 2021.

Overall, there was a slight decrease in the trend of PM₁₀ concentrations from the beginning of 2007 until the end of 2021. During 2021, PM₁₀ concentration increased in both of Al Ain Region and Al Dhafra Region, while decreased in both of Abu Dhabi industrial areas and Abu Dhabi Region. In Abu Dhabi Region the lowest concentration of PM₁₀ recorded by Hamdan Street station, in Al Ain Region recorded by Sweihan station, and in Al Dhafra Region recorded by Ruwais station.

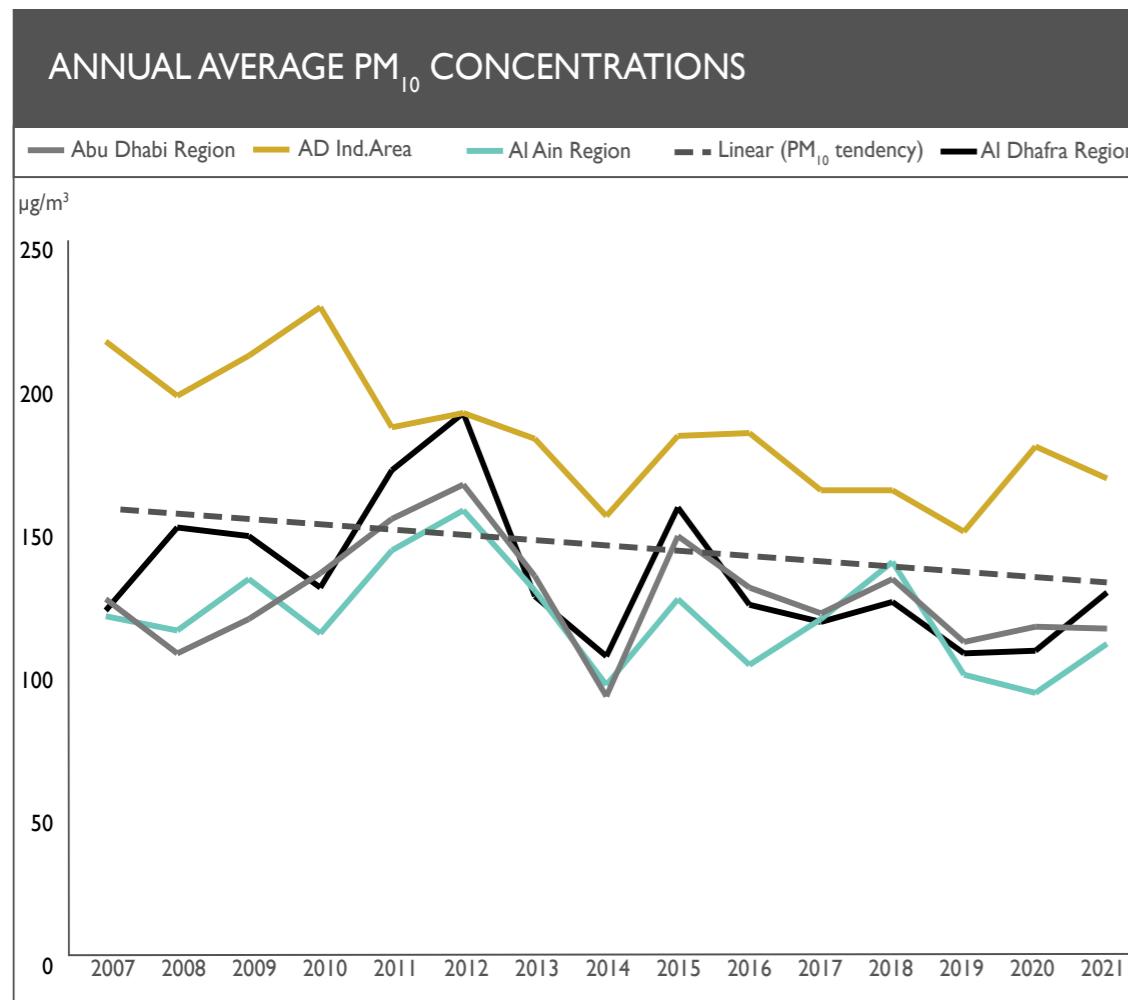
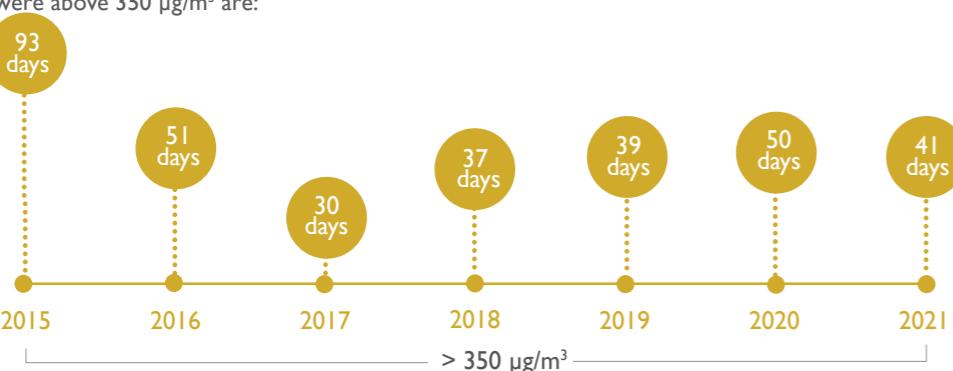


Figure 1:

Averages of the annual average concentrations of PM₁₀ given for the sites in Al Dhafra Region, Al Ain Region, Abu Dhabi Region, and Abu Dhabi Industrial Areas. The overall Abu Dhabi Emirate PM₁₀ trend (linear regression) from 2007 to 2021 is shown as the dotted line. Averages were above 350 µg/m³ are:



09 PARTICULATE MATTER PM_{2.5}

Figure 2 shows the annual average PM_{2.5} concentrations by region together with the linear regression of PM_{2.5} annual means measured at all stations from the beginning of 2012 until the end of 2021.

Overall, there was a very slight decrease in the trend of PM_{2.5} concentrations from the beginning of 2012 until the end of 2021. During 2021, PM_{2.5} concentration slightly increased in all region except in Abu Dhabi industrial areas. In Abu Dhabi Region the lowest concentration of PM_{2.5} recorded by Mussafah station, in Al Ain Region recorded by Al Tawia station, and in Al Dhafra Region recorded by EII Road Station.

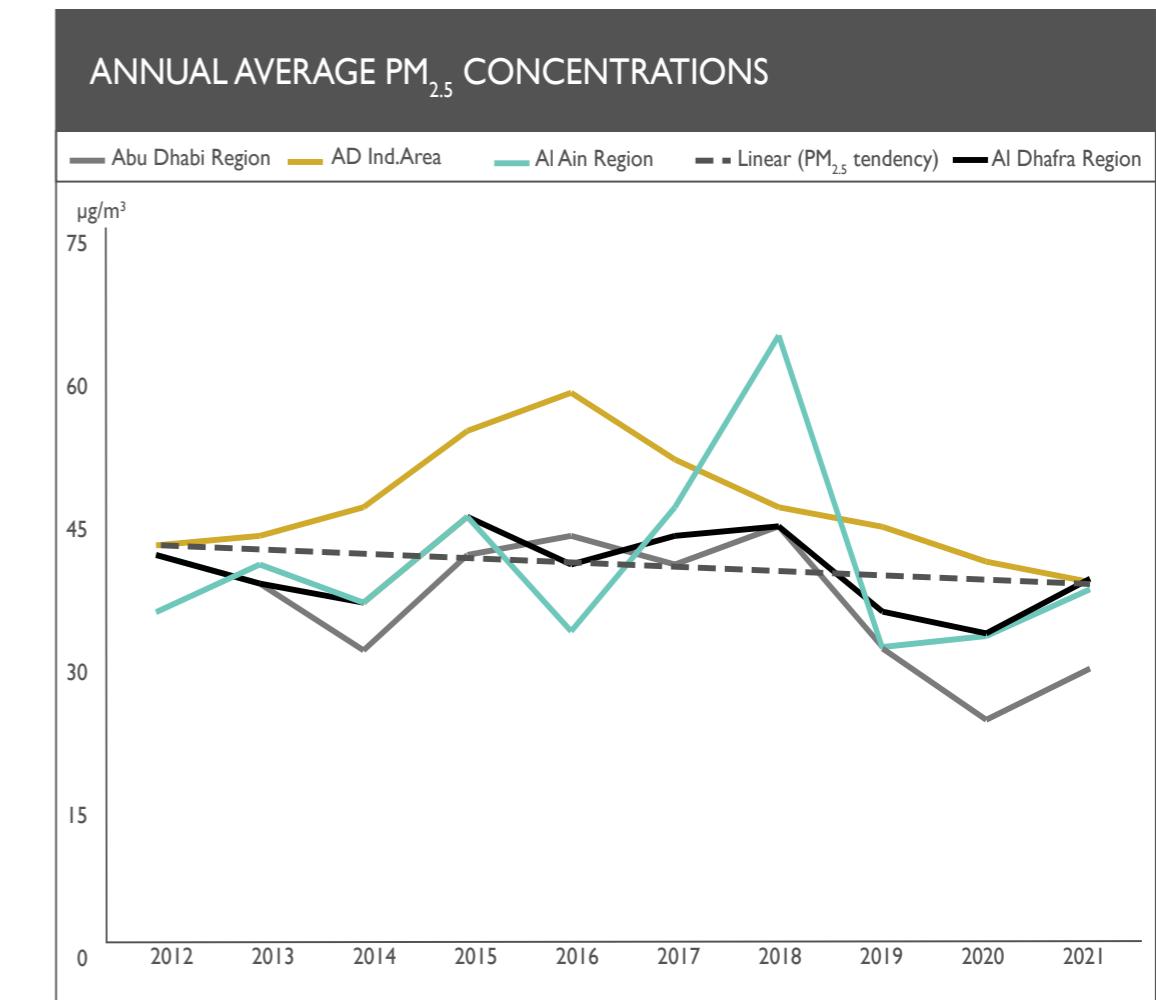


Figure 2:

Averages of the annual average concentrations of PM_{2.5} given for the sites in Al Dhafra Region, Al Ain Region, Abu Dhabi Region, and Abu Dhabi Industrial Areas. The overall Abu Dhabi Emirate PM_{2.5} trend (linear regression) from 2012 to 2021 is shown as the dotted line.

OZONE O₃

OZONE O₃

Figure 3 shows the annual average O₃ concentrations by region together with the linear regression of O₃ annual means measured at all stations from the beginning of 2007 until the end of 2021.

Overall, there was a notable increase in the trend of O₃ concentrations from the beginning of 2007 until the end of 2021. During 2021, O₃ concentration almost constant in all regions. In Abu Dhabi Region the lowest concentration of O₃ recorded by Khalifa School station, in Al Ain Region recorded by Al Ain Islamic Institute station, and in Al Dhafra Region recorded by Habshan South Station.

O₃ TREND

Ozone trend can be related to the following factors:

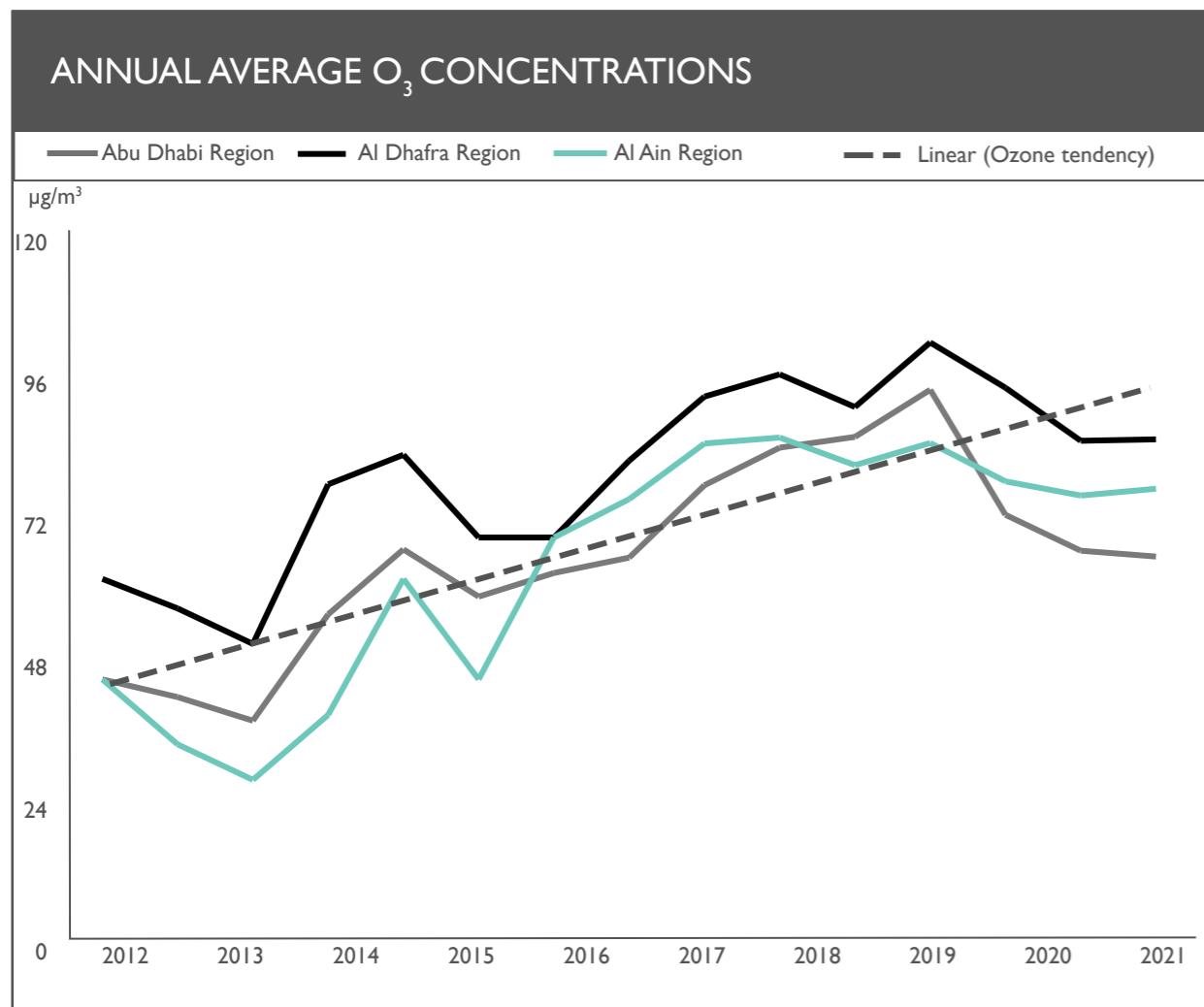


Figure3:

Averages of annual average concentrations for O₃ given for the sites in the Al Dhafra Region, Al Ain Region, and Abu Dhabi Region. A total Abu Dhabi Emirate trend for O₃ (linear regression) from 2007 to 2021 is presented as the dotted line.

DECREASE



Expand the use of renewable energy(e.g. solar energy) to reduce greenhouse gases.



Apply the best available technologies to control emissions.



Encourage the use of international best practices to minimise emissions.

INCREASE



An Increase of traffic and industrial activities.



Effect of global atmospheric circulation.



Climate change increasing global temperature leading to higher potential for O₃ generation

SULFUR DIOXIDE SO_2

Figure 4 shows the annual average SO_2 concentrations by region together with the linear regression of SO_2 annual means measured at all stations from the beginning of 2007 until the end of 2021.

Overall, there was an increase in the trend of SO_2 concentrations from the beginning of 2007 until the end of 2021. During 2021, SO_2 concentration decreased in all regions. In Abu Dhabi Region the lowest concentration of SO_2 recorded by Khalifa City A Station, in Al Ain Region recorded by Sweihan Station and in Al Dhafra Region recorded by Liwa Oasis Station.

ANNUAL AVERAGE SO_2 CONCENTRATIONS

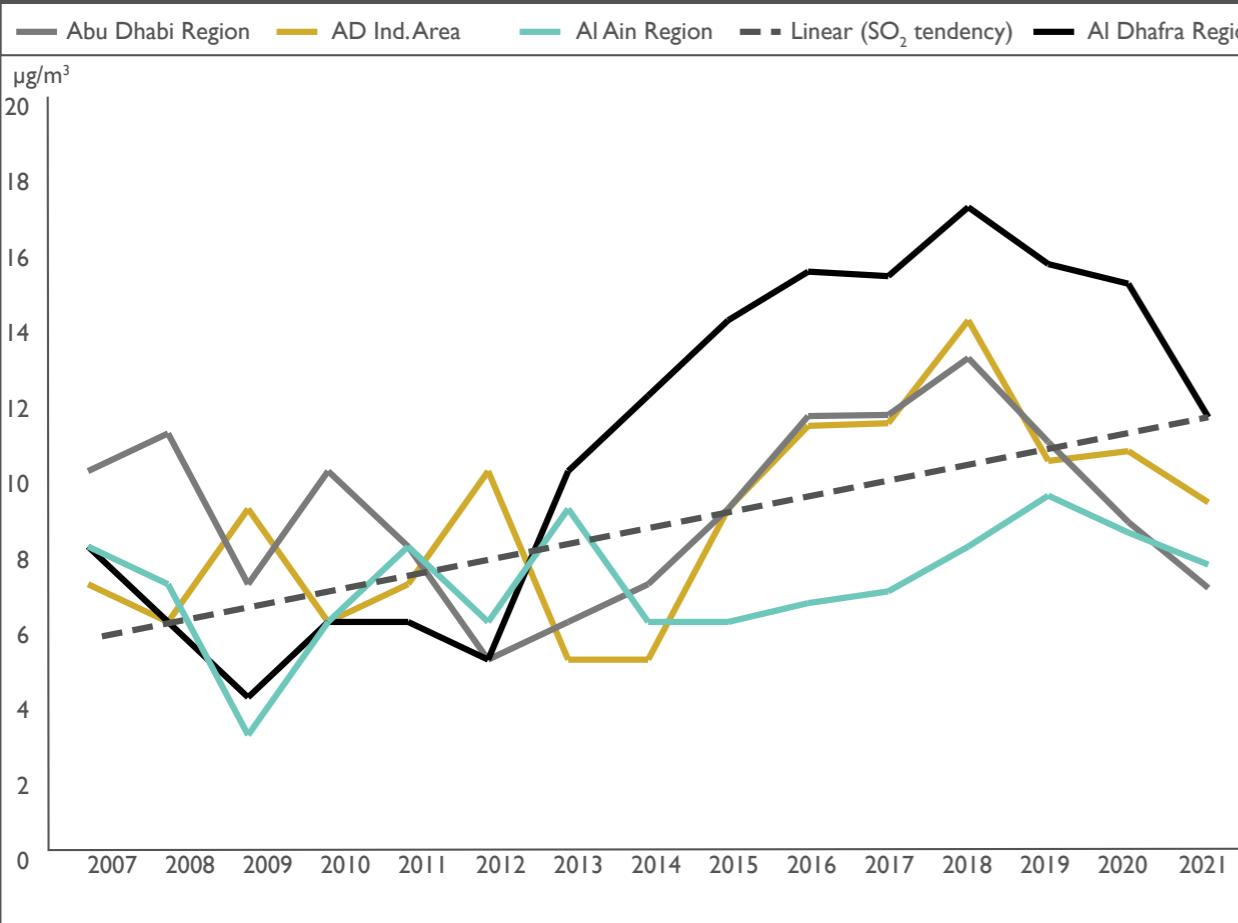


Figure 4:

Averages of annual average concentrations for SO_2 given for the sites in the Al Dhafra Region, Al Ain Region, Abu Dhabi Region, and Abu Dhabi Industrial Areas. A total Abu Dhabi Emirate SO_2 trend (linear regression) from 2007 to 2021 is presented as the dotted line.

NITROGEN DIOXIDE NO_2

Figure 5 shows the annual average NO_2 concentrations by region together with the linear regression of NO_2 annual means measured at all stations from the beginning of 2007 until the end of 2021.

Overall, NO_2 concentrations trend had a very slight decrease from the beginning of 2007 until the end of 2021. During 2021, NO_2 concentration increased in both of Abu Dhabi Region and Abu Dhabi Industrial Areas, while stable in both of Al Ain Region and Al Dhafra Region. In Abu Dhabi Region the lowest concentration of NO_2 recorded by Khalifa School Station, in Al Ain Region recorded by Al Qua'a Station, and in Al Dhafra Region recorded by Liwa Oasis Station.

The annual average NO_2 concentrations reached 132 % at Hamdan Street station, 153 % at Mussafah station, and 125 % at Al Mafrq station of the annual WHO 2005 guideline value.

ANNUAL AVERAGE NO_2 CONCENTRATIONS

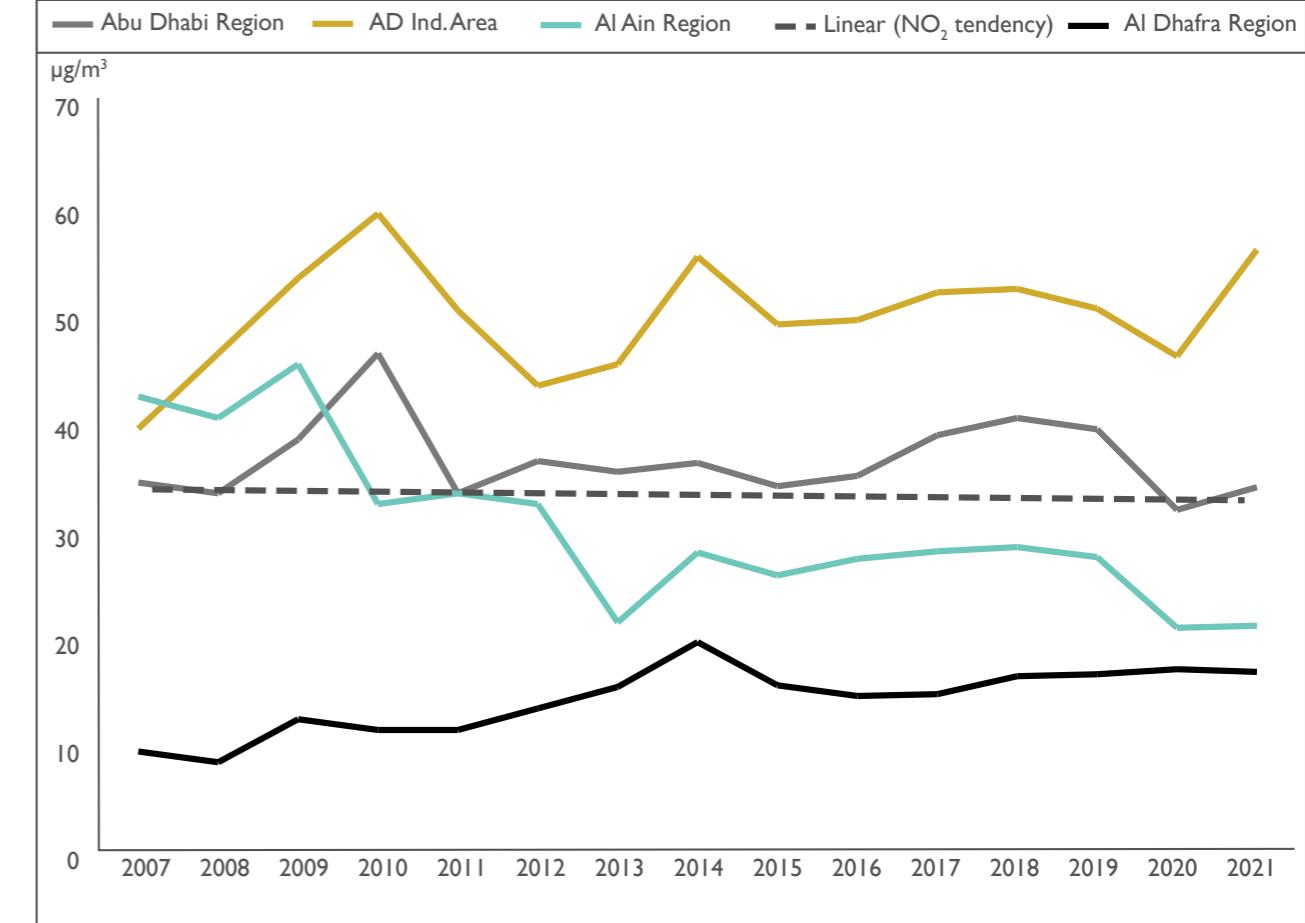


Figure 5:

Averages of annual average concentrations for NO_2 given for the sites in the Al Dhafra Region, Al Ain Region, Abu Dhabi Region, and Abu Dhabi Industrial Areas. A total Abu Dhabi Emirate NO_2 trend (linear regression) from 2007 to 2021 is presented as the dotted line.

3

CARBON MONOXIDE CO

Figure 6 shows the annual average CO concentrations by region together with the linear regression of CO annual means measured at all stations from the beginning of 2007 until the end of 2021.

Overall, there was a decrease in the trend of CO concentrations from the beginning of 2007 until the end of 2021. During 2021, CO concentration decreased in all regions and CO concentrations never exceeded any of the air quality limit value in the same year.

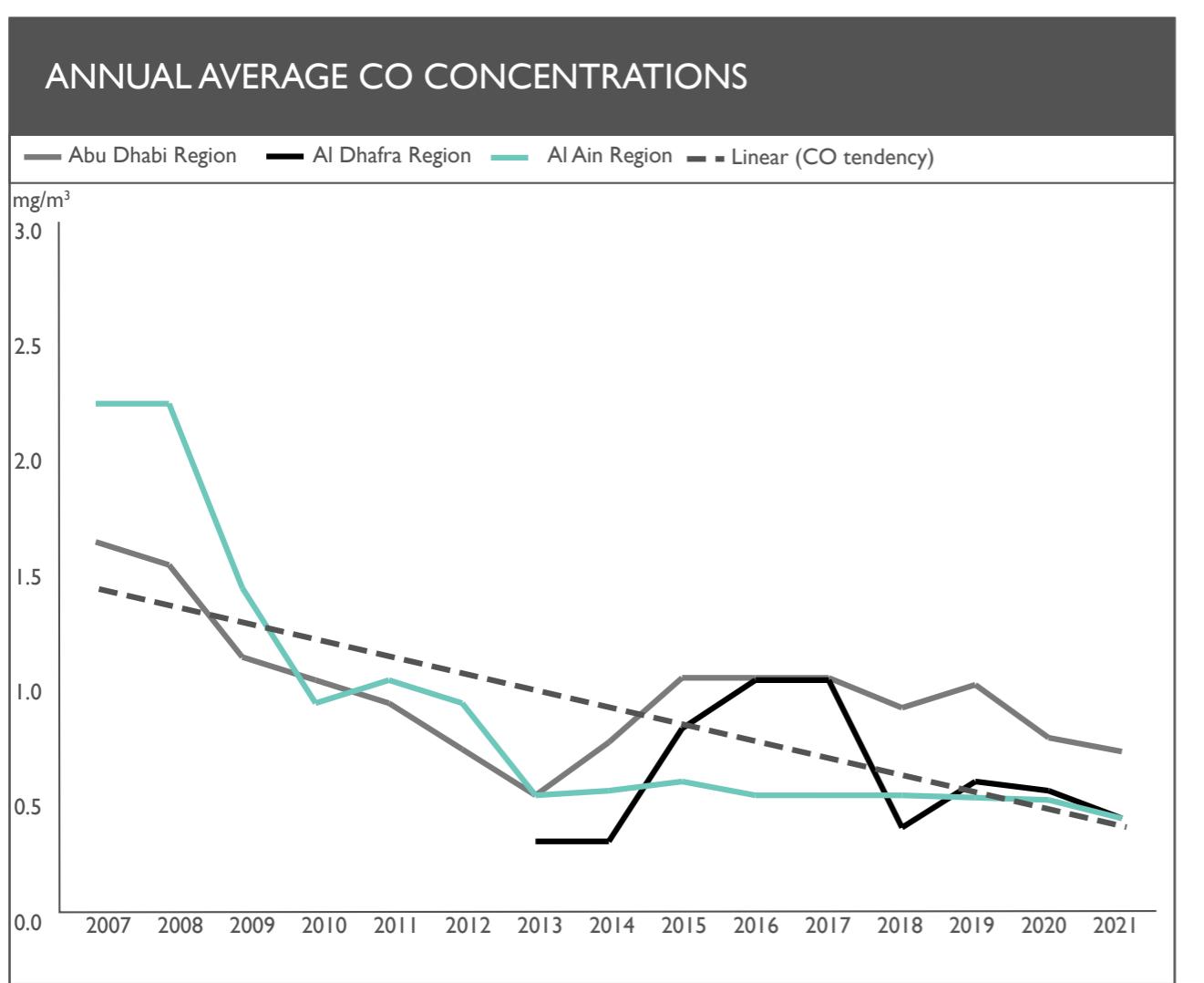


Figure 6 :

Averages of annual average concentrations for CO given for the sites in the Al Dhafra Region, Al Ain Region, and Abu Dhabi Region. A total Abu Dhabi Emirate trend (linear regression) for all stations from 2007 to 2021 is presented as the dotted line.

4

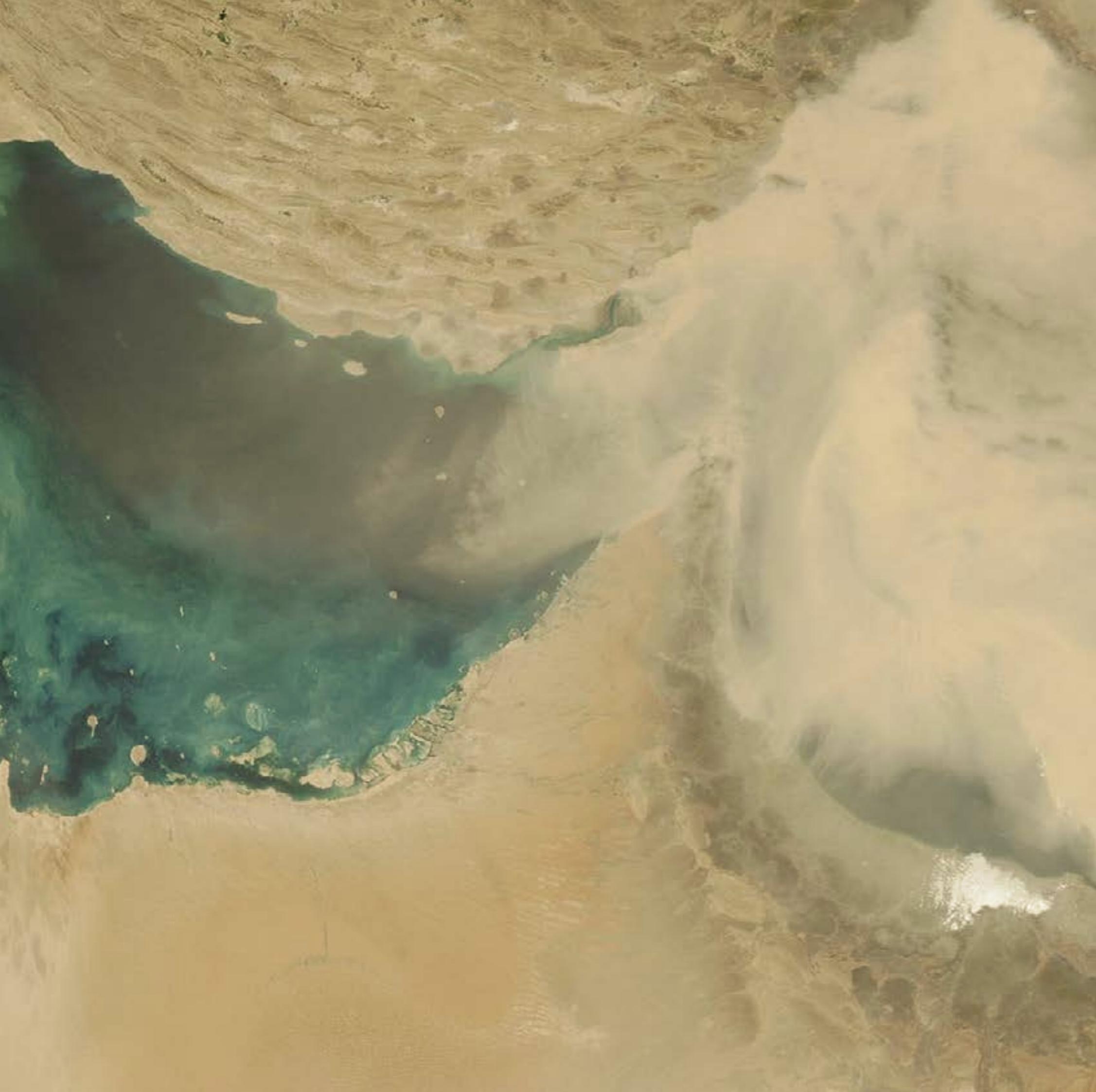
HYDROGEN SULFIDE H₂S

There is no air quality limit value for H₂S in UAE. H₂S is not one of the criteria pollutants, but may cause odour nuisance at concentrations far below those that cause health hazards. The World Health Organization has presented a 24 hour average guideline value of 150 µg/m³. Half-hour average concentrations exceeding 7 µg/m³ are likely to produce odour problems and complaints among persons exposed.

The WHO guideline given for 24-hour average concentration of H₂S at 150 µg/m³ was never exceeded.

In Abu Dhabi Emirate H₂S concentrations are well within the health threshold recommended by WHO. However, there has been an increase in H₂S concentrations in some specific areas, which may cause odour nuisances.



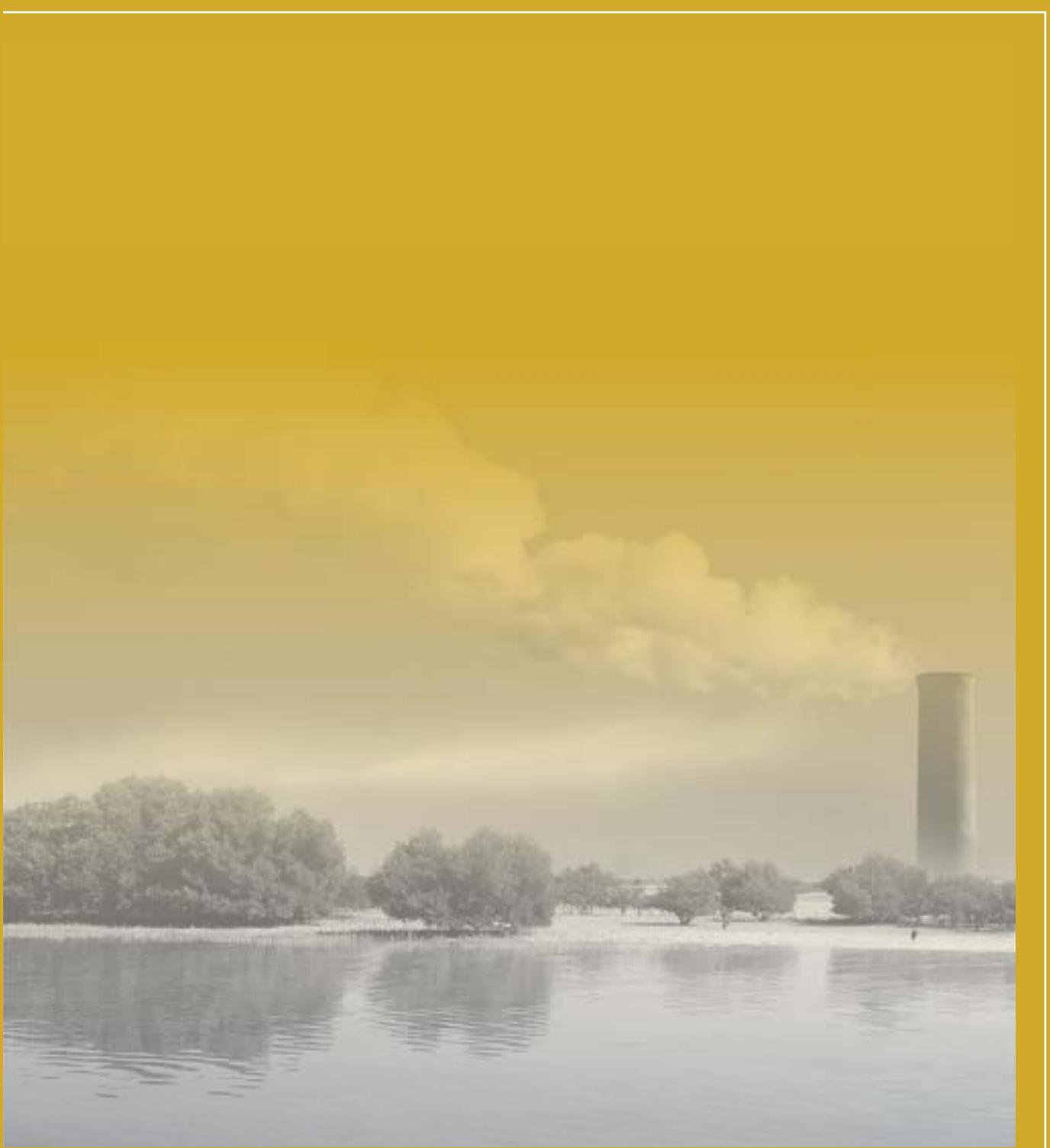


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CONCLUSION

Natural and man-made activities are the main contributors to the air quality of Abu Dhabi. Our desert environment plays an important role in quality of the air as well. As our population grows, our contribution to the level of air quality will get affected.

To sum up, compared to the previous year, 2021 show a decrease in the average of $PM_{2.5}$ concentration in both of Abu Dhabi industrial areas and Abu Dhabi Region. PM_{10} concentration slightly increased in all regions except Abu Dhabi industrial areas, and O_3 concentration almost constant in all regions. However SO_2 , NO_2 and CO were compliant in all the stations.



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