Egyptian Environmental Affairs Agency

EEAA

Air Quality in Egypt,2000

EIMP Environmental Information & Monitoring Programme (EIMP)

Air Quality Monitoring Component

Air quality in Egypt, 2000
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1. Introduction

EIMP is an 8 years programme established by Egyptian Environmental Affairs Agency (EEAA) in co-operation with Danida in order to have a view of the present environment. As part of the EIMP programme a national air pollution-monitoring programme consisting of a total 42 measurement sites have been developed and established. The monitoring programme was designed to be expandable either in the Geographical coverage or the list of parameters measured based on the further needs. The programme will be expanded to include a new monitoring station at El Qalyubia governorate to support the Early Warning System established under the environmental quality sector.

The design of the EIMP Air Quality Monitoring network includes:

- Data collectors; sensors and monitors
- Data transfer systems and data quality assurance/control procedures
- Data bases
- Data distribution systems.

The Center of Environmental Hazard Mitigation (CEHM) at Cairo University and the Institute of Graduate Studies and Research (IGSR) at Alexandria University are operating on behalf of EEAA, a total of 14 sites located in Greater Cairo area, 8 sites in Alexandria area, 7 sites in Delta, 3 sites in Canal area and 10 sites in Upper Egypt and Sinai.

2. The Programme

It is important to bear in mind, when looking to the distribution of sites, that EIMP is concerned only with the air that people breath. Due to this reason most of the sites are located in residential areas or industrial areas surrounded by residential or urban areas.

2.1 Selected Sites

EIMP Air Quality Monitoring Programme is providing information to support and facilitate the assessment of air quality in the selected areas. The information produced by the EIMP Programme will:

- Provide a general description of Air Quality, and its development over time(trend)
- Enable comparison of Air Quality from different areas
- Produce estimates of individual source contributions
- Indicate the exposure of air pollution to the population
- Evaluate levels of pollution compared to national and international limits
- Represent the main input to the early warning system of air pollution episodes.

2.2 Site Characteristics

The design, development, construction and installation of the measurement programme started in 1997 and were completed in July 1999. CEHM is operating 27 Monitoring and Sampling sites in Cairo, Canal area, Upper Egypt and Sinai while 15 sites are being operated by IGSR in Alexandria and Delta.These sites are all part of EIMP/EEAA Air Quality Monitoring Programme.

The number of sites and area types are presented in the following table (1).

Area type	Cairo	Alex.	Delta and Canal	Upper Egypt	Sinai	Total
Industrial	3	3	3	2		11
Urban	1	1	3	4		9
Residential	4	2	2	2		10
Street/road	3					3
Regional/backr.	1	1			1	3
Mixed areas	2	1	2	1		6
Total	14	8	10	9	1	**42**

In addition to the above monitoring and sampling sites, about 20 sites have been selected for undertaking passive sampling of SO_2 and NO_2 on a monthly or quarterly basis.

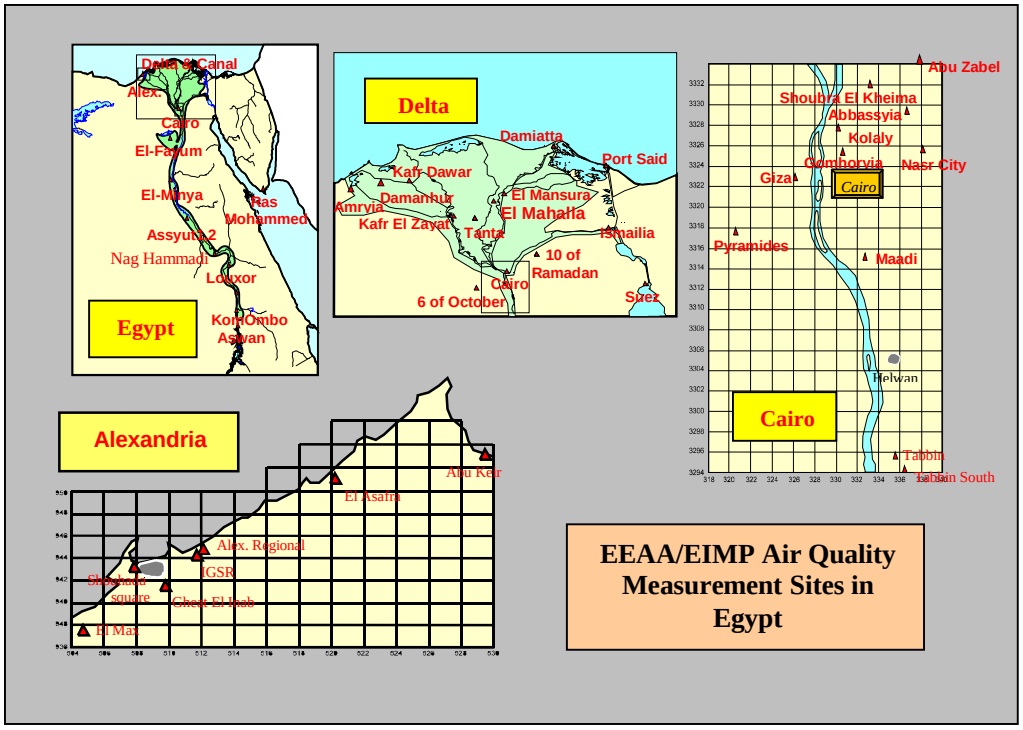


Figure 1: The EEAA/EIMP Air Quality Measurement Sites in Egypt

Not all parameters are being measured by the EIMP/EEAA Programme at all sites. This depends on site specification and typical dominating sources in the specific area. In some sites in Egypt VOC (Volatile Organic Compounds) and Dust Fall are being measured.

Table2: EIMP Air Quality Monitoring Programme, Operated Jan. 2001.

ID	Station Name	Area Type	Parameters														Starting Date
			Monitors						Samplers								
			SO_2	NO_x	PM_{10}	O_3	CO	Met.	SO_2	BS	NO_x	PM_{10}	VOC	TSP	DF	PS	
1	El-Kolaly	Urban Center	1	1	1*									1**			24-May-98
2	El-Gomhoryia	Street Canyon	1	1			1					1					25-Dec-97
3	Abbassyia	Urb. /Res.	1		1	1		1								1	22-May-99
4	Nasr City	Residential							1	1	1	1					08-Oct-98
5	El-Maadi	Residential	1	1								1++					10-Dec-98
6	Tabbin	Industrial	1	1	1			1						1			27-Oct-97
7	Tabbin South	Industrial							1	1				1--	1		19-Oct-98
8	Fum El-Khalig	Road side/Urb.	1	1	1		1										07-Nov-98
9	Abu Zabel	Ind./Res.										1			1	1	16-Nov-98
10	Shoubra El Kheima	Industrial	1					1-			1””	1		1			01-May-98
11	Cairo University	Residential	1	1		1+		1									18-Jul-98
12	Giza Pyramides	Monumental														2	1-Jul-2000
13	6 October	Res./Ind.							1	1	1	1					12-Jan-99
14	10 Ramadan	Residential							1	1		1			1		15-Dec-98
15	Suez	Urban	1	1										1	1		03-Feb-99
16	Port Said	Residential										1				2	10-May-99
17	Ismailia	Urb. /Res.										1				2	04-Feb-99
18	El Fayum	Urban										1			1	2	03-Feb-99
19	El-Minya	Res./Ind.										1			1	2	09-Jul-99
20	Assyut1	Res./Urb.													1	2	08-Jul-99
21	Assyut2	Res./Urb.	1	1	1			Por.									Jan-2000
22	Nag Hammadi	Ind./Res.										1			1	2	07-Jul-99
23	Luxor	Urb./Res.							1	1					1		08-Jun-99
24	Edfu	Ind./Res.										1			1	2	06-Jul-99
25	KomOmbo	Industrial							1	1		1			1		09-Jul-99
26	Aswan	Urb./Res.	1			1		1”							1	1	23-Jun-99
27	Ras Mohamed	Background				1						1			1	2	13-Mar-99
28	Abu keir	Industrial									1	1				2	22-Mar-2000
42	El Shouhada	Traffic	1	1								1					
29	El-Max	Industrial							1	1	1	1			1		15-Nov-98
30	IGSR	Traffic	1	1	1		1										15-Nov-98
31	El Asafra	Residential							1	1		1			1	1	15-Nov-98
32	Gheat El-Inab	Residential							1	1	1	1			1	1	15-Nov-98
33	IGSR. Regional	Back.				1		1									15-Nov-98
41	El -Nahda	Industrial										1			1		20-Feb-2000
34	Damanhur	Industrial/Res.										1				2	15-Feb-99
35	Kafr El-Zayat	Industrial/Res.	1	1	1							1			1		20 Aug-99
36	Tanta	Urban							1	1		1				1	15-Jun-99
37	El-Mahalla	Industrial	1		1												17-Jun-99
38	El Mansura	Indus./Res.	1	1				1									15-Apr-99
39	Damiatta	Residential							1	1		1			1		15-May-99
40	Kafr El Dawar	Residential							1	1		1				1	15-Mar-99

* Starting Date 21-Nov-98
” Starting Date 1-Oct.99
-- Starting Date 5-Mar-99

- Starting Date 1-Jul-98
** Starting Date 25-Jul-99
” ” Starting Date 5-Apr-99

+ Starting Date 13 -Aug-98
++ Starting Date 3-Aug-99

3.Parameters measured and Human Health

A set of selected parameters are being measured by the project to assess the quality of air in the areas of measurements. These paramters are: Oxides of Nitrogen

Nitorgen Oxides:

Nitrogen dioxide (NO_2) is one of a number of important oxides of nitrogen present in the atmosphere. Nitric oxide (NO) and nitrogen dioxide (together termed NOx) are the most abundant man-made oxides of nitrogen in urban areas; these are formed in all high temperature combustion processes, although NO predominates. Nitric oxide is not generally considered to be harmful to health at the concentration found in the ambient atmosphere.

Nitrogen emissions originate originally from motor vehicles, with most of the remainder arising from power stations and other industrial sources. Since power stations and industrial emissions are usually from elevated sources, motor vehicles represent the nearest source to ground for NOx emission and therefore make the largest contribution to ground level concentrations in urban areas.

Sulphur Dioxide

Sulphur Dioxide (SO_2) is formed by the oxidation of sulphur impurities in fuels during combustion processes. A very high proportion of SO_2 emissions originates from power stations and industrial sources.

Though virtually no SO_2 is emitted from petrol engine vehicles, it is emitted from diesels which lead to increase of SO_2 concentrations in the urban and roadside areas.

PM_{10} Particulate Matter

Attention has focused increasingly on gravimetric particulate measurements. In particular, concern has been expressed on the possible health impacts of the PM_{10} fraction of particulate matter. This fraction comprises fine particles of diameter less than 10 μm which can be inhaled deeply into the lungs.

The major sources of PM_{10} particles are motor vehicle emissions, wind blown dust, point sources and open waste burning.

Carbon Monoxide

Carbon Monoxide in urban areas resulted almost entirely from vehicle emissions. The emission rate for individual vehicles depends critically on vehicle speed, being highest at very low speeds.

since traffic is the most important source of CO, its spatial distribution will follow the traffic scheme: this will generally result in the highest level being observed in the city centre.

Ozone

A background ozone concentration exists in the atmosphere due to mixing of ozone from the stratosphere and its generation in the troposphere. The background concentration depends on latitude and time of year.

The concentrations of ozone is depleted by deposition to surfaces and reaction with other pollutants (primarily NOx) in the atmosphere.

The reactions producing ozone occur, under appropriate meteorological conditions, in the plume of such sources as it moves downwind; ozone formation can occur over a time scale of a few hours to several days.

4.Air Quality Limit values

Air Quality Limit values are given in the Executive Regulations of the Environmental Law no. 4 of Egypt (1994). These Air Quality Limit values are presented in Table3

Table 3: Ambient Air Quality Limit values as given by Law no.4 of Egypt

Polluant	Maximum Limit	Averaging Time
Sulfur Dioxide (SO_2)	350 $\mu g/m^3$	1 Hour
	150 $\mu g/m^3$	24 Hour
	60 $\mu g/m^3$	Annual
Carbon Monoxide (CO)	30 mg/m^3	1 Hour
	10 mg/m^3	8 Hour
Nitrogen Dioxide (NO_2)	400 $\mu g/m^3$	1 Hour
	150 $\mu g/m^3$	24 Hour
Ozone (O_3)	200 $\mu g/m^3$	1 Hour
	120 $\mu g/m^3$	8 Hour
Black Smoke (BS)	150 $\mu g/m^3$	24 Hour
	60 $\mu g/m^3$	Annual
Total Suspended Particulate (TSP)	230 $\mu g/m^3$	24 Hour
	90 $\mu g/m^3$	Annual
Suspended Particulate <10 µm in diameter (PM10)	70 $\mu g/m^3$	24 Hour
Lead (Pb)	1 $\mu g/m^3$	Annual

The status of air quality in Egypt during the year of 2000 will be discussed deeply in the following chapters.

Air Quality in Egypt during 2000

The sources of pollution are distributed all over Egypt and are varying from point sources using fossil fuel in burning to open waste burning to deisel cars running day and night in the streets. All of these sources are producing high amount of pollution and affect the Egyptian human health.

5-Annual averages

Figure2 showes the annual average concentrations of SO_2 for the year 2000 at the sites measured under EIMP programme

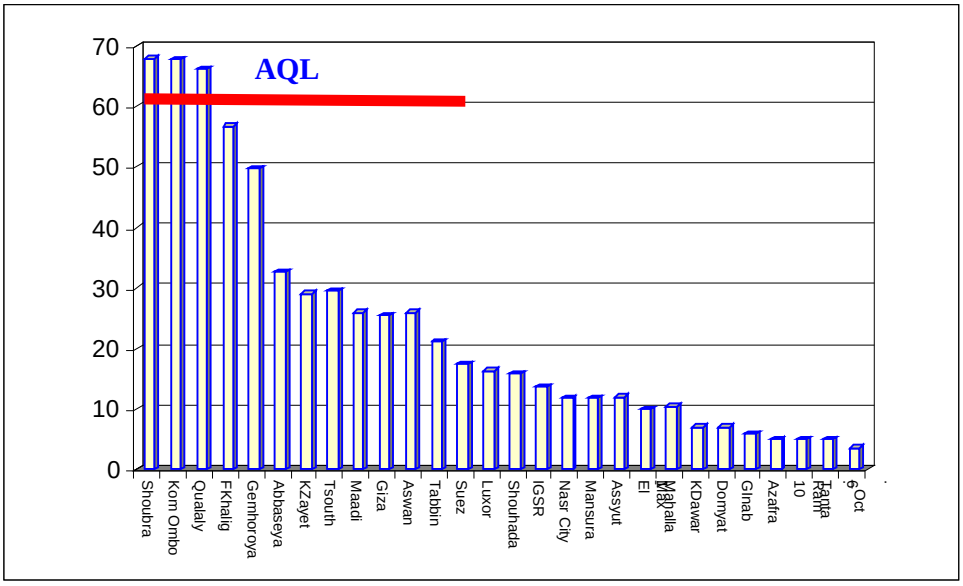


Figure2: Annual average concentrations of SO_2 measured under EIMP Programme

From the figure we can see that the annual Air Quality Limit value of 60 µg/m^3 for **SO_2** has been exceeded at 3 of the 28 sites in 2000 (at Shoubra, Komombo and Qualaly). At Fum khalig the annual average reaches 57 µg/m^3.

It is important to note that 2 of the 3 sites which exceeded the Air Quality Limit value are industrial surrounded with residential areas.

The Annual Air Quality Limit value for **BS** of 60µg/m^3 has been exceeded at four sites in 2000 (At KomOmbo, Domyat, Tabbin south and Luxor). BS annual average are presented in Figure (3.B).

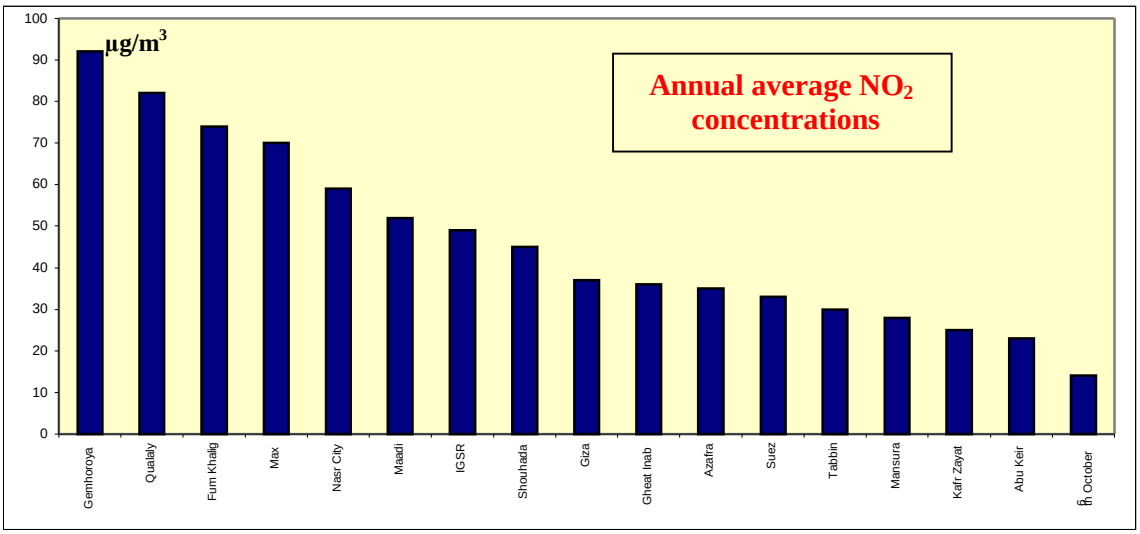
Although there is no Annual limit for **NO_2** in the environmental law no.4 of Egypt, World Health Organization Air Quality Limit is 40-50 µg/m^3. This Air Quality Limit value has been exceeded at 6 sites (Gomhoryia, Qualaly, Fum Khalig, El Max, Nasr city and Maadi). Most of these sites are traffic areas impacted by emissions from motor vehicle cars.

Egypt is subjected to high concentrations of particulates most of the year. There is no annual limit for **PM_{10}** concentrations in the Egyptian law of Environment but comparing to the 24 hour average, PM_{10} is representing health risks on the long-term. El Mahalla and Kafr Zayat station have very high concentrations on annually basis (369 and 251 $\mu g/m^3$ respectively).

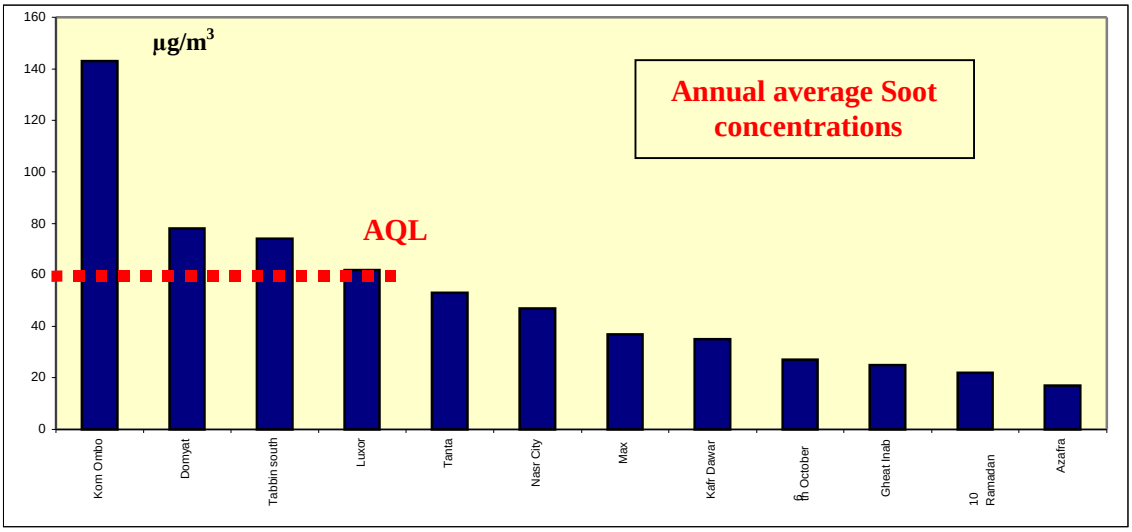
Table 4: Annual Average Concentrations of SO_2, NO_2, Soot, PM_{10}, TSP, O_3, CO and DF.

		Paramters							
		SO_2	NO_2	Soot	PM_{10}	TSP	O_3	CO	DF
AQ-01	Cairo city El Qualaly.	66	82		180	684			
AQ-02	El Gemhoroya street	50	92					7.6	
AQ-03	Abbaseya	33			140		69		
AQ-04	Nasr City	12	59	47	122				
AQ-05	Maadi	26	52		105				
AQ-06	Tabbin	21	30		161	573			
AQ-07	Tabbin south	29		74		778			31
AQ-08	Fum El Khalig	57	74		185			4.4	
AQ-09	Abu Zabel								27
AQ-10	Shoubra el Kheima.	68				337			35
AQ-11	Giza, Cairo University.	26	37				55		
AQ-13	6_October	4	14	27	92				
AQ-14	10 Ramadan	5		22	79				9
AQ-15	Suez	17	33			754			21
AQ-18	El Fayum								12
AQ-19	El Minya								30
AQ-20	Assyut 1	12*							
AQ-21	Assyut 2								38
AQ-22	Naga Hammadi								13
AQ-23	Luxor	16		62					12
AQ-24	Edfu								9
AQ-25	Kom Ombo	68		143					21
AQ-26	Aswan	26							6
AQ-27	Sharm ElSheikh						80		
AQ-29	El-Max Petrogas	10	70	37	103				
AQ-30	IGSR	14	49		139			3.26	
AQ-31	El-Azafra	5	35	17					
AQ-32	Gheat El-Inab school	6	36	25	35				
AQ-33	Alex Regional						57		
AQ-34	Damanhur								
AQ-35	Kafr el Zayet	29	25		251				
AQ-36	Tanta	5		53					
AQ-37	ElMahalla El Kubra	10			369				
AQ-38	El Mansura	12	28						
AQ-39	Domyat	7		78	74				
AQ-40	Kafr Dawar	7		35					
AQ-41	ElAmreya								
AQ-42	ElShouhada square	16	45						
AQL	Annual average	60		60		90			10

(A)



(B)



(C)

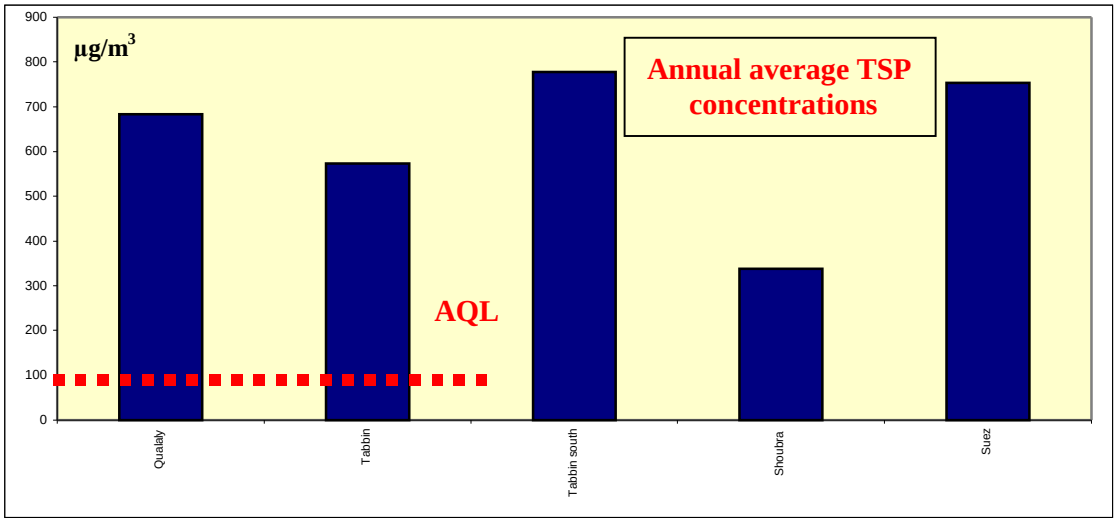


Figure3 : Annual Average Concentrations (µg/m^3) During 2000 for (A) NO_2, (B) Soot and (C) TSP

From the figure we can see that the annual average TSP concentrations in all measuerment sites during 2000 was ranging between 4 to 8 times the Air Quality Limit value.

6) 24 hour average

The Daily average concentrations are being measured by sequential samplers and estimated from the readings measured by continous monitors.

The daily average Air Quality Limit value for **SO_2** of 150 $\mu g/m^3$ has been exceeded at the following sites:
El Gomhoryia by 4.07 %, Tabbin south by 0.33%, Shoubra El Kheima by 0.62% and Komombo by 9.43% of the measuring period.
None of the sites in Alexandria or Delta have exceeded the Air Quality Limit value.

Soot are being measured only by sequential samplers as pre-filters on SO_2 sequential samplers.
The Air Quality Limit value of Soot has been exceeded during 0.6, 0.86, 6.9, 7.82, 2.87, 29.71% of the measuring period in 2000 at Nasr City, Tanta, Domyat, Tabbin south, Luxor and Komombo respectively.

NO_2 Air Quality Limit value has been exceeded at the following sites : El Gomhoryia , El Max and Nasr city (13.2, 3.5 and 1.44% of the measuring time respectively).

Egypt are subjected to very high concentrations of **PM_{10}** .This has been reflected on the concentrations measured under EIMP Programme.The Air Quality Limit value has been exceeded at most of the measuring stations.
The data collected by continous monitors shows that all stations at El Kolaly, Abbassyia, Tabbin, Assut1,IGSR, Mahalla and Kafr El Zayat exceeded the Air Quality Limit value during 97.4, 73, 94.6, 94.6, 84.5, 98.2 and 98.9% of the measuring period.

High volume samplers measuring PM_{10} as daily average showes that the Air Quality Limit value has been exceeded at Nasr City, Maadi, 6 October and 10 Ramadan during 60.47, 79.07, 62.96 and 44.26% of the measuring period.

TSP are being measured also by high volume samplers at selected station under EIMP programme.all station has been exceeded the Air Quality Limit value of 230 $\mu g/m^3$

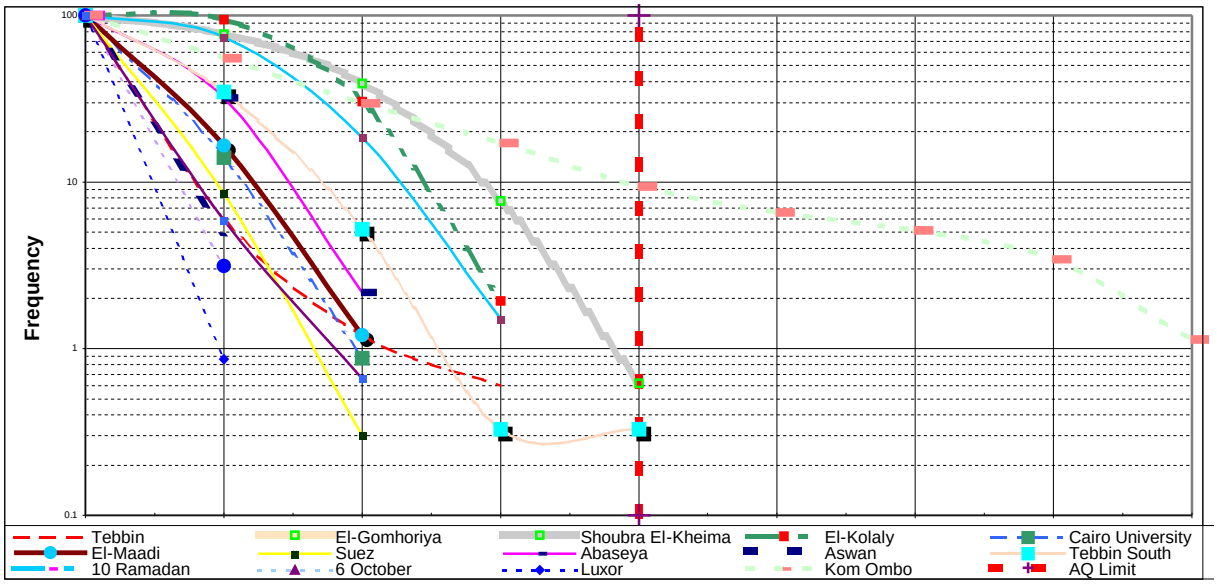


Figure 4 (A): Cumulative Frequency Distributions (%) for 24-Hour Average SO_2 Concentrations Relative to Air Quality Limit Values for All Measurements Sites in 2000

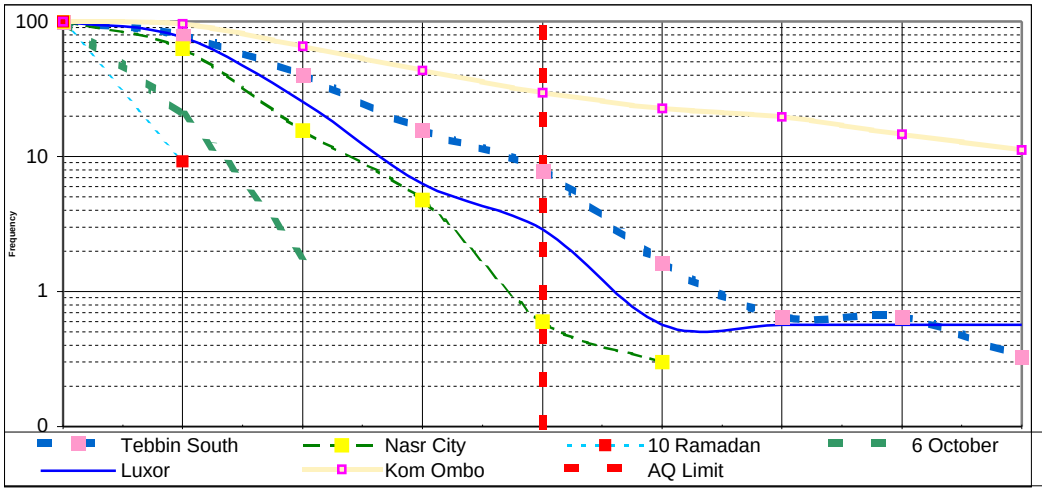


Figure 4 (B): Cumulative Frequency Distributions (%) for 24-Hour Average BS Concentrations Relative to Air Quality Limit Values for All Measurements Sites in 2000

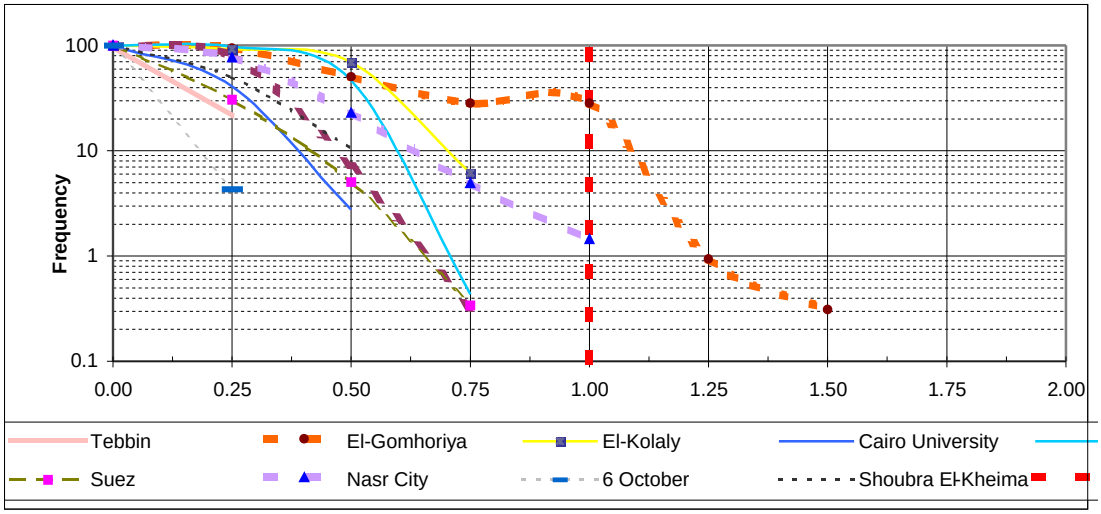


Figure 4 (C): Cumulative Frequency Distributions (%) for 24-Hour Average NO_2 Concentrations Relative to Air Quality Limit Values for All Measurements Sites in 2000

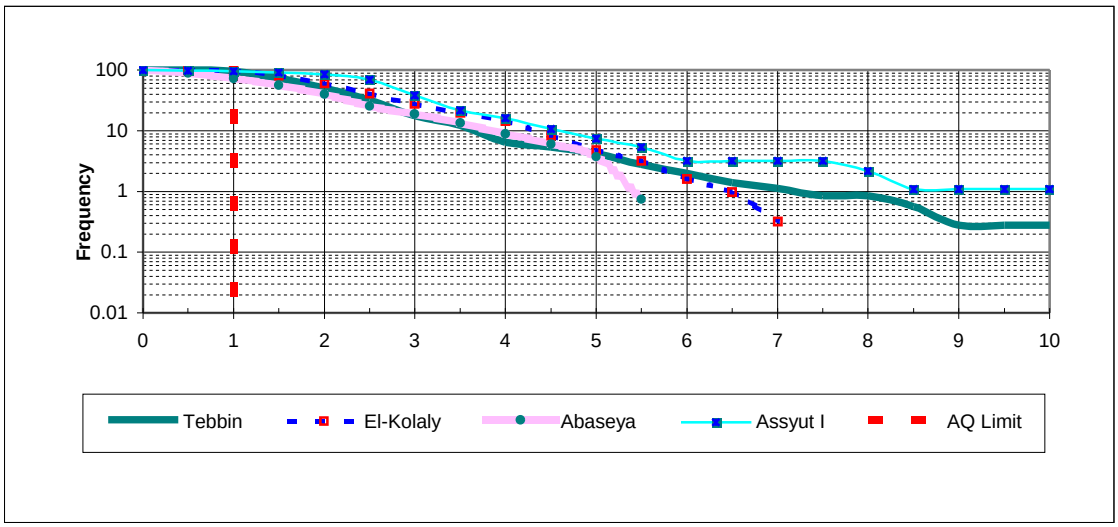


Figure 4 (D): Cumulative Frequency Distributions (%) for 24-Hour Average PM_{10} Concentrations Relative to Air Quality Limit Values for All Measurements Sites in 2000

Table 5: Exceedances of the Air Quality Limit Values
for 24-Hour Average Concentrations as Given by Executive Regulations of the
Egyptian Law for Environment No. 4 of 1994 .
N = Number of Days, % = Percent Exceeding Limit Value.

ID	Station Name	SO_2		BS		NO_2		PM_{10}		TSP	
		N	%	N	%	N	%	N	%	N	%
1	El-Kolaly	0	0.00	----	----	0	0.00	302	97.4	54	98.18
2	El-Gomhoriya	14	4.07	----	----	42	13.2	16	100	----	----
3	Abaseya	0	0.00	----	----	----	----	97	73.00	----	----
4	Nasr City	0	0.00	2	0.60	5	1.44	26	60.47	----	----
5	El-Maadi	0	0.00	----	----	0	0.00	34	79.07	----	----
6	Tebbin	0	0.00	----	----	0	0.00	336	94.60	32	80
7	Tebbin South	1	0.33	24	7.82	----	----	----	----	54	93.1
8	Fum El-Khalig	0	0.00	----	----	0	0.00	218	98.6	----	----
9	Abu Zabal	----	----	----	----	----	----	3	100	----	----
10	Shoubra El-Kheima	2	0.62	----	----	0	0.00	32	96.97	32	50.79
11	Cairo University	0	0.00	----	----	0	0.00	----	----	----	----
13	6 October	0	0.00	0	0.00	0	0.00	34	62.96	----	----
14	10 Ramadan	0	0.00	0	0.00	----	----	27	44.26	----	----
15	Suez	0	0.00	----	----	0	0.00	----	----	29	63.04
16	Port Said	----	----	----	----	----	----	6	75.00	----	----
17	Ismailia	----	----	----	----	----	----	8	88.89	----	----
18	El-Fayum	----	----	----	----	----	----	4	100	----	----
19	El-Minya	----	----	----	----	----	----	8	100	----	----
21	Assyut I	0	0.00	----	----	----	----	88	94.60	----	----
22	Naga Hammadi	----	----	----	----	----	----	7	77.78	----	----
23	Luxor	0	0.00	10	2.87	----	----	----	----	----	----
24	Edfu	----	----	----	----	----	----	12	100	----	----
25	Kom Ombo	33	9.43	104	29.71	----	----	35	97.22	----	----
26	Aswan	0	0.00	----	----	----	----	----	----	----	----
27	Ras Mohammed	---	-----	----	-----	----	-------	0	0.00	----	------
29	El Max	0	0.00	0	0.00	12	3.5			-----	-------
30	IGSR	0	0.00	-----	------	0	0.00	169	84.5	-----	-------
31	El Azafra	0	0.00	20	6.9	0	0.00	----	-----	----	--------
32	Gheat Inab	0	0.00	0	0.00	0	0.00			-----	--------
35	Kafr El Zayat	0	0.00	-----	------	0	0.00	184	98.9	----	-------
36	Tanta	0	0.00	3	0.86	---	-----	----	----	-----	------
37	El Mahalla	0	0.00	-----	------	0	0.00	111	98.2	-----	------
38	Mansura	0	0.00	----	-------	0	0.00	-----	-----	-----	------
40	Kafr Dawar	0	0.00	0	0.00	---	-----	----	------	-----	-------

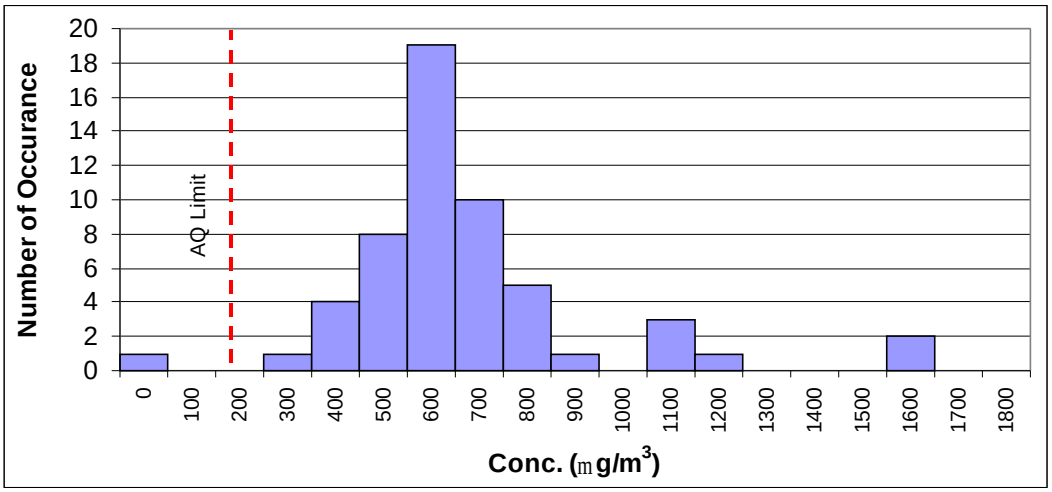


Figure 5 (A): Number of Occurrence of Daily Average TSP Concentrations Measured at El-Kolaly, 2000

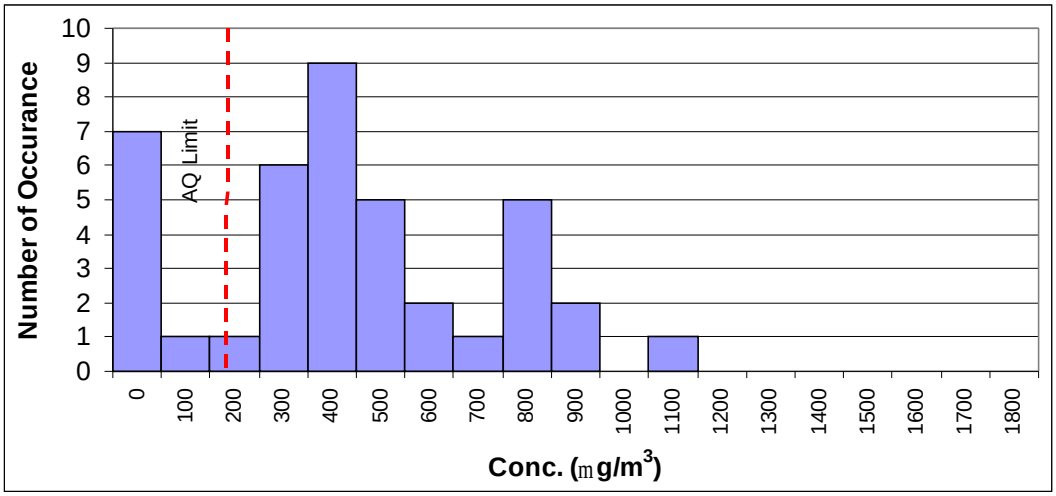


Figure 5 (B): Number of Occurrence of Daily average TSP Concentrations Measured at Tebbin, 2000

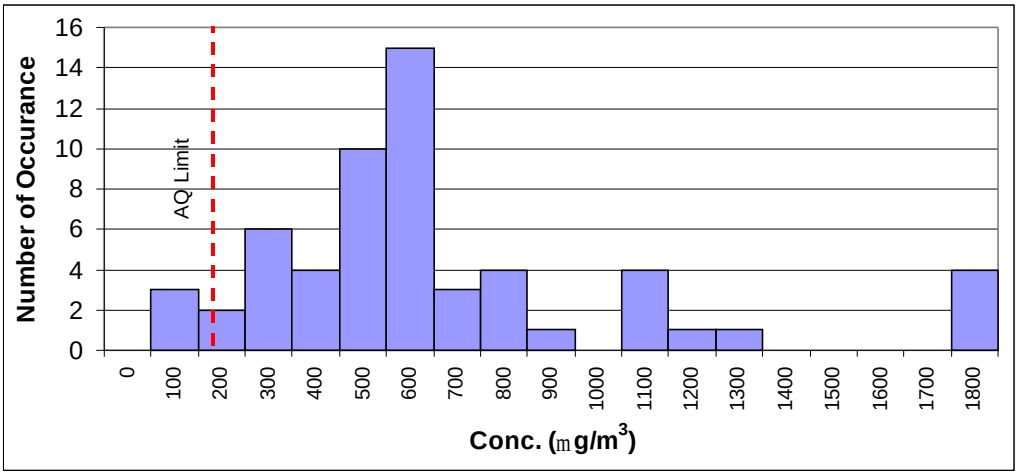


Figure 5 (C): Number of Occurrence of Daily average TSP Concentrations Measured at Tebbin South, 2000

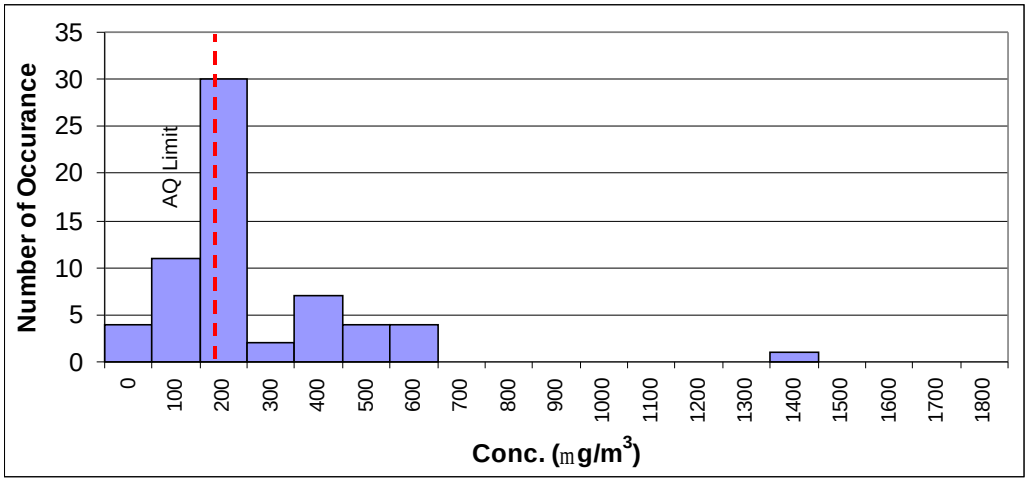


Figure 5 (D): Number of Occurrence of Daily average TSP Concentrations Measured at Shoubra El-Kheima, 2000

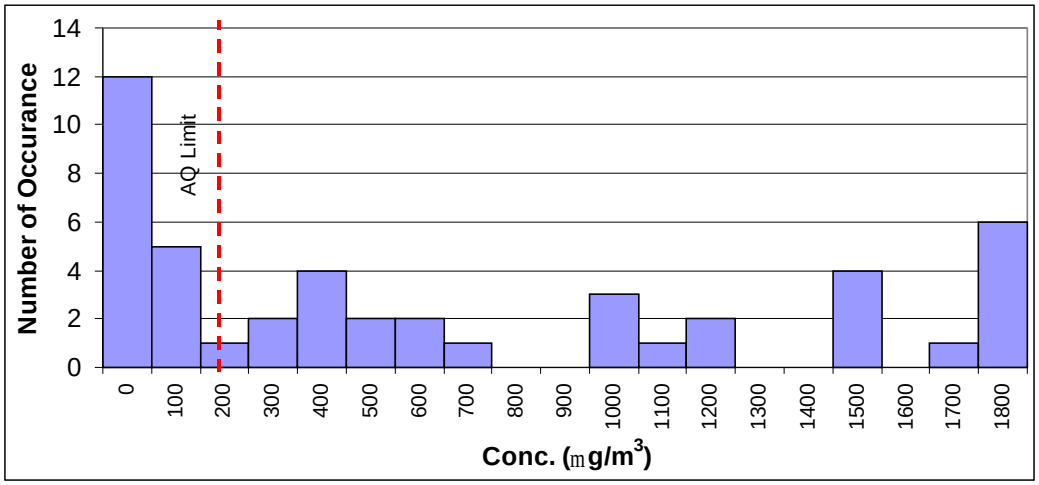


Figure 5 (E): Number of Occurrence of Daily average TSP Concentrations Measured at Suez, 2000

7) One Hour Average Concentrations

Hourly data are being collected using on-line moitors in 18 sites operated under EIMP Programme

SO_2 has been measured at 15 sites distributed all over Egypt. The Air Quality Limit value of 350µg/m^3 has been exceeded at 5 sites of the 15 sites collected SO_2 .the highest concentrations occurred at the industrial areas, urban and street canyon areas indicating that high emissions are released at certain times (not on continous basis). The exceedances happened at Gomhoryia, Shoubra, Kolaly, Kafr El Zayat and Mahalla during 0.16, 0.1, 0.04, 3.1, 1.08% of the measurement time respectively.

NO_2 has almost low concentrations on hourly basis comparing to the Air Quality Limit value of 400 µg/m^3 . only one site has exceeded the Air Quality Limit value at Gomhoryia station during 0.03% of the measurement time.

Only two sites has exceeded the Air Quality Limit value for **CO** of 30 mg/m^3 at Gomhoryia and Fum El Khalig during 0.62 and 0.03% of the measurement time during 2000.

O_3 concentrations have very low exceedances comparing to the other parameters. The Air Quality Limit value of 200µg/m^3 has been exceeded at Abbassyia, Giza and Aswan during 0.2, 0.01 and 0.02 % of the measuring time at each station respectively.

As there is no Air Quality Limit value for **PM_{10}** hourly average concentrations in the Environmental Law no. 4 of Egypt, **PM_{10}** concentrations will be discussed only on daily basis.

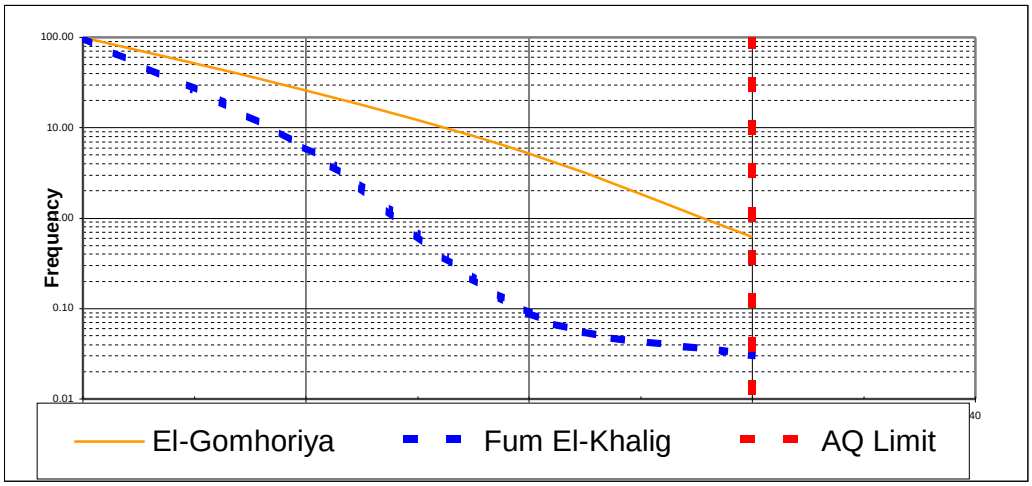


Figure 6 (A): One-Hour Average Cumulative Frequency Distribution (%) for CO Data Collected in 2000

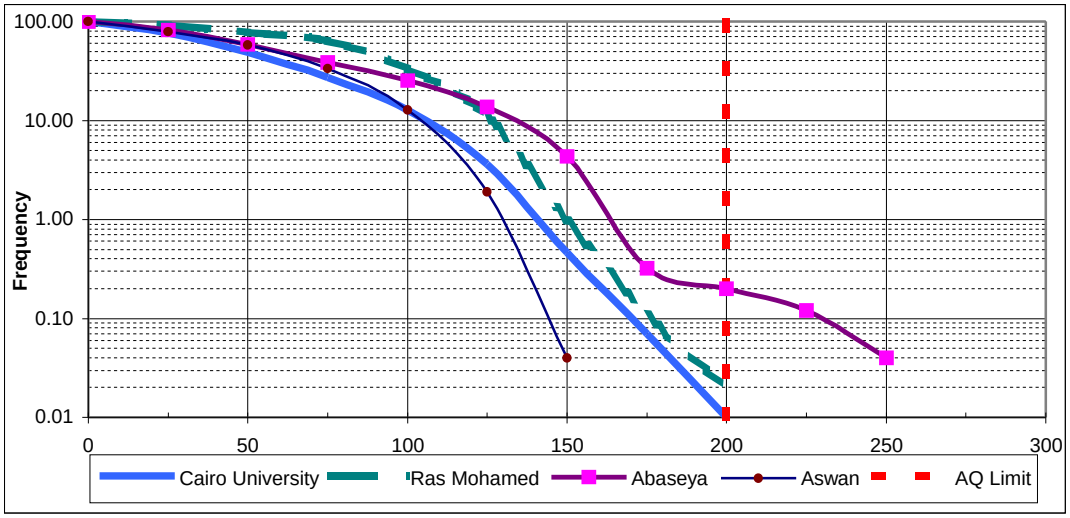


Figure 6 (B): One-Hour Average Cumulative Frequency Distribution (%) for O_3 Data Collected in 2000

Table 6: Exceeding of the Air Quality Limit Values for One-Hour Average Concentrations as Given by Executive Regulations to Environmental Egyptian Law No. 4 of 1994 .

N = Number of Hours, % = Percent Exceeding Limit Value.

ID	Station Name	SO_2		NO_2		O_3		CO	
		N	%	N	%	N	%	N	%
1	El-Kolaly	3	0.04	0	0.00	----	----	----	----
2	El-Gomhoriya	12	0.16	2	0.03	----	----	45	0.62
3	Abaseya	0	0.00	----	----	5	0.20	----	----
5	El-Maadi	0	0.00	0	0.00	----	----	----	----
6	Tebbin	0	0.00	0	0.00	----	----	----	----
8	Fum El-Khalig	0	0.00	0	0.00	----	----	2	0.03
10	Shoubra El-Kheima	7	0.1	----	----	----	----	----	----
11	Cairo University	0	0.00	0	0.00	1	0.01	----	----
15	Suez	0	0.00	0	0.00	----	----	----	----
21	Assyut I	0	0.00	----	----	----	----	----	----
26	Aswan	0	0.00	----	----	0	0.00	----	----
27	Ras Mohamed	----	-----	-----	-----	1	0.02	-----	-------
30	IGSR	0	0.00	0	0.00	-----	-----	0	0.00
33	IGSR. Reg.	----	-----	-----	-----	0	0.00	----	------
35	Kafr El Zayat	5	3.1	0	0.00	----	-----	----	-----
37	Mahalla	2	1.08	-----	------	----	-----	----	------
38	Mansura	0	0.00	0	0.00	-----	------	----	------

8) 8 Hour average

Only CO and O_3 have Air Quality Limit values for the 8-hour average concentrations in the Environmental Law no. 4 of Egypt. The 8-hour Air Quality Limit value for **CO** of 10 mg/m^3 as rolling 8 hour average has been exceeded at Gomhoryia, Fum Khalig and IGSR during 25.9, 4.4 and 0.06% of the measerement time. Gomhoryia was giving high concentrations at about 5% of the measurement times.

O_3 concentrations have exceeded the 8-hour Air Quality Limit value of 120 µg/m^3 at all stations except IGSR Reg.

The highest number of exceedances occurred at the background site of Ras Mohammed during 12.7% of the measurement time.

Table 7: Hours of exceedance of the Air Quality Limit Values for 8-Hour Average Concentrations

N = Number of Times, % = Percent Exceeding Limit Value.

ID	Station Name	O_3		CO	
		N	%	N	%
2	El-Gomhoriya	----	----	1941	25.85
3	Abaseya	288	10.49	----	----
8	Fum El-Khalig	----	----	337	4.43
11	Cairo University	130	1.67	----	----
26	Aswan	92	1.15	----	----
27	Ras Mohamed	848	12.74	----	------
30	IGSR	-------	------	4	0.06
33	IGSR Reg.	0	0.00	-----	------
AQ Limit value		120µg/m^3		10mg/m^3	

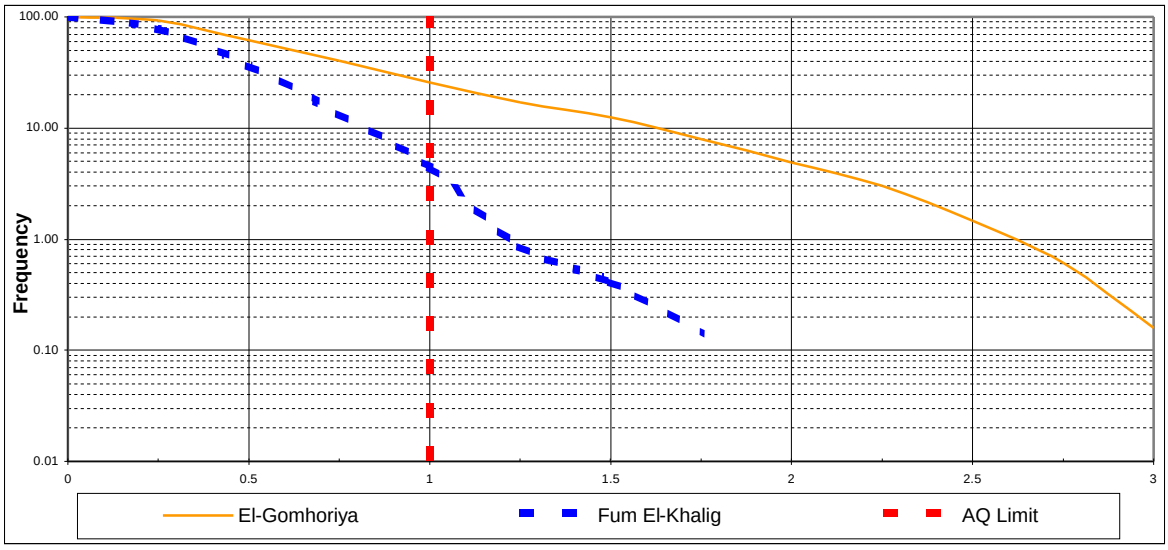


Figure 7 (A): 8-Hour Average Cumulative Frequency Distribution (%) for CO Conc. (mg/m^3)
Relative to Air Quality Limit Value, 2000

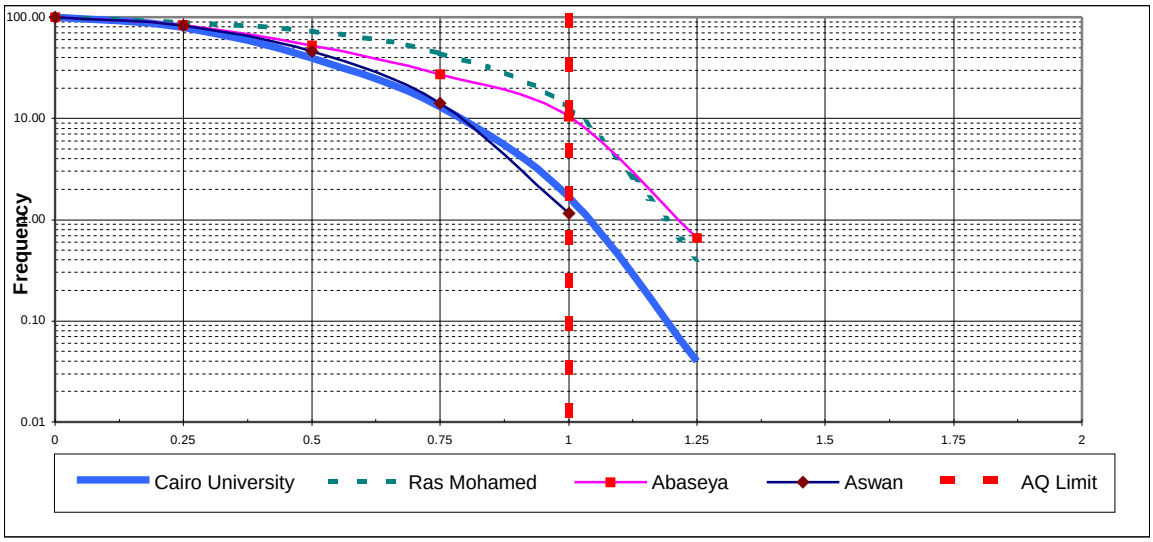


Figure 7 (B): 8-Hour Average Cumulative Frequency Distribution (%) for O_3 Conc. ($\mu g/m^3$)
Relative to Air Quality Limit Value, 2000

9-Meteorology

The meteorological data collected as part of the EIMP Programme will be disscussed in the following section.

Meteorology is being measured at the following sites: Abbassyia, Tabbin, Shoubra, Giza, Aswan, Assuit1, IGSR Reg. and Mansura.

9.1) Winds

Figure (8-A) to (8-D) show the wind direction frequency distribution for selected sites during the year of 2000.

The most prevailing wind direction is from north in Greater Cairo area but this direction is shifted little to north west in Alexandria and Delta.

Wind from north occurred during 65% of the time at Abbassya, 74% of the time at Tabbin, 49% of the time at Shoubra, 66% of the time at Giza, 33% of the time at Aswan, 58.4% of the time at IGSR Reg. And 96% of the time at Mansura station.

The wind direction at Mansura station can be taken as good indication to proof that mainly the high concentrations of pollutants in Cairo during episodes are coming from Delta area.

The highest wind speed occurred at Tabbin, Shoubra and Giza exceeding 10m/s. The average wind speed as a function of wind direction are presented in figure (9-A) to (9-C).

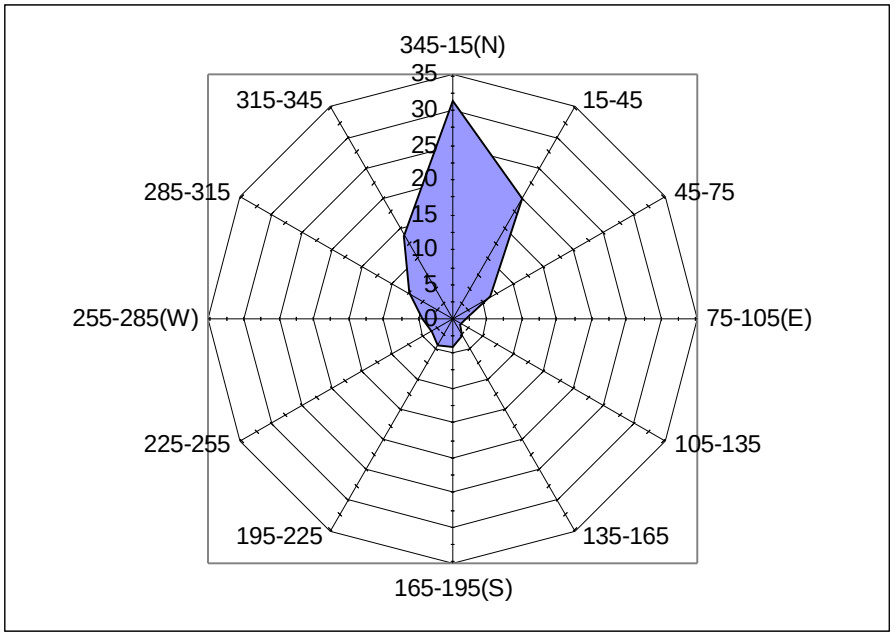


Figure 8 (A): Wind Direction Frequencies (%) for Twelve 30-Degree Sectors Measured at Abbaseya

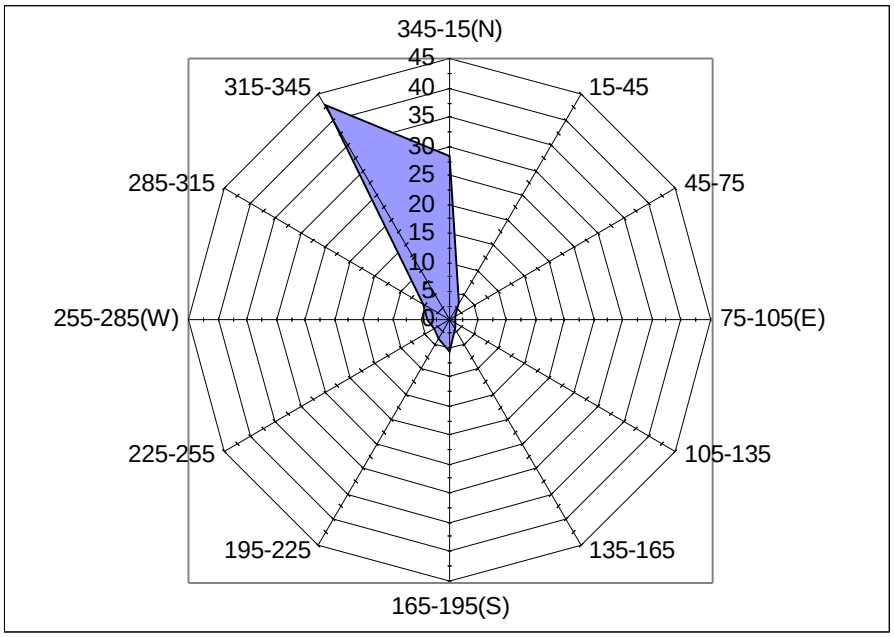


Figure 8 (B): Wind Direction Frequencies (%) for Twelve 30-Degree Sectors Measured at Tebbin

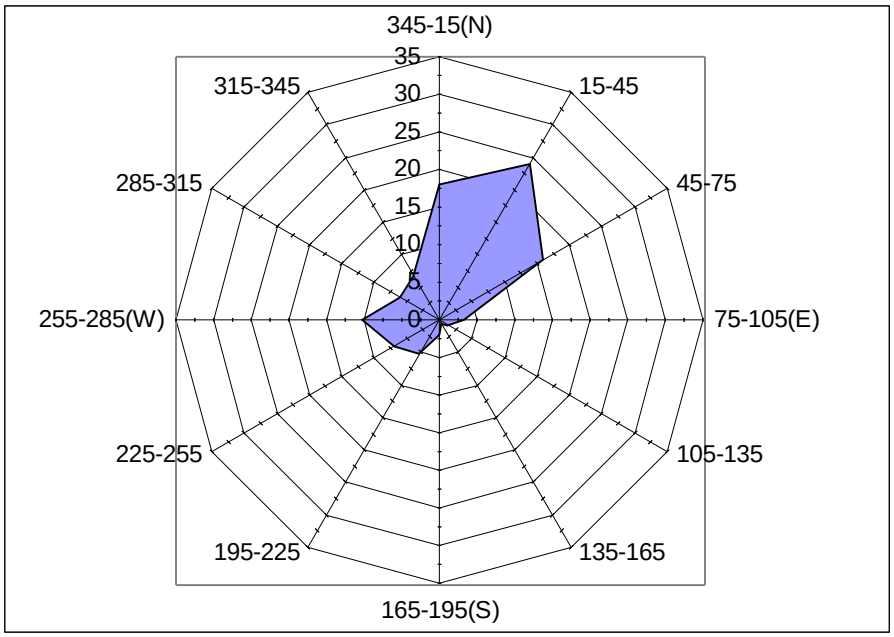


Figure 8 (C): Wind Direction Frequencies (%) for Twelve 30-Degree Sectors Measured at Shoubra El-Kheima

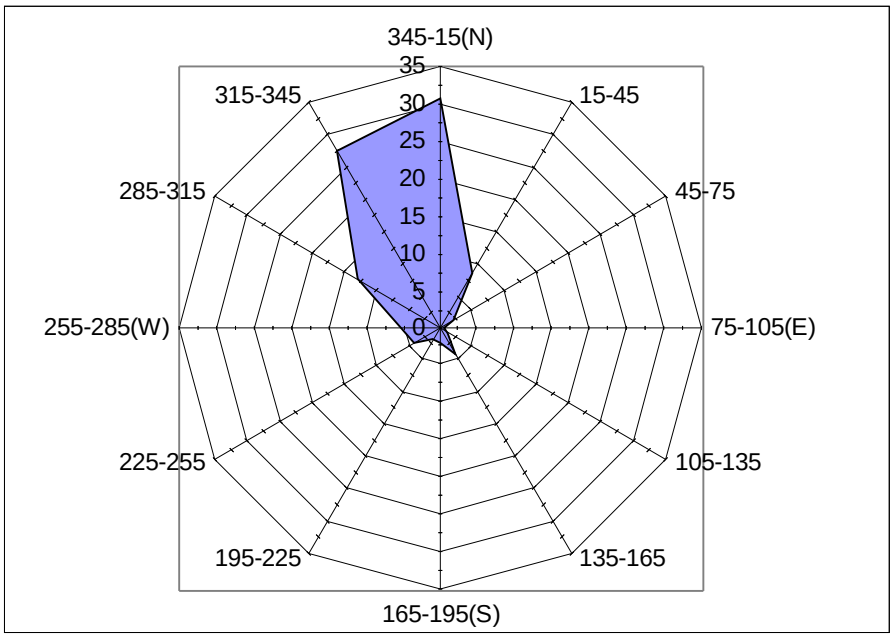


Figure 8 (D): Wind Direction Frequencies (%) for Twelve 30-Degree Sectors Measured at Cairo University

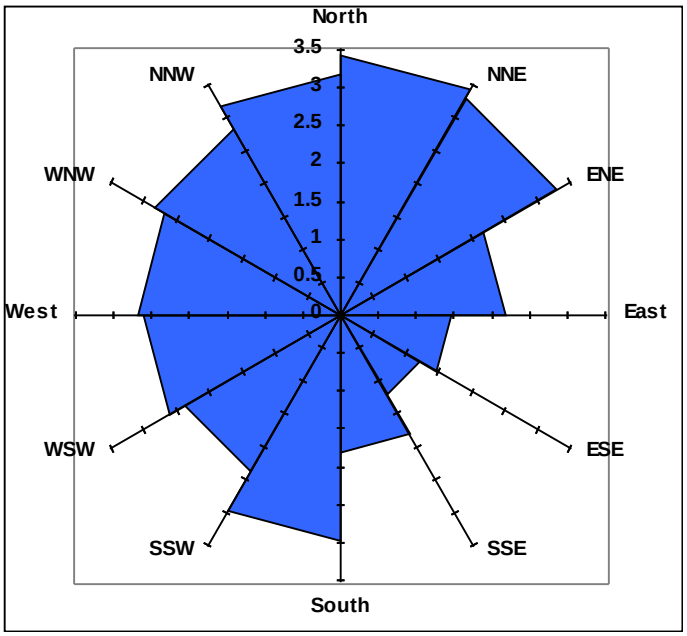


Figure 9 (A): Average Wind Speed (m/s) for Twelve 30-Degree Sectors Measured at Abbaseya

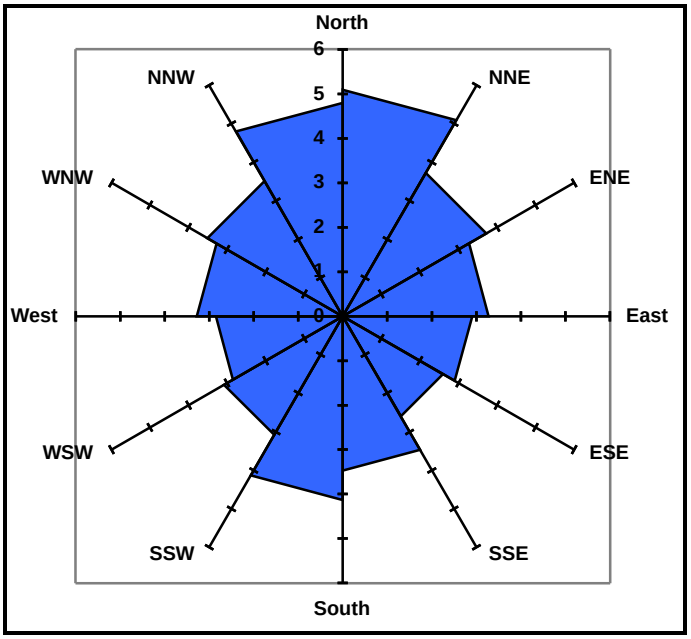


Figure 9 (B): Average Wind Speed (m/s) for Twelve 30-Degree Sectors Measured at Tebbin

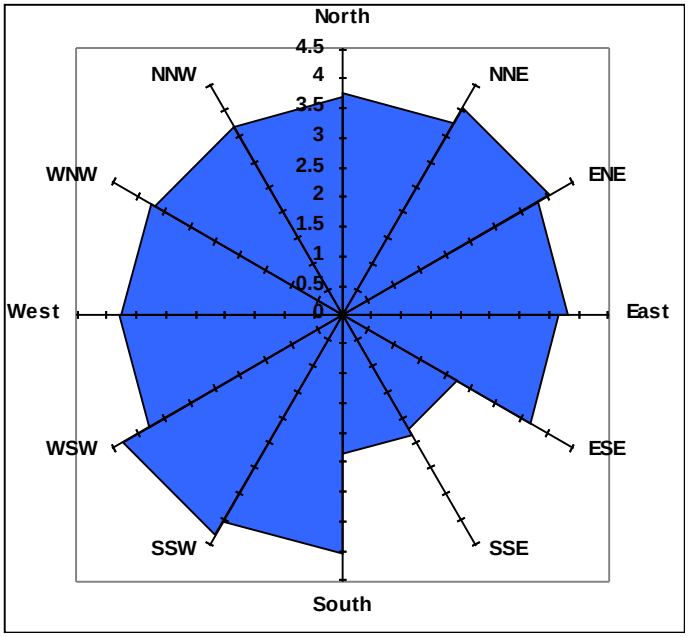


Figure 9 (C): Average Wind Speed (m/s) for Twelve 30-Degree Sectors Measured at Shoubra El-Kheima

Wind rose plot

Wind rose has been calculated and plotted at selected sites operated under the programme. The following figures showes the wind rose at Shoubra, Abbassyia, Tabbin and IGSR.

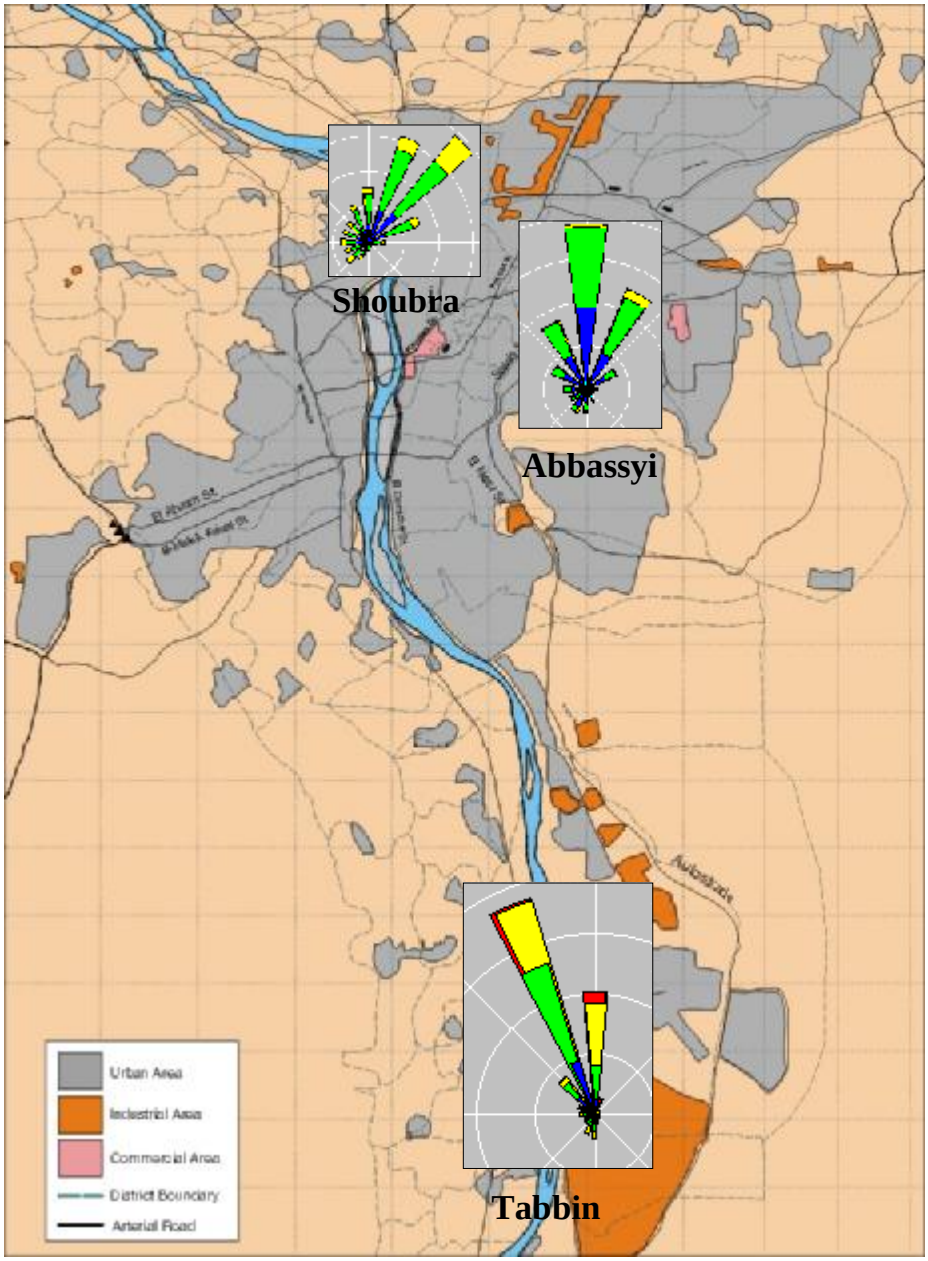


Figure10 : the plot of wind rose at Shoubra, Abbassyia and Tabbin

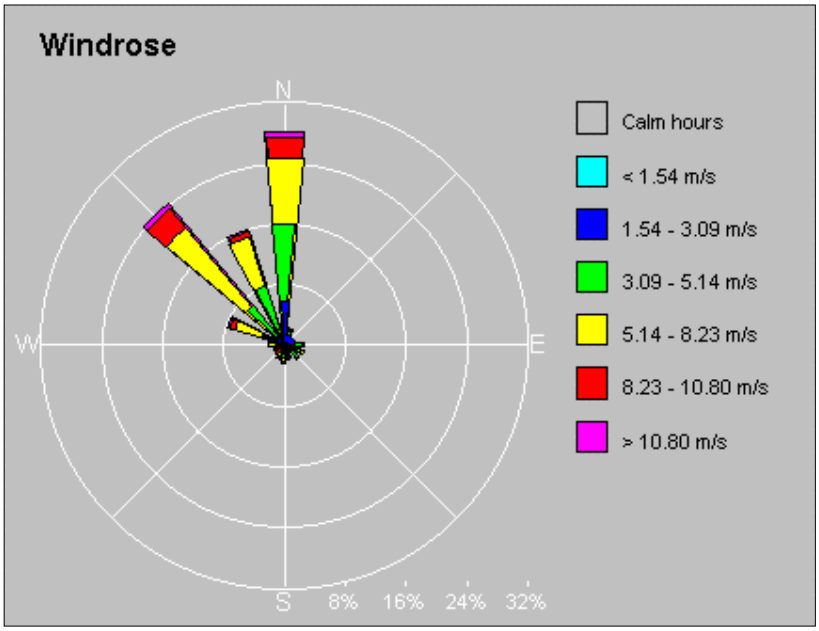
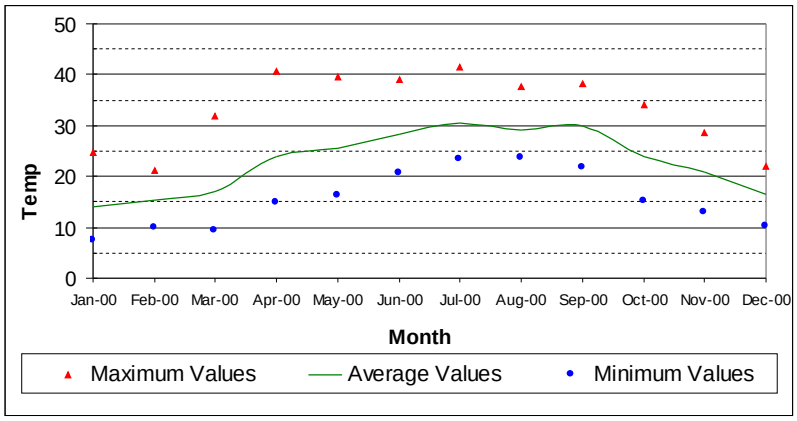


Figure11 : the wind rose at Alexandria as measured in IGSR station.

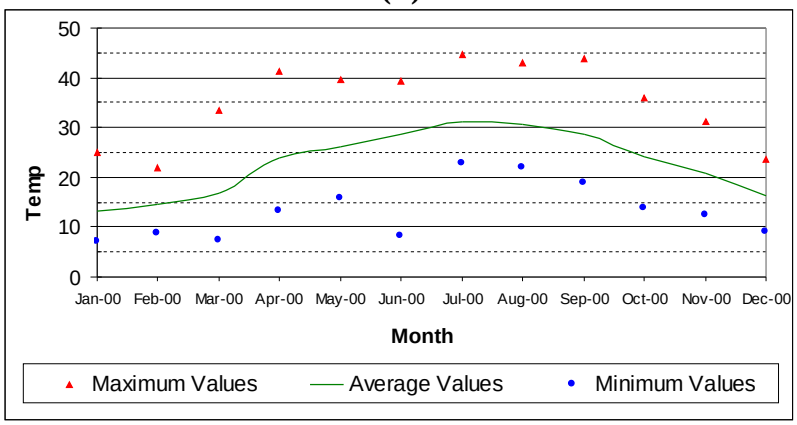
9.2-Temperature

Monthly average,maximum and minimum temperatures in Cairo are presented in the figure (12-A) to (12-C) showing that the highest temperature in 2000 was 45°C on 5 July 2000; the minimum temperature recorded was 7°C on 28 January 2000. The annual average temperature was 25°C.Temperature in Alexandria is slightly lower comparing to the temperature in Cairo where the maximum recorded temperature was 31°C , the minimum was 8°C and the average was 19°C.

(A)



(B)



(C)

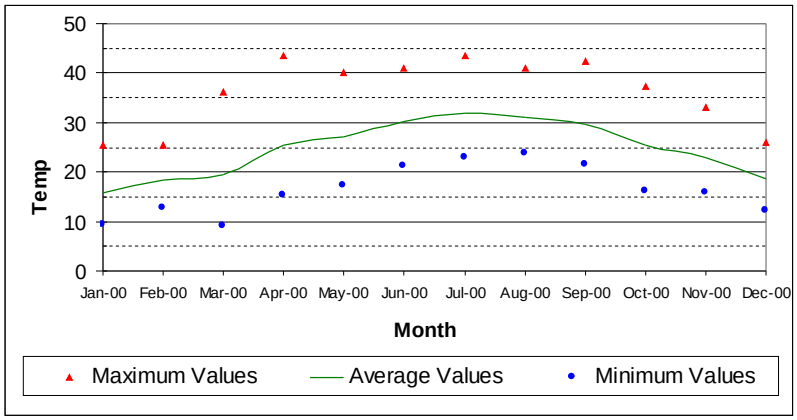


Figure 12: Monthly Temperature Statistics Showing Average, Maximum, and Minimum Temperature for each Month at
(A) Abaseya, (B) Tebbin, and (C) Giza-Cairo University, 2000

10) Sources of Pollution comparing to wind directions in industrial sites

The source of SO_2 concentrations in Shoubra station is mainly from north west which is the location of electrical power plant . There is high concentrations occurred only when the plant use mazoot as burning fuel when it has shortage of Natural gas.

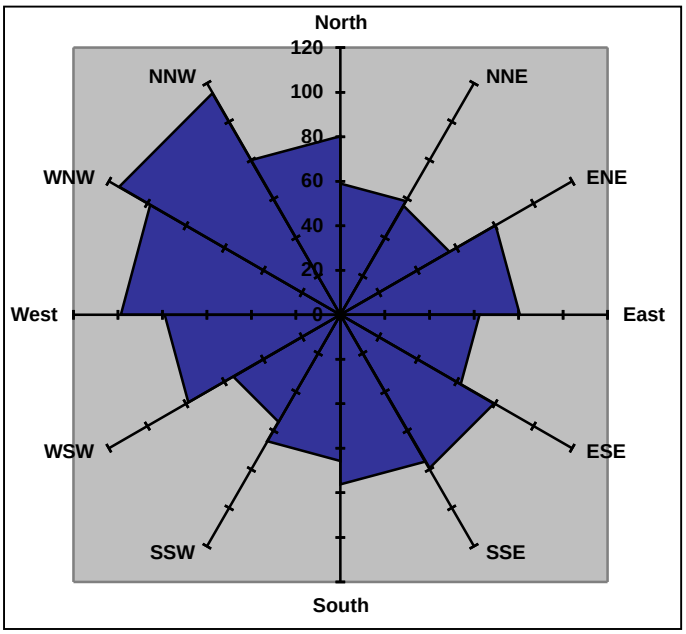


Figure13: Breur diagram for SO_2 concentrations measured at shoubra station during 2000

PM_{10} concentrations in Tabbin area have generated by brick factories located in Arab Abu Saed area (south of the station) which has been approved by the wind direction in the breur diagram shown below.

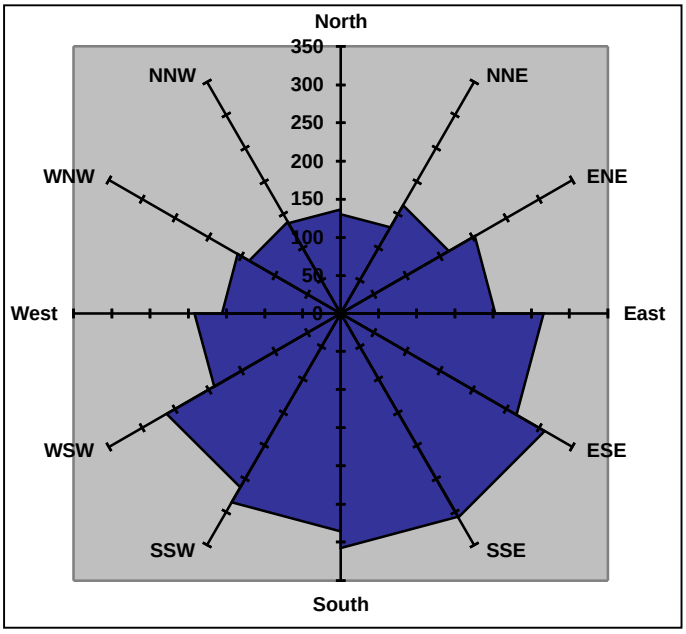


Figure14:Breur diagram forPM_{10} concentrations measured at Tabbin during 2000

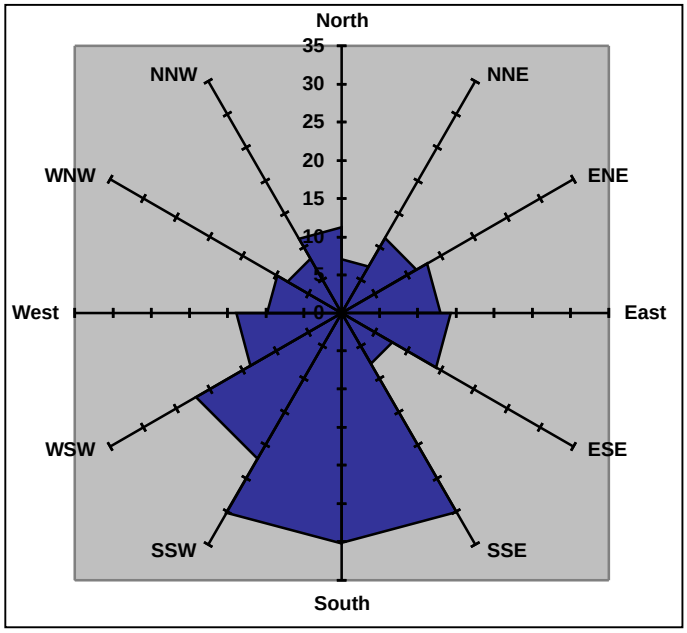


Figure15: Breur diagram for SO_2 concentrations measured at Mansura station during 2000

Figure (15) shows the breur diagram of SO_2 at Mansura station.the figure shows that the high concentrations of SO_2 are coming from south where down town of Mansura city is located, this indicate that the high concentrations of SO_2 in Mansura city are mainly from high traffic at the down town.

11-Conclusion

By comparing the measured concentrations of the Air Quality Paramters measured under EIMP Programme during year 2000 we can see that:

1-PM_{10} is still the most critical problem facing Egypt. It still giving very high concentrations which can reach 6 times the Air Quality limit value as daily average this may be due to the high background in Egypt which is mainly generated by wind blown dust.

2-highest concentrations of PM_{10} are found in industrial and traffic areas.

3-SO_2 concentrations are not so high but it can exceed the Air Quality Limit value under certain coditions.

4-NO_2 are giving low concentrations comparing to the other paramters.

5-CO concentrations are exceeded in street canyon and traffic areas mainly during traffic jamming.

6-The greatest number of exceedances for O_3 occurred at the background site of Ras Mohamed.