



1 Air Pollution

Introduction

Clean air consists of many gases, most important of which are Nitrogen and Oxygen; they represent around 78% and 21% of air weight respectively, in addition to some other gases that exist in small amounts such as Carbon dioxide, helium, neon, argon and others. Life on earth depends on this natural composition of air

Air is considered polluted if it undergoes a change in its composition, or if it contained other impurities or gases in amounts harmful to the life of organisms inhaling it or living on it. Air pollution occurs either due to natural factors or as a result of different human activities. In the former case (for example, dust emissions by storms such as Khamasin and others) where pollution is transient with limited impacts and returns back to its normal state quickly after the departure of such natural factors. While in

the latter case, air pollution continues with the continuity of different human activities, and its sources are usually divided into two types: stationary sources (such as factories, power plants operating on fossil fuel, open burning of wastes...etc.) and mobile sources (different means of transport using gasoline or gas as fuel).

Egyptian industry consists of mining industries (extracting crude oil and natural gas and some crude minerals), and processing industries consisting mainly of: food products industry (37% of total processing industries added value), spinning and weaving industry (21%), metallurgical and engineering industry (20%), chemical and pharmaceutical industries (14%), construction materials and theramics industry (8%).

Type and volume of pollutants emitted from industry differ widely from one in-

dustry to another and depend on many factors, most significant of which are:

1. Industry type;
2. Facility size, age, and maintenance system;
3. Factory work system and production quantity;
4. Technology used in industrial processes;
5. Fuel type and primary materials used;
6. Availability and efficiency of different pollutants prevention methods.

As for the transport sector, passengers and goods transport by land routes is of the most frequently used types of transport in Egypt. Expansion of land transport during the last decades led to high rates of increased number of cars in Egypt. In 31/12/2006, the number of registered vehicles in Arab Republic of Egypt governorates, according to the Central Agency for Public Mobilization and Statistics (CAPMAS) has reached 3,953,811 vehicles versus 3,662,888 vehicles end of December 2005, i.e. a 7.95% increase in one year. Governorates with the largest number of vehicles are Cairo (29.5% of total registered vehicles in Egypt until last December 2006), Alexandria (12.9%), Giza (12%), Sharqya (4.7%), Daqahlia (4.5%), El Gharbya (4.1%) and Qalubia (3.3%). It is estimated that there are 2 million vehicles in Greater Cairo area. Table (1-1) shows the main types of registered vehicles in Cairo governorates only until last December 2006.

Table (1-1) types of registered vehicles in Cairo governorate Until last December 2006

Type of vehicle	Numbers of vehicles	Percentage
Private	796692	68.4%
Taxi (all types)	72091	6.2%
Buses (all types)	30099	2.6%
Trucks	110851	9.5%
Tractors	442	0.04%
Motorcycle	121854	10.5%
Public and government sector	33208	2.8%
Total	1165237	100%

Source: Central Agency for Public Mobilization and Statistics (CAPMAS)

Common pollutants emitted from these sources are Sulfur and Nitrogen oxides, Total Suspended Particles (such as dust, smoke, different chemical compounds sprinkles), Carbon monoxide, and Hydrocarbon. However, the distance of pollutants emitted in the air differs from one place to another according to its natural and chemical characteristics and the weather circumstances prevailing around the pollution sources; wind speed in some areas could help carry and spread the pollutants to far distances, thus help reduce its concentration. Thereby, pollutants concentrations in the air do not depend on the amount emitted only, but on the weather circumstances surrounding the sources as well. Additionally, some natural and chemical interactions may often occur between some pollutants, which may increase or decrease the acuteness of the effects. For example, Sul-

fur oxides interacts with the water vapor to form Sulfuric acid which may agglutinate to the acute particles suspended in the air, and NO₂ interact with Hydrocarbons under the sun light and certain weather circumstances to form a number of poisonous chemical compounds such as the ground Ozone. Some pollutants may also concentrate around its emission sources; For example, some chemical compounds may concentrate in the air around some industries (organic compounds around Petrol refinery, Cement dust around cement factories, Lead around lead foundries...etc.). Some insecticides concentrate in the air in the areas neighboring agricultural fields sprayed with insecticides.

Air Quality in 2006

Concentrations of different pollutants in air – as abovementioned – depend on their natural and chemical characteristics and on prevalent weather conditions around pollution sources. Thus, pollutants' concentrations in air differ from one city to another according to their geographical location, size and type of industry in and around it,

traffic movement and other factors that affect the type, amount and destination of pollutants. Pollutants' concentrations inside the city also differ from one place to another. They reach their maximum in industrial areas, and are less in residential areas located far from pollution sources.

For identifying air quality, EEAA is monitoring key pollutants in ambient air by 54 monitoring stations established under The Egyptian-Danish Environmental Information and Monitoring Project. Twenty Seven of these stations are equipped with automatic monitoring devices, while the other 27 stations are equipped with sampling equipment for further analysis. Monitoring stations monitor one or more pollutant, e.g. Sulfur dioxide is monitored by 24 automatic stations and 12 sampling stations, while inhaled particulates less than 10 micron (PM₁₀) are monitored by 14 automatic stations and the 27 sampling stations. As for Nitrogen Oxides, they are monitored by 18 automatic stations and 7 sampling stations. Table (1-2) shows the distribution of air pollutants monitoring stations country-wide.

Table (1-2) Monitoring Stations and Site Types

Distribution of Operating Stations						
Site Type	Cairo	Alexandria	Delta	Upper Egypt	Sinai and Canal Cities	Total
Industrial areas	4	3	3	3		13
Urban areas	2	1	3	7		13
Residential areas	6	2	2	2		12
Traffic dense areas	5			1		6
Remote areas	1	1		1	1	4
Areas of mixed use	2	1	2	1		6
Total	20	8	10	15	1	54

Map (1-2) shows the Greater Cairo map with 20 monitoring stations monitoring chest dusts and Lead pollutants.



1 – Sulfur dioxide (SO₂)

SO₂ is often a product of oxidizing sulfur residues of liquid petroleum fuel during combustion in the stationing sources or the mobile sources, especially those operated by solar.

Using mazot as a fuel in industrial operations causes the emission of Sulfur oxides largely in the air due to increase of sulfur substance in mazot.

Monitoring results indicated that average Sulfur oxide concentrations in the air per day in Greater Cairo were high (exceeded the limit defined which is 150 microgram/square meter) during few months in 2006 and in some stations (three months on El Qalaly station, six months in Shoubra EL khaima station). Generally, there is improvement in SO₂ concentrations in comparison with year 2005 in all monitoring stations in Greater Cairo, except for Shoubra El khaima which became worse than it was in 2005; this situation needs to be checked at the table (1-3).

Figure (1-1) shows average annual SO₂ concentration during 2005 and 2006.

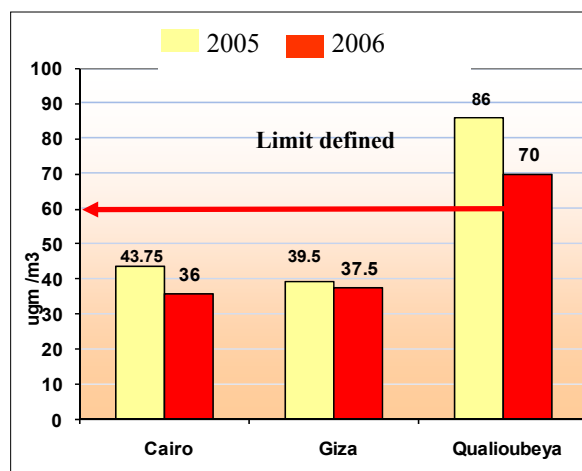


Figure (1-1) Annual Sulfur Dioxide Average Concentrations in Greater Cairo 2005-2006

Table (1-3) annual average of SO₂ concentration in Greater Cairo During 2005-2006 (µg/m₃)

Station		Months											
		1	2	3	4	5	6	7	8	9	10	11	12
Qulaly	2006	160	100	108	104	42	92	81	177	241	123	158	158
	2005	132	163	199	248	185	256	276	133	101	136	186	140
Nationwide	2006	123	151	70	75	111	43	61	41	74	131	128	188
	2005	124	285	66	154	70	107	79	54	72	129	186	119
Abassya	2006	95	78	81	40	41	48	44	32	43	62	64	107
	2005	89	83	115	134	72	69	62	36	52	70	216	90
Maadi	2006	83	77		15	6	28	24	59	40	54	62	59
	2005	27	29	42	60	40	57	70	43	60	41	50	56
Tibbeen	2006	43	27	58	79		39	47	33	55	111	125	111
	2005	126	54	86	58	59	31	23	25	62	33	41	22
Fum El-Khalig	2006	44	84	78			49	41	37	60	73	90	118
	2005	88	104	96	115	96	42	33	61	56	56	182	
Shubra El-Khaima	2006	145	99	84	281		274	126	172	195	180	115	253
	2005	151	128	98		128	180	153	110				164
Giza	2006		114	100	98		50	71	72	57	59	47	107
	2005	18	69	83	109	86	128	105	48	52	31	43	44

Black squares: measures NA

Grey squares: concentration exceeds permissible limit (150 µg/m₃)

Annual average concentrations of Sulfur Dioxide in air in all monitoring stations Gumhureya - table (1-4) – witnessed increased concentrations in 2006 in Tibbin, Fum El-Khalig, 10th of Ramadan, Luxour, Asafraa, Kafr El-Zayat, Tanta, Mahalla Kobra, Mansoura and Damietta as compared to 2005. However, concentrations in all cases did not exceed permissible limit (60 µg/m³). Although SO₂ concentrations in Kulaly, Shubra El-Khaima and Kom Ombo in 2006 were less than that of 2005,

concentrations are still higher than permissible limit. SO₂ concentrations significantly decreased in Suez, Aswan, Max and Beni Sueif.

Table (1-4) annual average of SO₂ concentration in air During 2005-2006 ((μg/m₃))

Station	2005	2006
Qulaly	121	84
Nationwide	59	52
Abbassya	36	32
Nasr City	12	13
Maaddi	27	25
Tebbeen	19	31
South Tebbeen	14	12
Fom El-Khalig	40	43
Shoubra El-Khaima	86	70
Giza	29	27
6 th Oct.	5	5
10 th Ramadan	5	8
Suez	20	9
Luxour	11	15
Koum Ombo	89	92
Aswan	35	13
Shohadaa'	16	27
Max	26	8
Alexandria 1	13	9
A'safraa	3	5
Ghaiset El-Enab	8	7
Kar El- Zaiat	24	25
Tanta	5	6
Mahalla Kobra	4	9
Mansoura	8	12
Damietta	3	5
Kafr El-Dawar	6	7
Giza, Koleyet El-Zeraa (Faculty of	50	48
Heliopolis	36	32
Bani-Sweif (down town)	41	30
Bani-Sweif (Government Bldg)	32	24

Figure (1-2) shows SO₂ concentration annual average in all monitoring stations during 2006.

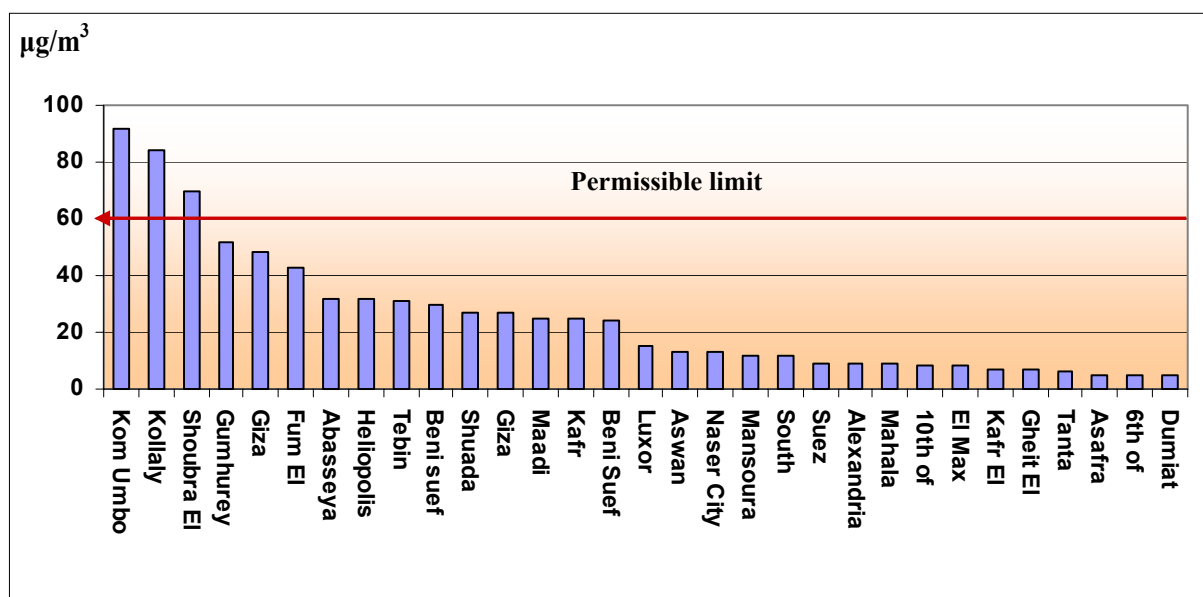


Fig (1-2) annual Average SO₂ Concentration during 2006

Figure (1-3) shows the annual average of SO₂ concentration in some Greater Cairo GC monitoring stations during the period from 1999-2006.

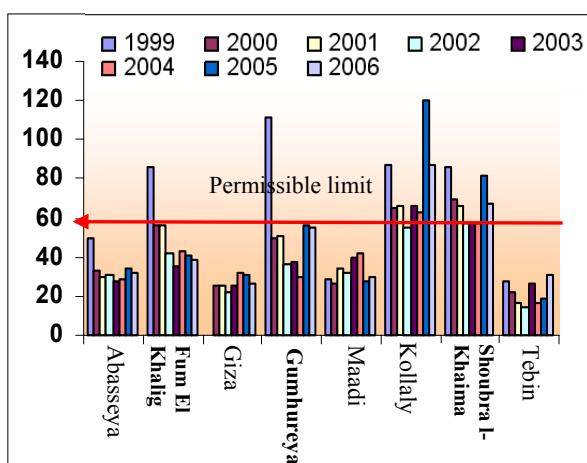


Figure (1-3) annual average of SO₂ concentrations in some Greater Cairo monitoring stations

Figure (1-4) shows as well the monthly average of SO₂ concentration in 2005-2006 in a station at a traffic dense area (Kulaly Square) illustrating the clear improvement in SO₂ concentration in most 2006 months as compared to 2005.

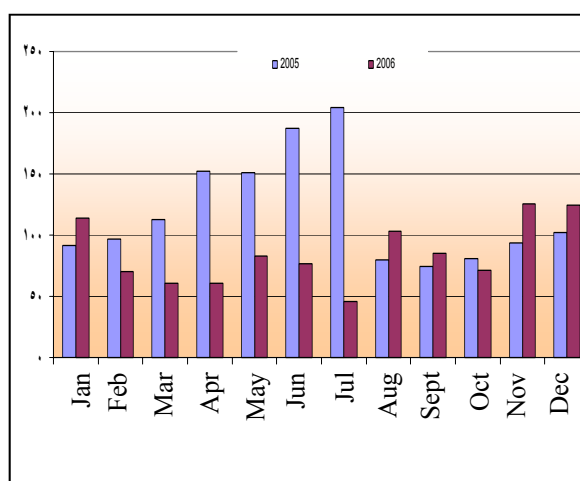


Figure (1-4) monthly average of SO₂ concentrations in 2005-2006 in Kulaly Square (Traffic station)

Figures (1-5, 1-6, 1-7) show a change in SO₂ concentrations in Alexandria, Delta, Suez and Aswan respectively during 2000-2006, illustrating clear improvement in SO₂ concentrations in different areas such as Aswan, Suez, Delta, Mansoura and Alexandria (Oceanography Institute), whereas other station, findings indicate some increases in 2006 compared to 2005.

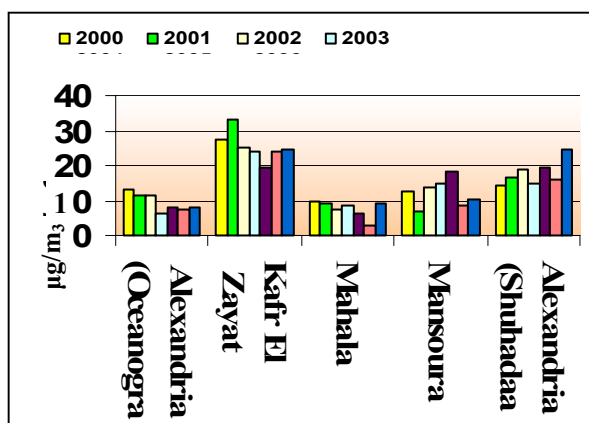


Fig (1-5) average SO₂ concentrations in Alexandria and Delta during 2000-2006

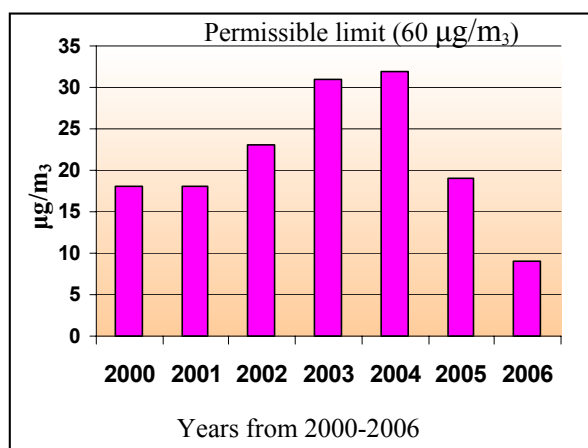


Fig (1-6) average of SO₂ concentration in Suez during 2000-2006

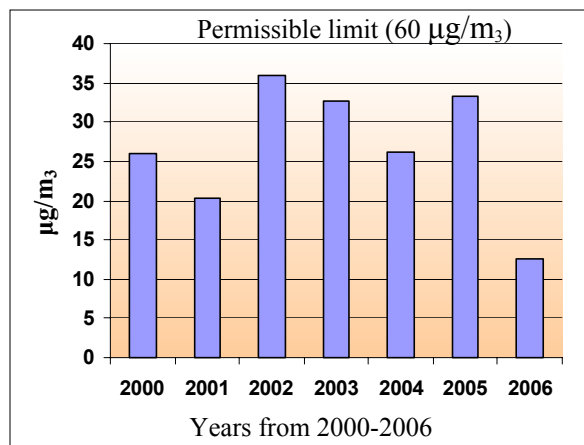


Fig (1-7) SO₂ concentration average in Aswan during 2000-2006

2- Nitrogen Dioxide NO₂

NO₂ produced from fuel combustion under high temperatures as a result of oxidation of nitrogen found in fuel and in the air entering the combustion chamber. About 55% of NO₂ emitted in air are from the exhaust of different vehicles. 2006 monitoring results illustrate that daily NO₂ average concentrations in GC do not exceed the permissible level (150 µg/m³, according to Law 4/1994 executive regulations and WHO guidelines), except in Shoubra El-Kaima Station where NO₂ increased in August 2006. Table (1-5).

Table (1-5) Daily NO₂ average concentrations in Greater Cairo During 2005-2006 ($\mu\text{g}/\text{m}^3$)

Station		Month											
		1	2	3	4	5	6	7	8	9	10	11	12
Qulaly	2006	70	114	121	110	84	90	103	107	126	97	99	188
	2005	106	138	115	99	92	97	98	77	90	90	146	122
Nationwide	2006	63	72	78	95	63	65	69	109	120	97	90	81
	2005	76	104	58		102	101	82	73	96	67	156	97
Maadi	2006	77	69			6	114	76	57	68	77	83	83
	2005						59	65	59	62	57	95	144
Tibbeen	2006	18	56	58	42	34	42	32	22	30	36	81	73
	2005	89	69	61	58	46	37		29				
Fum El-Khalig	2006	49	135	144	145	122	110	115	109	100	93	104	124
	2005	75	93	69	90	83			78	126	95	58	
Shubra El-Khaima	2006	113	85	49	41	28	48	40	169	37	39	13	
	2005	102	64	46		65	80	55				212	160
Giza	2006	111		68	54	46	36	51	45	69	66	77	123
	2005	106	118	93	121	93	90	62	48	76	72	112	99

Black squares: measures NA

Grey squares: concentration exceeds permissible limit ($150 \mu\text{g}/\text{m}_3$)

Figure (1-8) shows Annual average of NO₂ concentrations Countrywide in 2006. Highest concentrations were recorded at dense traffic areas.

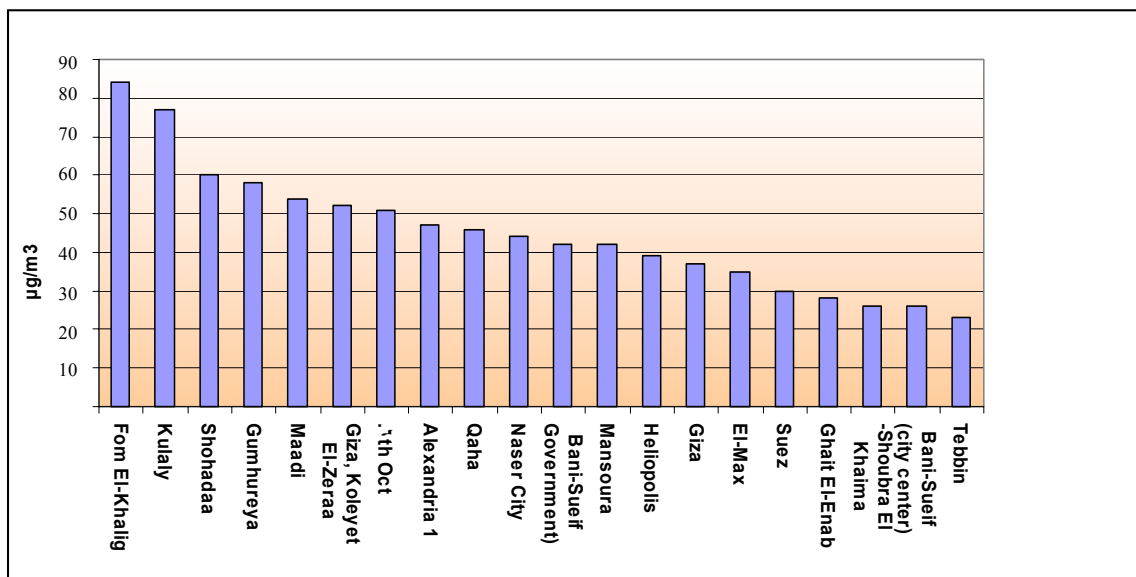


Fig (1-8) Annual average of NO₂ concentrations during 2006

Figure (1-9) shows NO₂ concentration annual average in some Greater Cairo stations during 1999-2006; the state in 2006 is somehow similar to that of 2005.

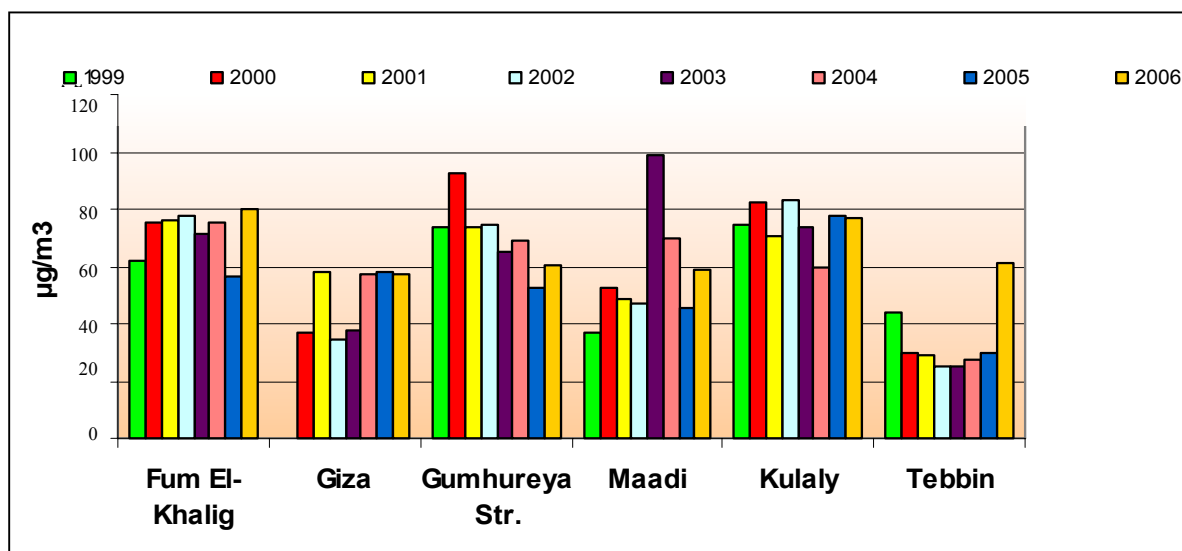


Fig (1-9) Annual average of NO₂ concentration in some Greater Cairo stations during 1999-2006

Figure (1-10) shows NO_2 concentration annual average in Alexandria, Delta, and River Nile during 2000-2006; illustrating that the concentration in 2006 is more than that of 2005 in addition there were no noteworthy improvement in the previous years, this fact leads us to review necessary procedures again.

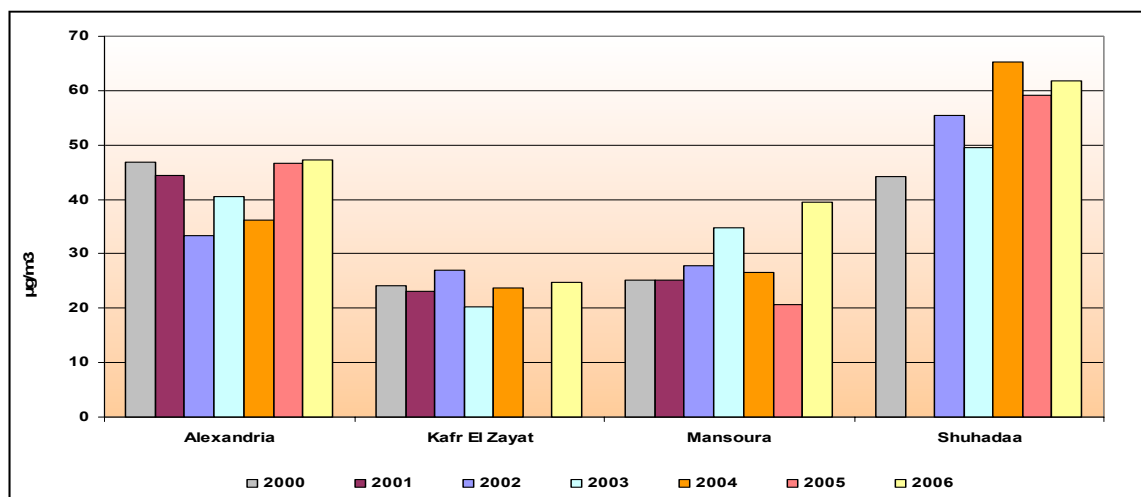


Fig (1-10) Annual average NO_2 concentrations in Alexandria, River Nile Delta during 2000-2006

3- Inhaled Particulates (PM_{10})

Inhaled Particulates (PM_{10}) are parts of total suspended particulates TSP in air. PM_{10} are currently monitored as being the part inhaled by Man which reaches the lungs. Monitoring results showed that daily average of PM_{10} concentrations in all GC stations is higher than the permissible limit ($150 \mu\text{g}/\text{m}_3$, - table (1-6)) according to amendments of Law 4/1994 executive regulations, given that WHO and EU recommended daily average limits are $70 \mu\text{g}/\text{m}_3$ and $50 \mu\text{g}/\text{m}_3$ respectively.

Table (1-6) PM₁₀ concentration in GC (daily average during 2005- 2006 in (µg/m³))

Station		Month											
		1	2	3	4	5	6	7	8	9	10	11	12
Qulaly	2006	450	388	616	370	394	337	192	198	178	333		
	2005	297	199	51	22				76		250	605	408
Abassya	2006	377	338	711	391	376	201	120	164	134	194		
	2005	221	249	284	387	269	120	244	198	186	209	409	384
Tebbeen	2006	424	320	657	543	465	226	182	213		584		
	2005	154	103	139	160	117	69	90	83	270	283	533	627
Fom-Khaleig	2006	527	434	514	66	497	210	264	525	267	297		
	2005	224	222	244	332	163	113	99	99	173	297	831	501
Mo-handseen	2006	282	204	210	213	388	178	125	139	157	186	188	303
	2005				114				197	374	233	369	192
Heliopolis	2006	88	256	655		294	162	159	383	201	184	190	237
	2005	98	57	485	281	463	203	68		200			
Giza (Qoliet Al-Zeraa')	2006	283	327	394	358	365	194	159	198	173	190	187	336
	2005										114		

Black squares: measures NA

Grey squares: concentration exceeds permissible limit (150 µg/m₃)

Table (1-7) shows a comparison between PM_{10} annual average in some stations for 2005 and 2006; PM_{10} annual average in all stations is higher than the maximum limit ($70 \mu\text{g}/\text{m}^3$) stipulated in Law 4/1994 executive regulations.

The table also illustrates the increase in PM_{10} annual average during 2006 as compared to 2005 in more than 60% of the monitoring stations.

Table (1-7) annual average PM_{10} concentration during 2005- 2006 in $\mu\text{g}/\text{m}^3$

Station	2005	2006
Qulaly	129	165
Abassya	118	91
Tebbeen	96	167
Fom Khalig	122	170
Shubra Khaima	131	189
Qaha	99	211
Alex. 1	101	97
Kafr Zaiat	132	132
Tanta	153	141
Kafr Dawar	124	154
Kom Ombo	270	214

Figure (1-11) shows the annual average of inhaled particulates (PM_{10}) in GC during 2005-2006 showing increased concentrations in 2006 compared to 2005 except for Abbaseya area.

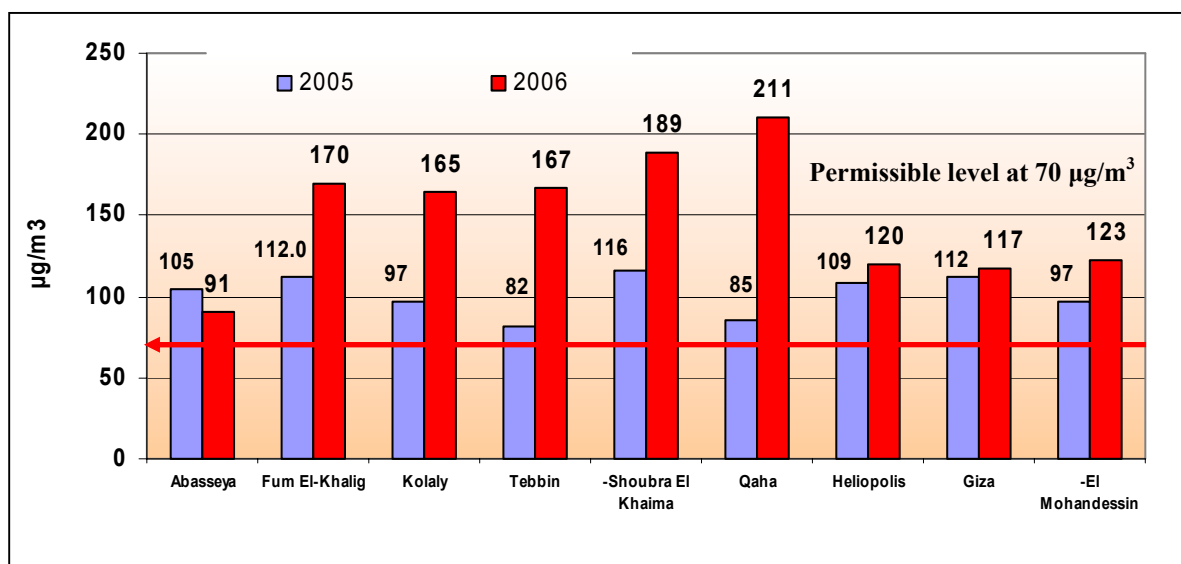


Fig (1-11) Annual average chest dusts up to 10 microns in GC during 2005-2006

Fig (1-12) provides a comparison between inhaled particulates concentrations less than $10\ \mu$ and less than $2.5\ \mu$ in Greater Cairo during the period from 1998 to 2006. This indicates significant improvement in these concentrations except for particulates less than $2.5\ \mu$ in 2006, which showed slight increase than 2005.

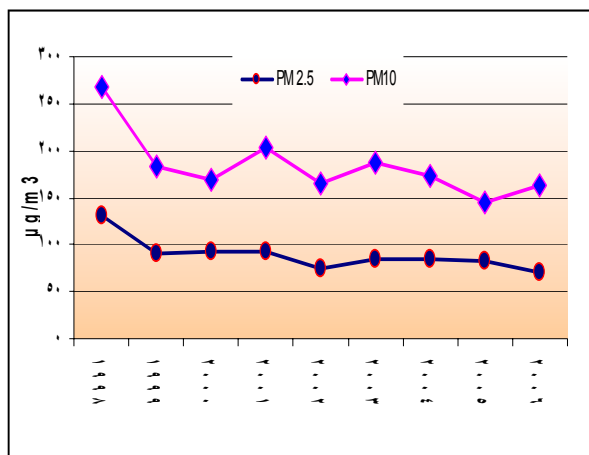


Fig. (1-12): Comparison between inhaled particulates (PM₁₀) (PM_{2.5}) concentrations in Greater Cairo during several years from 1998 to 2006

Fig. (1-13) shows the annual average of inhaled particulates up to $10\ \mu$ in Alexandria station during 2000 – 2006.

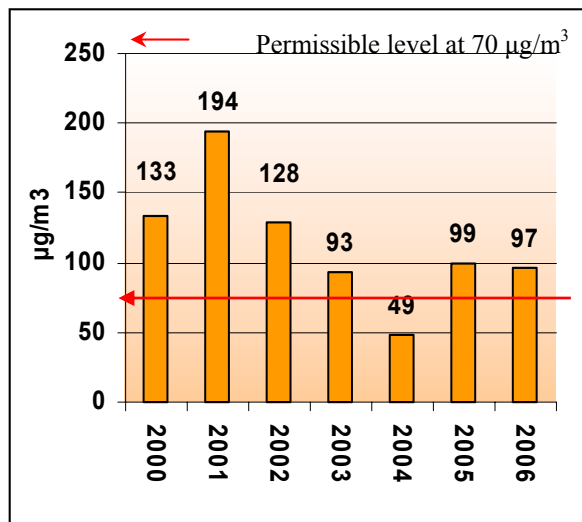


Fig. (1-13): Annual average of suspended dust particulates up to $10\ \mu$ in Alexandria station during 2000 – 2006

Fig. (1-14) shows the annual average of inhaled particulates up to $10\ \mu$ in Canal and Sinai area during 2000 – 2006 showing significant increase in 2005 and 2006 compared to

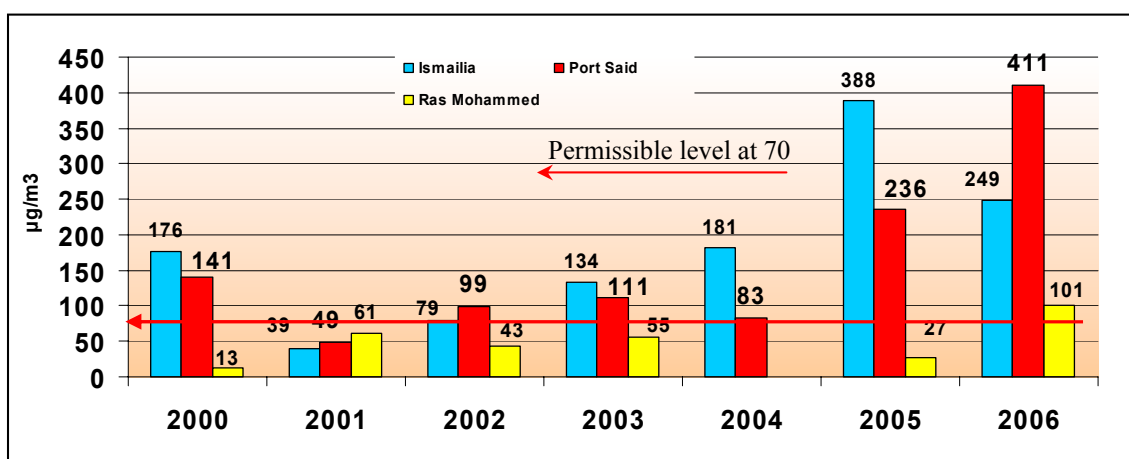


Fig. (1-14) shows the annual average of suspended dust particulates up to $10\ \mu$ in Canal and Sinai area during 2000 – 2006

4- Smog (Black Smoke)

Smog monitoring results showed that its concentrations in air during 2006 did not exceed permissible level of annual average provided for in the Executive Regulations of Law 4/1994 except in Kom Umbo and Gheit El-Enab (Alexandria) (Fig. 1-15).

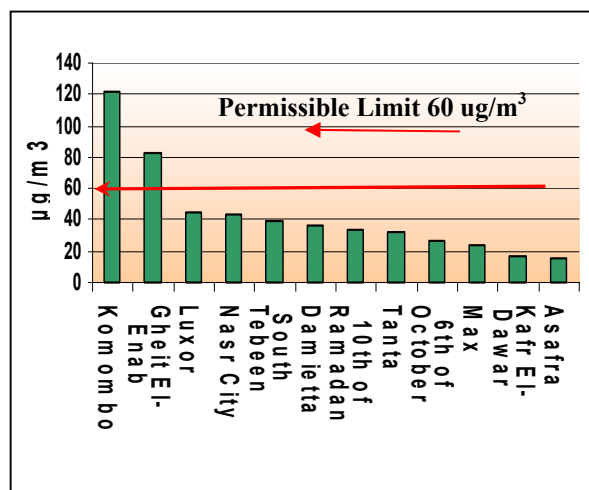


Figure (1-15) Annual Average of Smog Concentrations in some monitoring sites in Egypt during 2006

Comparing 2005 and 2006 results, it was clear that smog concentrations were less during 2006 than 2005 in most sites except Gheit El-Enab, Asafra, and Nasr City (see Fig. 1-16).

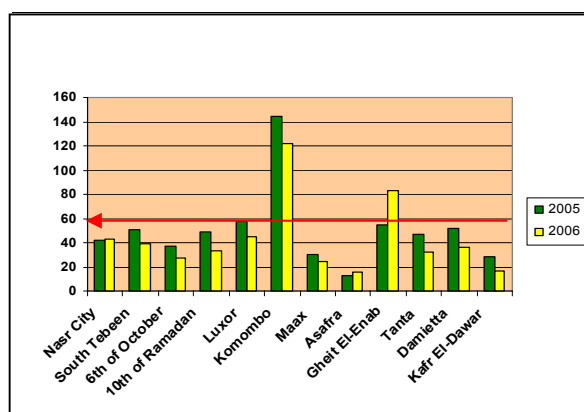


Figure (1-16) Annual Average of Smog in Some Monitoring sites in Egypt during 2005 and 2006

Figure (1-17) shows the annual average of smog in some monitoring stations in Greater Cairo area during 2006 indicating that it exceeds permissible limits in 50% of stations.

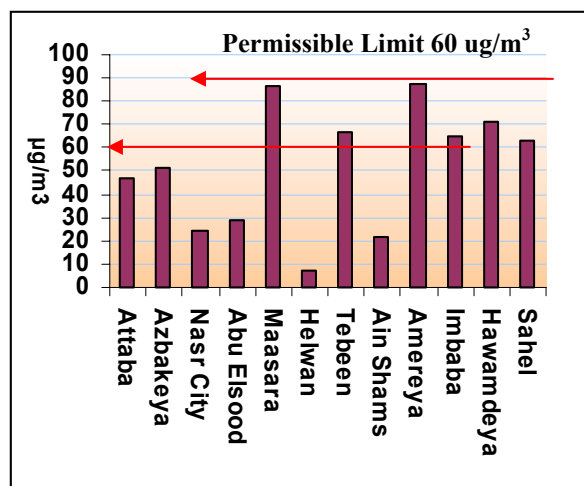


Figure (1-17) Annual Average of Smog Concentration in some monitoring stations in Greater Cairo During 2006

5. Lead

Monitoring results show that lead concentrations have decreased during 2006 compared to 2005 in Greater Cairo (see Table 1-8 and 1-18). This decrease is the result of the relocation of most lead smelters outside residential agglomerates and cleaning up five smelter sites. Highest lead concentrations in 2006 were recorded in Shubra El-Kheima Industrial Area ($1.37 \mu\text{g}/\text{m}^3$).

Table (1-8) Annual Average of Lead Concentrations during 2005 and 2006 ($\mu\text{g}/\text{m}^3$)

Area	2005	2006
Industrial Areas	2.31	0.73
Residential Areas	1.01	0.59
Traffic Areas	1.09	0.68

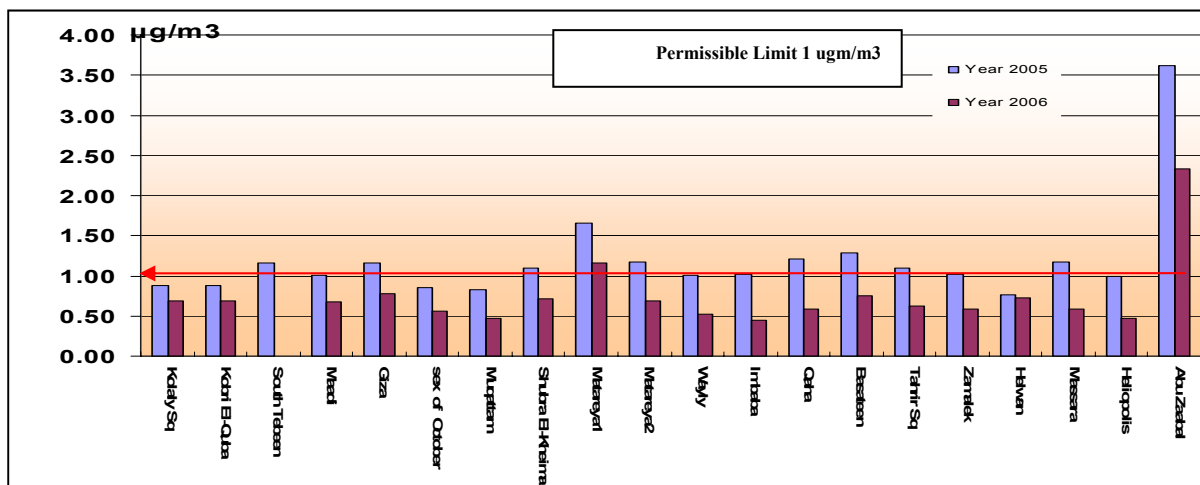


Figure (1-18) Annual Average of Lead Concentrations during 2005 and 2006

Figure (1-19) illustrates lead concentrations change rate in inhaled particulates up to 10 µ during 1999–2006 (annual average for Greater Cairo). Significant improvement in these concentrations during this period could be noticed.

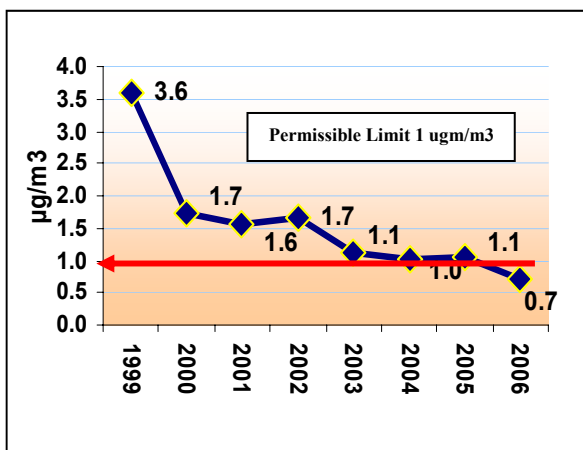


Figure (1-19): Change Rate of Lead Concentrations in Inhaled Particulates PM₁₀ during 1999-2006 (Annual Average for GC)

6. Ozone

Ozone is formed in the troposphere as a result of the reaction of pollutants emitted from transportation means or appliances containing hydrocarbons (Freon) used in manufacturing refrigerators, ACs, and other industries. Ozone is considered a hazardous component to human health.

Environment Law Executive Regulations do not stipulate any daily, monthly, or annual limits of Ozone concentrations.

Environment Law executive regulations specify the maximum limit of exposure to surface Ozone to be one hour and not to exceed 200 µg/m³. Permissible limit during 8 hours should not exceed 120 µg/m³.

Figure (1-20) shows the annual average of Ozone concentrations during 2005 and 2006.

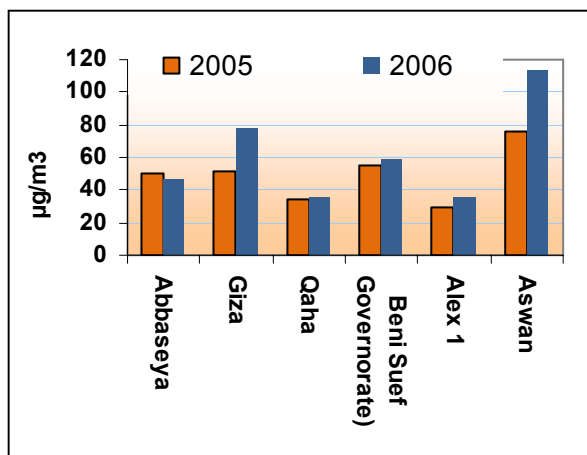


Figure (1-20) : Annual Average of Ozone Concentrations during 2005 and 2006

The above figure shows that Ozone concentrations have increased (as an annual average) in all sites in Egypt, except for Abbaseya station. The only reason for this increase is the significant increase in the number of vehicles during 2006.

7. Carbon Monoxide Gas

Carbon monoxide (CO) is emitted from vehicle exhaust and burning coal or wood in heaters. It is considered one of the most dangerous and toxic pollutants affecting both human beings and animals. CO reacts with hemoglobin forming carboxi-hemoglobin preventing oxygen from combining with hemoglobin, depriving the body from oxygen resulting in suffocation.

Environment Law executive regulations stipulate that the maximum permissible limit of exposure to CO for one hour and

eight hours is 30 mg/m^3 and 10 mg/m^3 respectively. The Executive Regulations do not specify any daily, monthly, or annual limits for CO concentrations.

Figure (1-21) clarifies the annual average of CO concentrations during 2005 and 2006 in the three working stations measuring CO in Egypt. It is clear that concentra-

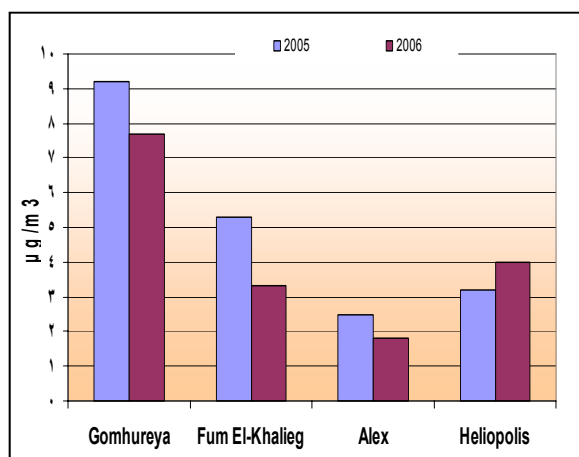


Figure (1-21): Annual Average of CO Concentrations during 2005 and 2006

tions in 2006 were less than those in 2005 in most of the stations. All concentrations are less than permissible limits.

Figure (1-22) shows average CO change per day in Alexandria monitoring station (Institute of Oceanography). Concentration levels monitored during any time of the day did not exceed 4 mg/m^3 ; which is less than permissible limits.

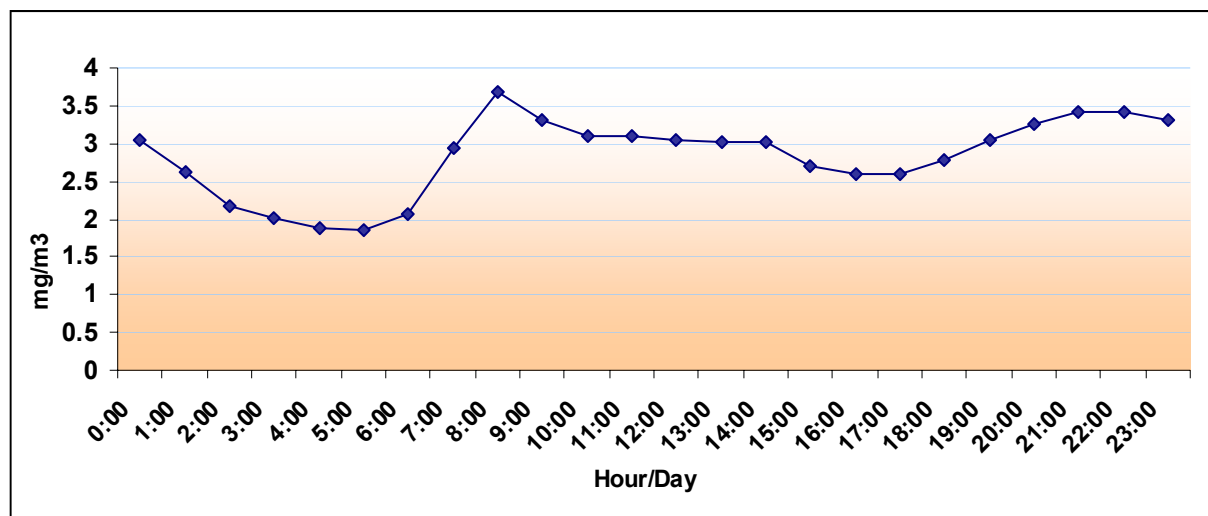


Figure (1-22): Average CO Change rate per Day in Alexandria Monitoring Station (Oceanography Institute)

Severe Air Pollution Episodes (Black Cloud)

In autumn 2006, severe air pollution episodes (black cloud) occurred, repeating annually in autumn since this phenomenon started in 1999. It is well known that these episodes occur due to the accumulation of air pollutants' loads over Greater Cairo coinciding with the meteorological phenomenon known as thermal inversion in autumn. Citizens often feel the accumulation of particulates in air accompanied by the smell of "burning" particularly after sunset till the dawn of the following day. These episodes usually extend for separate periods (days) during September, October, and November.

Results of inhaled particulates monitoring from September to mid-November 2006 show that number of hours during which concentrations exceeded $300\mu\text{g}/\text{m}^3$ have increased in some monitoring stations in Cairo (see Table (1-9)).

Table (1-9): Number of hours during which Concentrations Exceed $300\mu\text{g}/\text{m}^3$ for Suspended Chest Particulates in some Monitoring Stations in Cairo

Area	2005	2006
Kolaly	33	64
Abbaseya	18	28
Tebbin	94	155
Heliopolis	3	25
Muhandeseen	24	34

Considering SO_2 and NO_2 concentrations during the same period, there were no tangible change between 2005 and 2006.

Reasons for high inhaled particulates percentage monitored in October 2006 Compared to October 2005

1. Meteorological Factors

- a. From 1 to 9 of October, 2006, for seven successive days wind direction was North to North-East, wind speed was calm, and burning rice straw was intensified. This led to concentration of pollutants from Delta governorates during this period.
- b. In 12 and 13 of October, 2006, thickness of thermal inversion layer was less than 15 m for 10 and 12 hours, respectively. Accordingly, citizens felt the crisis.
- c. Traffic volume in 22 and 23 of October, 2006, had a great impact in increasing dust concentrations for only two hours (just before Bayram).

2. Human Activities

Increased emission loads lead to polluting the air in Greater Cairo this year compared to previous years due to:

- a. Areas cultivated with rice increased in 2006 compared to 2005 by approx. half million feddans. Total area cultivated by rice was 2 million feddans in 2006, while it had been 1.5 million feddans in 2005. As a result rice straw volume increased by around 1 million tons.
- b. Large traffic jams in various Greater Cairo regions especially after "Iftar" (breaking Fast) till the early hours of the following day. Accordingly, pollutant concentrations increased in stations at dense traffic areas, such as Kolaly and Fum El-Khaleig Squares.

c. Some foreign garbage collecting and cleaning companies stopped working, and garbage accumulated inside residential agglomerates in Cairo and Giza. Accordingly, self burning rates increased producing polluting emissions. This is one of the factors contributing largely to feeling such phenomenon. MSEA, however, made great efforts to collect 15 million tons of historic accumulations surrounding Greater Cairo by the end of 2006.

d. Dumpsites are not tightly controlled. As a result they burn in e.g. El-Wafaa Wal-Amal dumpsite in Cairo and Shubramant dumpsite in Giza.

Results Analysis

1. What Greater Cairo air witnessed during October, 2006, when meteorological factors combined with increased pollution loads from human activities, had a clear impact on feeling such phenomenon. However, MSEA bodies in cooperation with other authorities exerted many efforts to control different pollution sources and reduce the crisis' intensity and duration.
2. These efforts succeeded in limiting the hours during which Greater Cairo was exposed to high pollution concentrations, reaching to just 6% in total monitoring hours during October.
3. These efforts have also participated in reducing concentration intensity during crisis periods preventing them from reaching an alarming state. All concentrations were within average and more than average limits.
4. Monitoring results during Bayram vacation showed significant improvement in pollutant concentrations. This phenomenon could be eliminated and air quality

of Greater Cairo could be improved if pollution loads produced by different pollution sources are decreased, particularly vehicular emissions, open burning of wastes, and industrial emissions.

5. All concerned ministries should collaborate, namely Ministries of Agriculture, Interior, Local Development, Investment, Petroleum, and Irrigation. The objective is decreasing pollution loads from all pollution sources. All ministries should be committed to executing and prioritizing this plan's programs.

Under the Greater Cairo Air Improvement Project, EEAA studies have indicated that air pollution sources in Greater Cairo due to suspended particulates **Under Normal Conditions** are: burning solid wastes, industry, transport, and burning agricultural wastes.

Figure (1-23) represents proportional distribution of each of these sources.

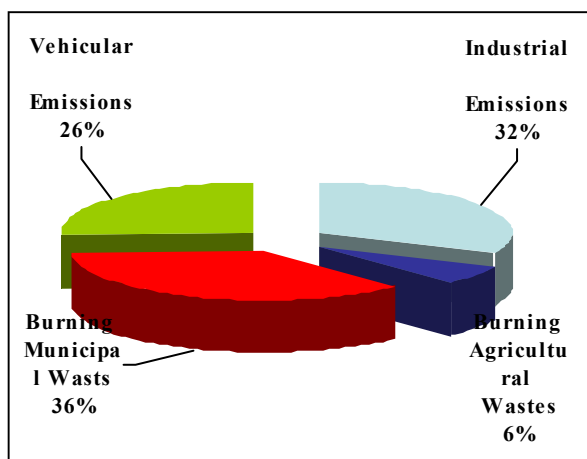


Figure (1-23): Annual Average of Pollution Ratios by Suspended Dust from various sources

A detailed study made through this project during the black cloud of 1999 show that burning agricultural wastes occupied the highest percentage among suspended particulate sources.

Figure (1-24) represents the sources of these particulates in this year during severe pollution period.

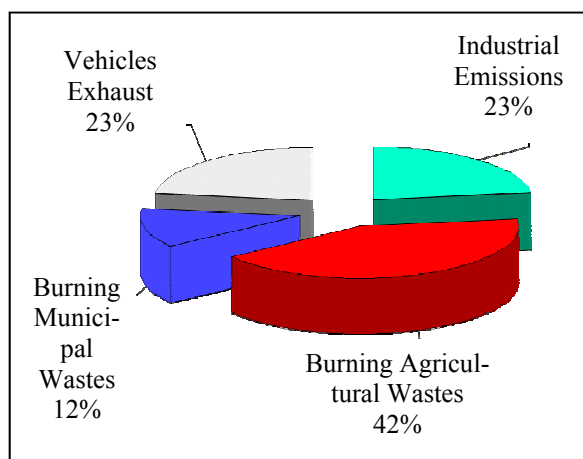


Figure (1-24): Rates of suspended chest dusts pollution from different sources (during severe)

MSEA Air Quality Improvement Efforts

1. Environmental Impact Assessment Studies

Environmental Impact Assessment (EIA) is the regular inspection of unintentional impacts resulting from a developmental project or program. EIA aim is to minimize or mitigate negative impacts and maximize positive impacts. From practical side, this means studying and analyzing the environmental feasibility of a proposed project, since execution and/or operation of this project can affect environment safety, natural resources, and/or human health.

MSEA reviewed 345 major industrial projects to limit negative impacts on air quality which may be produced by these activities (see Table 1.10). This process is among 12,332 EIA studies which were reviewed during 2006 (see Table 1.11).

Table (1-10): Industrial projects with EIA studies reviewed during 2006

Metallurgy Plants	4
Cement Plants	11
Clay Brick Plants	311
Petrochemical Plants	2
Fertilizers Plants	5
Foundries	5
Chemical Plants	7
Total	345

Table (1-11): Number of EIA Studies during 2006

A	8959
B	3193
C	180
Total	12332

2. Cement Factories

MSEA concern to monitor emissions from major industrial sources was one of the most important steps for controlling and preventing pollutants' risks. Accordingly, a national network for monitoring emissions from cement plants and companies was established. This network links self-monitoring systems in these companies with EEAA where emissions are constantly monitored.

Cement industry in Egypt represents an important part of Egyptian economy. It is characterized by abundance of production and raw material sources. This industry has witnessed great developments all over the last decades. Cement plants increased from 4 plants in 1975, with 4 million tons/year production capacity, to 15 plants by December 2006, with more than 35 million tons/year total production capacity. These plants cover wide areas in Egypt, in addition to investments intended to be directed to establishing new cement companies which, if approved, are expected to double production capacity.

The study on identifying the sources of each pollutant shows that current cement

companies in Greater Cairo are responsible for about 6% of suspended chest dusts in Greater Cairo generally. This ratio reaches 30% in the environs of these plants and companies.

Cement companies shifted from wet process to dry process with the purpose of rationalizing energy, water consumption, and maximizing production. However, the problem of emitted dusts and By-Pass dusts appeared. These dusts are estimated at hundred thousands tons per year, which gives a kind of warning of significant problems in production sites as well as environmental problems in the surrounding areas (it is well-known that the dry process produces tripled amount of dust compared to the wet process).

Cement Plants Monitoring Results Indicators during 2006

Daily round-the-clock monitoring for ensuring emission compliance with maximum levels stipulated in Law 4/1994 has shown the following:

- 1228 violations were recorded due to dust emissions from some cement plant stacks, which exceeded maximum limits all the year round (2006).
- Highest number of violations (63% of violations) was recorded at the beginning of 2006, during January, February, and March, due to application of new strict maximum limits, amended at the end of 2005. Companies within Greater Cairo recorded the largest number of violations (65% of total number of violations).
- Significant reduction in the number of monitored violations was recorded by the end of 2006 as a result of EEAA efforts to ensure compliance of such

companies with the new maximum limits. Rate of violation reduction during 2006 was 97%.

On comparing cement plants monitoring results in 2006 versus those of 2005, the Following was found:

- Total number of emission violations of cement companies monitored in 2006 exceeded those of 2005 by five folds.
- Clear and significant reduction (37%) in number of violations monitored in December 2006 compared to December 2005 as a result of EEAA's efforts with these companies to comply with the new maximum limits. Thus, reducing the number of monitored violations.
- By the end of 2006, monitored violations of factories within Greater Cairo had decreased significantly. The number of these violations was near that recorded in 2005 despite difference in maximum permissible limits of dust emissions (500 mg/m³ in 2005 and 300 mg/m³ in 2006).

3 – Control of Mobile Sources of Pollution:

A –Vehicular Emission Testing as Part of Licensing Requirements:

Completing MSEA's plan to associate vehicle licensing with exhaust testing, the third phase, in 6 new governorates involving Menia, Fayoum, Beheira, Qena, Sohag and the Red Sea, has been implemented. Thus, the program would have been implemented in 12 governorates by the end of 2006, which represents 77% of total number of vehicles in Egypt (figure 1-25).

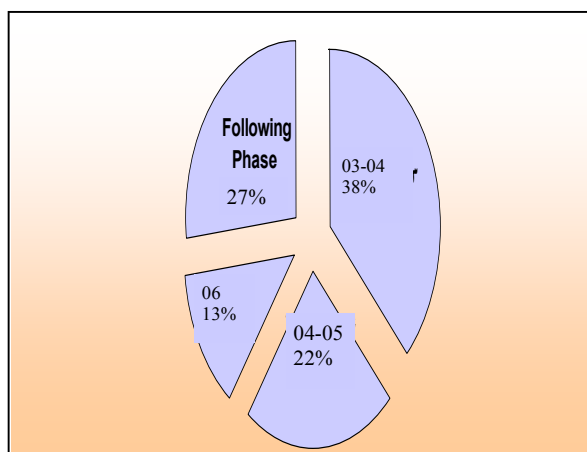


Figure (1-25) Vehicular testing program as part of vehicles licensing

B – On-the-Road Vehicle Emissions Testing:

In 2006, technical testing of vehicle exhaust on roads has been implemented in several Greater Cairo areas for 56430 vehicles (Gasoline and diesel) through joint campaigns by the traffic departments in governorates and the EEAA. Results indicate that almost 72% of the vehicles passed the test (figure 1-26).

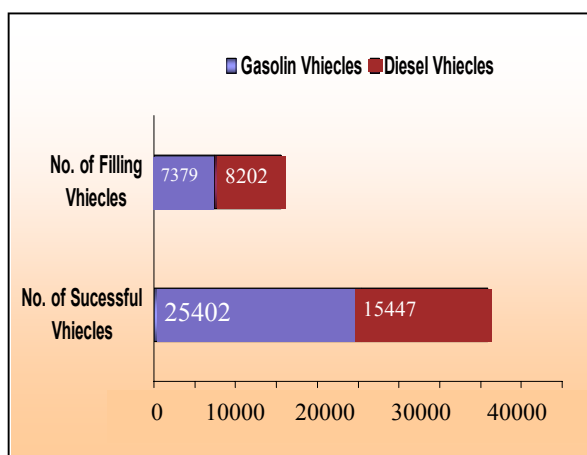


Figure (1-26) Results of technical testing of vehicle exhaust on roads in 2006

Public Transportation Authority Bus Inspection Program

A bus inspection program was implemented for testing Public Transportation Authority buses in garages in 2006. Results indicate that almost 36% of total numbers of Public Transportation Authority and Greater Cairo Co. buses have passed the test (figure 1-27).

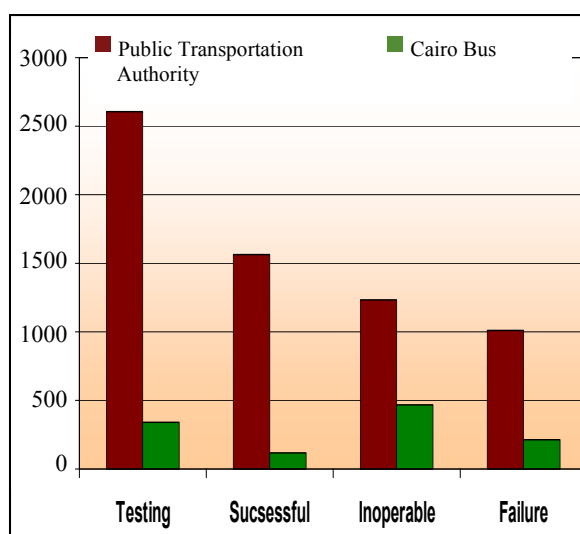


Figure (1-27) Results of technical testing of Public Transportation Authority and Greater Cairo Co. buses exhaust on roads in 2006

C – Reducing Pollution from Motorcycles:

Studies conducted worldwide concluded that hydro-carbons emitted from one motorcycle with binary vapor engine equate emissions from 10 – 15 gasoline operated cars. In Egypt, there are 500,000 motorbikes, 95% of which have binary vapor engines. In Greater Cairo alone, there are 200,000 motorbikes emitting 120,000 tons of air pollutants per annum, thus adversely impacting on air quality.

Within the context of efforts directed to reduce motorcycle emissions, importing of used motorcycles with binary vapor engines has been prohibited. Likewise, production of motorcycles with binary vapor engines not equipped with oil injecting pumps has been banned. Using motorcycles with binary vapor engines of all types and sizes in Egypt will be prohibited starting 31/12/2007.

D- Phase-2 of the program to turn 5000 governmental vehicles to run on Compressed Natural Gas (CNG):

- A. All agencies involved have been addressed, governmental vehicles that work with Gasoline have been scanned and a relevant database established. Moreover, a committee has been established for following up the project, and studying the results of this phase to follow up on the requirements and standards for the switching process.
- B. In the framework of completing the project phase I, 87 vehicles have been fuel-switched to work with natural gas in Greater Cairo during the period from September 2006 – December 2006.
- C. This represents 33.9% of the whole plan until December 2006. By that time, the number of vehicles, being turned since the beginning of phase 1 reached 1943.
- D. 800 vehicles had been surveyed in the period from September 2006 – December 2006, 698 of which in Greater Cairo, representing 87.3% of total surveyed vehicles, Alexandria came second with almost 84 vehicles, i.e. 10.5 % of total vehicles. While 18 vehicles have been

surveyed in the rest of the governorates. Therefore, the number of scanned vehicles since the beginning of the project's phase-1 reached 2800.

4- Surveying Pollution Spots at the National Level:

- A. Smelters that require development to work with natural gas instead of mazot (1408 smelters) have been identified. Currently technologies used in foundry work are being modified, in addition to the possibility of changing the fuel used to natural gas or solar.
- B. Brick factories that require improvement by atomization of mozat have been scanned, and 546 factories identified. ("50" factories of the total number of factories in Arab Abu Sa'ad area have been developed). Violating factories are being closed down and legal measures against them taken, while coordination with such factories to comply is being carried out. Development costs reached 50,000 Egyptian pounds per factory.
- C. Potteries that require improvement to operate on natural gas have been surveyed and a total of 665 identified. Measures have been taken to improve such potteries by experimenting many models of such potteries that meet the specifications required for safe operation and product quality. Currently, a study is being conducted on providing the financial source for funding and rolling on pottery development.
- D. Kilns needed to be developed into closed burning were surveyed and 675 kilns identified. Kilns standard specifications are currently being endorsed to issue standard specifications for the

first time in order to allow for approving the development of all kilns.

5- Relocating and Developing Polluting SMEs in Greater Cairo Region:

SMEs that impact air quality in Greater Cairo region include potteries, kilns, smelters, brick factories, quarries, and crushers. In dealing with these activities, MSEA depends on two main axes:

Urgent Plan

To reduce emission from these activities through implementing quick measures, with the knowledge of facility owners, to control pollution sources while implementing Environmental inspection plans to address violating cases and taking respective legal measures.

Long-term Plan

Relocating and developing such activities according to their respective types and geographical location through providing financial packages in coordination with the Ministry of International Cooperation and governorates. The following describes the current situation:

Potteries

Potteries's activities are concentrated in Batn El Baqar and El Mothalatha areas in Old Cairo district. 179 facilities are currently being developed in the same site; 29 has been developed in El Mothalatha, and developed pottery units are currently being established in Batn El baqar, in addition to building an exhibition and occupational training center to preserve this heritage craft.

Smelters

Since their establishment, smelters are found in GC governorates and are spread inside residential blocks. Due to their environmental impacts, coordination between the Ministry of International Cooperation and the governorates has been implemented to provide the funding required for relocating such activities to safe sites that comply with environmental requirements, allocated by the governorates. The following is the current situation of relocating such activities:

Shobra El Khaima Smelters in Qaliubya Governorate (99 Smelters)

Safa industrial zone (142 feddans) has been allocated for this purpose. The Governorate has provided basic utilities and services to the allocated zone. A MSEA/ Qaliubya Governorate/IDA agreement has been signed on technical requirements, financial obligations and time plan to relocate all Smelters to Safa industrial zone. To date, 6 Smelters have been relocated and another 35 are underway.

Giza Governorate Smelters (41 smelters)

An area of 1500 feddans within to the Industrial zone on Cairo-Fayoum road has been allocated for relocating these smelters. The infrastructure and utilities are currently being connected. Development operations will include establishing model units that comply with environmental requirements appropriate to the type, area and volume of current Smelters to be relocated.

Cairo Governorate Smelters (569 Smelters)

They are planned to be relocated to Be'r Gendali area on Qatamyia/Sokhna road, which was allocated to relocate the Cairo

Governorate polluting activities. Land use plans and EIAs are currently being undertaken for relocating these activities in order to satisfy sound specifications and environmental requirements.

Kilns

Such activities are concentrated in Qaliubya Governorate (166 Kilns), most of them are in Tikh Markaz. Through joint coordination between MSEA, Qaliubya Governorate and the Egyptian General Authority for Standards and Quality, a standard specification for the improved kiln model has been completed based on sound environmental and industrial basis. Currently and agreement for implementing the development plan is being developed.

Brick Factories

Those activities spread in Giza Governorate (418 factories) and Qaliubya Governorate (12 factories). However, in order for such factories to comply, and in the framework of international efforts to address climatic changes, 50 factories have been developed to work with natural gas. Preparations are underway to develop another 300 factories in Giza Governorate. The remaining factories are being developed using atomization to minimize gaseous emissions. In case of violation, necessary legal measures are adopted.

Marble workshops and Stone Crushers

Shaq El Thu'ban industrial area in East North Cairo was allocated for relocating and developing these activities. Currently there are 250 marble and granite workshops and 4 crushers. Utilities and services are currently being extended to the area. A special area has also been allocated for the disposal of industrial solid wastes as well

as another area for establishing industrial effluents treatment plant to prevent environmental impacts resulting from these activities.

Quarries activities

Those activities are concentrated in Giza Governorate (294 Quarries), in Cairo Governorate (50 Quarries) and in Qaliubya Governorate (3 Quarries). For those activities to achieve environmental compliance according to their type and location, quarry regulatory environmental requirements have been established in the framework of environmental law 4/1994 and the Mines and Quarries law. In addition, a decision has been issued to close down some Quarries having direct environmental adverse impact and to stop granting licenses to environmentally non-compliant Quarries. Halting Quarry activities 30 km around Greater Cairo is currently being considered. As for the Cement companies' quarries, there is an ongoing monitoring plan associated with the implementation of strict controls and requirements for minimizing their impacts on the ambient environment.

Cleaning Up Lead contaminated areas in Shobra El Khaima:

In the framework of activating State policy to relocate environmentally polluting industries outside residential blocks, MSEA in cooperation with Qaliubya Governorate has implemented the closure of 5 Lead smelters in Shobra El khaima, considered the largest in Egypt, whose production represent over 70% of total national production. These were relocated to Safa industrial zone and 10th of Ramadan city and provided with advanced technologies to minimize their polluting emissions. This step has reduced Lead concentrations in

Shobra El Khaima by more than 80%, compared to estimated concentrations before relocation.

For completely eliminating the lead pollution problem in Shobra El khaima, MSEA has implemented a project in cooperation with Qaliubya Governorate and the USAID for cleaning Lead contaminated areas in the region, whose soil and walls are soaked in lead dust. Over the past two years, the project has cleaned and treated the locations of the five relocated smelters with a total area of 7,984 m². Other two sites were treated as well, and are being utilized as Lead melting sites in the same area. The project has also cleaned two schools in the area as well as a medical center in Kablat area.

These efforts have led to success in eliminating Lead pollution sources in Shobra El Khaima area.

To ensure ongoing success and avoid re-exposure of treated sites to pollution, Qaliubya Governorate has prepared Al Safa industrial zone to relocate all Shoubra El Kheima foundries. To encourage smelter owners to relocate, The Governor of Qaliubya has approved lowering the price of the land in this area from LE 175 to only LE 100/m², while providing payment facilities. This contributed in encouraging smelter owners to participate in a group initiative led by FEI Foundries Department, to relocate these smelters to Al Safa zone. An agreement has been developed to regulate the relocation process.

6- Minimizing Industrial Emissions

The importance of industry lies in its representation of 35.5% of the national income in Egypt, and around 25% of manpower are working in industry in 2006. The concern

to achieve high industrial development rates without full awareness of the resulting environmental pollution risks has led to deteriorating environmental conditions and pollution of some natural resources leading to increased health risks.

Total number of industrial facilities in Egypt is around 27,600. Greater Cairo encompasses half of these industrial facilities (13,840 facilities), where large industrial facilities that produce huge loads of air and water pollutants, like Cement, Iron, Steel, Chemical industry and Tanning factories are concentrated.

Industrial Pollution Prevention Programs

1- Industrial Pollution Prevention Project (Phase 2):

- Due to the importance of pollution control, in addition to SMEs, a field survey has been developed focusing on the largest polluting industries in Greater Cairo and Alexandria Governorates.
- Investments required for large establishments to comply (200 industrial facilities) have been estimated at LE 2 billion. MSEA has provided around LE 1 billion Egyptian pounds funding donors (our partners in development) to support industrial compliance projects:
- In collaboration with our partners in development, MSEA has started implementing Industrial Pollution Prevention Project phase 2 (2007 – 2012), which was announced in December 7, 2006 with total funding of LE 1 billion.

Table (1-12) Investments required to achieve Industrial Compliance

Governorate	Number of proposed projects	Investment cost (LE million)
Qaliubya Governorate	35	294.34
Alexandria Governorate	20	458.6
Cairo Governorate	139	1057.462
Giza Governorate	6	126.94
Total	200	1937.342

The Final Beneficiary:

Large, Medium and Small Industrial Enterprises

Project Objectives:

- Industrial facilities compliance with environmental laws.
- Reducing pollution load generated by industrial facilities to improve air quality and prevent severe pollution episodes.
- Establishing permanent mechanisms to activate pollution prevention projects, enhance environmental compliance capacity and to encourage Egyptian industry so that their products would be compatible with export requirements and competitiveness in international markets.
- Supporting cleaner production projects, as such environmental projects contribute in reducing the use of raw materials and generated wastes, thus increasing production.

Projects Proposed for Funding:

- Supplying industrial pollution prevention equipment (air pollution, water pollution, work environment pollution).
- Supplying new production lines with modern and clean technologies in compliance to Egyptian environmental requirements.
- Supplying hazardous wastes treatment equipment within industrial facilities.