

## 5.2 Air Quality

### (1) Outline

Poor air quality, especially in urban areas (primarily Greater Cairo, Alexandria and other urban centers), is a major contributor to the high cost of environmental degradation in Egypt. According to an estimate of 1999, the cost of environmental degradation in Egypt is of the order of 4.8% of Gross Domestic Products, or GDP. Of that total amount, 2.1% of GDP (an equivalent to 6.4 billion Egyptian Pounds) is attributed to the impacts of poor air quality on health and quality of life.

The poor air quality is as a result of both natural and anthropogenic sources. These anthropogenic sources may in turn be categorized as stationary (point) sources or mobile (non-point) sources. Stationary sources of air pollution include industrial facilities, thermal power plants and some commercial and residential activities. Other major stationary sources of air pollution include the burning of municipal solid wastes and agricultural residues. Mobile sources include passenger cars, buses, trucks and motorcycles. There are an estimated 1.5 million vehicles in Cairo alone.



Photo 5.8: Traffic Congestion in Cairo

For the past five years, there has been continuous public concern related to the degradation of air quality in the major cities of Egypt and, in particular, in Greater Cairo. This concern was sparked by the occurrence of a “Black Cloud” appearing in the skies of the capital around 1999. The cause was a thermal inversion climatic phenomenon trapping air pollutants from a multiple of sources in and around Cairo. One major cause attributed this to the open burning of solid waste in general, and agricultural residues in particular.

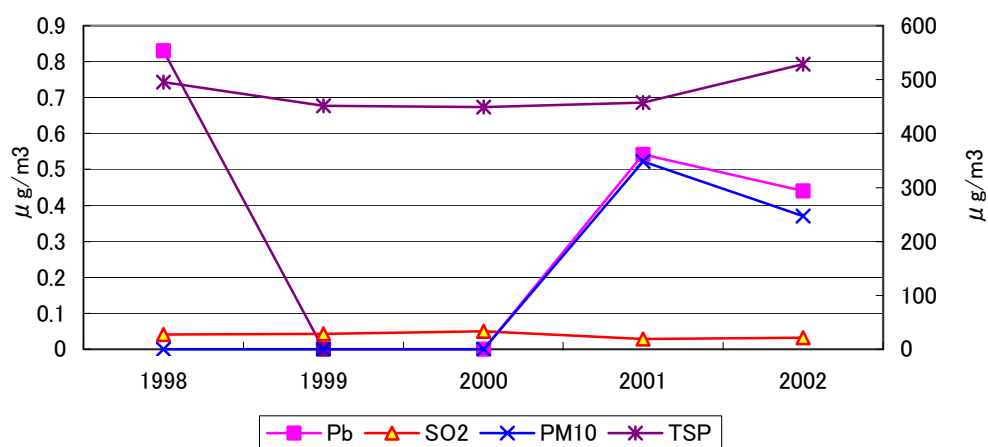
Regarding air pollution, USAID started the Cairo Air Improvement Project in 1997 and completed in 2004. The details and results will be described later.

Following Table 5.10 and Figure 5.4 show the air environmental standard and current air condition in Egypt.

Table 5.10: Ambient Air Quality Limit Values as Given by Law No.4 for Egypt (1994) Compared to the World Health Organization (WHO) Air Quality Guideline Values

Pollutant	Averaging	Maximum limit value ( $\mu\text{g}/\text{m}^3$ )	
	Time	WHO	Egypt
Sulfur Dioxide ( $\text{SO}_2$ )	1 hour	500 (10 min)	350
	24 hours	125	150
	Year	50	60
Nitrogen Dioxide ( $\text{NO}_2$ )	1 hour	200	400
	24 hours	-	150
	Year	40-50	-
Ozone ( $\text{O}_3$ )	1 hours	150-200	200
	8 hours	120	120
Carbon Monoxide (CO)	1 hour	30,000	30,000
	8 hours	10,000	10,000
Black Smoke (BS)	24 hours	50	150
	Year	-	60
Total Suspended Particles (TSP)	24 hours	-	230
	Year	-	90
Particles $<10 \mu\text{m}$ ( $\text{PM}_{10}$ )	24 hours	70	70
Lead (Pb)	Year	0.5-1.0	1

Source: EIMP web site, <http://www.ecaa.gov.eg/eimp/limit%20values.html>



Note: Pb on left axis,  $\text{SO}_2$ ,  $\text{PM}_{10}$ , TSP on right axis

Source: Arab Republic of Egypt, Central Agency for Public Mobilisation and Statistics, '1995-2003 STATISTICAL YEAR BOOK of A.R.E', June 2004, pp.374-375

Figure 5.4: Shift in Air Pollutant Density in Cairo

## (2) Industrial Air Pollution

- There are 26,000 plants with outdated facilities.
- Fuel conversion is being promoted from mazot, a kind of heavy oil, to CNG. A CIDA supported project established 50 factories using CNG near CNG distribution facility.
- Cement industry is a major stationary source of air pollutants.



Photo 5.9: Brick Factories (mazot combustion)      Photo 5.10: Iron Works at Alexandria

## (3) Black Smoke (or Black Cloud)

Since the autumn of 1999, serious air pollution called Black Smoke was started to be observed in Cairo. Sources were unknown in the beginning, but the Analysis Component of the CAIP found that 1) incineration of garbage and farm wastes (mainly straw), and 2) weather condition were both closely related to the occurrence of phenomenon.



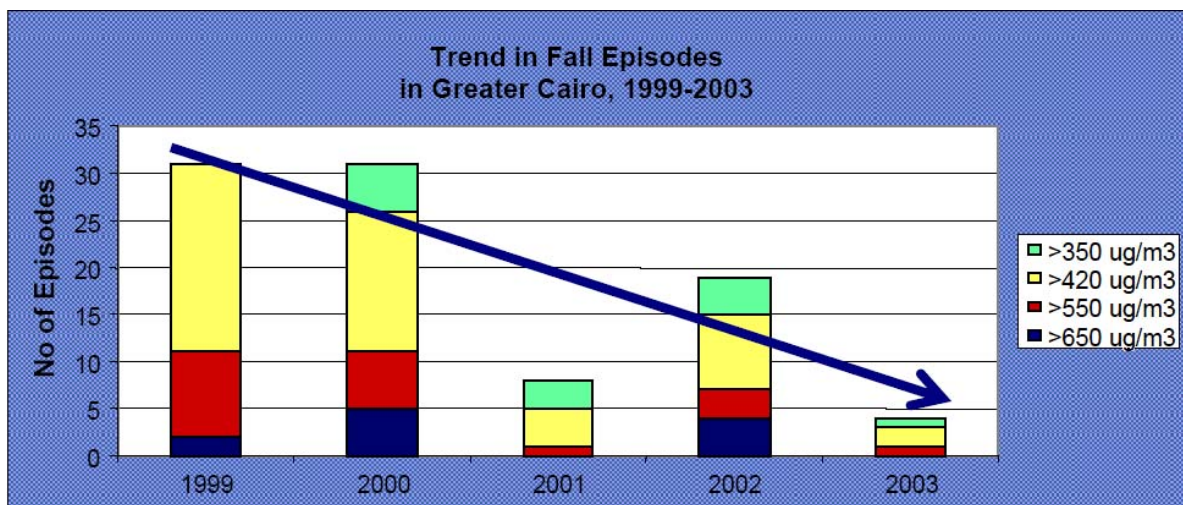
Photo 5.11: Generation of Black Smoke from Open Burning

As comprehensive air pollution measures, fuel conversion program, automobile maintenance, industrial pollution control, Black Smoke forecast, and agricultural waste management program were implemented. As a result of these measures, Black Smoke episode is in a downward trend. (See Figure 5.6)

- 2.5 million of rice straws are generating every year and but no efficient way to use. For example, there are only two lumbers in Egypt.
- Systematical measure for transportation system is also necessary besides rice straw utilize technology.

Air Quality in Cairo		
	STATUS	PM Concentration
Most days	Clear	0 - 99 $\mu\text{g}/\text{m}^3$
	Normal	100 - 199
	Moderate	200 - 349
Episode day	Attention	350 - 419
	Alert	420 - 549
	Warning	550 - 649
	Emergency	650 +

Figure 5.5: Black Smoke Forecast



Source: USAID, "Final Report The Cairo Air Improvement Project – Helping millions live healthier lives", march 2004, p47

Figure 5.6: Trend in Black Smoke Episodes in Greater Cairo

Table 5.11: Annual Average of Air Pollutant in Each Governorate, Part 1

Governorates	Pb "PM10"					PM10					Pb				
	2002	2001	2000	1999	1998	2002	2001	2000	1999	1998	2002	2001	2000	1999	1998
Cairo	0.214	0.389	0	0	0	246.722	348.68	0	0	0	0.441	0.541	0	0	0.83
Alexandria	0.141	0.164	0	0	0	162	257.606	0	0	0	0.148	0.199	0	0.25	0
Port Said	0	0	0	0	0	0	0	0	0	0	0.13	0.147	0	0.27	0
Suez	0	0	0	0	0	0	0	0	0	0	0.095	0.14	0	0	0
Dmiatta	0	0	0	0	0	0	0	0	0	0	0.12	0.152	0	0	0
Dakahlia	0	0	0	0	0	0	0	0	0	0	0.12	0.16	0	0	0
Sharkia	0	0	0	0	0	0	0	0	0	0	0.11	0	0	0	0
Kalyoubia															
Kafr El Sheikh															
Gharbia	0.081	0	0	0	0	251.42	0	0	412.1	0	0.116	0	0	0	0
Behera															
Ismailia															
Beni seuf	0	0	0	0	0	0	0	0	0	0	0.34	0.201	0	0	0
Menia	0.058	0	0	0	0	272.888	0	0	0	0	0.132	0.14	0	0.17	0.27
Asiut	0.172	0.27	0	0	0	263.484	289.286	282.65	0	0	0.318	0.256	0	0.2	0.26
Souhag	0.313	0	0	0	0	648.102	0	0	0	0	0.336	0.221	0	0.2	0
Aswan	0	0	0	0	0	0	0	0	0	0	0.144	0	0	0	0

\*Annually Limits allowed: Pb10: 70(Microgram/M3), Pp: 1(Microgram/M3), Smoke:60(Microgram/M3), SO<sub>2</sub>:60(Microgram/M4), TSP:90(Microgram/M3),

Source: Ministry of health & Population

Source: Arab Republic of Egypt, Central Agency for Public Mobilisation and Statistics, '1995-2003 STATISTICAL YEAR BOOK of A.R.E', June 2004 pp.374-375

Table 5.11: Annual Average of Air Pollutant in Each Governorate, Part 2

Governorates	TSP					SO <sub>2</sub>					Smoke				
	2002	2001	2000	1999	1998	2002	2001	2000	1999	1998	2002	2001	2000	1999	1998
Cairo	528.79	457.55	448.9	452	495.7	21.22	18.9	32.9	28.08	27.1	72.72	89.98	67.3	86.4	75.66
Alexandria	398.16	478.3	372.9	419.2	0	22.41	17.31	14.3	0	0	19.4	18.31	12	11	0
Port Said	224.63	241.41	170.85	202.7	232.97	0	0	6.5	0	0	24.8	28.18	23.9	32	15.7
Suez	183.62	180.65	0	0	364.53	13.27	17.83	0	0	0	22.62	43.83	0	0	28.5
Dmiatta	196.21	149.63	140.9	163.8	169.79	8.02	10.96	6.5	0	0	24.82	25.65	0	21	24.6
Dakahlia	297.39	376.8	0	332.5	0	0	0	0	0	0	31	30.46	0	35	0
Sharkia	267.94	0	0	0	0	33.54	0	0	0	0	52.51	0	0	0	0
Kalyoubia	0	0	0	0	0	24.23	22.3	0	0	0	21.53	20.61	0	0	0
Kafr El Sheikh	0	0	0	0	0	18.2	0	0	0	0	16.59	0	0	0	0
Gharbia	555.69	594.91	654.9	558	540.6	14.04	1.76	0	0	3	154.72	165.72	175.2	189.5	148.4
Behera	0	0	0	0	0	23.65	0	0	0	0	22.69	0	0	0	0
Ismailia	0	290.06	0	0	0	8.19	8	0	0	11.8	8.5	11.98	0	0	7.55
Beni seuf	477.71	522.75	0	0	0	0	0	0	0	0	26.67	29.04	0	52	0
Menia	567.13	605.39	0	800.6	853.23	32.33	35.01	0	0	21.3	60.11	64.19	0	56	26.85
Asiut	430.6	425.88	0	352.2	438.18	17.2	17.54	0	0	11.1	46.83	42.14	0	44	42.3
Souhag	1100.38	898.27	0	335.6	0	0	0	0	0	2.22	66.4	67.53	0	59	36.02
Aswan	408.6	365.47	0	367.3	354.35	43.1	31	0	0	30.5	33.44	36.62	0	32	29.5

\*Annually Limits allowed: Pb10: 70 (Microgram/M3), Pp: 1(Microgram/M3), Smoke:60(Microgram/M3), SO<sub>2</sub>:60(Microgram/M4), TSP:90(Microgram/M3),

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As Table 5.11 indicates, major air pollutants in Egypt are sulfur dioxide (SO<sub>2</sub>), suspended particulate matters (PM<sub>10</sub> or TSP) and lead (Pb).

The Environmental Information Monitoring Program (EIMP) with the support from Netherlands started monitoring air quality in 1999 around River Nile, the Delta area and Cairo. Monitoring data is publicized on the EEAA web site every month.

#### (4) The Cairo Air Improvement Project (CAIP)

The CAIP is USAID run project, which started in 1997 and concluded in March 2004. CAIP aimed to improve the quality of air in the Greater Cairo by including “activities that have some immediate impacts on reducing vehicular emissions and lead while setting the stage for a long term effort through demonstrations and pilot tests of alternative technologies and increased public awareness.”



Photo 5.12: Vehicle Emission Testing Center (top)  
CNG Fueling Station (left)



Photo 5.13: Lead Smelting; Old Style (left) and New Style Intruded by CAIP (right)

Table 5.12 shows CAIP’s main components, activities / results, and future trend.

Table 5.12: CAIP Components and Results and Future Trend

	Contents/ Results	Targets	Future trends						
1	Clean Alternative Fuel in Transportation								
	<table border="1"> <tr> <td> <p>Building CNG-fueled Buses</p> <ul style="list-style-type: none"> <li>• Use of alternative fuel in corroboration with Cairo Transit Authority (CTA) and private bus company (US technology transfer)</li> <li>• CNG buses: 50 buses</li> </ul> </td> <td rowspan="4">Mobile emission source</td> <td rowspan="4"> <ul style="list-style-type: none"> <li>• CTA: Planning to purchase 25 CNG additional buses (2005)</li> </ul> </td> </tr> <tr> <td> <p>Garages for CNG-fueled bus</p> <ul style="list-style-type: none"> <li>• Constructed at two locations (houses up to 400 CNG buses)</li> </ul> </td> </tr> <tr> <td> <p>Developing Human Resources</p> <ul style="list-style-type: none"> <li>• Training of drivers, maintenance personnel, managers, and top executives</li> </ul> </td> </tr> <tr> <td> <p>Others</p> <ul style="list-style-type: none"> <li>• CNG-fueled taxi: 20,000 taxis (1999), CNG-fueling station: 17 stations</li> </ul> </td> </tr> </table>	<p>Building CNG-fueled Buses</p> <ul style="list-style-type: none"> <li>• Use of alternative fuel in corroboration with Cairo Transit Authority (CTA) and private bus company (US technology transfer)</li> <li>• CNG buses: 50 buses</li> </ul>	Mobile emission source	<ul style="list-style-type: none"> <li>• CTA: Planning to purchase 25 CNG additional buses (2005)</li> </ul>	<p>Garages for CNG-fueled bus</p> <ul style="list-style-type: none"> <li>• Constructed at two locations (houses up to 400 CNG buses)</li> </ul>	<p>Developing Human Resources</p> <ul style="list-style-type: none"> <li>• Training of drivers, maintenance personnel, managers, and top executives</li> </ul>	<p>Others</p> <ul style="list-style-type: none"> <li>• CNG-fueled taxi: 20,000 taxis (1999), CNG-fueling station: 17 stations</li> </ul>		
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2	VET: Vehicle Emission Test								
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3	<b>Lead Pollution Abatement</b>													
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4	<b>Education and Raising Awareness</b>													
	<ul style="list-style-type: none"> <li>• Raise overall awareness of air pollution among general public in Cairo (ex; hazard of lead in gasoline)</li> <li>• Awareness raising in each component of CAIP</li> </ul>	General public and target of each component	<ul style="list-style-type: none"> <li>• Support MESA with a comprehensive information dissemination plan, a part of an overall air quality strategy.</li> </ul>											
5	<b>Monitoring/Analysis</b>													
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15px;"></td> <td>Establishing a network of monitoring sites</td> </tr> <tr> <td></td> <td> <ul style="list-style-type: none"> <li>• 36 monitoring stations (Pb, PM<sub>10</sub>, PM<sub>2.5</sub>)</li> <li>• Provide Black Smoke (BS) forecast on website</li> </ul> </td> </tr> <tr> <td></td> <td>Inventory of lead releases to the air in Cairo</td> </tr> <tr> <td></td> <td>Source Attribution Study</td> </tr> <tr> <td></td> <td> <ul style="list-style-type: none"> <li>• Vehicles, industry and open burning</li> <li>• Identify the causes of 'Black Smoke' episode</li> </ul> </td> </tr> </table>		Establishing a network of monitoring sites		<ul style="list-style-type: none"> <li>• 36 monitoring stations (Pb, PM<sub>10</sub>, PM<sub>2.5</sub>)</li> <li>• Provide Black Smoke (BS) forecast on website</li> </ul>		Inventory of lead releases to the air in Cairo		Source Attribution Study		<ul style="list-style-type: none"> <li>• Vehicles, industry and open burning</li> <li>• Identify the causes of 'Black Smoke' episode</li> </ul>	Mobile / stationary source	<ul style="list-style-type: none"> <li>• Continue the monitoring by EEAA</li> </ul>	
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6	<b>Training</b>													
	<ul style="list-style-type: none"> <li>• Held more than 220 sessions (more than 2,800 participants)</li> </ul>	Technicians and top managers	<ul style="list-style-type: none"> <li>• Continued effort on skills enhancement</li> </ul>											

CAIP completed its mission in March 2004. However, USAID is going to follow up the CAIP as a part of the Livelihood & Income from Environment (LIFE) project, which is going to be conducted for the next four years. The total budget of the LIFE project is 33 million dollars, the U.S covers the half and another half is from Egypt.