Arab Republic of Egypt

Ministry of State for Environmental Affairs

Egypt State of Environment 2010

Contents

Ministry of State for Environmental Affairs
Egyptian Environmental Affairs Agency

Egypt State of Environment 2010

Foreword

It gives us great pleasure to present State of Environment Report- 2010, which is issued for the consecutive seventh year pursuant to article (5) of Environment Law 4/1994, amended by Law 9 /2009. It stipulates developing annual report reflecting environmental status in Egypt. Government pays keen interest towards environmental protection to insure the healthy and safe life for Egyptians, through applying green economical development, supporting integrated environmental management, activating sustainable development policy, addressing impacts of climate change and mainstreaming environmental dimension within national policies.

Within the framework of improving environmental performance MSEA cooperates with Universities of Yale and Columbia to review Egypt's rank in the Environmental Performance Index (EPI) -2010 and analyze its indicators for improvement within coming years. This work indicated Egypt's regular progress. It ranked 85 out of 133 countries in 2006, 71 out of 149 in 2008, and 68 out of 163 in 2010.

The report is divided into four parts; the first discusses air quality, the second water quality (fresh and marine), the third earth and the fourth discusses urban and industrial environment.

In the field of air quality, 87 stations are currently affiliated to the National Network for Monitoring Air Pollutants in Egypt distributed on different areas with different activities (industrial, residential, urban and reference areas). MSEA has established the Environmental Observatory in Damietta governorate to observe air quality instantaneously and measure water quality and noise levels. In the framework of cooperation with the World Bank a study was conducted to evaluate air quality in Greater Cairo by attributing pollutants to their sources in 5 areas with different activities.

During 2010, number of cement companies' stacks connected to the National Network for Monitoring Industrial Emissions increased to 92 for 39 production lines in 18 factories all over Egypt; to follow-up their emissions instantaneously during the 24 hours daily. In addition, developing guidelines for devices measuring emissions to help factories' owners choose the appropriate. Concerning vehicles' emissions, during

2010 MSEA coordinated with both Traffic and Environment police (Ministry of Interior) and about 42953 vehicles were inspected on roads. As well as the 3677 buses of the Public Transportation Authority in Greater Cairo were inspected and the Technical Inspection Center for vehicles' exhausts in Shoubra El-Khima developed database for vehicles' exhausts.

Concerning climate change; international reports expected that Egypt will be vulnerable to risks and threats; such as sea-level rise, increased temperatures and consequently potential shortage in water resources which will be followed by subsequent decline in agricultural productivity. These threats will negatively impact coastal zones, public health and infrastructure. Egypt takes several actions to face this phenomenon, and in commitment of its obligations towards UNFCCC Egypt issued the second National Communication in 2010 to review national circumstances, inventory anthropogenic GHGs emissions in different sectors, study possibilities to mitigate and reduce these emissions, identify risks and means of adaptation.

In the field of mitigation, 82 is the total number of CDM projects including 7 internationally registered projects, 10 approved, 63 accepted and 2 in the pipeline stage . Total investment of these projects will be 3 billion pounds and will achieve reduction of 9 million tons of carbon dioxides equivalent.

In the field of adaptation, MSEA is keen to coordinate with relevant ministries like Ministries of Agriculture, Irrigation and Water Resources and Health to implement adaptation measures; including develop crops tolerant to high temperature and water shortage ,develop irrigation systems, seek new water resources , prepare mathematical model for Nile River and improve health services especially in rural and remote areas.

In the field of Ozone Layer Protection, Egypt implemented its commitments with Montreal Protocol by executing some activities to transfer modern technology and implement awareness programs about environment-friendly alternatives. These activities resulted in phasing out importation of more than 95% of Ozone Depleting Substances (ODS) HCFC's, Halon, Carbon Tetra Chloride (CTC) and Methyl Chloroform(R-140a) in several industrial and agricultural sectors.

2010 has witnessed conclusion of the Monitoring Program for Noise Levels in most areas of Greater Cairo and some areas of Helwan governorates. Monitoring results of noise levels within areas of different activities in Greater Cairo governorate were compared with those of 2009, to observe improvement level in noise reduction, activate proposed recommendations to reduce noise and prepare contour maps for noise levels in some important districts of Cairo governorate.

During 2010, monitoring of noise levels initiated in 7 districts in Giza governorate, 3 areas in Kaloubia governorate and 2 areas in 6 October governorate. All monitoring sites were selected to cover different activities in each governorate to identify noise levels, sources and prepare reduction programs for these areas.

Fresh water quality chapter addresses available quantities of fresh water and actual needs and taken actions to fill the gap between them. It discussed means to strengthen relationship between Egypt and Nile Basin countries and current status of water quality in Egypt. Monitoring results indicated water quality of Lake Nasser is not affected by any of the development activities surrounding the lake. So that its water is the reference point for water quality in Nile River, due to being the first recipient of water coming from Sudan .Monitoring results indicated an improvement in the quality of Nile water from Aswan to Cairo during 2010 than previous years, as a result of exerted efforts to reduce Nile pollution. In general, results indicated the vitality of water, its ability of self-purification and nonexistence of pollution exceeding the allowed limits of organic matters, heavy metals and nutrients. Monitoring results of water quality in Damietta and Rosetta branches were less than the allowable limits and previous year limits of organic matters and ammonia concentrations, which indicates remarkable improvement in water quality as result of the exerted efforts.

The report addresses Periodical Monitoring Program for Egyptian lakes “Northern lakes, El-Temsah and El-Morra Lakes "(large and small).This program is important to trace their environmental conditions and different pollutants affecting them to set future plans for their protection, solve their problems and achieve their sustainable development through an Integrated National Strategy .This chapter reviewed monitoring results of the 4 field trips conducted during different seasons of the year. Measurements were taken to deduce natural, chemical and bacteriological indicators. Results have shown that Bardawel Lake is considered the purest northern lake, because it doesn't receive any discharged water from industrial or agricultural drainages, while other measurements varied from one lake to another.

The chapter of Coastal Water, Marine and Coastal Zones reviewed MSEA's role in developing the National Strategy for Coastal Zones Management. It dealt with risks coastal and marine zones are facing and taken measures for their management and conservation, as well as its role in handling marine pollution accidents.

The section of Marine Pollution Control and Ports Affairs referred to the occurrence of 33 marine pollution accidents during 2010. Inspections clarified that 30 accidents caused environmental damages, oil derivatives recorded 50% of the pollution, followed by oil waste 30%, crude oil 16.6 % and dead animals, 3.4%. Marine ports are considered the most vulnerable areas with pollution and to reduce environmental impacts resulting from maritime and river transportation, three guidelines were developed, to apply the environmental management system along naval and river ports, prevent pollution from ships and mobile river units, conduct several field visits to seaports to inspect their environmental status and ensure their environmental compliance.

The report reviewed results of Coastal Monitoring Program, measurements of coastal water quality and their different indicators. Results of Mediterranean and Red seas and Gulfs of Suez and Aqaba were compared with those of previous years. Indicators clarified improvement in water quality of the Mediterranean and the Red Seas in 2010 compared to those of previous years, as a result of the exerted efforts in cooperation with relevant authorities, continuous inspection and environmental compliance achieved by industrial facilities which were discharging directly or indirectly on the Mediterranean and Red Seas and Gulfs of Suez and Aqaba. As well as executing projects to protect marine environment. The report reviewed exerted efforts to minimize negative impacts on marine environment and future vision for the integrated coastal zones management along Egyptian coasts.

2010 was dedicated for biodiversity, Biodiversity chapter discusses exerted efforts and developed programs to realize sustainable use and conserve biodiversity. This was conducted through some indicators to measure achieved progress, identify threats fauna and flora exposed to and taken actions to reduce their rate of loss. Results clarify that southern area of the Red Sea is not suffering from the negative impacts of human activities contrary to northern coastal areas. This necessitates preserving natural resources of this region and develops appropriate programs for its protection. Biodiversity Monitoring Programs help in identifying state of fauna species and develop an inventory for their endangered species that need to be included in the Red List for protection. MSEA collaborates with several relevant ministries and entities to confront invasive species through controlling and management of ballast water in Egyptian ports and territorial water of the Red Sea. This chapter refers to threats biodiversity in protected areas are facing as a result of various activities such as tourism, mining, fishing, overgrazing etc…. It explains taken measures and procedures for biodiversity conservation inside and outside protected areas and achieved progress.

Green landscapes, afforstation and plantation of gardens are among the important elements of natural environment which greatly contribute in improving air quality and providing protection and shade on earth. In this regard MSEA established Peace Park in Sharm El-Sheikh on an area of 30 feddans and work is going on to finalize Family Park in El-Rehab city on an area of 70 feddans. In addition to establishing public garden in Luxor on an area of 700 m^2, 5 gardens in Helwan and public garden on the entrance of Talkha city-Dakahlia governorate. The Ministry provided environmental support to 14 governorates and 327 public schools represented in providing them with 590.000 trees for youth campaigns to be planted around mosques, monasteries, public hospitals, units of central security, public squares and NGOs. Within the framework of 2010 celebrations with World Environment Day, MSEA supported all governorates with about 350.000 trees, afforestating 124 schools in four educational areas in Cairo serving 160.000 students with 77.000 trees and 32.000 m^2 of green landscapes. Maintenance of trees and irrigation systems along the 14 km of the first phase of Green Belt project around Greater Cairo is sustained and work is going on to implement second phase of the project with length of 12 km.

In the field of **Environmental and Urban Development** , the concept of new urban communities emerges to achieve several objectives among which combating urban sprawl on agricultural land which is one of the urban patterns began to spread since the beginning of sixties and became more common during seventies. As a result of the unbalanced growth between demand and supply in urban housing market, increased migration to major cities and implementing urban planning in isolation from the basic requirements of environmental protection; the gap between urban growth, actual needs of population and resources that could be provided by the environment widened till resources began to deplete, especially the non-renewable. This caused imbalances in many components of the natural ecosystems. Unbalanced urban growth accompanied by rapid industrial development during early fifties concentrated in highly populated areas (Shubra, Helwan ...... etc.) without taking environmental dimension into account. This has resulted in economic benefits and environmental damages, till the extent of environmental standards' deterioration within areas of industrial activities, which obligates implementing environmental compliance projects to achieve remarkable improvement in their environmental status. Providing good living conditions in both residential and industrial new urban communities constitute a challenge otherwise investment projects will be considered waste of resources in a country that needs the optimal use of its resources efficiently and effectively.

In the field of Energy, during 2010, MSEA issued environmental approvals for 299 onshore and offshore projects for oil and gas concession areas, 6 power plants and two cement projects operating with natural gas.

Environmental Impact Assessment is considered one of the strategic tools that EEAA depends on, as it is one of the main preventive measures to assess impacts of initiatives, projects or development activities in order to identify required procedures to reduce negative impacts and maximize positive effects. In this framework 16652 forms and EIA studies were reviewed during 2010, to assess the environmental impact of new projects. They are classified into 10832 under form (A), which is reviewed, by EEAA Regional Branches and 5542 under form (B) and 278 full EIA under form (C).Public participation is activated through presenting projects under class (C) in public hearing sessions to ensure community approval on these projects.

In the field of Protecting and Improving Industrial Environment, 51 projects for 30 major companies and 200 brick clay factories (Arab Abu Saed area) are currently included under the Industrial Pollution Abatement Project. Their investment cost amounted one billion pounds. Transferring program of crafts and smelters in 12 governorates with total cost of about 407 million pounds, Ministry of International Cooperation contributes with about $ 327 million pounds and participation of Ministries of Environmental Affairs, Local Development, Housing, Utilities and Urban Development and some of the relevant governorates.

In the field of solid waste, developing new plans and systems for solid waste management in Greater Cairo is with first priority. These development plans aims at improving performance efficiency and increase recycling rate to achieve great economic return. This will be conducted by increasing the efficiency of residential and commercial collection through advanced environmentally compatible delivery plants and intermediate transfer stations to improve performance of contractors and garbage collectors. System of solid waste management includes activities for sorting, recycling and final disposal of municipal solid waste in accordance with the technical standards. Accounting system for companies is determined according to the operating cost per ton at different stages. Presidential Decree No. 86 / 2010 issued to allocate 5 sites for new complexes of sorting, recycling and final disposal of waste. Cairo governorate amended its contract with a company to be according the operating cost per ton in all stages. This amended contract will be applied while contracting with other companies in this field. Development procedures include the establishment of 4 delivery stations, one intermediate transfer station and 22 observation units. Work has begun to extend infrastructure for one of the 5 sites. At the same time urgent procedures were taken to raise and level 15.2 million cubic meters of accumulations with cost of about 35 million pounds. Also procedures were taken to start closure of El-Wafaa &El-Amal landfill and provide relevant authorities in governorates with vehicles and equipment.

At the national level, Terms of Reference and specifications have been prepared for the collection, transfer, sorting, recycling and final disposal; in addition to prepare pilot model for developing waste management systems in governorates.

Within the framework of developing solid waste management systems in the neediest villages, some procedures have been taken to provide these villages during second phase of this project which will serve 373 villages with 184 vehicles with capacity of 5 tons, 21 loaders, 68 equipped tractors, 58 trailers and 3730 containers; as well as establish 21 official landfills, 2 intermediate transfer stations and raising efficiency of the 2 solid waste recycling factories. Estimated cost of this phase is 124 million pounds .It is worth to mention that some of the pre- mentioned equipment have been delivered to the concerned governorates according to the following plan (171 vehicles with capacity of 5 tons-68 equipped tractor loader - 58 trailers -6 caterpillars). Cost of these equipments amounted with 50 million pounds. The Central Agency for Reconstruction affiliated to Ministry of Housing is currently establishing 10 controlled landfills in the 5 areas allocated by the presidential decree.

Integrated Management of Hazardous Substances and Waste dealt with exerted efforts in collaboration with Germany to implement Institutional Twining Project for building capacities and exchanging experts in the field of safe management of hazardous substances according to local needs and international conventions. Hazardous Substances Department concluded revision and evaluation for the following issues : institutional system to identify its needs from technical staff and devices, laws and legislations concerned with hazardous substances &waste for their amendment to cope with the international conventions and EU legislations ; different databases of environmental pollutants, information and management system of hazardous substances to prepare proposal for their amendment and connection with European rules , lists of hazardous substances and waste in concerned ministries to unify them . The department identified three issues to cooperate with NGOs in their implementation (electronic waste- plastic bags and their substitutes- labels on hazardous substances, waste and their products). MSEA cooperated with Korea to implement the Integrated System for Safe Management of Mercury Waste resulting from expired florescent pulps. As a result of this cooperation an integrated unit for recycling florescent pulps has been established in Alexandria governorate.

Within the framework of environmental policy, which aims at developing an integrated environmental management to combat any damage may harm the environment and to achieve sustainable development; MSEA in cooperation with Ministry of Health has prepared the Integrated System for Medical Waste Management including specifications and model contract for their management through private sector. The system identified an integrated action plan with priorities, responsibilities and roles. It focuses on capacity building, provide training, prevent illicit traffic, develop sorting system from the source, insure receipt and delivery according to weight, and insure their delivery to treatment plants and safe disposal. Execution of this system is based on participation of private sector and civil society.

To achieve MSEA's objectives of safe disposal of hazardous medical waste, **Environmental Protection Fund** provided support for Ministry of Health to achieve this objective. EPF prepared a plan to provide public hospitals with clinical waste incinerators distributed according to listed priorities. 4 clinical waste incinerators were provided for Assiut University, Sohag governorate, Helwan University and Ismailia governorate, in addition to contribute in the establishment of a treatment unit for mercury waste.

EPF supported public sector in the field of cleaner production projects, its Board of Directors approved to finance projects with 15.545 million pounds in the following fields: cleaner production in cooperation with Environmental Compliance Office affiliated to Federation of Egyptian Industries ,air pollution, solid and hazardous waste and natural protectorates .EPF participated in some exhibitions such as the exhibition organized on the margin of "Towards Clean and Safe

Chemical Industry Conference " . Brochures about the importance of natural protectorates and its role in promoting environmental tourism in Egypt were published and distributed to raise awareness among youth.

Finally, We would like to extend our thanks and appreciation to all who have contributed in publishing this report particularly Ministries of Agriculture, Health, Water Resource and Irrigation for their active role in providing information and data that enriched this report .The Report highlights the importance of integrated environmental work and effective cooperation among national authorities.

Special thanks for all workers in different environmental fields in MSEA, ministries, institutions, universities, agencies, educational institutions, NGOs and private sector for their distinguished efforts to preserve sustainability of natural resources and combating all forms of pollution. Their exerted efforts contribute in improving Egyptian environment and insuring clean environment for present and future generations.

Ministry of State for Environmental Affairs

Methodology

Report objectives:

First: Apply an important article of the Environment Law no. 4/1994 amended by Law no. 9/2009.
Second: Provide clear and precise description for the basic components of environment (air, water, land, urban environment and industry) during 2010. Clarify the extent of occurred changes, whether positively or negatively through environmental indicators, which illustrate the state of environment in comparison with previous years.

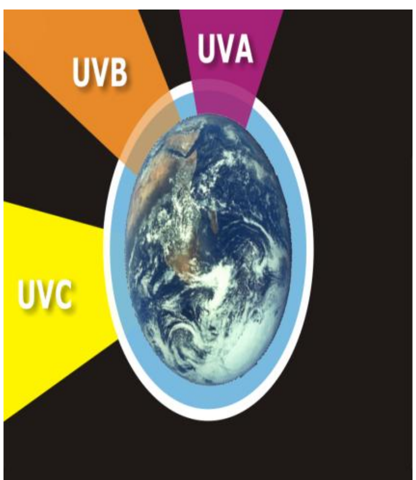
To realize these objectives the methodology depends on the following four principles:

Principle I:
Transparency: Actual state of environment in Egypt has been displayed using updated data available to MSEA- EEAA, through cooperation with all ministries, organizations and research centers. Egyptian government believes that transparency principle will aware public with the nature and impacts environment exposed to, as well as exerted efforts to reduce negative impacts.

Principle II:
Participation: Community participation is important to improve environment in Egypt. Preparation and revision of this report depends on participation of experts and researchers representing various executive sectors such as concerned ministries, research centers, universities, media experts, private sector and NGOs.

Principle III:
Adoption of global standards: Approved global standards are adopted in developing State of Environment Reports ; therefore the scientific approach has been applied including (sources , adverse impacts, environmental indicators , exerted efforts , future visions and plans and international trends to protect environment .

Principle IV:
International obligations: The need to link between international obligations and agreements ratified by Egypt and exerted efforts on the national level to deal with national environmental issues; as it is difficult to separate local from global environmental impacts due to the fact that we are living on one planet (Earth).

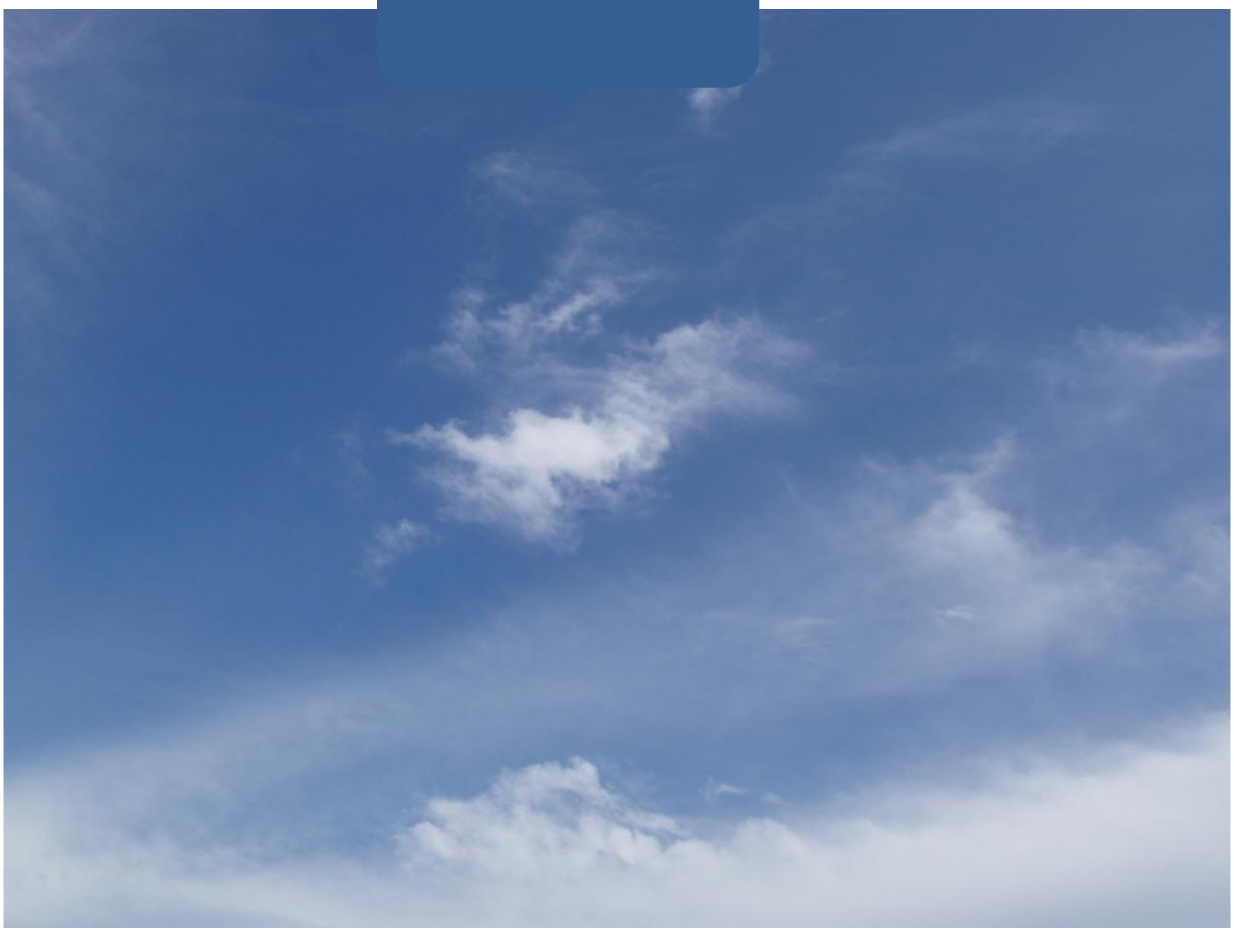


First Part

Air

Chapter one

Air Quality



1.1. Introduction:

Air is the main component of atmosphere; all humans, animals, plants and other living organisms depend on it for survival on earth, so protecting air from pollution is one of the major challenges facing Egypt and most countries of the world. Air pollution problem in Egypt is on the top of the Ministry of State for Environmental Affairs' priorities. Various pollution resources are resulting from the different economic and development activities and industrial progress that Egypt is witnessing recently.

Sources of air pollutants are variable; pollutants resulting from emissions of vehicles, industrial activities, open burning of agricultural and municipal solid waste; all of theses are causing several economic and health damages.

Depending on scientific and research studies conducted during previous years, International Environmental Protection Agencies and World Health Organization (WHO) identified six main air pollutants that determine the quality of ambient air. These pollutants have significant impact on human health and surrounding environment; so that efforts must be exerted to reduce their impacts through adopting all technical and scientific methods to reach the permissible limits recommended by both (WHO) and each country. These six pollutants are inhaled suspended particles, lead, carbon monoxide, nitrogen dioxide, sulfur dioxide, and ozone.

1-2 Main pollutants of ambiant air:

Ambient air pollutants that have an impact on public health in Egypt are divided into two major types; the suspended inhaled particles and gases. The following will clarify these pollutants, their sources and negative impacts as a result of exceeding the permissible limits stipulated in law No. 4/1994 amended by law No. 9/2009.

1-2-1 Particulate matters PM10

The inhaled particulate matters are the most common pollutants in dry and semi dry areas, industrial and heavy traffic density areas. It has direct negative impacts on public health through the particulate matters that emitted as a result of the incomplete fuel combustion processes and the chemical interactions of pollutants in the atmosphere.

These suspended particulates are mostly resulting from the incomplete combustion of fossil fuel especially diesel fuel. They emitted from public transportation powered by diesel fuel with an average of 40%-50% more than other transportation means using gasoline. They also emitted from industrial facilities consuming energy such as, power plants and cement factories …etc.

It is worth to mention that theses particulates have negative impacts on human health, as they cause dangerous diseases depending on many factors including " their diameter" ; the inhaled particles that are less than 10 micron (PM10) are more harmful because they can be easily inhaled and penetrate to the lower respiratory system.

Recent reports , based on researches and studies , issued by different international environmental protection agencies clarified that fine pollutants , especially inhaled particulates constitutes the most environmental dangerous on public health in most countries of the world . Researchers and academics have decided that these particulates are directly responsible for asthma, chest allergy and cardio vascular diseases which cause thousands of early deaths all over the world.

1-2-2 Gaseous Pollutants:

Fuel combustion is the main source of gaseous pollutants, such as nitrogen oxides, sulfur oxides and carbon monoxide (NO_x, SO_2, CO). These gases play an important role in deteriorating air quality and forming smog over cities. They indirectly produce some other dangerous gases when these gases interact with nitrogen oxides in the presence of hydrocarbons under the effect of ultra violet rays; they form very dangerous secondary pollutants such as ozone (O_3). These pollutants cause inflammation of the mucous membranes of respiratory system, eye irritation, cough, and bronchitis... etc.

1-3 National Network for Monitoring Air Pollutants:

Within the framework of the important role conducted by the Ministry of State for Environmental Affairs and its Executive Agency (EEAA) to reduce problem of air pollutants and identify air quality. The Ministry established an Integrated National Air Monitoring Network for ambient pollutants consist of 87 stations distributed all over Egypt to identify pollution sources. Monitoring equipments are measuring main pollutants of air quality periodically and continuously since 1998 until now, in addition to compiling data from metrological stations, that measure and monitor different metrological factors such as: wind speed and direction, temperature and relative humidity…etc

Particulate matters are monitored by two different methods:

- **First method:** using devices for instantaneous and continuous monitoring along the 24 hours, to monitor concentrations and calculate their average per hour.

- **Second method:** using devices that collect samples on filters for 24 hours / day. Samples are analyzed in specialized laboratories to determine particulates concentrations on these filters.

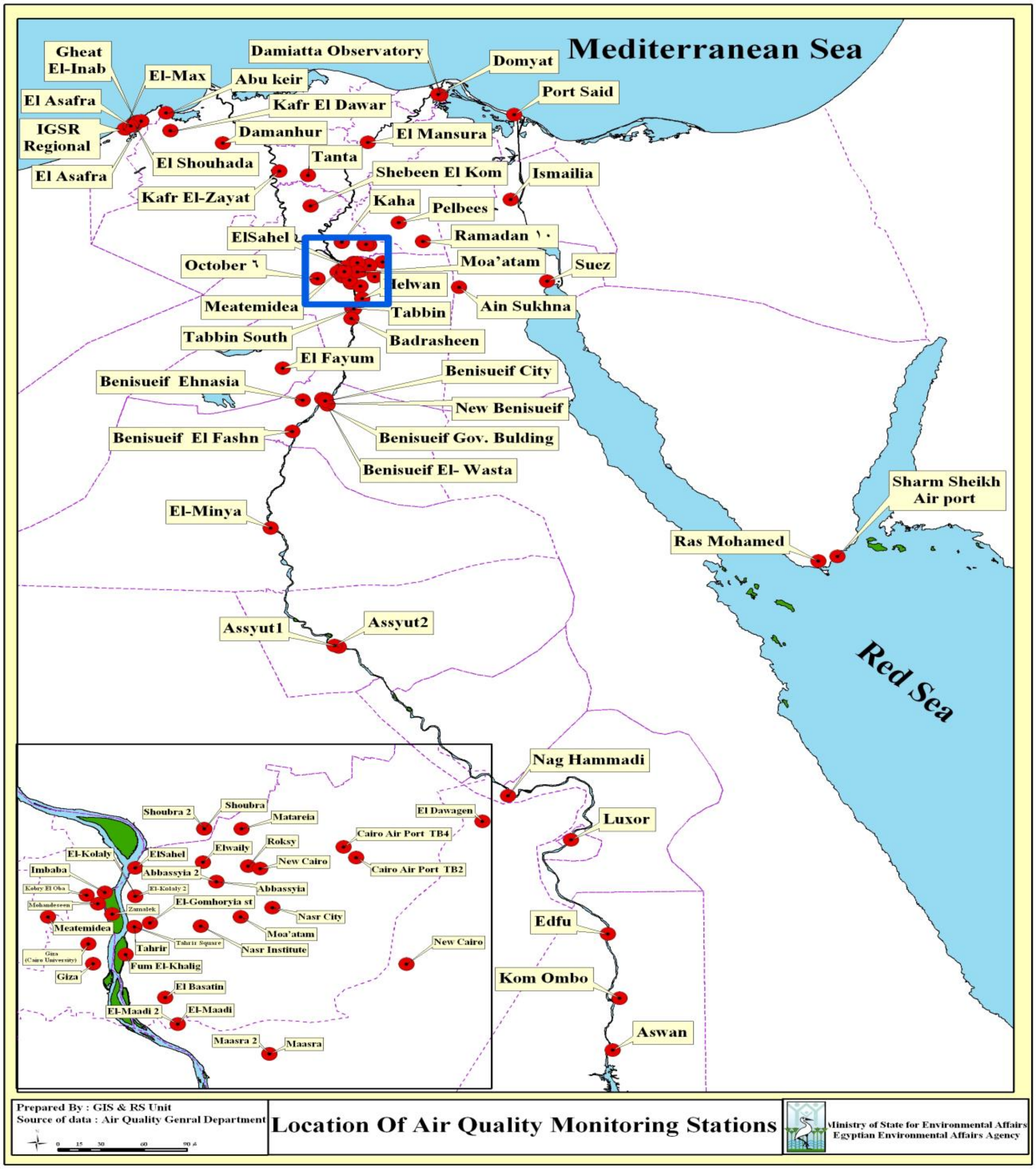
MSEA continuously upgrade, replace and increase number of monitoring stations to cope with the continuous scientific development in monitoring methods and cover all areas of the country. Table (1-1) shows geographical distribution of monitoring stations and their places.

Table (1-1) Geographical distribution of EEAA's National Network Stations for Monitoring Air Pollutants, 2010

Source: National network for monitoring of ambient air pollutants

Site Type	Greater Cairo		Alexandria		Delta		Upper Egypt		Sinai and Canal Cities		Total	
	Established Sites	New Sites	Established Sites	New Sites	Established Sites	New Sites	Established Sites	New Sites	Established Sites	New Sites	Established Sites	New Sites
Industrial areas	7	1	3		3	1	3			1	16	3
Urban areas	9		1		4		7				21	
Residential areas	4	1	2		2		2				10	1
Traffic dense areas	7	3					1				8	3
Remote areas	4		1		1		1		2		9	
mixed areas	10	2	1		2		1				14	2
total	41	7	8	--	12	1	15	--	2	1	78	9
	48		8		13		15		3		87	

Monitoring Network includes 87 Stations, distributed as follows:
42 instantaneous monitoring stations ,45 sampling stations including 20 stations to collect lead samples in Greater Cairo



Map (1-1) Distribution of Air Quality Monitoring Stations in Egypt

Source: National network for monitoring of ambient air pollutants

1-4 Air Quality Indicators:

Environmental indicators and data of air pollution monitored along previous years by the National Network for Monitoring Air Pollutants affiliated to Ministry of State for Environmental Affairs are important tools in the field of environmental assessment. They are used to follow-up achieved progress in the improvement rate of air quality along years, as follows:

1. Environmental indicator is considered an important tool in identifying, evaluating, and analyzing pollution resources to set priorities. Also, it is used to monitor changes in air quality and improvement rate to achieve goals of development plans.
2. Indicators and data are used to prepare integrated environmental assessment reports, environmental status reports, sustainable development reports and environmental indictors.
3. Indicator is an important tool to follow up performance of policies and measure improvement in air quality according to the success in executing these policies to achieve targeted objectives.
4. Indicator provide a simplified and clear view for decision makers , about air quality and achieved progress according to adopted procedures and plans to reduce pollution levels.

The following is a list of major indicators statistically calculated to clarify air quality during 2010, in comparison with previous years' data.

1-4-1 Sulfur Dioxide (SO_2):

Sulfur dioxide gas is mainly generated as a byproduct of fuel's sulfur oxidation during burning processes. It is emitted from stationary sources such as power plants, different industries or mobile sources such as vehicles.Noting that the maximum annual allowable limit in the Executive Regulation of Law no. 4/1994 amended by law no. 9/ 2009 is 60 µg/m3.

Figure (1-1) shows annual average concentrations of sulfur dioxide from (2004 – 2010) in Egypt. Indications clarified significant gradual improvement in SO_2 concentrations measured since 2004 till 2010. Annual average for 2010 was 27 µg/m3, while the average of 2009 was 31 µg/m3.

The significant improvements in the annual average concentrations of SO_2 represent 50% in comparison with 2004. These improvements were due to the strict enforcement of controlling regulations on industrial facilities and their emissions, intensifying inspection campaigns on vehicles' emissions, imposing fines on violating vehicles of the limits prescribed by Environment Law, efficiency of controlling devices and the increased interest to use natural gas instead of other types of fuel in factories and power plants.

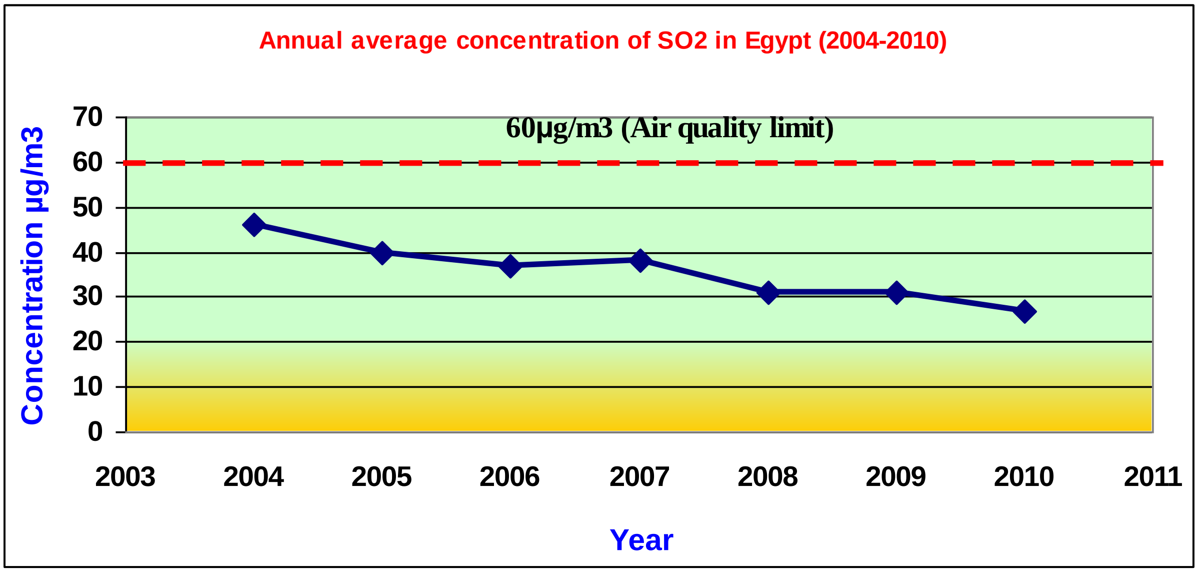


Figure (1-1) Annual average concentrations of sulfur dioxide in Egypt from 2004-2010

Source: National network for monitoring of ambient air pollutants

Analysis of air quality indicator of sulfur dioxide during 2010 clarifies that the annual average of all monitoring stations in Egypt did not exceed the permissible limits of the Executive Regulation of Environment law No. 4/1994 amended by law No.9/2009 (60 µg/m^3) as annual average.

Table (1-2) clarifies the annual average concentration of sulfur dioxide from 2007 – 2010 compared to the base year 1999 in Greater Cairo and Delta. In general there was a significant decrease and improvement in sulfur dioxide concentrations during 2010 in Greater Cairo, as follows:

1. Relative stability in the annual average monitored in Greater Cairo during 2010. It recorded 27 µg/m^3 in comparison with 28 µg/m^3 recorded in 2009 which is less than the permissible limits of Environment Law This is due to expansion of using natural gas in electric power plants and in many other industries located in Greater Cairo.

2. Slight increase in the total annual average monitored in Delta during 2010 20µg/m^3, while it was 16µg/m^3 during 2009. This increase is less than the permissible limits of Environment Law (60 µg/$m^{3)}$.

Table (1-2) Annual average concentration of sulfur dioxide (microgram/m^3) during previous years in comparison with base year1999

Year / Region	1999	2007	2008	2009	2010
	Concentration (µg/m^3)				
Greater Cairo	65	49	39	28	27
Delta	19	18	15	16	20

Source: National network for monitoring of ambient air pollutants

Figure (1-2) clarifies annual average concentrations of sulfur dioxide concentrations in Greater Cairo & Delta during previous years. It shows rate of improvement in average concentrations of 2010 in comparison with the base year1999.

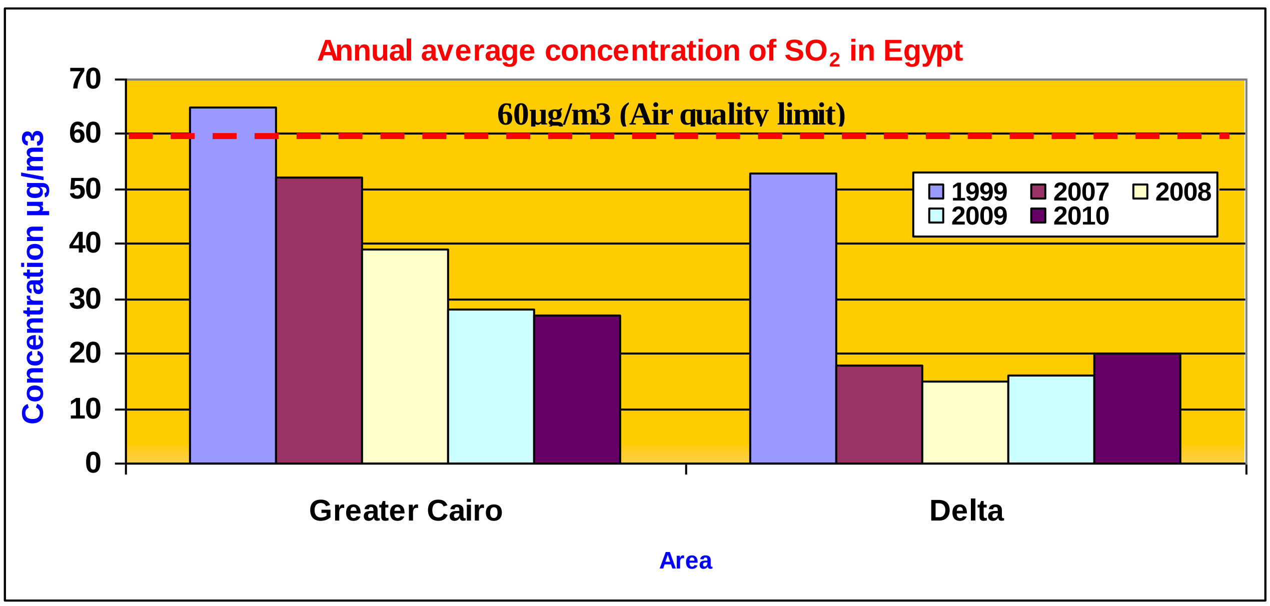


Figure (1-2) Annual average concentration of sulfur dioxide at different monitoring areas

Source: National network for monitoring of ambient air pollutants

1-4-2 Nitrogen dioxide NO_2:

Nitrogen dioxide is formed as a byproduct of fuel combustion process that happen at high temperatures. Executive Regulation of the Environment Law no. 4/1994 did not identify maximum annual average limit for its concentrations. However, EEAA adopted the annual average maximum limit 40µg/m^3 which is identified by the World Health Organization. It is worth mentioning that Executive Regulation of Environment Law no.

4/1994 amended by law no.9/2009 has been amended where a proposal was added for the annual level for nitrogen oxides in the ambient air, it is in the process of being issued after Cabinet of Ministers approval.

Comparing the annual average of 2010 with 2009, a slight increase was recorded in the average concentrations according to the allowed limit by WHO which is 40µg/m^{3}. Annual average concentration of 2010 was 43µg/m^3 compared to 40µg/m^3 in 2009. This increase may be due to the remarkable increase in the number of licensed vehicles during 2010 with an increase rate mounted 1.1 million vehicles all over the country. Figure (1-3) clarifies annual average concentration of nitrogen dioxide from 2004-2010

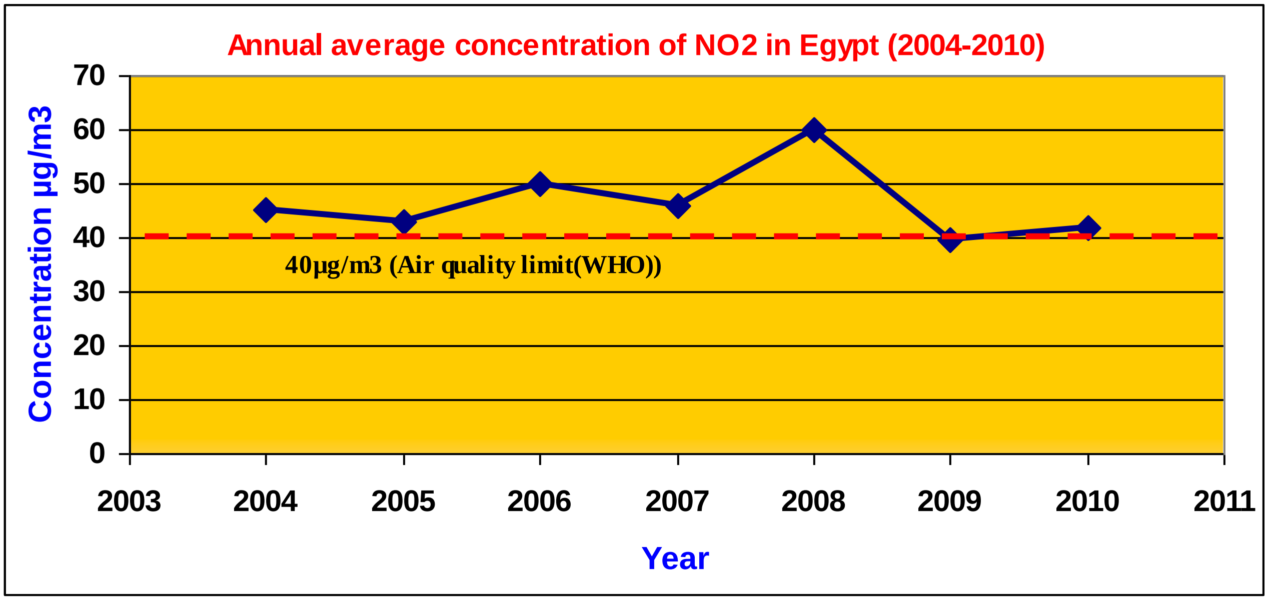


Figure (1-3) Annual average concentration of nitrogen dioxide from 2004-2010

Source: National network for monitoring of ambient air pollutants

Table (1-3) shows annual average of nitrogen dioxide from 2007- 2010 compared to 1999 the base year in some areas of the country. It was remarkable that annual average concentrations during 2010 vary from one area to another compared with previous years as follows:

1. Annual average concentration in Greater Cairo during 2010 was 44 µg/m^3 compared to 36 µg/m^3 in 2009, this is due to the increasing number of vehicles during 2010. This necessitates developing plans and studies to encourage use of public transportation and decrease numbers of private cars, which will consequently decrease pollution levels.
2. Relative stability was recorded in the annual average of Delta region during 2010. It recorded 38 µg/m^3 compared to 39µg/m^3 in 2009 which did not exceed the permissible limit of WHO.

Table (1-3) Annual average concentrations of Nitrogen dioxide (micrograms/m^3) from 2007 – 2010 in comparison with base year 1999

Year / **Region**	1999	2007	2008	2009	2010
	Concentration (µg/m^3)				
Greater Cairo	58	51	64	36	44
Delta	31	--	37	39	38

Source: National network for monitoring of ambient air pollutants

Figure (1-4) clarifies annual average of nitrogen dioxide in Greater Cairo & Delta along previous years in comparison with base year (1999) in most monitoring areas.

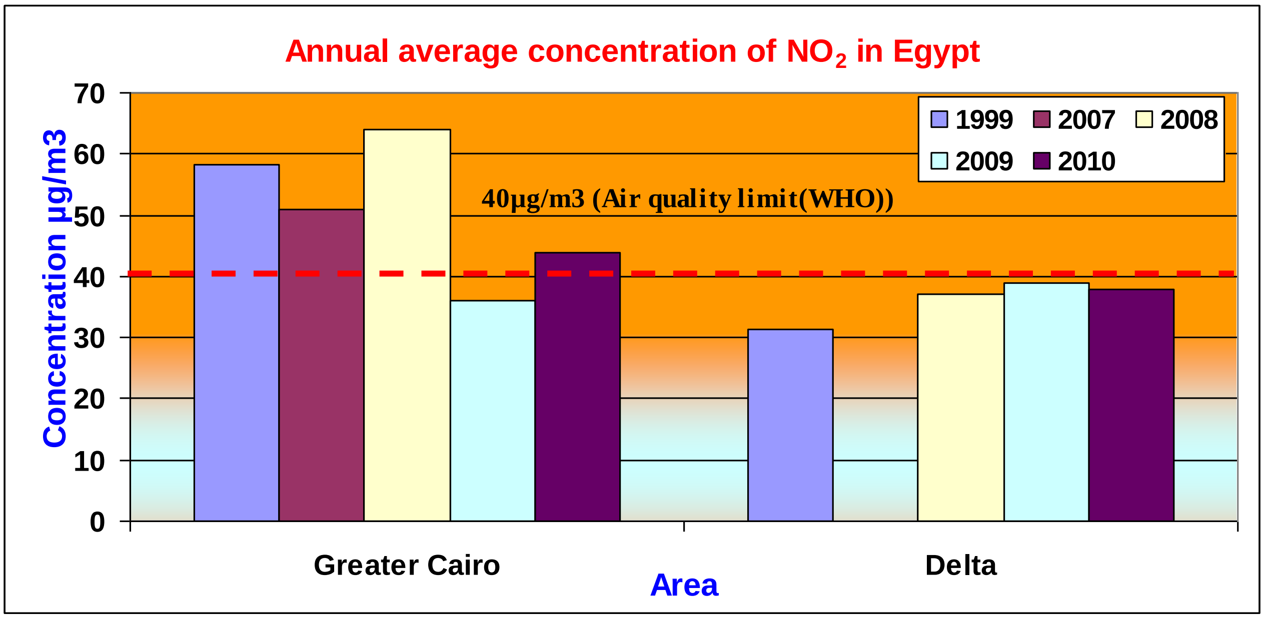


Figure (1-4) Annual average concentration of nitrogen dioxide at different monitoring areas

Source: National network for monitoring of ambient air pollutants

Most hourly average concentrations of nitrogen dioxide did not exceed the permissible limit (400µg/m^3/hour) stipulated in the Executive Regulation of Environment Law no. 4/1994. This is good indicator of that nitrogen oxide emission didn't have negative impact on public health.

1-4-3 Inhaled Particulates Matter PM_{10}:

The geographical nature of Egypt, its location in the greater desert of North Africa and scarcity of rainfall increase the contribution of natural sources on rates of monitored dust.

Inhaled particulates are one of the main causes of increasing pollution levels in Egypt, especially in Greater Cairo and neighboring areas. This is due to the multiple sources of pollution in the area ; recently Ministry of State for Environmental Affairs focused on monitoring all types of dust, especially the inhaled particulates less than 10 micron in diameter (PM_{10}), that have a negative impact on human health . Environment Law no 4/1994 has stipulated that the allowed annual average for these particulates is 70 microgram/m^3.

Figure (1-5) clarifies decrease in the annual average concentrations during 2010 for the inhaled particulate matter compared to 2009. It recorded (130 µg/m^3) during 2010 while during 2009 it was 137 µg/m^3. This is considered a good indicator, especially in light of the increasing human activities during previous years and the traffic density as a result of the increasing number of new licensed vehicles on roads. As well as the natural dust storms which were repeated during summer and fall of 2010 .These storms closed ports, airports and roads more than one time.

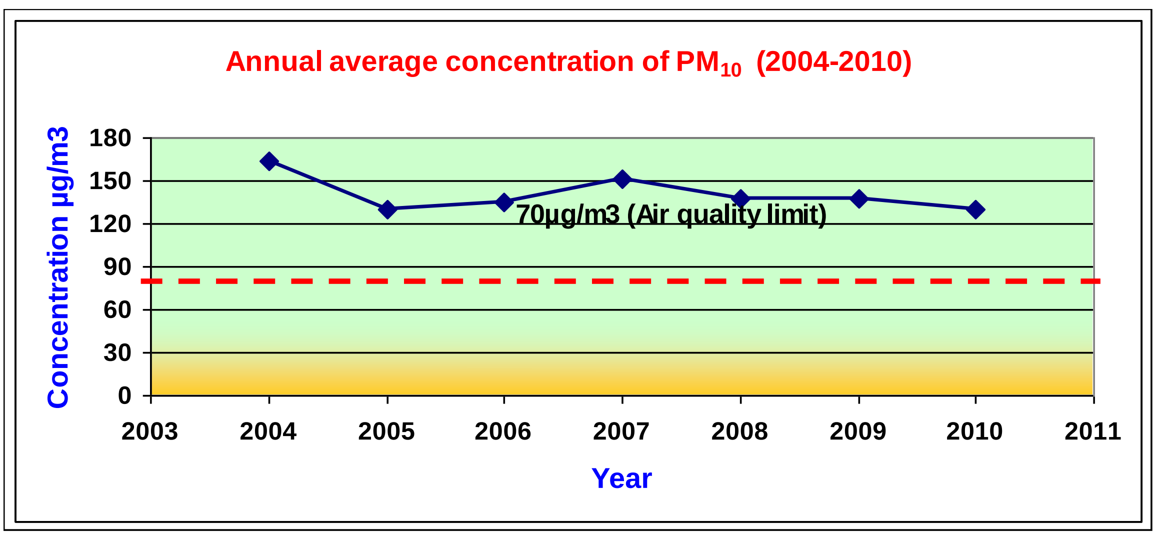


Figure (1-5) Annual average concentrations of PM_{10} during previous years (2004-2010).

Source: National network for monitoring of ambient air pollutants

Table (1-4) clarifies annual average concentrations of inhaled particulate matter along previous years (2007-2010) in comparison with base year (1999) in some areas, as follows:

1. Significant improvement in the annual average concentrations in Greater Cairo during 2010. It recorded 126µg/m^3 compared to 149µg/m^3 in 2009. This improvement is due to exerted efforts to control levels of industrial pollution through policies and projects implemented by the Ministry of Environment in industrial zones.
2. Obvious improvement in the annual average concentrations in Delta during 2010. It recorded 138µg/m^3 compared to 234µg/m^3 in 2009 .This is due to controlling burning of agricultural waste. Especially rice straw and maize straw (stems and leaves), which are burned in violation of Environment Law. In addition MSEA has contracted with specialized companies to collect rice straw for recycling during harvest period and intensifying inspection campaigns on factories located in the Delta.

Table (1-4) Annual average concentrations of inhaled particulate matter (PM_{10}) (micrograms/m^3) during previous years in comparison with base year (1999)

Year / Region	1999	2007	2008	2009	2010
	Concentration (µg/m^3)				
Greater Cairo	234	139	145	149	126
Delta	150	176	164	234	138

Source: National network for monitoring of ambient air pollutants

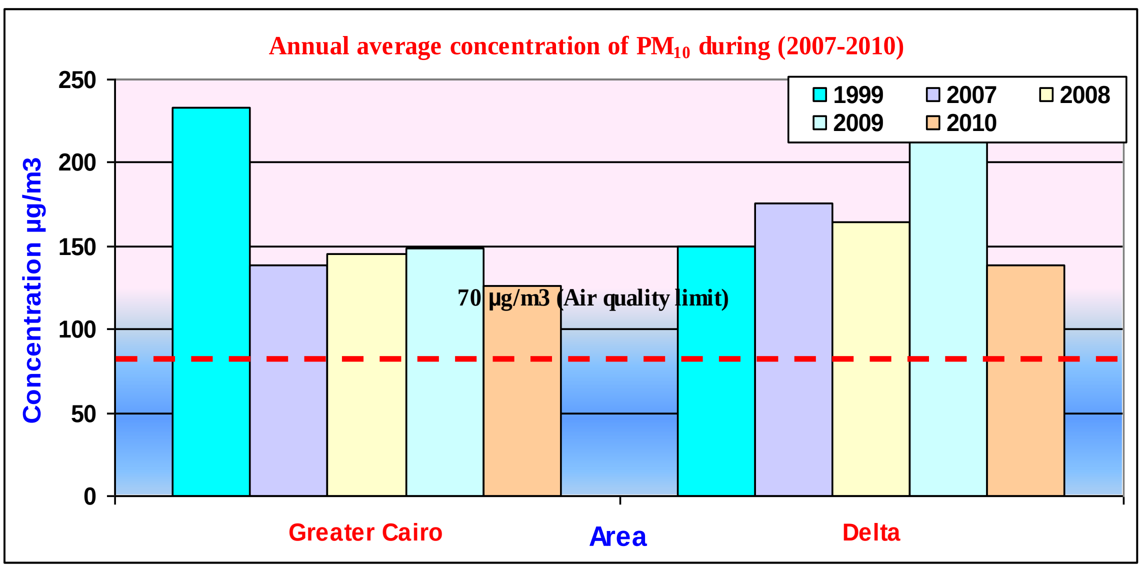


Figure (1-6) Annual average concentrations of inhaled particulate matter less than 10 micron (PM_{10}) in different monitoring areas

Source: National network for monitoring of ambient air pollutants

1-4-4 Lead Pb:

During 2010, a study was conducted to attribute pollutants to their sources in Greater Cairo during summer and fall seasons and comparing their results with previous years. Ten years ago, Ministry of state for Environmental Affairs implemented a plan to combat lead contamination through developing guidelines and policies to identify main sources of lead in Greater Cairo. The plan focused on two main factors causing lead emission in ambient air; the first was lead smelters as they are the most important source for lead emissions. MSEA exerted efforts to transfer smelters from residential areas and establish modern smelters to reduce their emissions and prevent their negative impacts on workers. Replace mazout (heavy oil) with natural gas in operating smelters. The second was using free-lead gasoline in vehicles, which greatly reduce lead concentration.

Through the study implemented in cooperation with the World Bank to attribute pollutants to their sources in Greater Cairo, air samples were taken twice during summer and fall seasons from five locations (Kaha, Shubra El-Khima, Qulaly, Zamalek and Helwan); they represent different activities (reference, industrial, traffic, residential and commercial) .A specialized chemical analysis were conducted in authorized laboratories and the results were as follows:

1. Significant improvement in lead average concentrations was recorded in Greater Cairo during summer of 2010. It recorded 0.3 $\mu g/ m^3$ compared to 7.2 $\mu g/m^3$ during summer of 2002.The rate of improvement was about 96% and concentrations were less than the allowable limit in the Environmental Law no. 4 /94 and its Executive Regulation as figure (1-7) clarifies. This represents a significant improvement in reducing lead concentrations in Greater Cairo air. This is success story realized by relevant entities that were responsible about executing developed policies to reduce lead pollution in Greater Cairo air.
2. Significant improvement in lead average concentrations was recorded in Greater Cairo during fall of 2010. It recorded 0.7 $\mu g/ m^3$ compared to 12.7 $\mu g/ m^3$ during fall of 1999. The rate of improvement was about 95%. It is worth to mention that maximum allowed concentration in air is 0.5 micrograms / m^3 as figure (1-8) clarifies.

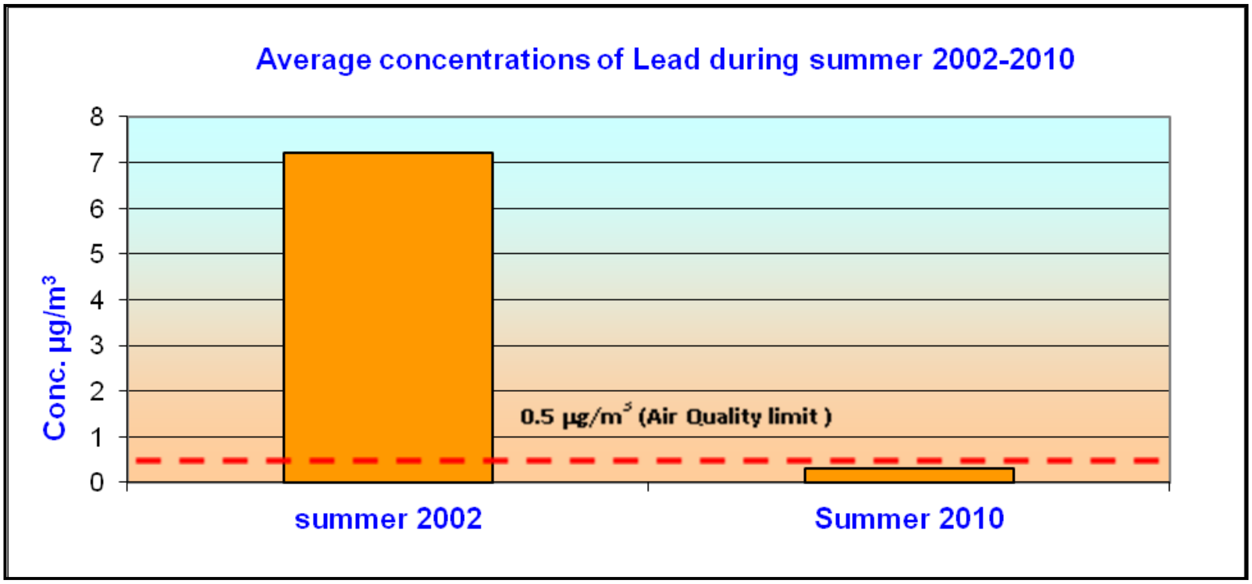


Figure (1-7) Average concentrations of Lead during summer of 2002 and 2010

Source: National network for monitoring of ambient air pollutants

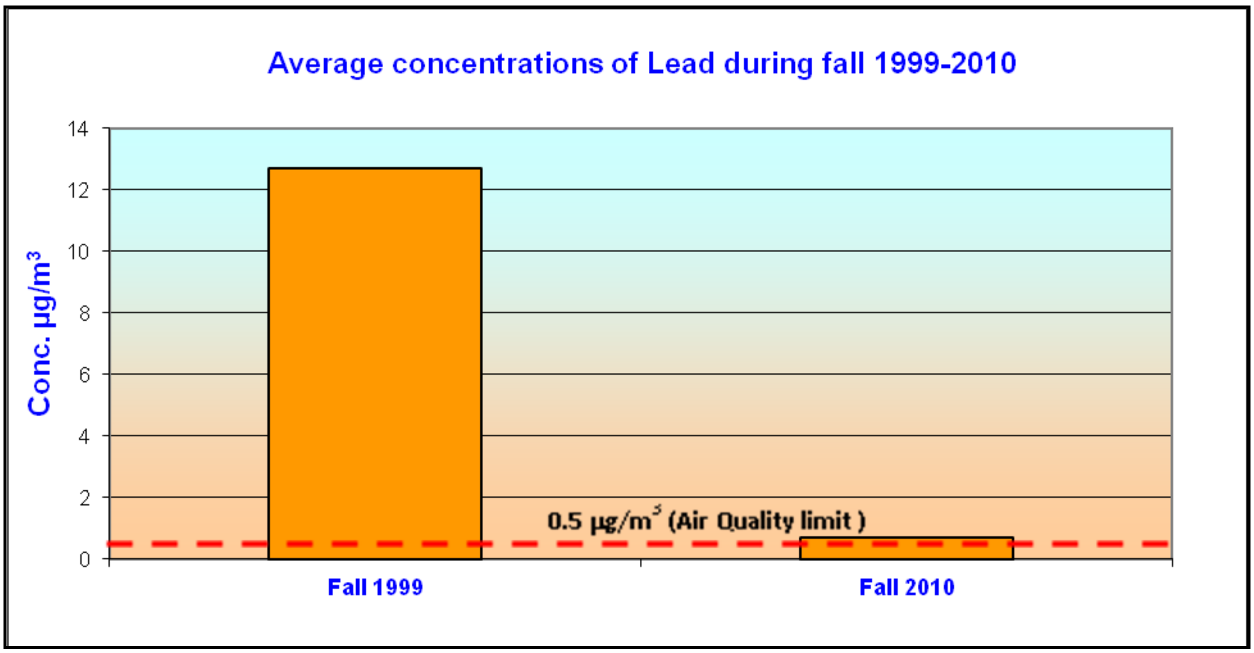


Figure (1-8) Average concentrations of Lead during fall of 1999 and 2010

Source: National network for monitoring of ambient air pollutants

1-4-5 Carbon Monoxide CO:

Carbon monoxide is considered one of the toxic gases that cause death when exposed to high concentrations of it during short periods. It binds with hemoglobin forming carboxyl hemoglobin; thus prevents oxygen from combining with hemoglobin and deprives body from getting oxygen which causes asphyxiation. Carbon monoxide gas emits from incomplete combustion processes of fuel in various industries, vehicles and burning of coal or wood in different activities. Executive Regulation of Environment law stipulates that maximum allowable exposure to carbon monoxide for one hour is 30 mg/m^{3}and 10 mg/m^3 for 8 hours.

1. The compatibility rate of carbon monoxide with the maximum allowed limits was 99.3% for one hour average compared to 99.1% during 2009 despite of the remarkable increase in human and industrial activities, and energy consumption rates.
2. Figure (1-9) clarifies hourly average frequent distribution of carbon monoxide during 2010.

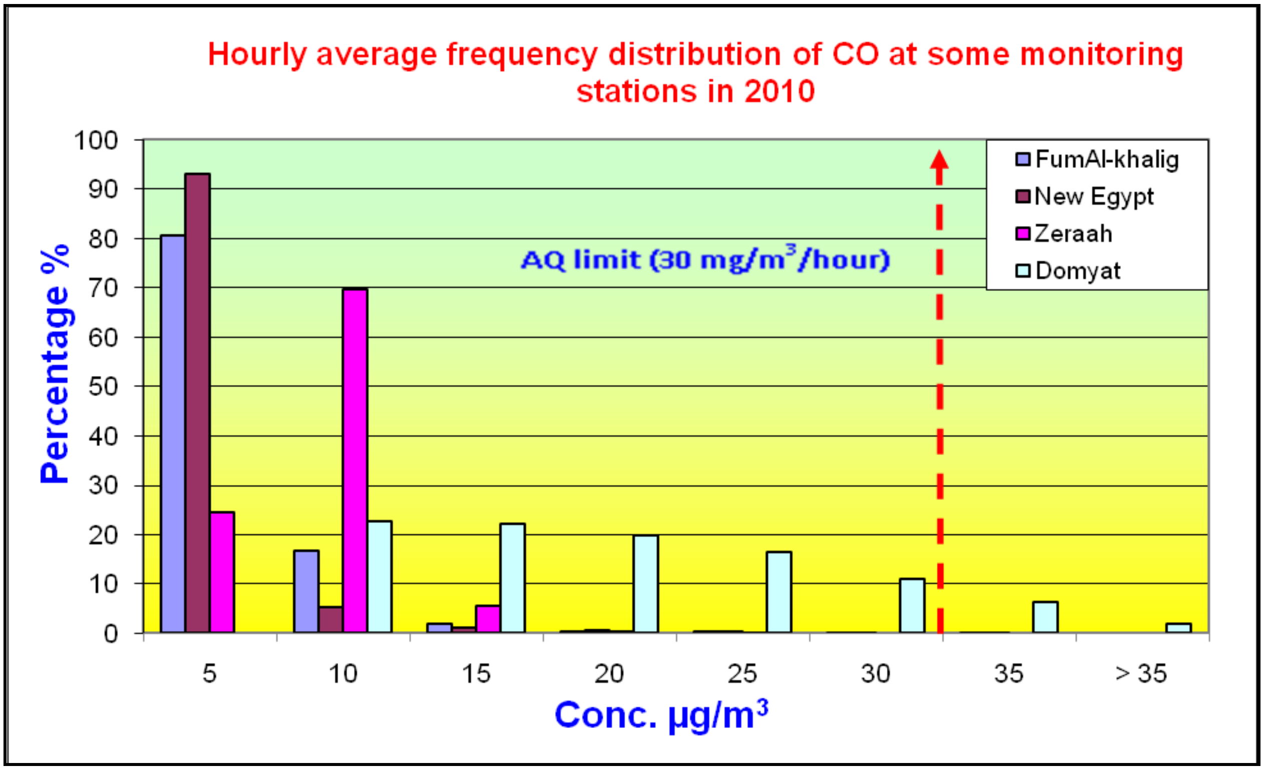


Figure (1-9) Hourly average frequency distribution of carbon monoxide at some monitoring stations in 2010

Source: National network for monitoring of ambient air pollutants

The improvement in compatibility rate is due to the exerted efforts by implementing many programs and steps to improve efficiency of fuel combustion in power plants and industrial sector, reduce use of mazout (heavy fuel) in these sectors, expand in using natural gas and replace old cars with modern cars in Greater Cairo.

1-4-6 Troposphere Ozone O_3

Troposphere Ozone is a secondary pollutant formed at lower levels of the atmosphere. It results from the interaction of volatile organic compounds with nitrogen oxides in the presence of sunlight. . Accordingly, ozone concentrations levels increase during summer than winter, because of the increasing sunlight hours. Ozone is considered very dangerous to human health as its high concentration contributes in the formation of smog. Accordingly, Executive Regulation of Environment law stipulates that maximum concentrations of Ozone must not exceed 200 microgram/m^3/hour and 120 microgram/m^3/8hours.

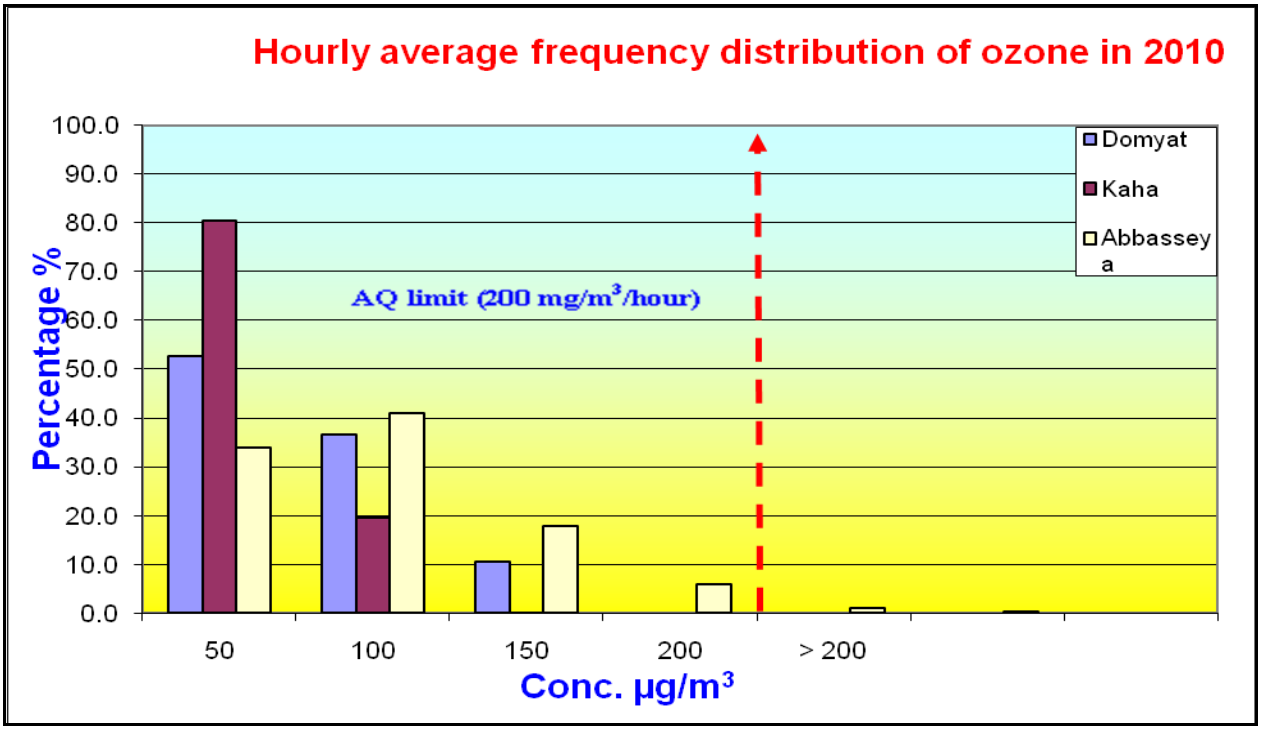


Figure (1-10) Hourly average frequency distribution of Troposphere ozone concentrations during 2010 in some monitoring stations

Source: National network for monitoring of ambient air pollutants

Figure (1-10) clarifies hourly average frequency distribution of Troposphere ozone during 2010; an improvement is monitored during 2010 in the compatibility percentage with the allowed limits. It recorded 99% compared to 62.2% during 2009 which was in the same sites of monitoring ozone. Due to the limited number of ozone monitoring sites and the importance of its monitoring, EEAA has prepared an integrated monitoring plan to increase number of its monitoring sites to conduct scientific analysis of its average concentrations in different areas.

1-5 The Most important results of monitoring ambient air quality in 2010:

1-5-1 General average concentrations of sulfur dioxide:

1. Remarkable improvement recorded during 2010 in the annual average concentrations of sulfur dioxide compared to previous years.

2. Annual average concentration shows steady improvement since 2004 till 2010. General average concentrations recorded 27 $\mu g/m^3$ during 2010 in comparison with 31$\mu g/m^3$ during 2009, its rate of improvement is about 13%.
3. Daily average concentrations were about 40 $\mu g/m^3$ which is extremely less than the allowable limit (150 $\mu g/m^3$ as a daily average) in the Executive Regulation of Environmental Law 4/1994, while the daily average concentrations during 2009 ranged between 30-50 $\mu g/m^3$.
4. This relative improvement in the daily average concentration of sulfur dioxide is due to many factors, such as improving efficiency of fuel combustion used in power plants and industrial sector and the expansion in using natural gas in all fields.

1.5.2 General average concentrations of nitrogen oxides:

1. Relative stability was recorded in nitrogen oxides concentrations during 2010 compared to previous years.
2. Daily average concentrations of nitrogen oxides recorded decrease. It ranged between 50 - 60 $\mu g/m^3$/day, which is less than the allowable limits (150$\mu g/m^3$/day) in the Executive Regulation of Environment Law no. 4/1994, while it ranged between 55- 85 $\mu g/m^3$ during 2009.

1.5.3 General average concentrations of particulate matters:

1. Annual average concentrations of particulate matters recorded decrease during 2008, 2009 and 2010 than the annual average of 2007.
2. Remarkable improvement was recorded in the monitored concentrations during September until end of November 2010 (period of acute episodes of air pollution).

1.5.4 General average concentrations of lead:

1. Significant decrease was recorded in the annual average concentrations of lead compared to previous years beginning from 1999 in Greater Cairo. General average concentrations in Greater Cairo during fall and summer of 2010 were 0.7 $\mu g/m^3$ and 0.3 $\mu g/m^3$ respectively; while during fall and summer of 1999 were 12.7$\mu g/m^3$ and 7.2 $\mu g/m^3$ respectively.
2. General indicator of lead levels extremely decrease due to the expand in using unleaded gasoline, transfer of the old smelters from Shubra Al-Khaimah to Abu Zaabal industrial zone in addition to adopting modern technology to control emissions from industrial facilities and other sources.

1-6 National network for monitoring industrial emissions:

Ministry of State for Environmental Affairs is concerned with monitoring emissions from major industrial sources as one of the most important steps to control and reduce risks of these pollutants; and in activation of article no. (20) of the Executive Regulation of Environment Law no. 4 / 1994, amended by Law no. 9 /2009, which states that (EEAA shall supervise the establishment and operation of the Environmental Monitoring Networks).

Therefore, MSEA in 2004 established the National Network for Monitoring Industrial Emissions, it started with cement factories by connecting self-monitoring systems of these factories with MSEA's monitoring system to follow-up emissions of total suspended particulate instantaneously along the 24 hours of the day.

1-6-1 Cement companies:

Cement companies connected to the National Network for Monitoring Industrial Emissions are classified according to dates of their establishment, as follows:

Old factories

(Established prior issuance of the Executive Regulation of Environment Law - before 1995), the maximum allowed limits for these factories 300 mg /m^3. They are 9 factories all over Egypt.

New factories

(Established after the issuance of the Executive Regulation of Environment Law - after 1995) the maximum allowed limits for these factories 200 mg/m^3. They are 8 factories all over Egypt.

Modern factories

(Established after the amendment of the Executive Regulation of Environment Law - after 2005) the maximum allowed limits for these factories 100 mg/m^3, only one factory in Egypt.

Monitoring of total suspended particulates emitted from cement stacks depends on using specialized devices to monitor emissions of industrial process.
Figure (1-11) shows working system of the National Network for Monitoring Industrial Emissions; where data sent automatically to EEAA. These data are sent at the same time to EEAA's Regional Branches to follow up these companies .

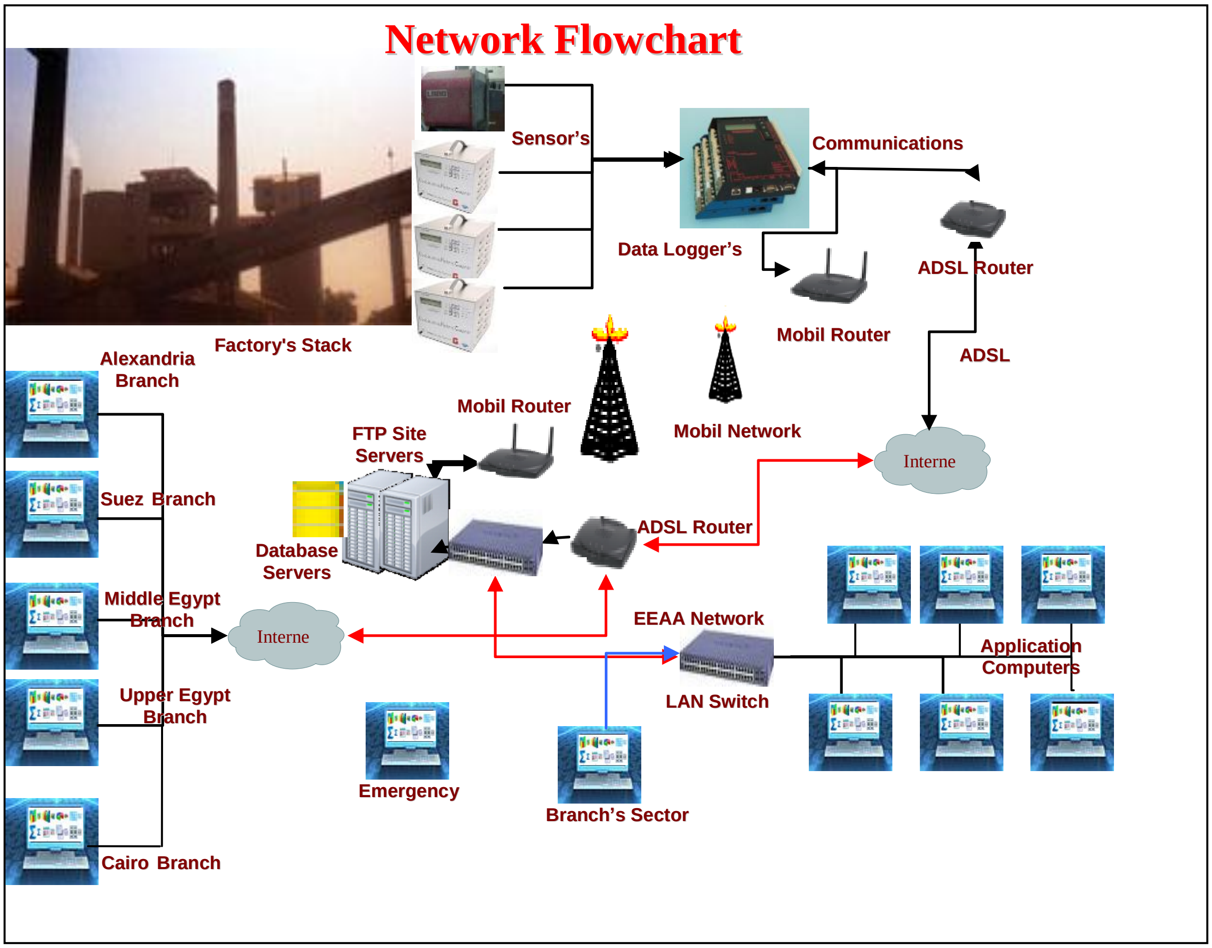


Figure (1-11) Working system of the National Network for Monitoring Industrial Emissions.

Source: National network for monitoring of industrial emissions

During 2010, number of companies' stacks connected to the National Network for Monitoring Industrial Emissions were increased with about 10 %. Where the total number of self monitoring sites linked with the Network have increased to 92 sites for 40 production lines in 18 companies (17 Cement companies + 1 fertilizer company), as table (1-5) clarifies .

Table (1-5) Locations of monitoring sites of total suspended particulates emissions from stacks of companies connected with the National Network for Monitoring Industrial Emissions in Egypt.

Serial	Company	No. Of sites	limits legally permitted mg/m^3	Serial	Company	No. Of sites	limits legally permitted mg/m^3
1	National cement company	11	300	**10**	El Ameriya sambor cement company	1	200
2	Portland Toura cement company	13	300	**11**	Misr Quena cement company	2	200
3	Helwan cement	10	300	**12**	Lafarge Cement	4	200

	company				company		
4	El katamyia cement company	3	300	**13**	Sinai Portland cement company	4	200
5	Suez cement company	4	300	**14**	Sinai White cement company	2	200
6	Beni Suef cement company	8	300	**15**	Misr Beni Suef cement company	5	200
7	El-Ameriya cement company	4	300	**16**	Alexandria Portland cement company	2	200
8	Assuit cement company	11	300	**17**	Helwan Fertilizers company	3	200
9	El Menia cement company	2	300	**18**	Arabian cement company	3	100
Total						**92**	

Source: National network for monitoring of industrial emissions

1-6-2 Monitoring Results of cement factories during 2010:

The 24 hours monitoring of the total suspended particulates' emissions from stacks of companies connected with the National Network for Monitoring Industrial Emissions in Egypt, evaluated according to the following two bases: compatibility of emissions of total suspended particulates with stipulated criteria in the Executive Regulation of Environment law and the environmental load of these emissions.

First: The compatibility of emissions of total suspended particulates with stipulated criteria in the Executive Regulation of Environment law No. 4/1994 amended by Law No. 9 / 2009:

1. The compatibility of emissions with the maximum limits stipulated in the Environment Law.

2. The compatibility of emissions with the maximum limits within the geographical location.

a. Compatibility of emissions with maximum limit stipulated in Environment Law:

- The compatibility percentage was 97.6 % in old factories stacks established before 1995 as shown in figure (1-12).

- The compatibility percentage was 98.1 % in new factories stacks established after 1995 as shown in figure (1-13).

- The compatibility percentage was 99.63% in the modern factory stack established after 2005 as shown in figure (1-14).

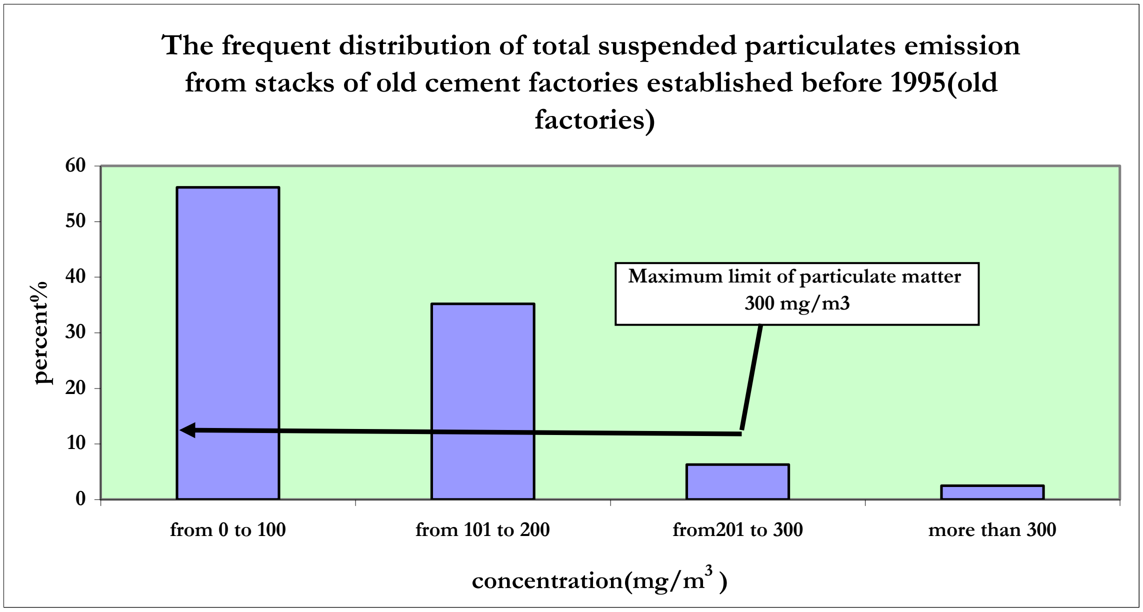


Figure (1-12) frequent distribution of total suspended particulates emissions from stacks of old cement factories established before 1995.

Source: National network for monitoring of industrial emissions

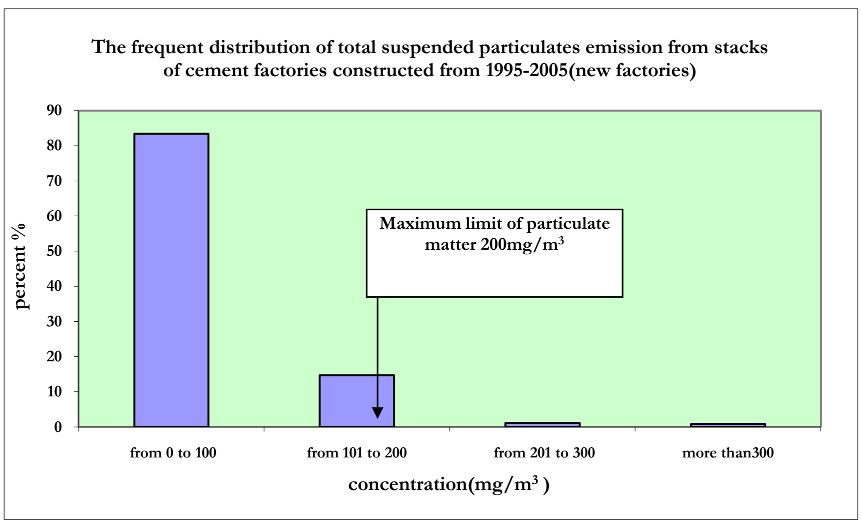


Figure (1-13) Frequent distribution of total suspended particulates emissions from stacks of new cement factories established from 1995-2005

Source: National network for monitoring of industrial emissions

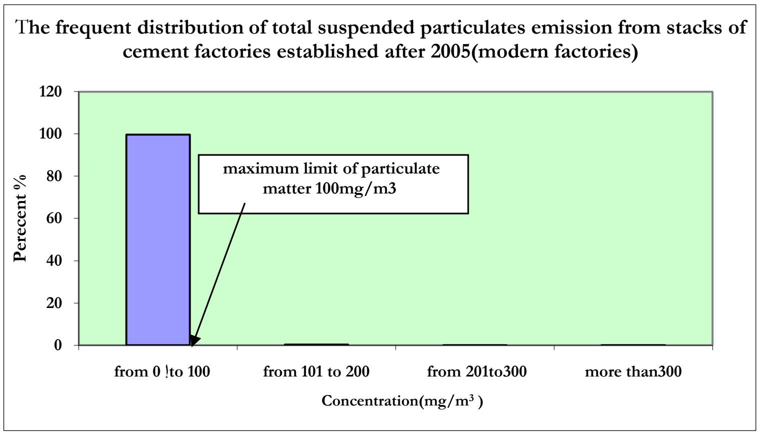


Figure (1-14) Frequent distribution of total suspended particulates emissions from stacks of modern cement factories established after 2005

Source: National network for monitoring of industrial emissions

- By comparing the compatibility percentage of total suspended particulates' emissions from stacks between 2009 and 2010, a relative stability has been noticed in the compatibility ratio of those two years .Percentage of compatibility in 2010 was about 98.4% compared to 98.5% in 2009. This stability is a good indicator, where the number of monitoring points increased to 92 during 2010 compared to 82 during 2009 with an increasing rate of about 10 %.

- MSEA started the second phase of developing the National Network for monitoring other industrial emissions by connecting fertilizers companies with the monitoring network system to monitor emissions of this industry. Coordination has been conducted with the 14 fertilizers companies in Egypt to conduct self-monitoring of their stacks and connect them with EEAA National network for monitoring industrial emissions. Helwan Fertilizers Company has been connected with the network to monitor emitted pollutants from their stacks.

b. Compatibility of emissions from companies' stacks with maximum limits according to the geographical location:

- **Companies located within Greater Cairo:**

Greater Cairo includes 4 cement factories (National Cement Company, Torah, Helwan and Katamyia); all of them are old factories, in addition to Helwan Fertilizers Company. Because of the sensitivity of sites of these companies, as they are located within residential areas; statistical analysis and relative distribution of total suspended particulates emissions were conducted as shown in figure (1-15).

In 2010, the ratio of compatibility of these factories increased. It reached 98.2% compared to 97.7% in 2009. This is due to intensifying inspection campaigns and follow-up of these factories.

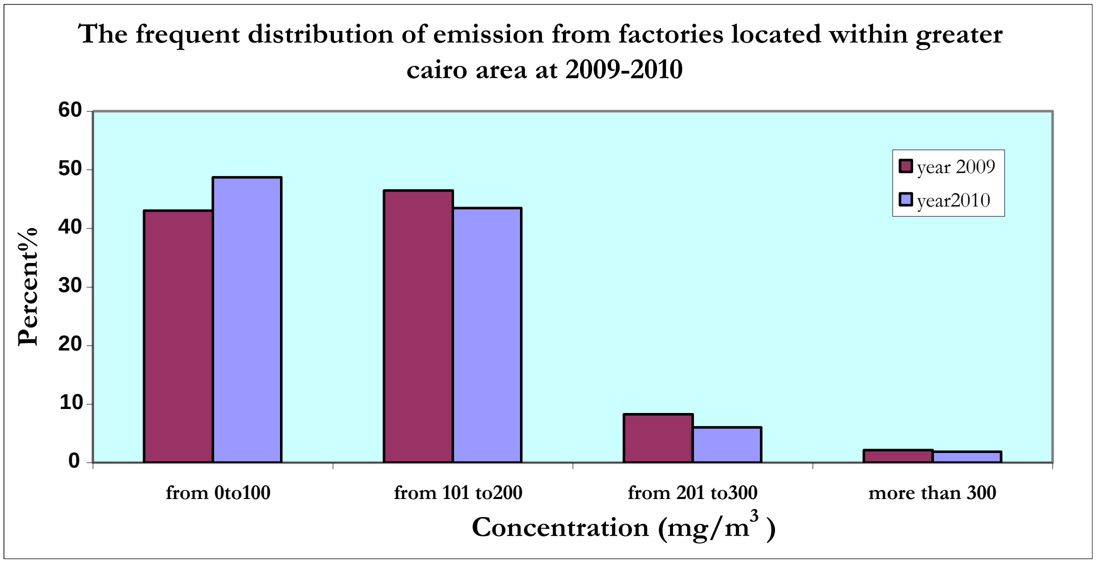


Figure (1-15) Relative distribution of emissions from factories located within Greater Cairo

Source: National network for monitoring of industrial emissions

- **Companies located within Alexandria governorate:**

❖ Alexandria governorate includes 3 Cement companies (Alexandria Cement Company, Amiriya Cement and Amiriya Cimpor). They directly affect large-scale of population, especially (Alexandria Cement Company) due to its existence near a residential area. By conducting the statistical analysis and relative distribution of total suspended particulates emissions for those companies , the following has been indicated as shown in figure (1.16):

❖ In 2010, relative stability was recorded in the compatibility percentage with permissible limits by 93.6% compared to 94.4% in 2009. This indicates necessity of rehabilitate the environmental status and intensify inspection campaigns on those factories especially Amireya Cement Company.

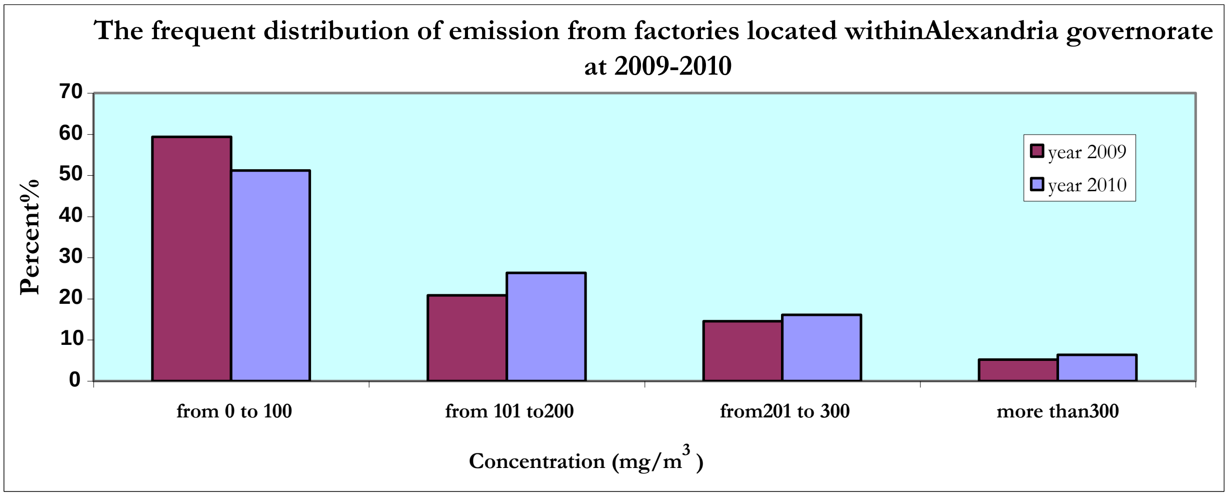


Figure (1-16) Relative distribution of emissions from factories located within Alexandria governorate

Source: National network for monitoring of industrial emissions

- **Companies located within Upper Egypt:**
  - ❖ Upper Egypt includes 5 Cement companies (Misr Qena , Misr Beni Suef, Minya , Assiut and Beni Suef), which directly affect the residential areas. Statistical analysis and relative distribution of total suspended particulates' emissions were conducted which indicated the following, as shown in figure (1-17).
  - ❖ In 2010, a relative stability was recorded in the compatibility percentage with permissible limits by 98.52% compared to 99.3% in 2009. This is due to the increased number of self-monitoring points connected with the national monitoring network in 2010.

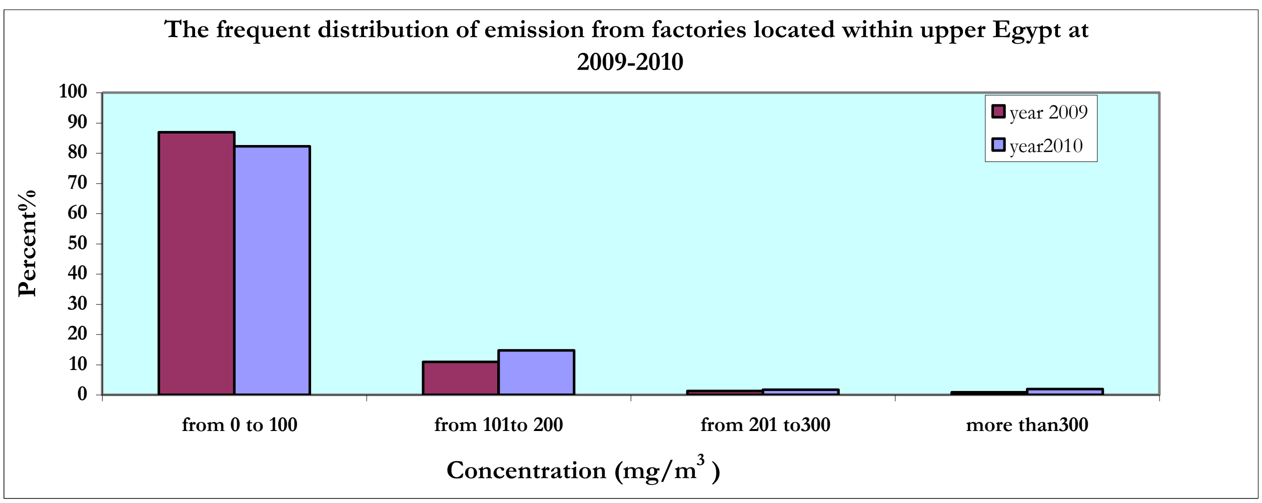


Figure (1-17) Relative distribution of emissions from factories located within Upper Egypt

Source: National network for monitoring of industrial emissions

- **Companies located within Suez governorate:**

❖ Suez governorate includes 3 companies (Suez, Lafarge and Arabia Cement) , the statistical analysis and relative distribution of total suspended particulates emissions were performed and clarified the following as shown in figure (1-18).

❖ in 2010 , a relative stability was recorded in the compatibility percentage with permissible limits by 99.3% compared to 99.8% in 2009

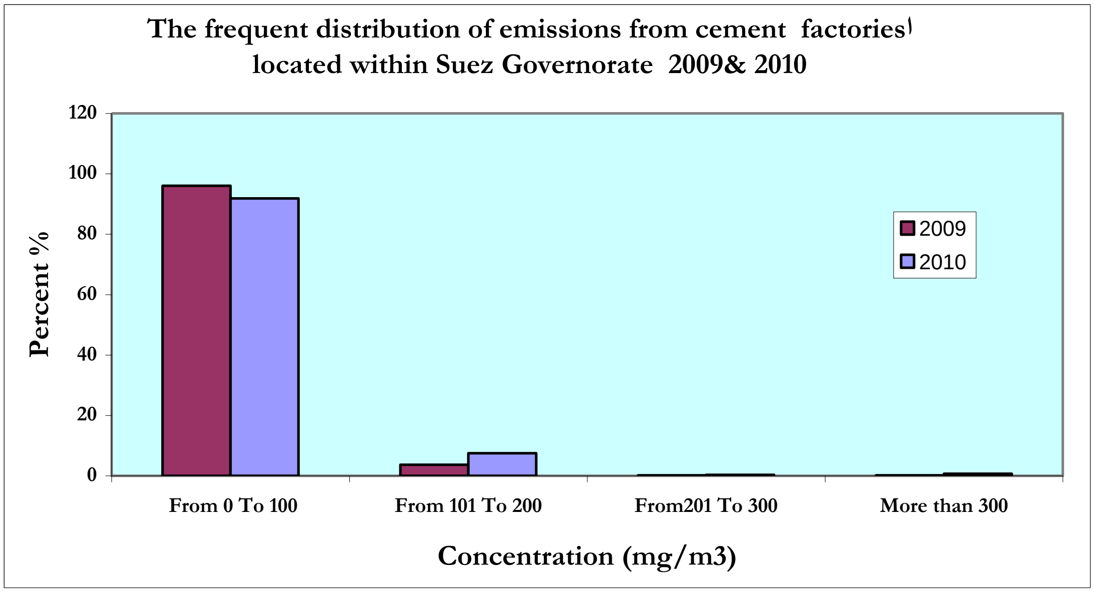


Figure (1-18) Relative distribution of emissions from cement factories located within Suez governorate.

Source: National network for monitoring of industrial emissions

- **Companies located within Sinai Peninsula:**

❖ Statistical analysis and relative distribution of total suspended particulates emissions were performed for (Sinai Portland and Sinai white) located within North Sinai governorate. It indicated the following as shown in figure (1-19).

❖ In 2010, a relative stability was recorded in the compatibility percentage with permissible limits by 99.84% compared to 100% in 2009.

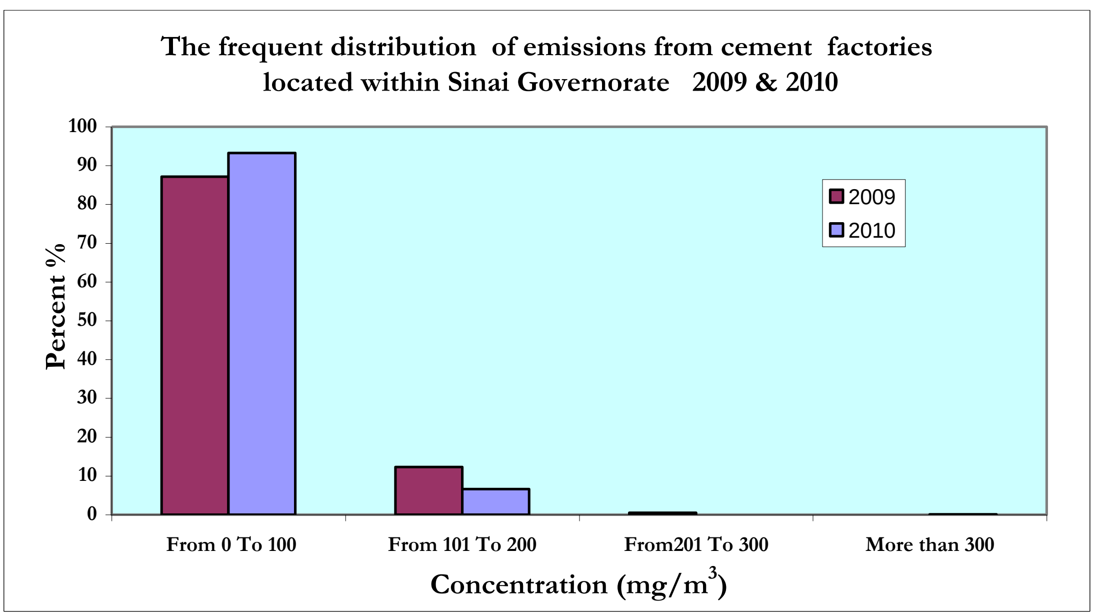


Figure (1-19) Relative distribution of emissions from cement factories located within North Sinai governorate

Source: National network for monitoring of industrial emissions

1-6-3 General indicators of cement factories emissions during 2010:

1. **Relative distribution of total suspended particulates :**

   By comparing indicators of monitoring network during 2009 and 2010, relative stability in results of emissions compatibility recorded as follows:

   a. Percentage of compatibility in old factories with permissible limits recorded 97.6% in 2010 compared to 97.3% in 2009.
   b. Percentage of compatibility in new factories with permissible limits recorded 98.1% in 2010 compared to 98.6% in 2009.
   c. Percentage of compatibility in modern factories with permissible limits recorded 99.6 % in 2010 compared to 99.7% in 2009.

2. **Standards and maximum limits of total suspended particulates emissions from stacks connected with the National Network for Monitoring industrial facilities' emissions :**

Database of the National Network for Monitoring Industrial Emissions contributed positively in formulating the final amendment of the Executive Regulation of Environment Law no. 4 / 2004 amended by Law no. 9 / 2009. These amendments impose more strict standards than currently permissible limits, to gradually cope with international standards. This resulted in starting another phase for amending these standards during 2011 to reach the international standards (100 mg / cubic meters for currently existing facilities and 50 mg / cubic meter for facilities that will be established after issuance of the new Executive Regulation). The next phase will focus on improving the efficiency of raw mills and their controlling devices through projects of environmental compliance, control of industrial pollution, intensify inspections campaigns and impose strict legal actions on those facilities.

1-7 Emissions from agricultural waste:

1-7-1 Emissions from open burning of rice straw:

Within the framework of MSEA's exerted efforts to address agricultural waste problem, especially rice straw. In 2008 and 2009, evaluation of the emitted pollution during burning conducted through practical and scientific experiments to develop Egyptian emission factor for rice straw in case of burning with conventional methods. This factor used in evaluating volume of emitted emissions. Scientific efforts were exerted in cooperation with Egyptian and foreign scientific institutions. This resulted in developing the first Egyptian emission factor for rice straw burning, as shown in table (1-6).
Emissions loads emitted during burning of rice straw were evaluated for (sulfur oxides - nitrogen oxides- total suspended particles), as shown in able (**1-6**):

Table (1-6) Emission factor of pollutants emitted during burning of rice straw by conventional methods

Pollutant	Emission factor (Kg/ton)
Total Suspended Particulates	10
Sulfur Dioxides	0.0685
Nitrogen oxides	0.409

1-7-2 Reduction amount in the environmental load of air pollutants resulting from recycling, compressing and reducing open burning of rice straw.

Despite of the decreased plantation of rice as a result of the strict commitment with determined areas by the Ministry of Irrigation, amount of rice straw increased during 2010 compared to 2009. This was obvious in processes of compressing and recycling for the production of compost, fodder and fuel. Table (1-7) shows the total amount of pollutants loads that have been reduced as a result of rice straw treatment by compressing and recycling.

Table (1-7) Total pollutants loads reduced as a result of rice straw treatment

Year	Amount of treated rice straw (Ton)	Amount of environmental load decreased		
		Suspended particles T.S.P (Ton)	Sulfur Oxides SO_2 (Ton)	Nitrogen Oxides NO_2 (Ton)
2004	61500	615	4	25
2005	70500	705	5	29
2006	78500	785	5	32
2007	106000	1060	7	43
2008	191000	1910	13	78
2009	374000	3740	26	153
2010	600000	6000	41	245

Source: Regional Environmental Management Improvement Project (REMIP)

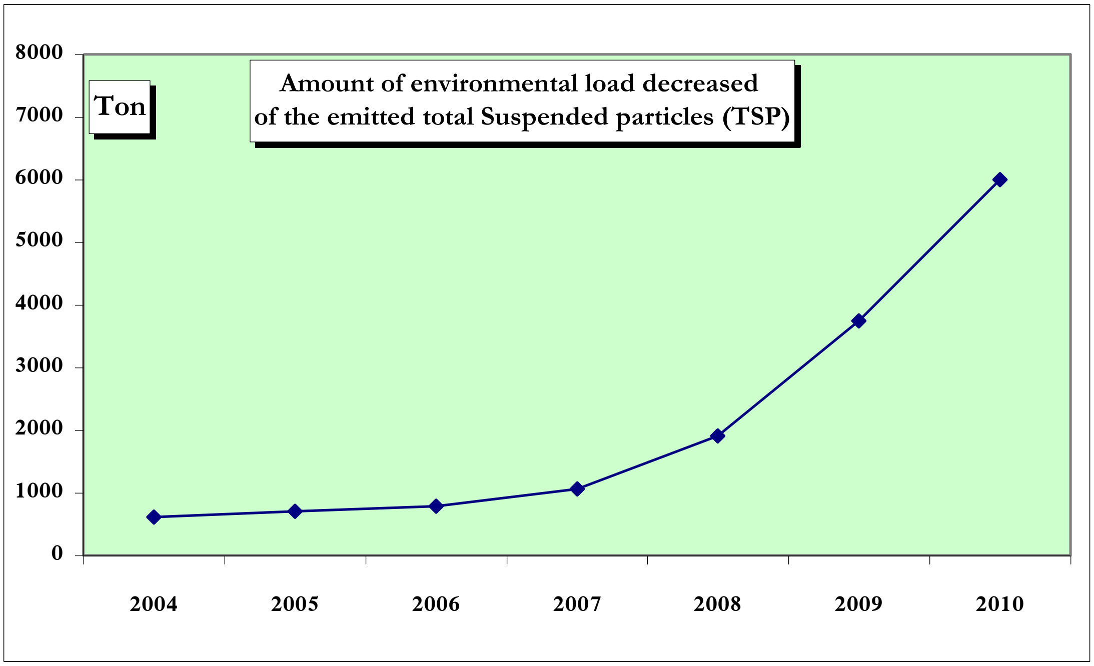


Figure (1-23) Reduced amount of (TSP) loads due to rice straw treatment.

Source: Regional Environmental Management Improvement Project (REMIP)

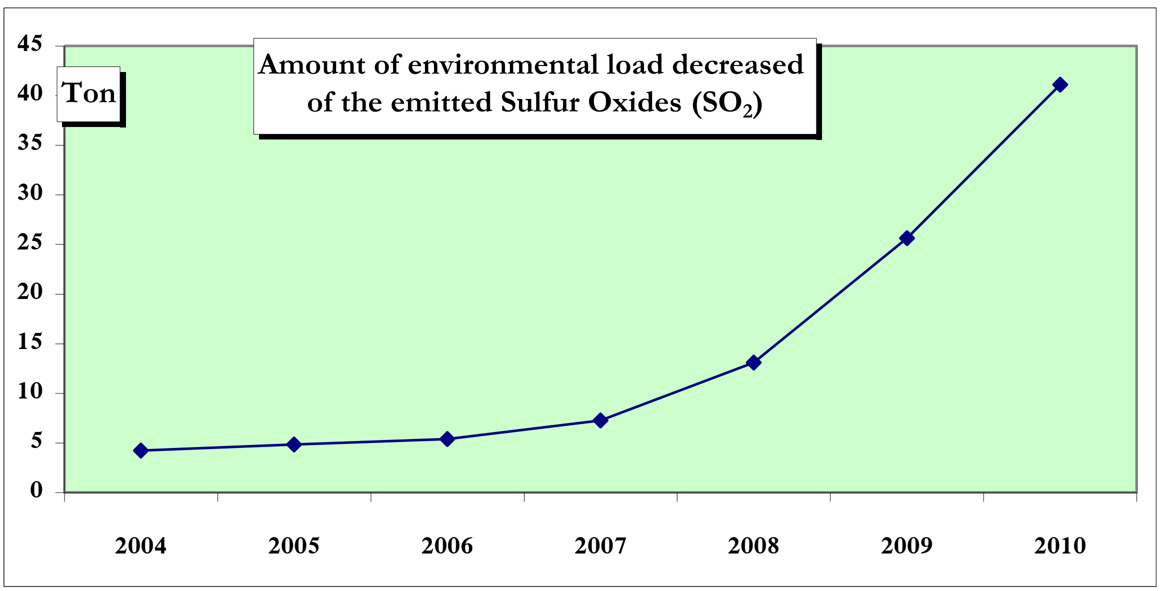


Figure (1-24) Reduced amount of sulfur dioxide (SO_2) loads due to rice straw treatment.

Source: Regional Environmental Management Improvement Project (REMIP)

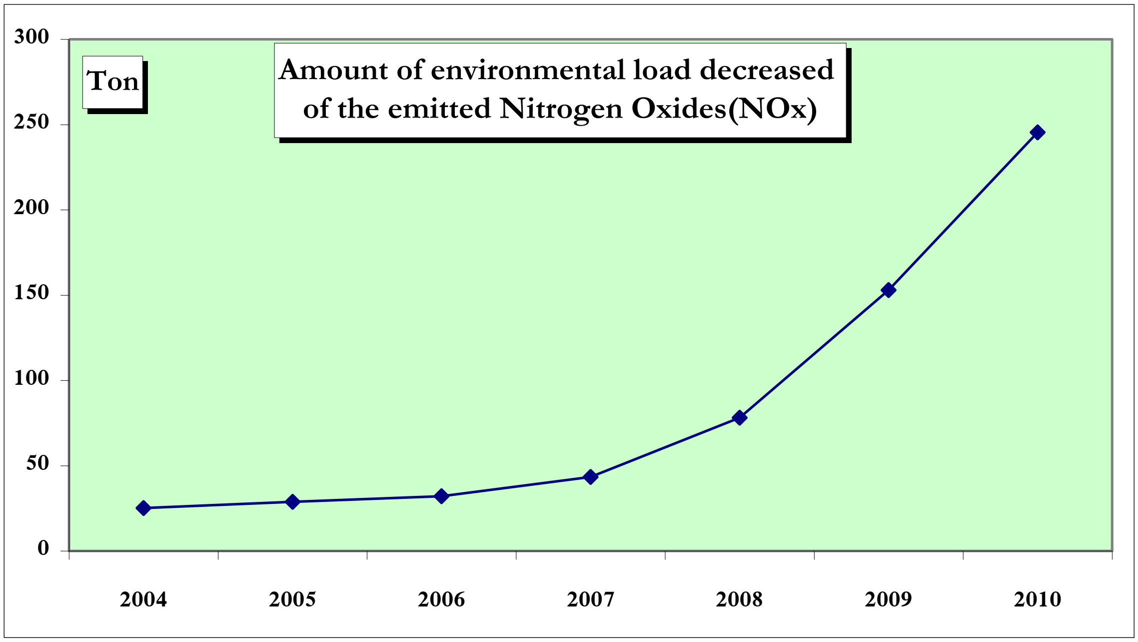


Figure (1-25) Reduced amount of nitrogen oxides (NO_X) due to rice straw treatment.
Source: Regional Environmental Management Improvement Project (REMIP)

Results of loads in 2010 indicate its reduction compared to 2008 and 2009. This is due to exerted efforts by Ministry of State for Environmental Affairs to control open burning of rice straw by:

1. Develop a system to collect, compress and recycle rice straw in cooperation with private sector and Armed Forces for the production of compost and fodder. This leads to the reduction of large amounts of pollutants.

2. Intensify inspection campaigns and taking legal actions against violating farmers.

3. Decrease planted areas with rice crop in 2010 compared to previous years.

1-8 Vehicles' emissions

1. Vehicles' exhausts represent one of the main sources causing air pollution especialliy in Greater Cairo, which suffers from high traffic density as a result of the increasing numbers of vehicles and reduction in their averge speed to 11 km/h, according to the recent study prepared by the National Institute for Transportation and the Japanese International Cooperation Agency (JICA). The amounts of emitted gases from vehicles' exhausts depend on the efficiency, lifetime, operating conditions, engine maintenance, heavy transportation movement and their conditions.
2. Recent years witnessed increased population growth and economic development that led to the increase of pollutants loads in Greater Cairo

air with group of pollutants released from vehicles' exhausts represented by (particulate matter, carbon oxides, nitrogen oxides and hydrocarbons).

3. Studies conducted by Ministry of State for Environmental Affairs to artribute pollutants to their sources indicated that vehicles emissions' contribute with about (26% of the total pollution loads of particulate matter, more than 90% of carbon monoxide, 90% of hydrocarbons and 50% of nitrogen oxides) in Greater Cairo. These gases cause harmful impact on both eco-system and public health. They cause many respiratory diseases and have dangerous impacts on nervous system.
4. Licensed vehicles increased during 2010 to 5.9 million while they were 4.8 million in 2009 with an increasing rate of 1.1 million. Vehicles considered an important mean for transportation in Egypt, as fig (1-26) indicates. Although this increase has revived vehicles' markets in Egypt; it become a prerequisite to develop policies and plans to deal with the problem of traffic density and air pollution due to Vehicles exhaust emissions . This can be through encouraging use of Green sustainable transportation, use of public transportation and use of Electric vehicles particularly in mega cities.

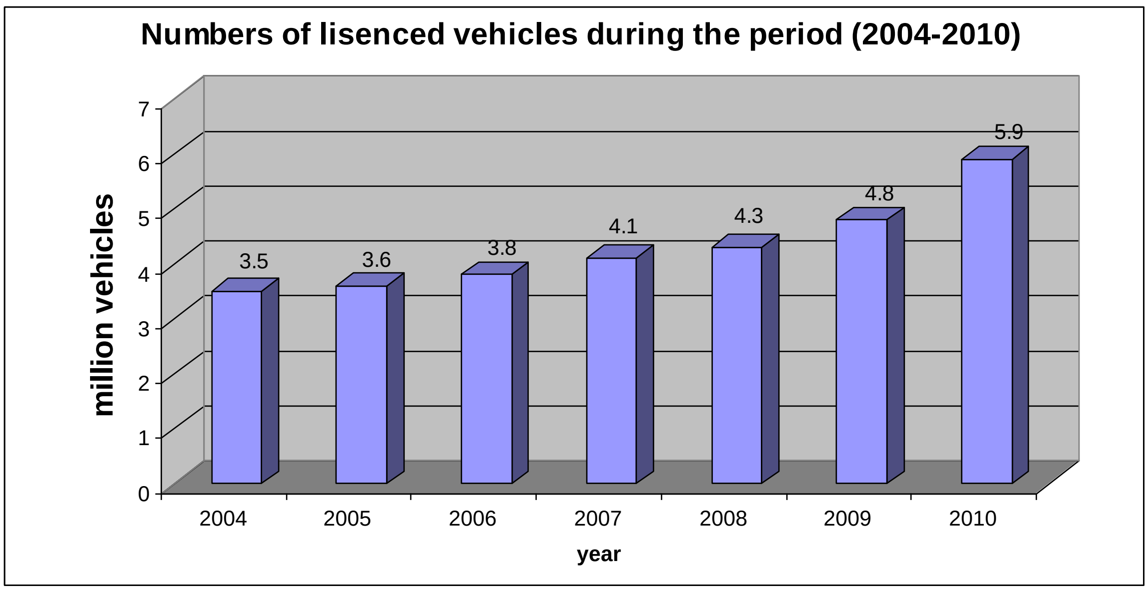


Figure (1-26) Numbers of total licensed vehicles in Egypt from (2004-2010)

Source: Traffic dept. Ministry of Interior

5. Numbers of vehicles increased in general, and private cars in particular. They increased with about 48% of the total licensed vehicles in Egypt (2.8 million), trucks and trailers were about 16% (0.94 million), motorcycles were about 22% (1.3 million), while taxis were about 6% (0.35 million); and vehicles of public sector, governmental buses and others were about 8% (0.47million) of the total number of licensed vehicles in Egypt as shown in figure (1-27).

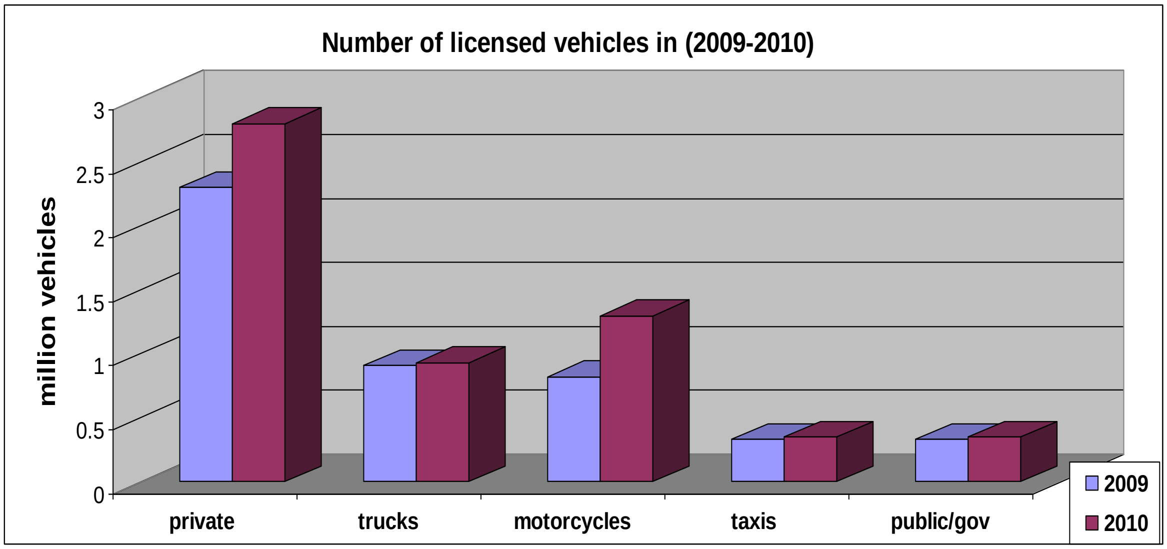


Figure (1-27) Number of licensed vehicles according to type of license

Source: Traffic dept. Ministry of Interior

1-8-1 Implemented programs to reduce pollution from vehicles' exhausts:-

1. National project for replacement of old taxis in Greater Cairo:-

a. Ministry of State for Environmental Affairs achieved great success by implementing its leading pilot project to replace 1100 old taxis with new ones powered by natural gas. Many of taxis owners responded positively to this national project. Especially, after the issuance of the New Traffic Law no. 121/2008 which stipulates in Article (4) item (2) that (it is not authorized to license cars which have been manufactured since ten years, including the manufacturing year , when it is licensed for the first time; and it is not permissible to licensee taxis, manufactured since twenty years old)

b. During 2009-2010, Ministry of Finance in cooperation with Ministry of Interior, national banks and vehicles' companies implemented the National Project to Replace Old Taxis in Greater Cairo, which amount 35000 taxis. Cost of replacement estimated with more than half billion Egyptian pounds, through a Fund established in the Ministry of Finance to finance required economic incentives for old taxis owners. 18000 taxis have been scraped, many of old taxis owners are in the waiting list for replacing their old cars through this National Project.

c. Ministry of State for Environmental Affairs prepared a study to evaluate environmental benefits that have been achieved from this project in Greater Cairo. According to this study, the replacement of 35.000 old taxis in Greater Cairo reduced emissions of nitrogen oxides by about 1147.9 tons per year, carbon monoxide by about

11725.6 tons per year and suspended particles by about 57 tons per year as shown in figure (1-28).

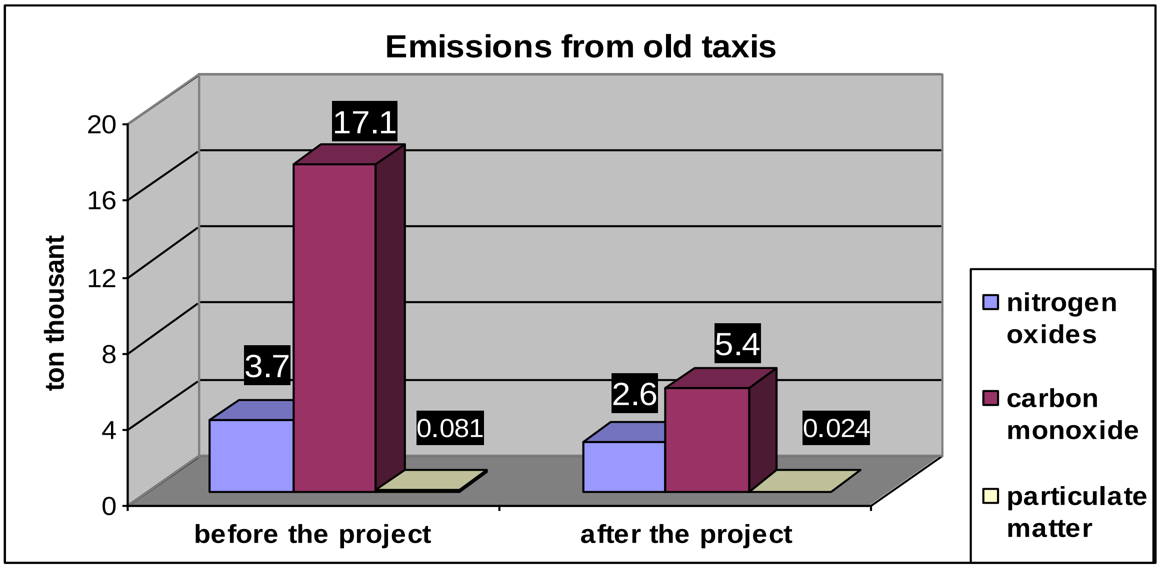


Figure (1-28) Emissions from taxis before and after implementation of the project

Source: Traffic dept. Ministry of Interior

d. After finalizing replacement project in Greater Cairo, it will be implemented in all governorates of Egypt. Implementation of this project will increase marketability of cars' sales, production and distribution, which will create new job opportunities to face expected increase in production capacity of assembling, dismantling and scraping factories.

2. Replacement of old motorcycles:-

a. Studies conducted in many countries of the world and in Egypt indicated that emitted hydrocarbons from a two-stroke motorcycle are equivalent to emitted hydrocarbons from 10-15 gasoline fuel cars. About 1.3 million motorcycles are in Egypt, the two-stroke engines motorcycles represent more than 60% of them.

b. In Greater Cairo, about 446.293 motorcycles emit large amount of pollutants negatively impact air quality.

c. Ministry of State for Environmental Affairs exerted great efforts to reduce emissions from two-stroke motorcycles through cooperation with relative ministries and agencies, these efforts were as follows:

- Banning production of all shapes, forms and sizes of two-stroke motorcycles in Egypt from 31/12/2007 (according to decree no. 85/ 2004 of the Ministry of Commerce and Industry).

- Banning importation of all shape، forms and sizes of two-stroke motorcycles to Egypt from 11/1/2008 (according to decree no. 23 /2008 of the Ministry of Commerce and Industry).

d. By issuing these decrees, all sources of motorcycles in Egypt (local production or importation) have been controlled.

e. By the end of 2010, Ministry of State for Environmental Affairs prepared a project to get rid of all two-stroke motorcycles which have negative impact on air quality. Two-stroke motorcycles will be scrapped and replaced with four-stroke and electric ones, according to the demand and potentials of Egyptian market, through providing economic incentives to owners to encourage them replacing their motorcycles with 4-stroke ones.

f. The first phase is targeting replace of (10000) old two-stroke motorcycles with new four-stroke. It will begin by a pilot project replacing (1000) two-stroke motorcycles costing 2 million Egyptian pounds provided by Environment Protection Fund. 2000 Egyptian pounds will be offered as incentives for each motorcycle's owner and the remaining will be paid in installments for Nasser Social Bank.

g. A study has been conducted to estimate economic and environmental benefits that will be achieved from implementing the project both in Greater Cairo and all governorates and the mechanism that will be developed to implement remaining phases of the project. The project is currently reviewed to be documented as a Clean Development Mechanism project (CDM), to provide financial resources for replacing all two-stroke motorcycles in Greater Cairo and all governorates of Egypt . Coordination is going on with the Ministry of Interior to establish a factory for scrapping old vehicles in conformity with environmental requirements.

3. Inspection program of vehicles' exhaust in Traffic Department:-

a. Based on the Cooperation Protocol between Ministry of Interior and Ministry of State for Environmental Affairs to implement a program binding issuance of vehicle's license with measurement and inspection of its emitted exhausts. This program was implemented in 26 governorates representing about 97% of the total licensed vehicles in Egypt. Allocated budget for this project is 15 million pounds to provide governorates with required equipments (267 devices to test gasoline vehicles and 251 smoke meters for diesel vehicles).

b. The Program is currently implemented in governorates of (Menoufia, Port Said and Ismailia) where vehicles represent about 3% of the total licensed vehicles in Egypt.
c. Ministry of State for Environmental Affairs encourages the establishment of technical inspection centers for vehicles' exhausts in all governorates to improve and develop inspection program in traffic units. In 2010, Ministry of Interior specified several locations in 17 governorates to establish integrated inspection centers, under the supervision of both Ministries of Interior and Environment, to inspect (security and durability, lights, brake, engine and test of emissions) during the renewal of annual license of vehicles.
d. Requirements and technical specifications for establishing technical inspection centers for vehicles’ emission have been finalized. First phase of the project will be initiated in 5 governorates.

4. **<u>Inspection program of vehicles’ exhausts on roads:</u>**

a. Ministry of State for Environmental Affairs in coordination with the General Traffic Department and Environment Police implemented the inspection program of vehicles’ exhausts on roads in some areas of Greater Cairo. Within the framework of this program campaigns are conducted to stop violating vehicles and withdraw their licenses. Vehicles’ owner granted grace period for one month to repair the engine and re-test exhausts in the technical center affiliated to MSEA at Shoubra El-Khaima, to ensure conformity of its emissions with stipulated limits in Environment Law no. 4 /1994 before permitting its operation.

b. In 2010, inspected vehicles increased to 45089 gasoline and diesel vehicles compared with 38995 gasoline and diesel vehicles in 2009. Passed vehicles were 29992 gasoline and diesel while failed vehicles were 15097 gasoline and diesel, as shown in figures (1-29), (1-30).

c. In 2010, inspection results of vehicles’ exhausts on road showed an increase in rate of compatible vehicles with limits of Environment Law, it was 67% for gasoline and diesel compared with 62% for gasoline and diesel vehicles in 2009.

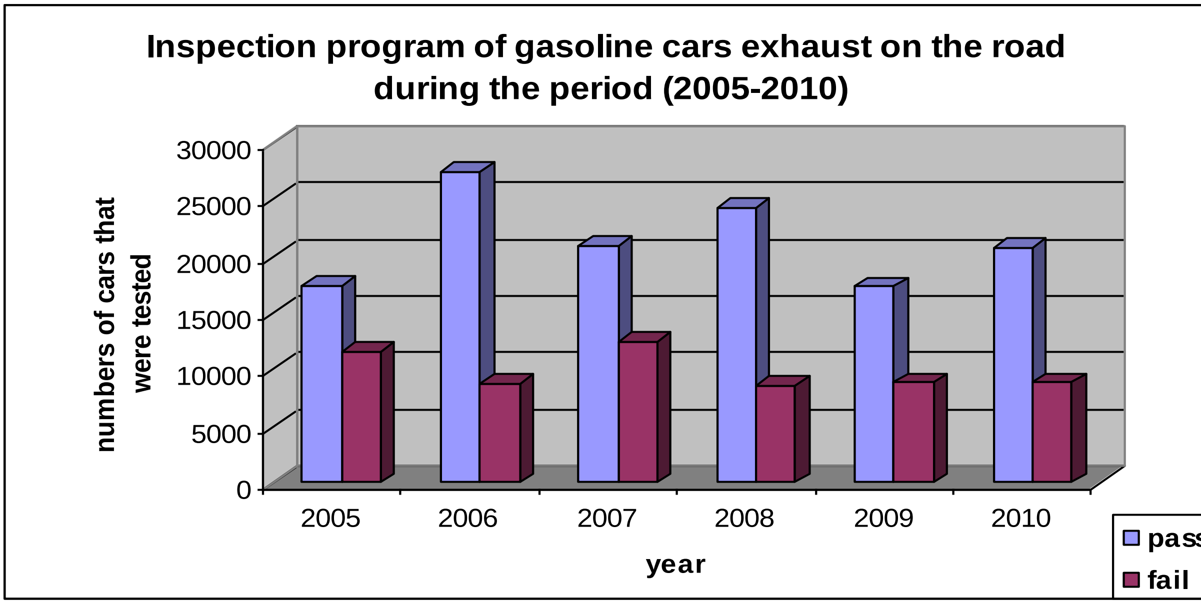


Figure (1-29) Inspection program of gasoline vehicles' exhausts on the road

Source: EEAA, General Dept. for Traffic Exhausts

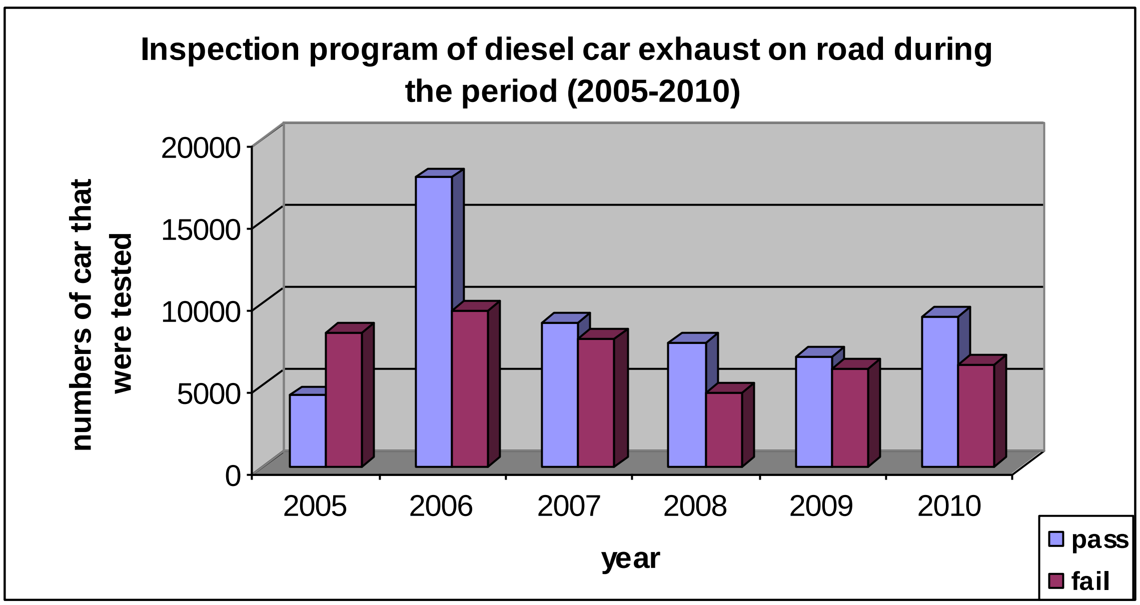


Figure (1-30) Inspection program of diesel vehicles' exhausts on the road

Source: EEAA, General Dept. for Traffic Exhausts

d. Ministry of State for Environmental Affairs adopted inspection system for vehicles' exhaust on roads in some Regional Branches of EEAA, as a pilot phase. Regional Branches of (Alexandria, Sharkia, Mansoura, Tanta and Aswan) were provided with 6 gasoline and diesel equipments to test vehicles' exhausts on roads. Total cost of these equipments was 210.000 Egyptian pounds. EEAA provided technical training for employees of these Branches. Success of this pilot phase will lead to expand its implementation in all Regional Branches of EEAA.

5. Inspection program of Public Transportation Authority Buses

a. Annual inspection is conducted for all buses of Public Transportation Authority and Greater Cairo Bus Company affiliated to the authority since 2007.

b. In 2010, inspection has been conducted for 3677 buses compared to 4020 buses in 2009 and 4436 buses in 2008. Number of buses decreased as a result of scrapping all old buses.

c. In 2010, inspection results showed that rate of passed buses were about 36%, rate of failed buses were about 33%, while rate of broken-down buses were about 31% from the total number of buses in the Public Transportation Authority and Greater Cairo Bus Company, as shown in table (1-8) and figure (1-31).

d. EEAA notified Public Transportation Authority with inspection results and failed buses. It prepared a program for re-examining failed buses after their maintenance and before operation.

Table (1-8) Inspection results of Public Transportation Buses

Buses	2008	2009	2010
Test	3316	2421	2541
Pass	1909	1143	1320
Fail	1407	1278	1221
broken-down	1120	1599	1136
Total	4436	4020	3677

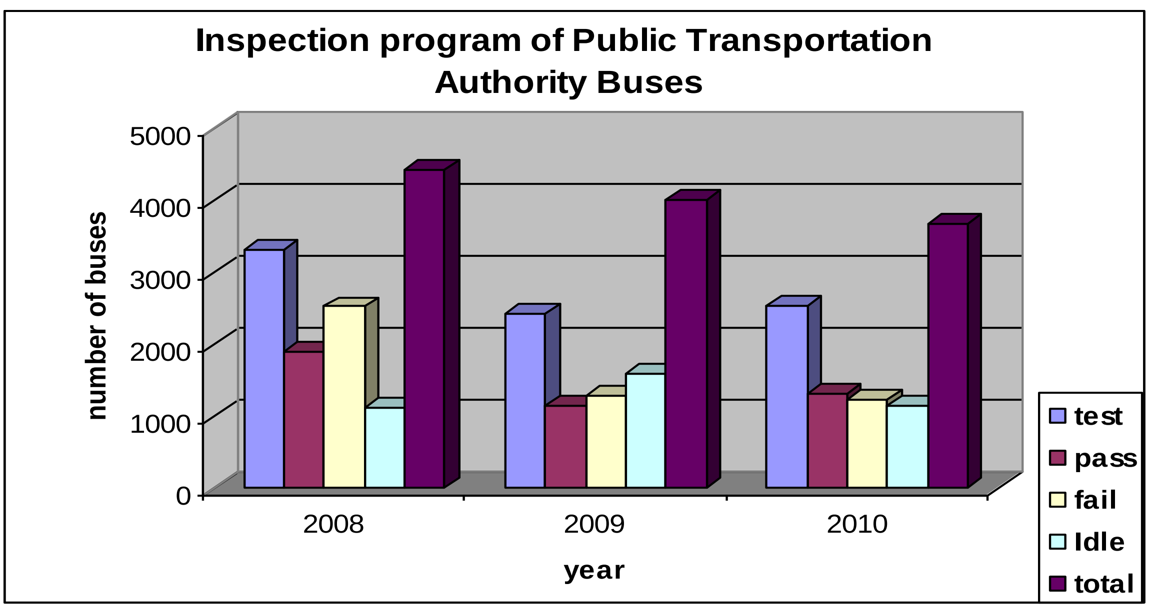


Figure (1-31) Inspection results of Public Transportation Buses

Source: Inspection Program of vehicle Exhausts

6. **Converting program of governmental vehicles to natural gas:**

Converting 2322 governmental vehicles belong to 114 governmental agencies to natural gas.

7. **Expanding program for using natural gas in transportation:**

   a. In 2010, 130 natural gas buses were added to Public Transportation Authority, increasing their number to 339 buses in Greater Cairo and Alexandria ; work is currently going on to provide Alexandria Public Transportation Authority with more 120 natural gas bus .
   b. Public Transportation Authority in Greater Cairo operated 300 diesel buses compatible with European specifications (Euro 3) , work is currently going on to supply it with more 200 buses.

8. **Smart card and increasing number of natural gas service stations;**

   a. This project is implemented under patronage of Ministry of Petroleum. During 2010, it succeeds in converting 23500 vehicles to natural gas. So that total number of converted vehicles amounted to 143.500 vehicles. This project provide cars' owners with fund to convert their cars to natural gas without pre-paid money and value of conversion discounted from the differences between prices of gasoline and natural gas.
   b. In 2010, 11 natural gas service stations were established, increasing their numbers to 130 gas stations.
   c. 68 centers were established for converting vehicles to natural gas, increasing their total number to 130 centers.
   d. Upper Egypt natural gas line extended from Dahshour in the north to Aswan in the south passing by Beni suief, Fayoum, Minya, Asuit, Sohag and Luxor.

1-9 Acute air pollution episode during 2010

Air pollution episode is a scientific phenomenon known all over the world. It occurs during different seasons of the year while in Egypt during fall season. This phenomenon occurred in many different countries since the fourth and fifth decades of the 20th century, (United Kingdom and the United States of America) as one of the negative impacts of industrial development.

The phenomenon of air pollution episode which is known by "Black Cloud" is considered the most important environmental phenomenon became chronic in Egypt since 1998. Severity of this phenomena increases during fall season and its intensity varies. Experts of research centers and EEAA highlighted that the following reasons are the main causes of air pollution episode:

1-9-1 Meteorological factors

Meteorological factors, especially thermal inversion are considered one of the most important factors in forming that phenomenon occurs during fall season. It shrinks the mixing layer carrying pollutants to the lowest levels less than 50 meters above earth surface. In addition, calmness of winds , continuous change of wind directions from the north and northeast to south and southwest and increasing humidity to reach more than 90% .

1-9-2 Nature of topography

Nature of topography contributes in this phenomenon in Greater Cairo. Governorates of Cairo, Giza, Qaloubia and Helwan are located in a rectangular depression along sides of the Nile from Shubra in the north to Helwan in the south. This topography acts as a crucible that accumulates pollutants from different human activities which increase our feeling with this episode.

1-9-3 Sources of pollution:

Sources of air pollution in Greater Cairo vary between industrial and mobile sources (more than 50% of industrial facilities and vehicles are concentrated in Greater Cairo). In addition, all human activities and burning of municipal & agricultural waste affect Greater Cairo, (most areas of rice and maize plantation are located north of Greater Cairo).

Studying and analyzing air quality indicators during fall season of 2010 (from 15 September to 15 November) indicates the following:

1. Significant improvement in the average concentration of particulate matter in Greater Cairo during 2010 compared to 2006. The improvement estimated by 86% as the average concentration of PM_{10} in all monitoring stations did not exceed the normal level according to definitions of early warning system.
2. During September and October of 2010, hours recorded attention limit (300 micrograms /m^3) were less compared to previous years. The improvement rate was 78% compared to 2009.

Monitoring results of particulate matters in October of 2010 recorded their best rates compared with rates of previous ten years.

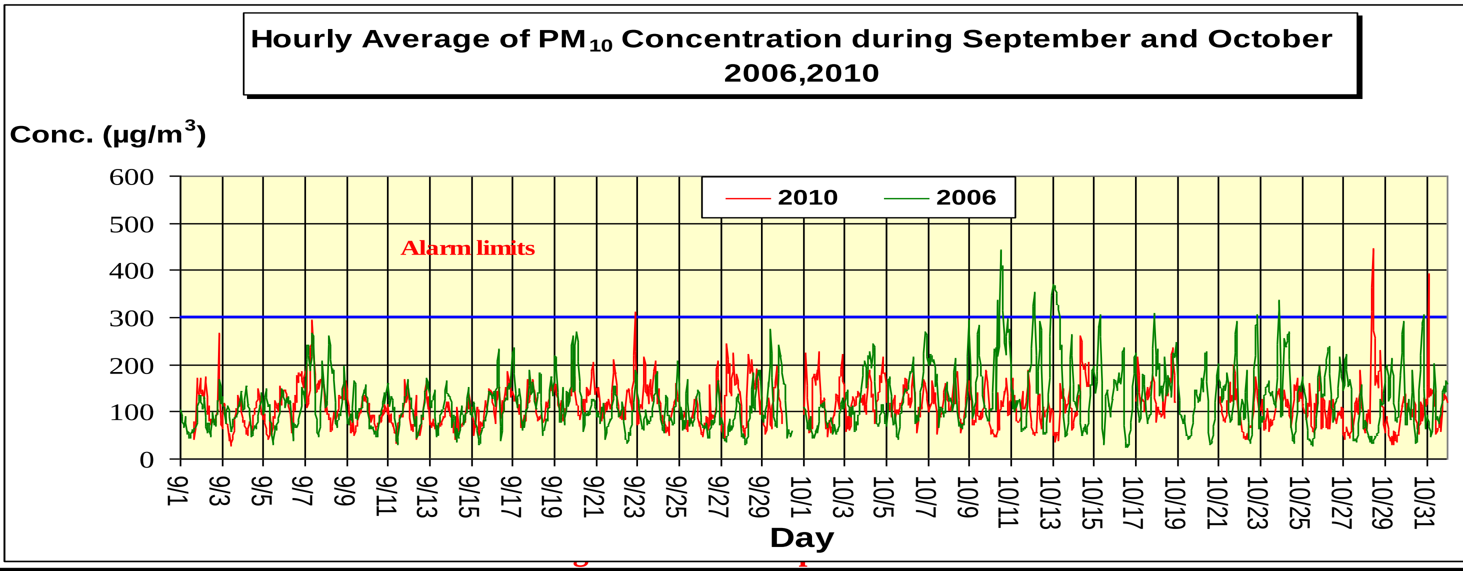


Table (1-9) Hours during which PM_{10} concentrations exceeded the alarm limits ($300 \mu g/m^3$) in 2006 and 2010

Station / Year	Abbassyea	Fum Elkhalig	Qolaly	Tabbin	Mohandseen	Giza	Heluopolice	Total Average
2006 $\mu g/m^3$	31	205	57	150	37	28	30	77
2010 $\mu g/m^3$	2	2	19	32	9	8	4	11
Improvement %	94%	99%	67%	79%	76%	71%	87%	86%

Source: National network for monitoring of ambient air pollutants

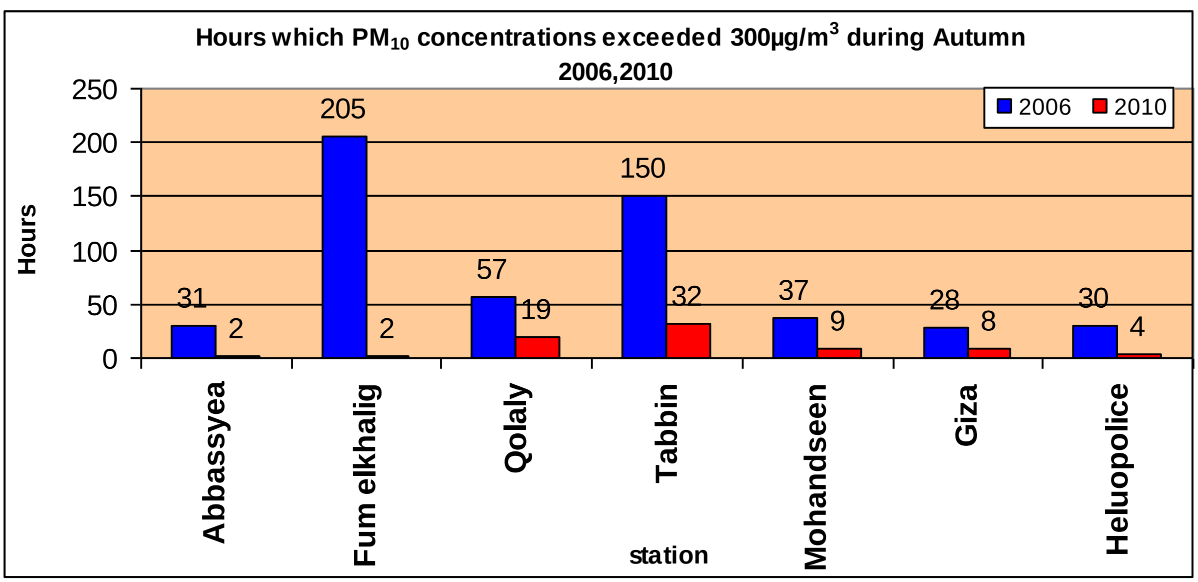


Figure (1-33) Comparison between numbers of hours during which PM_{10} concentrations exceeded $300 \mu g/m^3$ in 2006 and 2010

Source: National network for monitoring of ambient air pollutants

Table (1-10) Hours which PM_{10} concentrations exceeded the alarm limits (300µg/m^3) during 2009 and 2010

Station / Year	Abbassyea	Fum elkhalig	Qolaly	Tebbin	Mohandseen	Giza	Helopolise	Total Average
2009 µg/m^3	40	36	18	67	33	34	63	49
2010 µg/m^3	2	2	19	32	9	8	4	11
Improvement %	95%	94%	0%	52%	73%	76%	94%	78%

Source: National network for monitoring of ambient air pollutants

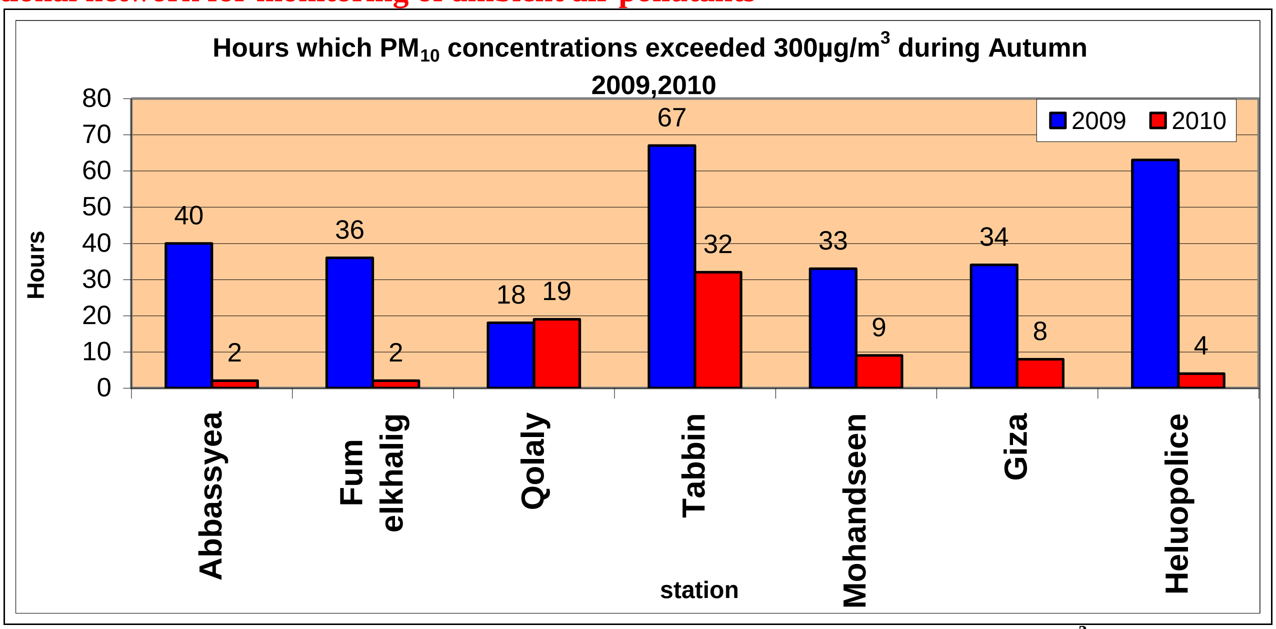


Figure (1-34) Comparison between hours during which PM_{10} concentrations exceeded 300 µg/m^3 in 2006 and 2010

Source: National network for monitoring of ambient air pollutants

1-9-4 Impact of natural sources on air quality:

Greater Cairo and Delta exposed to several dust storms during fall season extending to the beginning of winter. This cause an increase in particulate matters' concentration, it recorded high levels during storms, as shown in figure (1-35).

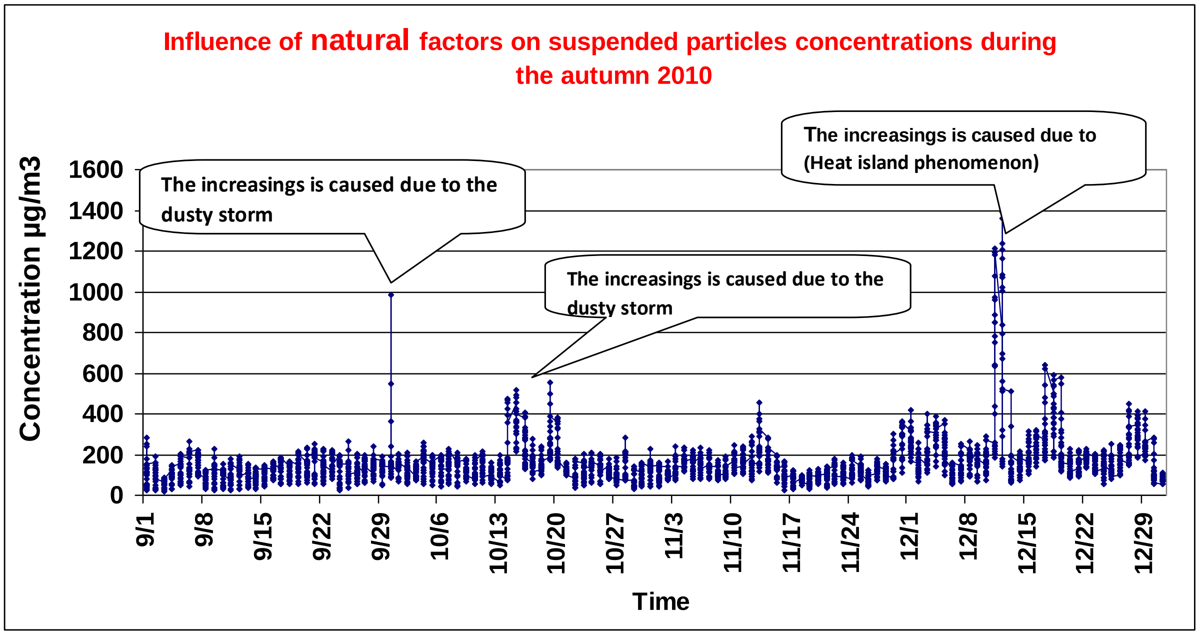


Figure (1-35) impact of natural factors on PM_{10} concentrations during fall of 2010

Source: National network for monitoring of ambient air pollutants

The above clarifies that exerted efforts by Ministry of State for Environmental Affairs in cooperation with all relevant ministries and agencies to face factors cause air pollution episodes (Black Cloud) are moving in the right direction. These actions can be summarized in controlling industrial pollution; collection, transportation and compressing of rice straw; controlling open burning of municipal waste, where 70 thousand tons of waste had been transferred out of Greater Cairo.

Cooperation with public can result in further mitigation of the phenomenon through conducting continuous inspection of vehicles' exhausts, maintain vehicles' engines and stop burning of all types of waste (agricultural, solid, etc...).All these actions require more public awareness about impact of the phenomenon and role of state agencies and civil society in reducing it.

1-9-5 Economic benefits from agriculture waste:

During the past 6 years MSEA concerned greatly with combating air pollution resulting from open burning of agriculture waste. Emitted pollution from this source amounts 42% during fall season (September, October and November), which contributes with about 6% all over the year .In this regard MSEA has implemented many programs to combat burning of rice straw as a main source of air pollution and raise farmers' awareness with the importance of this valuable resource which can be used by different means.

1-9-6 Implemented programs to treat agricultural waste:

1. **Contracting with some companies to collect and recycle rice straw (Queen Service Company)**

Queen Service Company is working at El-Sharkia governorate with capacity of 50.000 tones. It deals with rice straw with a characterized method. It transfers equipments to fields for compressing rice straw then transporting it to collection centers .The Company uses 675 equipments including 301 equipments presented by Ministry of Defense, 374 equipments presented by MSEA. Human power working in the company amounts 1920 person (120 officers, assistant-officers and 1800 soldiers). They are well-trained to work and maintain these equipments during different phases.

2. **Private sector companies:**

MSEA has contracted with 4 private sectors companies to collect straw from fields then transporting it without compressing to the collection centers, for compressing or recycling:

a. **ECARU Company:** This company works in all centers of Gharbia and Kaluobia governorates , 4 centers in Dakahlia governorate (Belqas, Meet Ghamr, Talkha and Agaa) ; and some centers in El-Sharkia governorate(Abu Kabeer ,El-Ebrahimya ,Belbes ,Mashtol El-Souk ,Menyia El-Kameh , El-Zakazik and El-Kanyat) with total area of 250.000 feddan representing 96 sites for collecting and compressing about 365.000 tons , with total of 1847 equipments.

b. **IES Company:**

It works in Dakahlyia governorate (centers of Sembelawain and Tamay El-Amded) with total area of 40.000 feddans , representing 12 sites, with production capacity of 61.000 tons and 199 equipments ; in addition to El-sharkia governorate (centers of : Awlad Sakr and Kafr Sakr) with total area of 26.000 feddans representing 7 sites , with production capacity of 48.000 tons and 211 equipments .

c. **MMG Company**

It works in Mansoura Governorate within an area of 35.000 feddans representing 9 sites, with production capacity of 50.000 tons and total of 266 equipments.

d. **Advanced Technology Company**

It works in Derab Negm centre, where the planted area was reduced from 25.000 feddans to 5.000 feddans during 2010. It works in 3 sites with production capacity of 10.000 tons.

MSEA in cooperation with Agriculture Directorates in governorates identified major farmers within working areas of the above mentioned companies , and contracted with them to transfer rice straw to the collecting centers in return for 40 pounds /ton . But it paid 45 pounds /ton for small farmers in return for delivering rice for the collecting centre.

3. Small farmer program:

This program is directed for farmers possess less than 50 feddans.

It has successfully recycled 50.000 tons of rice straw in the production of compost and untraditional fodder,

4. Recycling program:

MSEA supports program of recycling agricultural residues. It includes different projects that produce organic fertilizers, untraditional fodder and thermal gas …etc. These products are real investment for agricultural residues, because their burning cause acute air pollution episode during fall season. Most important of these projects are the following:

a- Organic fertilizers factories:

4 factories have been established for producing organic fertilizers distributed as follows: 2 factories in El-Sharkia governorate (El-Khatara and El-Karen). These factories are managed by the Arab Industrialization Authority with total capacity of 300.000 ton. 2 factories in El-Dakahlyia governorate (Kalabsho area) established by the Ministry of Military Production. They are managed by private sector companies, with total capacity of 300.000 ton.

b- Factory to convert rice straw to soil alternative: one factory has been established and operated in El-Sadat city in El-Menofyia governorate, to convert rice straw to soil alternative with production capacity of 50.000 ton annually.

c- Units of thermal gas production: 2 units have been established to produce thermal gas in El-SharKia and Dakhalyia governorates with production capacity of 500 tons annually, every unit feeds 300 houses.

d- Factory to convert straw to thermal fuel blocks: This project has been implemented in El-Sharkia governorate in cooperation with Czech Republic, to produce thermal fuel blocks from rice straw with total production of 50.000 ton.

1-10 Future plan to improve air quality:

1-10-1 Upgrade national network for monitoring ambient air quality:

1. Increase number of air pollutants monitoring stations, especially in deprived areas.
2. Review sites of the existing stations and relocate some of their positions, according to the changes these areas exposed to.
3. Add monitoring equipments for pollutants that are not monitored in some stations, such as ozone and carbon monoxide.

4. Complete the integrated study to evaluate air quality in Greater Cairo through developing plans to reduce pollution from different sources in Greater Cairo, in cooperation with World Bank, concerned ministries and authorities.
5. Use remote sensing systems to monitor impact of industrial pollution on air quality**.**

1-10-2 National Network for Monitoring Industrial Emission:

1. Cement Companies:

Increase kinds of pollutants monitored by national network to include sulfur dioxide and nitrogen oxides. Companies were directed to conduct continuous self-monitoring for these emissions and flow rate of their stacks, and linking their self monitoring with the national network for monitoring industrial emissions.

2. Fertilizers Companies:

Connect the 14 fertilizer companies located all over Egypt online with the National Network for Monitoring Industrial Emissions to conduct the self-monitoring of their emission from stacks.

3. Electrical Power Stations:

Adding the 28 electric power plants to the national network for monitoring industrial emissions; coordination has been conducted with officials responsible about power plants to conduct continuous self-monitoring of their emission from stacks and to be connected online with the national network for monitoring industrial emissions.

4. Major Industries:

Adding stacks of some major industries to the continuous self-monitoring plan, such as iron and steel, ferrosilicon, oil refiners and petrochemical companies; and to be connected with the national network for monitoring industrial emissions

1-10-3 Future plan to reduce vehicles' emissions

1. Cooperate with all concerned ministries and agencies to implement green and sustainable transportation projects.
2. Implement pilot project to replace two-stroke motorcycles already in service with four-stroke engines, similar to the national project for replacing old taxis with environmentally friendly ones in Greater Cairo.
3. Coordinate with private sector to establish technical inspection centers in all governorates, to raise efficiency of inspection programs of vehicles' exhausts. These centers will be implemented under supervision of the Ministry of Interior.
4. Cooperate with the Ministry of Petroleum to improve quality of diesel fuel.
5. Expand of using natural gas in public transportation buses.
6. Issue environmental standards for emissions from new vehicles that will be produced for the first time or imported /assembled in Egypt.

7. Implement awareness campaigns for motorists and passengers in streets about the importance of improving environmental situation , through the following :
   a. Technical inspection and maintenance of vehicles.
   b. Use of public transportation (metro, buses and trains).
   c. Reduce driving hours for private cars to decrease environmental load and traffic jam.

References

1. General Department of Traffic - Ministry of Interior
2. Inspection programs of vehicles' exhausts – EEAA
3. National project for replacement of old taxis – EEAA
4. Inspection program of vehicles exhausts on roads – EEAA
5. Conversion program of governmental vehicles to natural gas
6. Annual report for Monitoring network of Industrial Emissions
7. Data of monitoring stations affiliated to the Ministry of State for Environmental Affairs
8. Environment Law No. 4 of 1994
9. Inventory study of pollutants - Japanese International Cooperation Agency (JICA)
10. Online Sites, such as U.S. Environmental Protection Agency (EPA) - the World Health Organization (WHO).

Chapter two

Climate Change

2-1: Introduction:

Climate Change phenomenon is defined as an imbalance in the usual climatic conditions such as heat, wind and rainfall patterns that characterize each region on earth. Sustained increase in climate change, on the long run, cause negative impacts on biological ecosystems, which escalate temperatures on earth causing a change in weather types, as wind patterns, amount and types of rainfall; as well as increasing the potential of extreme weather events, which will lead to serious and unpredictable environmental, social and economic impacts.

Intergovernmental Panel on Climate Change (IPCC), established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP), concluded that earth's mean average temperature increased by 0.76 C° during the past hundred years. This of course, does not mean temperature increase on all parts of the earth, but means occurrence of defect accompanied with severe heat or cold waves, convulse of rain belts and an increase in the frequency and severity of extreme weather events.

Human activities since industrial revolution during mid-eighteenth century, increased rate of anthropogenic greenhouse gases' emissions and consequently their concentrations in global atmosphere, trapping more heat (infrared radiation) reflected from earth's surface as a result of sun rays (Ultra Violate) and this resulted in increasing severity of global warming that leads to a change in world's climate. This can be explained with the following example (average normal temperature of human body is 37 C° , in the case of exceeding this limit, human body afflicted with fever; the same can be applied on global warming which is as body's natural temperature and global warming as fever). It is known that, Climate Change is a global phenomenon; however its impacts vary from place to another on earth.

Table (2-1): Comparison between natural greenhouse gases impacts and global warming resulting from anthropogenic emissions

Comparison	Natural Greenhouse Gases	Global Warming
Gases	CO_2, CH_4, N_2O	CO_2, CH_4, N_2O, PFCs, HFCs, SF6
Sources	- Natural carbon cycle is an exchange process among carbon that stored in atmosphere, oceans, land and living organisms (plants' photosynthesis and respiration processes, particularly forests). - Natural cycle of methane in atmosphere produced as a result of anaerobic fermentation of organic	Anthropogenic burning of fossil fuels (coal, petroleum), industrial processes such as production of fertilizers. Agricultural processes (rice cultivation, livestock breeding and waste.)

	matter. - Natural cycle of Nitrous.	
Earth mean temperature	15 C°	Increased by an average of 0.76 C° since the industrial revolution during mid-eighteenth century

Table (2-2): Increase of atmospheric greenhouse gases concentrations since industrial age

Gas	Pre-industrial Level	Current Level	Increase since 1750	GWP
Carbon dioxide	280 ppm	388 ppm	108 ppm	1
Methane	700 ppb	1745 ppb	1045 ppb	23
Nitrous oxide	270 ppb	314 ppb	44 ppb	310
CFC-12	0	533 ppt	533 ppt	140-9200 According to the type of chemical compound

Source: Intergovernmental Panel on Climate Change

Despite the dangerous impacts of climate change phenomenon socially and economically; many political analysts, economists and environmental experts believe that there is much potential for implementing mitigation and adaptation technology to Climate Change; that stimulated the United Nations , in 1992 during Rio de Janeiro Summit , to develop the United Nations Framework Convention on Climate Change; its main objective is " stabilize concentrations of Greenhouse Gases in atmosphere at a level that would prevent dangerous anthropogenic interference with climatic system ". In this context, Egypt has immediately signed the UNFCCC to participate international community in tackling Climate Change phenomenon and ratified it in 1994.
Since then, Egypt is implementing all related obligations to the Convention which will be reviewed through the following:

2-2: Egyptian efforts to address Climate Change

2-2-1: Establishment of Climate Change Central Department;

Since 1996 Egypt has established Climate Change Unit at EEAA, to be the national focal point with United Nations Framework Convention on Climate Change (UNFCCC). And as a result of the increased scientific evidence of the dangerous of Climate Change phenomenon and its impacts on Egypt, the Central Department for Climate Change has been established in 2009, involving the following General Directorates: General Directorate of Vulnerability & Adaptation, General Directorate of Mitigation & Clean Development Mechanism, General Directorate of Research and Technology Transfer of Climate Change and Department of Climate Change Information. To achieve the following objectives:

1- Improve national performance in the field of Climate Change adaptation, with context of national plans of different sectors.

2- Contribute to pursue low-carbon development strategy for realizing sustainable development.
3- Enhance national capacity to attract international support.
4- Coordinate with international bodies and developing countries to avoid any commitments for emission reduction on the developing countries - including Egypt - which contradicts with economic and social development plans.
5- Raise awareness towards climate change issue on all levels.

2-2-2: Establishment of National Committee on Climate Change

The National Committee on Climate Change has been established in 1997, then activated and re-formed by Prime Minister's Decree in 2007. The committee involves representatives from Ministries of Foreign Affairs, Defense, Water Resources & Irrigation, Agriculture & Land Reclamation, Electricity & Energy, Petroleum, Trade & Industry and Economic Development, in addition to experts from relevant national agencies; to develop mitigation and adaptation strategies to address climate change phenomenon in relevant sectors and ministries: Agriculture & Land Reclamation, Irrigation & Water Resources, Electricity & energy. In addition, the National Committee helps in developing a vision to establish a Center of Excellence for collecting data and information related to climate change issues , take advantage of the institutional experience of “Information & Decision Support Center-Egyptian Cabinet”, establish a National Center for Research and Studies of Climate Change, establish a Committee on Science and Technology to coordinate with the National Committee on Climate Change and the National Research Centers and prepare list of mitigation and adaptation pilot projects. The Committee has held 3 meetings in 2010 to discuss topics related to climate change policies in Egypt.

2-2-3: Preparation of National Communications reports to UNFCCC:

According to the commitment to the UNFCCC’s terms, Egypt issued the Initial National Communication Report in 1999 and the Second in 2010. Preparation process for the Third has been started in 2011 by a team of Egyptian experts from the following various sectors: industry, energy, transport, agriculture, water resources, health, coastal zones, waste, urban planning and tourism. The report aims to review national circumstances such as location, climate and population data … etc. As well as anthropogenic GHGs emissions inventory, study possibilities of mitigation and reduction of these emissions, identify risks arising from climate change phenomenon on different sectors such as coasts, agriculture, health, water resources, tourism and others. In addition to review adaptation measures, costs and needed technologies beside raise awareness and education regarding climate change issues.

2-2-4: Kyoto Protocol and Clean Development Mechanism

1. **The National Committee for Clean Development Mechanism**
    a. In order to activate and stimulate CDM projects in Egypt, the Egyptian delegation had participated in three Designated National Authority (DNA) forums during 2010. Egyptian delegation emphasized supporting developing countries'

demands related to activities of CDM projects especially the programmatic CDM projects.

b. Total number of projects in the CDM portfolio has reached 82 projects since the beginning of the CDM National Committee in 2005 till end of 2010, they reduce about 9 million tons of carbon dioxide equivalent annually, with investment cost of approximately 3 billion U.S. dollars, these projects are as follows:
   - **7** CDM projects have been registered internationally at the CDM Executive Board.
   - 2 CDM projects have obtained letters of approval and requesting registration.
   - 8 CDM projects have obtained letters of approval and submitted for validation.
   - 63 CDM projects have obtained letters of no objection.
   - 2 CDM projects in the pipeline stage.

Table (2-3) Total progress in CDM projects during 2005 -2010

Year	2005	2006	2007	2008	2009	2010	**Total**
Number of Projects	5	10	15	14	5	33	**82**

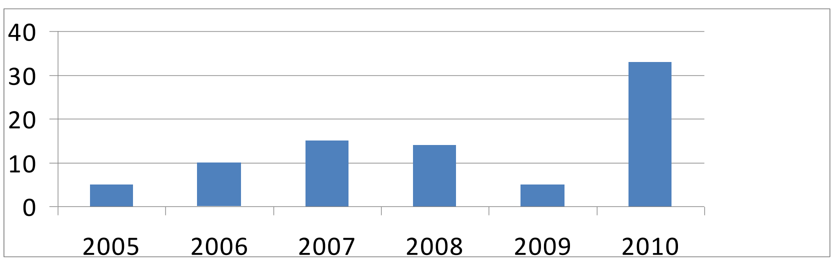


Fig (2-1) Progress in CDM projects during 2005-2010

Source: National Committee for Clean Development Mechanism

Table (2-4) Progress in internationally registered CDM projects during 2005 -2010

Year	2005	2006	2007	2008	2009	2010	**Total**
Number of Projects	0	2	1	1	0	3	**7**

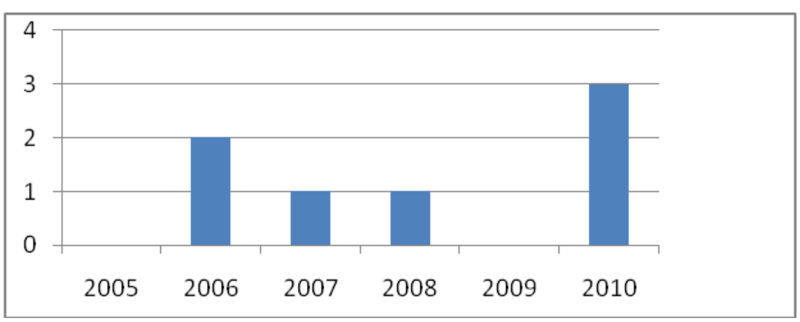


Fig (2-2) Progress in internationally registered CDM projects during 2005-2010

Source: National Committee for Clean Development Mechanism

Table (2-5) Progress in CDM projects and investments (US million $)

Year	2005	2006	2007	2008	2009	2010	Total
Number of Projects	5	10	15	14	5	33	**82**
Investment cost	400	1330	25	90	19	1150	**3014**

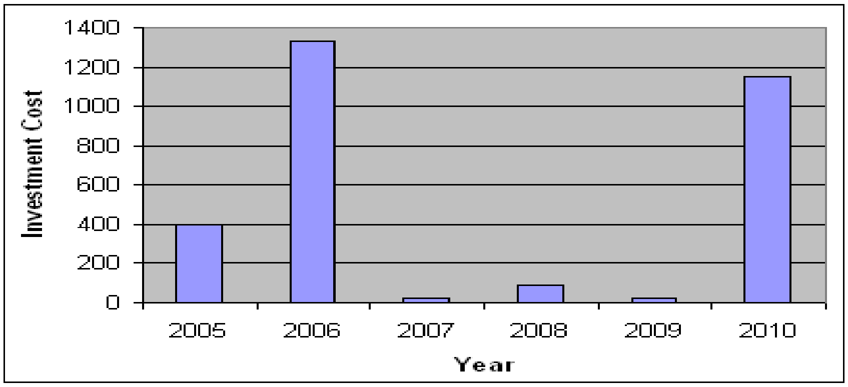


Fig (2-3) Annual investment in CDM projects

Source: National Committee for Clean Development Mechanism

Table (2-6) Progress of expected CO_2-eq reduction in CDM projects

Year	2005	2006	2007	2008	2009	2010	Total
Total accumulative reduction	**1.7**	**3.25**	**5.05**	**5.95**	**6.13**	**9.03**	
Annual reduction	**1.7**	**1.55**	**1.8**	**0.9**	**0.18**	**2.9**	**9.03**

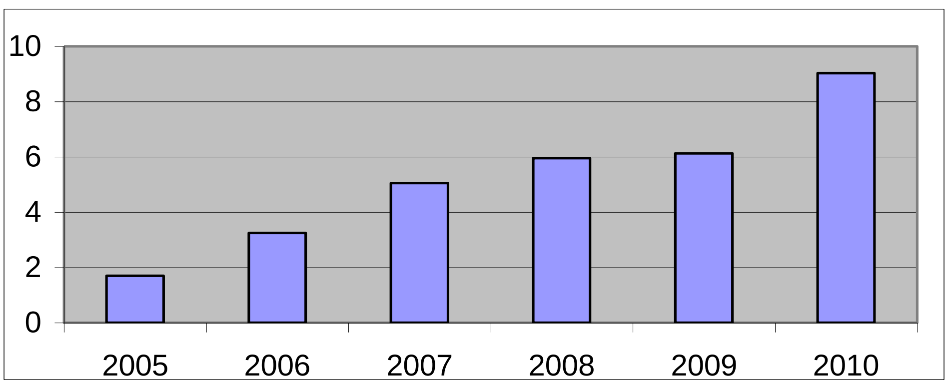


Fig (2-4) Progress of accumulative reduction

Source: National Committee for Clean Development Mechanism

Table (2-7) Overall situation of CDM portfolio until 2010

Index	Number
Total projects	**82**
Internationally registered projects	**7**
Approved projects	**10**

Accepted projects	63
Projects in pipeline	2
Total annual reduction of CO_2-eq	9.03 Million ton
Total investment	3.014 Billion USD

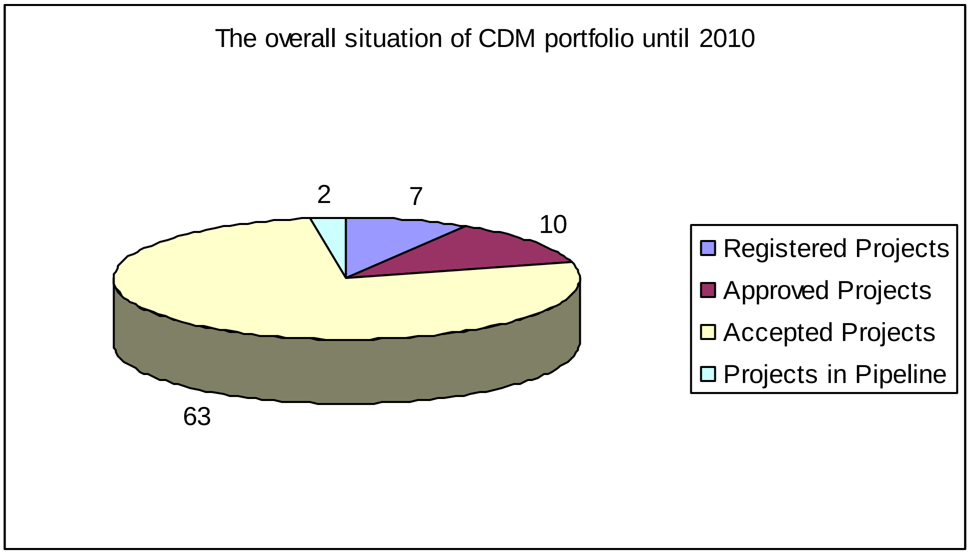


Fig (2-5) Situation of CDM portfolio until 2010

Source: National Committee for Clean Development Mechanism

Table (2-8) Internationally registered projects until 2010

CDM project	Cost (Million USD)
Catalytic N2O destruction project in the tail gas of the Nitric Acid Plant of Abu Qir Fertilizer Co.	11
Onyx Alexandria Landfill , Gas Capture and Flaring Project	4.15
Zafarana Wind Power Plant Project 120 MW (NREA– Japan)	348
Zafarana 8 - Wind Power Plant Project, 120 MW (NREA-Denmark)	170
Zafarana KfW IV Wind Farm Project 80 MW (NREA-Germany)	122
Egyptian Brick Factory GHG Reduction Project	36
Waste Gas-based Cogeneration Project at Alexandria Carbon Black Co.	15
Total investment	706.15

c. During 2010, the National Committee for CDM formed by ministerial decree on 2005 and re-formed by the ministerial decrees 221 and 222 / 2010 , held 5 meetings (3 for the Egyptian Bureau for CDM (EB-CDM) and 2 for the Egyptian Council for CDM (EC-CDM)), where 29 projects have obtained Letters of No-Objection (LoN) as shown in table(2-9), and 3 projects have obtained letters of Approval (LoA) as shown in table (2-10).

Table (2-9) CDM projects obtained Letters of No-Objection (LoN), during 2010

No.	CDM Project	Annual reduction (ton Co_2-eq)
1	Taxi Scrapping and replacement project , proposed by Ministry of Finance	953678.57
2	Gulf El Zeit Wind Power Farm Project , 120 MW (up to 400 MW) – Italgen Egypt	250,000
3	Fuel Switching from Natural Gas to Biomass Project ,Pepsi Cola Egypt , (6 October Factory)	2,585
4	Fuel Switching from Natural Gas to Biomass Project ,Pepsi Cola Egypt (Alexandria Factory)	1,747.09
5	Fuel Switch from Natural Gas to Biomass Project , Pepsi Cola Egypt (Sohag Factory)	1,620.14
6	Fuel Switching from Natural Gas to Biomass Project , Pepsi Cola Egypt (Port Said Factory)	3,662.21
7	Fuel Switching from Natural Gas to Biomass Project , Pepsi Cola Egypt (Cairo Factory)	3,662.21
8	Fuel Switching from Natural Gas to Biomass Project ,Pepsi Cola Egypt (El-Menya Factory)	2,157.79
9	Fuel Switching from Natural Gas to Biomass Project ,Pepsi Cola Egypt (Tanta Factory)	3,662.21
10	Fuel Switching from Mazout to Natural Gas , Egyptian Sugar and Integrated Industries Company (ESIIC) / Kom Ombo Factory Project	21,513
11	Fuel Switching from Mazout to Natural Gas , Egyptian Sugar and Integrated Industries Company (ESIIC) / Girga Factory Project	11,187
12	Fuel Switching from Mazout to Natural Gas , Egyptian Sugar and Integrated Industries Company (ESIIC) / Naga Hammadi Factory Project	7,314
13	Fuel Switching from Mazout to Natural Gas in the Egyptian Sugar and Integrated Industries Company (ESIIC) / Armant Factory Project	30,118
14	Fuel Switching from Mazout to Natural Gas , Egyptian Sugar and Integrated Industries Company (ESIIC) / Idfu Factory Project	27,536
15	Fuel Switching from Mazout to Natural Gas , Egyptian Sugar and Integrated Industries Company (ESIIC) / Deshna Factory Project	27,536
16	Fuel Switching from Mazout to Natural Gas , Egyptian Sugar and Integrated Industries Company (ESIIC) / Qus Factory Project	44,747
17	Fuel Switching from Solar fuel to Natural Gas , Egyptian Plastic and Electrical Industries (E.P.E.I) co. project	10,000
18	Fuel Switching from Mazot to Alternative Fuels (partial) ,Amreyah Cement Company	57,414

19	Energy efficiency measures , MRI-Mansoura unit	4000
20	Energy Efficiency in Water Pumping Systems Project , Greater Cairo Drinking Water Company	69,915
21	Energy Efficiency and Heat Recovery Project ,Sinai White Cement Co.	8,500
22	Gas Flare Recovery ,Suez Oil Processing Company	120,000
23	Greater Cairo Ring Road Afforestation Project	100,000
24	Jatropha Luxor Project – submitted by JatroSolutions GmbH – private sector / consulting firm	7800
25	Street Lighting Project – North Cairo Electricity Distribution Company	75,000
26	Shifting from Traditional Open-Pit Method to Mechanized Charcoal Production Program in Egypt, EEAA	36,000
27	Semadco Fertilizers N_2O Abatement project	275,265
28	Capture of Landfill Gas (LFG) from the Sanitary Landfill, Proposed by International City Cleaning Co.	22,000
29	Scrapping and Replacement Program of two-Stroke Motor Cycle in Egypt (POA)	14,400
	Total	2193020.22

Table (2-10) CDM projects obtained letters of Approval during 2010

No.	CDM project	Annual reduction (ton Co_2-eq)
1	Abu Zabal Landfill Gas Recovery and Flaring/Destruction	94,819
2	Egypt Vehicle Scrapping and Recycling (POA)	953678.57
3	Fuel Switching from Mazout to Natural Gas , Misr Fine Spinning , Weaving and Misr Beida	45,434
Total		1,093,931.57

d. During 2010, 3 projects have been registered at the Clean Development Mechanism Executive Board. Projects' annual reduction estimated with about 824,192 tons of carbon dioxide equivalent, and investment cost is estimated about $ 294 million, as shown in table (2-11).

Table (2-11) CDM projects internationally registered during 2010

No.	CDM project	Annual reduction (ton Co_2-eq)
1	Zafarana 8 Wind Power Plant Project, Egypt 120 MW (NREA-Denmark)	197,422
2	Zafarana KfW IV Wind Plant Project 80 MW (NREA-Germany)	171,500
3	Egyptian Brick Factory GHG Reduction Project	455,270
Total		824,192

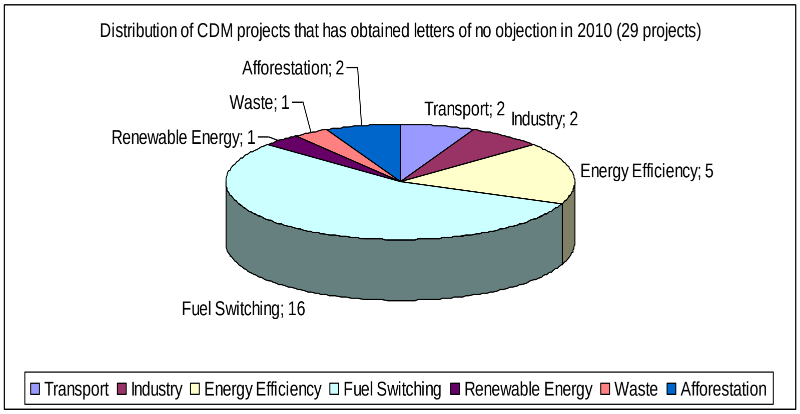


Fig (2-6) Distribution of CDM projects that have obtained Letters of No Objection in 2010

Source: United Nations framework convention on climate change (UNFCCC).int/CDM

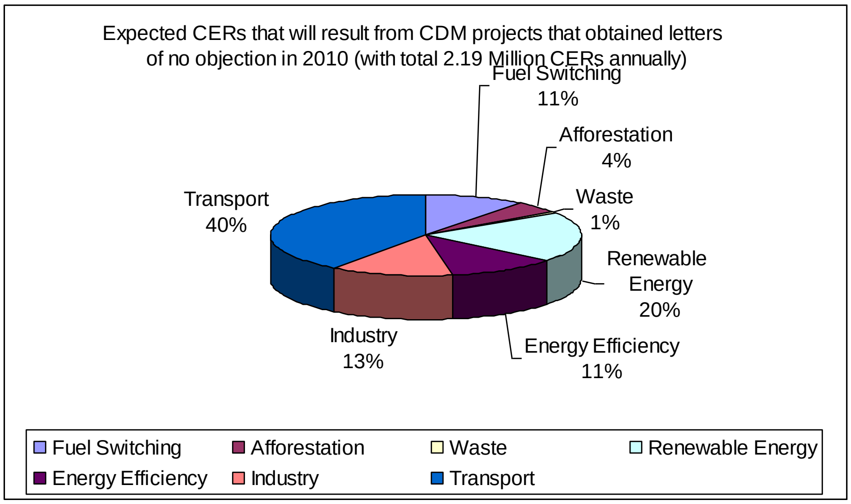


Fig (2-7) Expected CERs that will result from CDM projects obtained Letters of No Objection in 2010

Source: National Committee for Clean Development Mechanism

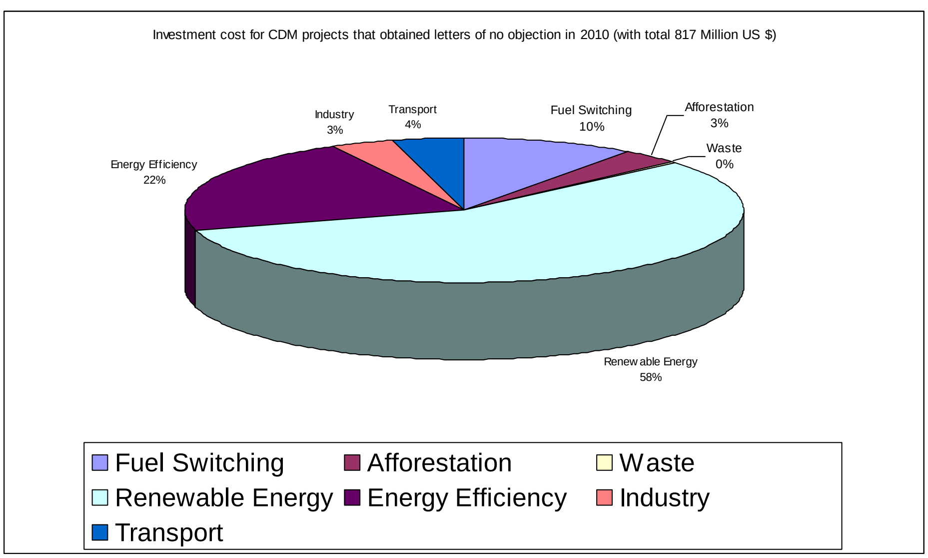


Fig (2-8) Investment cost for CDM projects obtained Letters of No Objection in 2010

Source: National Committee for Clean Development Mechanism

e. The Egyptian Council for CDM has authorized the Egyptian Bureau for CDM to issue letters of no objection to CDM projects.
f. The investment cost for CDM projects that have obtained (letters of no objection & letters of approval) in 2010 is estimated by 822 million US dollars with annual reduction of 2.3 million tons of carbon dioxide equivalent. These projects will be implemented in fields of new and renewable energy, afforestation, waste management, fuel switching, energy efficiency and industry.
g. In addition to activities of CDM National Committee, the Ministry of State for Environmental Affairs continues coordination with other relevant ministries, agencies and companies to highlight the importance of implementing CDM projects in Egypt; this along with holding meetings with international experts from South Korea, India, China, Denmark and Russia to discuss status of CDM projects in Egypt and cooperation opportunities with national and international private sector.

2-3 Environmental Indicators:

Regarding monitoring and following all exerted efforts to reduce greenhouse gas emissions caused by human activities, Egypt adopts the newest calculation methods developed by the Intergovernmental Panel on Climate Change (IPCC) for inventory, measurement and verification. It also uses group of indicators to clearly show achieved activities, projects, amount of reduced emissions and the total amount of emissions per capita.

Table (2-12) GHG emissions in Egypt (million tons of carbon dioxide equivalents)

Year	Egypt's amount of GHG emissions (CO_2eq Mt)	Egypt's share to the global GHG emissions (%)
2000	193.267*	0.64
2010	318.2**	0.63

Table (2-13) Carbon dioxide emissions in Egypt

Year	Value CO_{2e} (Mt)
2000	128.29*
2010	225.9**

Table (2-14): Carbon dioxide emissions per capita in Egypt

Year	2000	2010
Carbon dioxide emissions per capita (tons / year)	1.98*	3.88**

*** Source: verified data - Second National Communication**
**** Source: Mathematically estimated data**

Table (2-15) CDM projects in Egypt until December 2010

Title	Indicator
Number of CDM projects internationally registered	7 projects
Number of CDM projects requesting international registration in the International Executive Council of Clean Development Mechanism	2 projects
Number of CDM projects obtained final approval of the Egyptian Council of the Mechanism	8 projects
Number of CDM projects obtained initial approval of the Egyptian Council of the Mechanism	63 projects
Number of CDM projects in pipe-line phase	2 projects
Total amount of the expected reduction in emissions of greenhouse gases resulting from 82 projects	9.03 million CO_2eq
Total investment costs of 82 projects	3.014 billion US $

2-4 Adverse Impacts of Climate Change on Egypt's important sectors and adaptation measures: -

Release of the Fourth Assessment Report (AR4) by the Intergovernmental Panel on Climate Change (IPCC) in 2007 was a turning point in handling the issue of climate change, it stated that **"Climate Change is a reality and unambiguous"** that ended a lot of arguments among scientists on this phenomenon and mankind responsibility towards it. It also highlighted more the importance of dealing with risks of climate change and adaptation to it. Whatever the efficiency of emission reduction, there will be risks due to climate change which require more actions by all countries. Even if the adaptive capacity of developed countries is more, that pushed developing countries to be more rigorous with developed countries to carry their historical responsibility towards emission reduction parallel to provision of funds, supply of mitigation and adaptation technology.

According to the IPCC reports and national studies, it is expected that Egypt will be exposed to number of risks and threats, such as the Sea-Level Rise (SLR) which threaten the north coast specially the Delta ,increasing temperatures higher than normal which will be followed by subsequent decline in agricultural productivity for many species of crops, and negatively impacted tourist areas, public health and infrastructure; which will accordingly affect energy, industry, food security and macro economy sectors. Also there is a potential of water resources shortage, where Egypt relies by about 95% of River Nile.

The following is review of these risks and adaptation measures according to the importance of the threat.

2-4-1: Coastal Zones Sector:

Studies issued by the World Bank (WB), the Intergovernmental Panel on Climate Change (IPCC) and the National Communications emphasizes that Sea-Level Rise from 18 to 59 cm will lead to negative impacts and submergence of the low lying coastal zones and some parts of the north coast of Nile Delta, and negatively impact the aquifer locating near the coast as a result of seawater intrusion, quality of agricultural and reclaimed lands will be affected; in addition to the impact on tourism, trade and ports in coastal areas. It will also lead to a decline in productivity of some food crops such as rice and wheat, and difficulty in cultivating some of them, losses in agricultural land and change in Egypt’s prevailing crop structure.

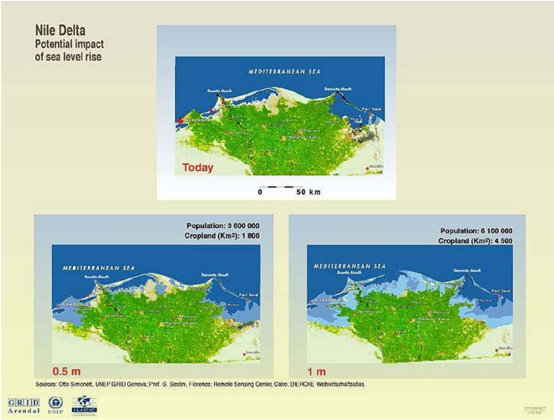


Figure (2-9): Expected scenarios of Sea Level Rise impact on the Egyptian Delta

Source: United Nations Environment Program

Sea Level Rise would destroy weak portions of the sand belt along the coastline that is important and necessary to protect the shallow and low lagoons besides reclaimed lands. It would also change water quality affecting most of freshwater fish, and threatening facilities in low level areas in Alexandria and Port Said. Recreational tourism may be affected through deterioration of beach facilities and salinity of groundwater.

It is also expected that the intensity and frequency of extreme weather events (heat waves, sand and dust storms) would affect coastal zones where strong impact on productivity of agricultural lands, supposed life of substances and public health.

Adaptation measures for coastal zone areas:

1. An Integrated Coastal Zone Strategy has been submitted and climate change adaptation measures will be included while developing the integrated coastal zone management plan.
2. Coastal Research Institute starts its experimental studies to protect and fix natural sand dunes which are considered natural protection against Sea-Level Rise.

2-4-2: Agriculture Sector:

Agriculture has an important role in the Egyptian economy; it contributes with about 20% of the Gross Domestic Product (GDP). More than 70% of agricultural land depends on low efficient irrigation systems that caused loss of large quantities of water, degradation of land productivity and salinity problems.

Several studies on the impact of climate change and high increasing temperature on crops productivity show that the productivity of strategic crops like wheat, rice, potatoes and soybeans will decrease while cotton productivity will increase, also the increasing fiercer of agriculture pests will reduce productivity .

High temperature would affect livestock health; some new diseases started to emerge such as aphthous fever and the availability of necessary forage will reduce due to the low productivity of forage crops.

Productivity of fisheries will be negatively affected by increased water temperature, lack of freshwater supplies, and quality of fish in northern lakes would change due to the increased salinity.

Adaptation measure for agriculture sector:

Ministry of Agriculture and National Center for Agricultural Research developed adaptation measures to cope with these negative impacts, such as:

1. Change sowing dates for each crop/crop pattern
2. Develop crops tolerant to high temperature and water shortage
3. Develop monitoring systems for current and new pests.
4. Improve productivity of live stocks breeds and develop nutrition program to cope with warmer climatic conditions.

2-4-3: Water Resources and Irrigation Sector:

There are different scenarios about the increase/ decrease of water level in Nile Basin. The natural flow of water in the Nile Basin is highly sensitive to changes in rainfall and increased temperatures rates, where some studies suggest a divergence in the periods of rainfall with an increased rate of precipitation, leading to increased potentials of flooding or longer periods of drought. Studies have shown that population growth and increased consumption rates, especially in agriculture and industry sectors, will increase stress on water resources. Sea Level Rise will affect the groundwater aquifers in the Nile Delta and will result in increased salinity and make it unfit for use.

Adaptation measures for water resources sector:

Ministry of Irrigation and Water Resources implements adaptation measures with regard to water sector such as:

1. Adaptation to decreased Nile water level through development of irrigation systems , best use of water and change crop pattern,
2. Seek new water sources through exploitation of groundwater ,deep aquifers, cloud seeding,
3. Water desalination and wastewater treatment.

2-4-4: Tourism Sector

Climate change is considered one of the challenges facing tourism industry. Climate Changes have an impact on tourism and tourists' attraction, which would have negative impact on economy. As Egypt is a tourist country characterized by beaches and coastline overlooking the Mediterranean and the Red Seas; heat waves, especially during summer could negatively affect the demand of tourists to visit Egypt and make them turn to another tourist coastal states.

According to the Initial National Communication most vulnerable sectors to climate change are coastal areas, agriculture, water resources and health sector; accordingly, Egypt will be subjected to water shortage that affect tourism sector in terms of the inability of the tourist resorts to meet their water needs.

Sea Level Rise, would threaten coastal areas and coastline in Egypt that impacts tourism sector.

It is known that coral reefs are factors of tourist attractions in Egypt, which it is famous with in Red Sea areas ; Coral reefs are one of the most living ecosystems, affected by climate change which will be subjected to degradation and bleaching (loss of color) as a result of increased water temperatures.

As for of archaeological and historical tourist sites, high temperature and intensity of carbon dioxide and changing weather conditions will accelerate deterioration of historical areas.

Adaptation measures for tourism sector:

1. Activate legal actions to protect natural protectorate areas.
2. Integrate climate change dimension in the Integrated Coastal Zone Management, which would have impact on the protection of eco-tourism and coastal tourist areas from the impacts of climate change.
3. Develop areas that are not threatened by climate change impacts and rehabilitate them to be tourist areas.
4. Adopt assessment research studies focus on climate change risks, coastal areas and monuments are vulnerable to and develop procedures to reduce them, such as in Alexandria and Rosetta cities.

Picture (2-1): Coral reefs bleaching

2-4-5: Housing and Roads Sector

1. **Housing**

High temperatures lead to the increasing consumption of electrical energy through the increase in using air conditioners and fans in all types of buildings and public facilities.

Adaptation measure for housing sector:

a. Ministry of Housing has issued energy efficiency CODE for buildings, whether domestic or commercial. It recommends that designing of buildings must allow natural ventilation and lighting , using local building materials to ensure the provision of thermal comfort inside buildings ,avoiding glass facades in the west and east directions to reduce energy consumption .
b. Encourage scientific research, in universities and specialized research centers, in fields of rationalize energy consumption through use of energy-saving bulbs and implement green architecture requirements in building design.

2. **Roads**

Roads affected by high temperatures, direct sunlight, traffic density, speed of vehicles and their exhausted emissions, which affect the hardness of asphalt and thus lead to roads deformity which have an impact on their safety. In Egypt, roads network- especially in Cairo - expose to these effects besides the increasing negative impacts of high traffic density.

Heavy rains and floods have an impact on roads. Areas such as Sinai and Red Sea expose to floods that crash and damage their roads.

Adaptation measures for roads sector:

- Paving road network away from the drains of storm water and vulnerable areas to Sea Level Rise.
- Using materials which give rigidity and resistance to all above mentioned impacts.
- Design new roads in accordance with international standards, which include road slopes and rain water drainage systems in areas that may be exposed to heavy rains in the future and other relevant standers.
- 4-Road Lighting Code must be applied in designing lighting system; it is recommended to provide electricity in lighting roads by using energy-saving bulbs, utilizing solar energy and using phosphoric reflectors in highways.

2-4-6: Health Sector

Climate Change has direct and indirect impacts on the health of citizens particularly children, elderly, women, poorest sectors of the society and rural areas whom are the most affected by these impacts. In Egypt, about 58% of the population lives in rural areas, so they will be the most affected sectors of the society to climate change. One of the most direct health impacts associated with climate change is the increase in diseases associated with high temperatures, such as sunstrokes, skin cancer and eye cataracts. The indirect impacts are water shortages and decrease of agricultural productivity that lead to food shortages and the emergence of diseases, anemia and malnutrition. There are forecasts and scenarios threaten Egypt with shortage of availability of water, which has an impact on the health sector.

The indirect health impacts of climate change are diseases associated with, insects and parasitic which temperature increase will help in their spread. However, there is shortage of studies and research in field of climate change impacts on public health, due to the lack of sufficient data and information.

Adaptation measures for health sector:

1. The Ministry of Health develop services of health institutions in Egypt, especially in rural and remote areas in addition to vaccination programs, which are handled by the Ministry of Health and provided to children and students of schools for free.
2. Red Crescent Society implements health awareness campaigns and send medical convoys to face any natural and environmental disasters in Egypt.

2-5 Studies & pilot projects:

Egypt has implemented many studies, pilot and operational projects in order to develop strategies, plans and necessary policies to reduce anthropogenic greenhouse gas emissions, and adapt to the impacts of climate change in addition to implement number of pilot projects to transfer modern technologies.

2-5-1 In the field of Climate Change Mitigation

1. In addition to Egypt's efforts in the field of clean development mechanism, this is considered at the same time mitigation efforts. Since eighties Egypt focused on implementing number of projects, especially in the field of energy, that have indirect impact in reducing greenhouse gases emissions, especially Carbon Dioxide. For example, Egypt focused on expands in using natural gas instead of traditional fuel, after the discovery of large quantities of natural gas. Switching resulted in increasing efficiency of power generation by up to 50% which lead to a significant annual decrease in national emissions of Carbon Dioxide estimated by about 20 million tons. Egypt also focused on using renewable energy sources - especially in remote and rural areas - as alternative sources of energy to reduce dependence on traditional sources.
2. An example of operational projects "Improve Energy Efficiency and Reduce Greenhouse Gases project" which is funded in partnership between the Ministry of Electricity & Energy and the Global Environment Facility / United Nations Development Program. It is implemented by the Egyptian Electricity Authority and Energy Planning Agency. The project aims at improving energy efficiency and removing obstacles to reduce greenhouse gas emissions produced from power-generation processes, on the long run.
3. New and Renewable Energy Programs: currently implemented to generate electricity from new and renewable energy sources by Ministry of Electricity - New and Renewable Energy Authority. The Egyptian Program for producing large capacities of electricity from renewable sources, includes two sub-programs:
   a- Sub-program of electrical systems for wind energy; implemented at the coasts of the Red Sea and the Suez Gulf by New and Renewable Energy Authority, with support of donor countries and private sector.
   b- Sub-program of the thermal generation of electricity; the project includes use of solar systems, or thermal power at capacity of 127 megawatts implemented in Kurimat.
4. Implementation of number of pilot projects to transfer technologies of emissions reduction such as 'Methane Collection and Burning from solid waste composting ", to encourage private sector to invest in such types of clean energy and waste treatment projects, e.g. "Onyx Project in Alexandria".
5. In order to contribute to greenhouse gas emissions reduction, National Program for Forest Plantations is implemented under the supervision of Ministry of Agriculture and Land Reclamation in all areas of treating sewage or industrial waste water projects, such

as in Sarabium / Ismailia, Sadat City / Menoufia, Mount Sinai / South Sinai, Kharga Oasis / New Valley, Paris / New Valley, Edfu / Aswan, Luxor, Qena, and Abu Rawash / Giza and Alexandria.

6. The Ministry of Environment in coordination with the related ministries exerted great efforts to combat burning of rice straw to prevent carbon dioxide emissions, through recycling and re-use of rice straw in composting.

2-5-2 <u>In the field of Climate Change Adaptation :</u>

1. In confirmation of taking serious actions towards implementation of adaptation projects and providing financing sources, Ministry of State for Environmental Affairs is keen to coordinate with agencies and donor organizations such as Global Environment Facility; where the integrated coastal zones management project is implemented for realizing the integrated planning to develop the coastal region located between Alexandria and Marsa Matrouh , improve the ambient environment and preserve biodiversity of eco-system.
2. Ministry of State for Environmental Affairs is keen to coordinate with concerned ministries and authorities to develop mathematical model to simulate the negative impacts of climate change on vulnerable sectors in Egypt, such as water resources, agricultural crops and coastal areas; to provide data and information necessary for the preparation of specialized national studies that help planners and economists to predict the future of food security and housing in Egypt.
3. The Center for Information and Decision Support affiliated to Cabinet of Ministers - National Committee for the Reduction of Crises, Disasters and their Risks in collaboration with all stakeholders and ministries, prepares the framework of the National Adaptation Strategy.
4. In this regard, MSEA plays an active role in coordination and cooperation with national and foreign entities to follow up implementation of many projects that support adaptation measures to potential climate change , the following are examples of such programs and projects :
   a. **Assessment and Strategy Development to respond to the impacts of Sea-Level Rise on human migration in Egypt**

   The project aims to conduct rapid assessments to develop understanding of the potential impacts and consequences of Sea-Level Rise on the migration and human security issues in low lying coastal areas in Nile Delta and coastal cities of Egypt. Since these areas are heavily populated and full of agricultural activities, Alexandria has been chosen as it is one of the most receiving internal migration governorate and its citizens are greatly interested in external migration. Accordingly the following three local communities, from this governorate, have been chosen for the study (model to be applied): Bay of Abu Qir, East Port and Max as communities to be affected by sea level rise. They are similar in their population, economic and social conditions and livelihoods (agriculture and fishing).

   The International Organization for Migration (IOM) in cooperation with the Ministry of Manpower and Migration, the Ministry of State for Environmental Affairs , the Coastal

Researches Institute and number of non-governmental partners are implementing this project to study the expected environmental, humanitarian, social and economic impacts on expected internal migration flows due to sea-level rise.

b. Climate Change and Human Migration project

The project aims to study the various dimensions of internal and external migration and the impact of climate change on migration in the countries of the Middle East. Five countries have been selected for the project (Egypt, Algeria, Yemen, Morocco, and Syria). Dakahlia and Sharkia are the two selected Egyptian governorates for the study.

The project is implemented under the auspices of the French Agency for Development and in partnership with the Institute of Environment and Human Security of the United Nations University and the World Bank.

c. Climate Change Risk Management Program CCRMP:

A national program aimed to apply adaptation and mitigation to climate change impacts and to assist Egypt in addressing climate change.

The program consists of four components; **the Supreme Council for Energy** seeks to support the objectives of the policy of the Supreme Council of Energy in fields of renewable energy and energy efficiency; **the Clean Development Mechanism** (CDM) to promote and encourage the use of the mechanism to add new economic benefit for investment projects; **Forecasting and Integrated Water Resources Management** to develop scenarios of the implications of climate change and to integrate it in the National Integrated Water Resources Management plans and **Finally Adaptation component of the agricultural secto**r, to develop crops capable of enduring extreme climatic conditions, lack of water, soil salinity and high temperatures.

The program is supported by the Spanish Development Fund, includes many ministries and sectors (Ministry of Irrigation and Water Resources, Ministry of Agriculture, Ministry of State for Environmental Affairs, Ministry of International Cooperation and Ministry of Foreign Affairs)

d. Climate Change Adaptation and Natural Disaster Preparedness in the Coastal Cities of North Africa (Alexandria)

The project aims to assess risks of natural disaster and determine the expected impacts of climate change through collection of data and information related to climate, marine environment, water resources, topography, seismic and economic characteristics of some coastal cities in collaboration with the World Bank and the Arab Academy for Science, Technology and Maritime Transport.

Alexandria has been chosen in Egypt, Tunisia in Tunis, Casablanca and Bouregreg Valley in Morocco. First phase of the project has been implemented; it included assessment of the weaknesses, expected impacts of climate change and risks of natural disasters in Alexandria.

The data has been analyzed to assess the expected impacts of climate change on the city by 2030.

Second phase of the project is ongoing, it focus on the development of adaptation action plan for Alexandria with the growing risks of climate change to be able to deal with natural disasters when they occur. The project is part of a regional study conducted by the World Bank on climate change, natural disasters and adaptation in coastal cities that suffer most from climate change in North Africa

2-5-3 In the field of Climate Change Mitigation & Adaptation :

Among 10 countries, Egypt has been selected by UNFCC to submit its National Environmental, Economic and Development Study (NEEDS) report. The report covers an assessment for the needs of agriculture and coastal zones sectors under adaptation, while it covers the needs of industry and energy sectors under mitigation. A list of proposed projects has been prepared by national experts to be submitted to the Conference of Parties (COP) for finance.

2-6 Future Vision:

1. Upgrade national performance on both national and international levels to sustain exerted efforts in the field of climate change on various relevant sectors. Develop the institutional structure of climate change in Egypt.
2. Establish and activate a Supreme Council for Climate Change chaired by the Prime Minister with membership of relevant ministers, and the Minister of State for Environmental Affairs is its rapporteur.
3. Establish the Science and Technology Committee, with membership of a group of Egyptian scientists, in the field of climate change and related areas, such as agriculture, irrigation, meteorological, health, petroleum and electricity.
4. Establish a center of excellence for climate change (to provide data and information) affiliated to Ministry of State for Environmental Affairs, one of its functions is supporting periodic preparation of national reporting and to be the core for the National Centre for Climate Change Research
5. Establish the Climate innovation Center.
6. Review and activate National Strategy for Climate Change, with the development of necessary short and long term programs and plans, and integrate them within Egyptian national development action plans.
7. Initiate development of a national program for shifting to a low carbon economy, inventory the Nationally Appropriate Mitigation Actions (NAMAs), and establish an interactive database to survey greenhouse gas emissions from their various sources. In addition, to improve the performance of clean development mechanism to attract international investment.
8. Prepare necessary plans for raising awareness towards mitigation and adaptation issues on the long run; in coordination with relevant agencies and involvement of Non Governmental Organizations for its vital role.

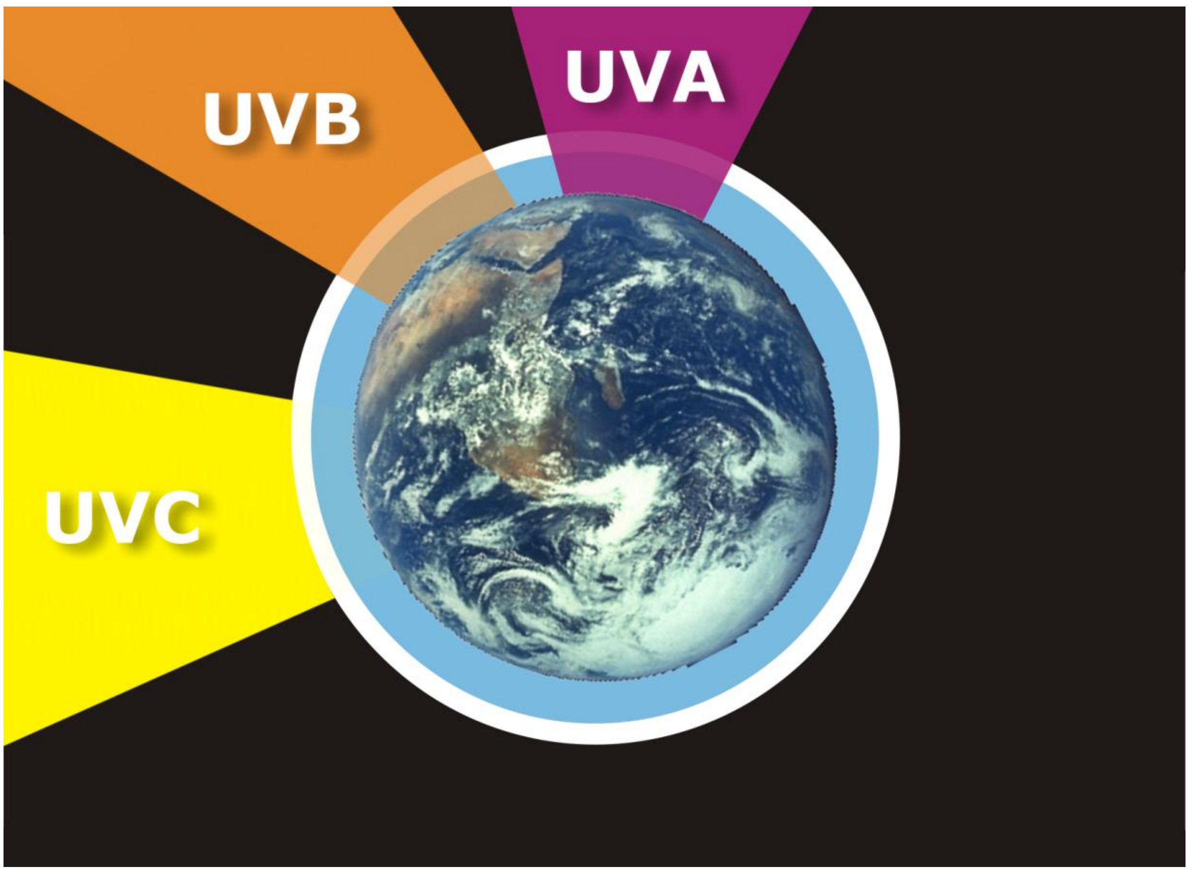
9. Prepare and develop plans to integrate climate change issues in different levels of education in collaboration with relevant stakeholders.

2-7 References:

1. The Fourth Assessment Report (AR4) – Intergovernmental Panel on Climate Change (IPCC): issued 2007
2. The Second National Communication (SNC) –Egyptian Ministry of State for Environmental Affairs issued 2010
3. World Health Organization (WHO): http://www.who.int/ar
4. United Nations Environment program (UNEP): http://www.grida.no/publications/vg/africa/page/3131.aspx
5. Global Environmental Facility (GEF): http://www.undp.org/gef
6. The Ministry of Agriculture and Land Reclamation: www.agr-egypt.gov.eg
7. The Ministry of Electricity and Energy: www.moee.gov.eg
8. Climate Change Central Department Presentation on Feb. 2010 (Shoura Council)
9. Recent Temporal and Spatial Temperature Changes In Egypt: 2005

Chapter three

Ozone Layer Protection



3.1 Introduction:

Egypt has succeeded in reducing targeted consumption rate of substances depleting Ozone Layer due to the effective national policies and controls. Ministry of State for Environmental Affairs in cooperation with concerned authorities have supervised execution of projects adopting alternatives to ODS, activities transferring modern technology and substituting old equipment and machines with modern ones operating with ozone friendly substances in different sectors. As well as implementing awareness programs, directed to all social categories, about environment-friendly alternatives. Egyptian environmental policy seeks to facilitate compliance with Montreal Protocol provisions to protect Ozone Layer, without prejudicing Egyptian economy, development programs or influencing priorities set by the State to achieve sustainable development.

These achievements do not mean that course of action is complete, or that all obligations with Montreal Protocol provisions have been implemented. Thus efforts are still under execution to completely phase out Ozone-depleting substances from all sectors in compliance with provisions and amendments of Montreal Protocol.

3.2 Environmental and health impacts of Ozone layer depletion:

Ozone layer is a natural filter and shield surrounds Earth to protect all creatures from harmful rays of Ultra Violet-B threaten human life health and safety.

This threat is a result of modern technology developed by man due to urbanization and development of new chemical substances. This led to the emission of gases from substances that cause Ozone layer depletion.

Rays of Ultra Violet-B emitted from the sun reaching to Earth surface have harmful impacts; including some diseases that afflict man such as skin cancer, cataract and immunodeficiency. Moreover, such rays negatively affect photosynthesis of green plants, which reduces plant growth and crop production, beside its negative impacts on aquatic environment systems which disorders ecological system of nature and life on Earth and consequently causes Global Climate Change. All these negative impacts threaten human being health and environmental integrity.

3.3 Environmental Indicators:

Environmental indicators of Ozone layer are closely linked with countries compliance with decisions and amendments of Montreal Protocol concerning gradual reduction of Ozone Depleting Substances, with a view to totally phase out such substances according to schedules set by the Protocol and its Amendments.

3.3.1 Halon Sector:

Halon Bank was established in Helwan Company for Engineering Industries (formerly, Military Factory 99), EEAA collects Halon from all entities that have stagnant stock of Halon due to being transferred to other alternatives in fire fighting systems. Collected quantities handed to the Halon Bank for recycle and re-use in various vital sectors where they are urgently needed. It is worth noting that Halon is allowed in some fire fighting systems used to protect critical and highly costly equipment. Besides, they are used to maintain technical capabilities of airplanes, ships, tanks, communication systems, central computers and other very important sophisticated and strategic electronic equipment till the transfer to other non-depleting Ozone layer alternatives within coming years. Figure 3-1 shows gradual reduction of imported Halon quantities.

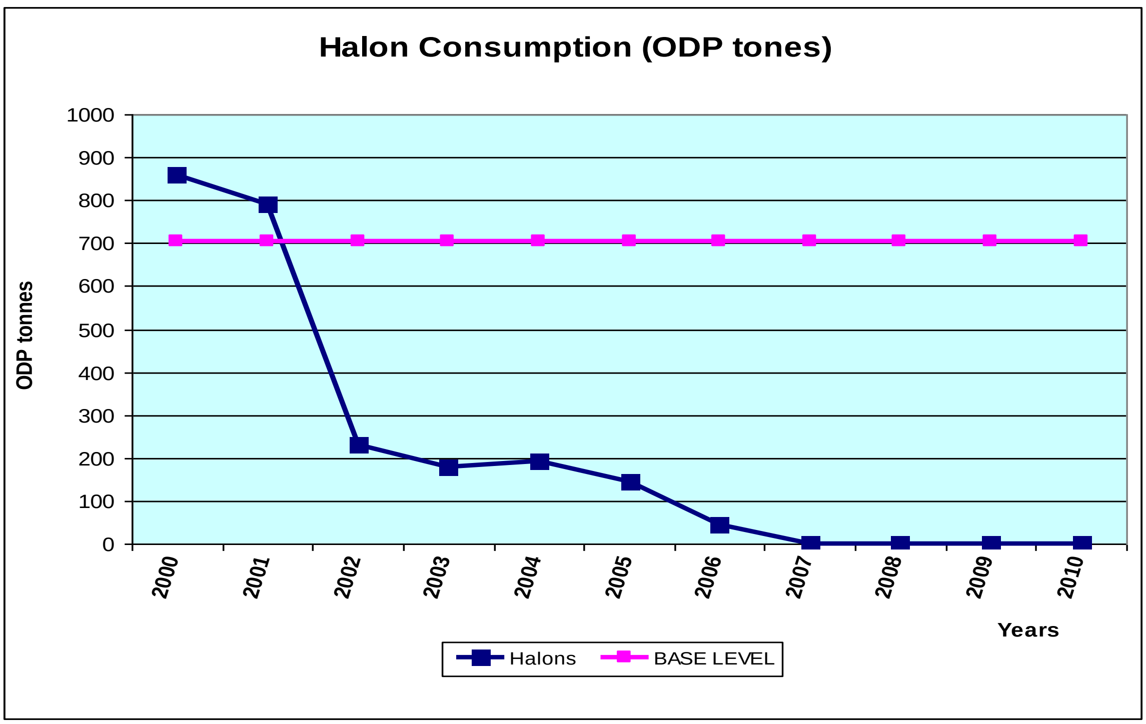


Figure (3-1): Gradual reduction of imported Halon

Source: Ozone Unit

3-3-2Medical Aerosols Sector:

In collaboration with Ministry of Health, Egyptian Environmental Affairs Agency (EEAA) converts production lines of medical aerosol manufacturers which consume 163 tons annually of Ozone Depletion Substances (CFC's) as propellant in sprays used by respiratory asthmatic patients to non-Ozone depleting alternatives. In cooperation with Pharmacy Department, Ministry of Health and pharmaceutical companies start execution of the national strategy to raise awareness, through training courses, for doctors and pharmacists with non-ODS aerosols alternative. Executing this strategy required preparing production locations for installing new equipments and new production lines for the manufacture of non-ODS medical aerosols. Currently, suitability of these products is tested. Total substitution of production lines of pharmaceutical manufacturers is expected by the end of 2011.

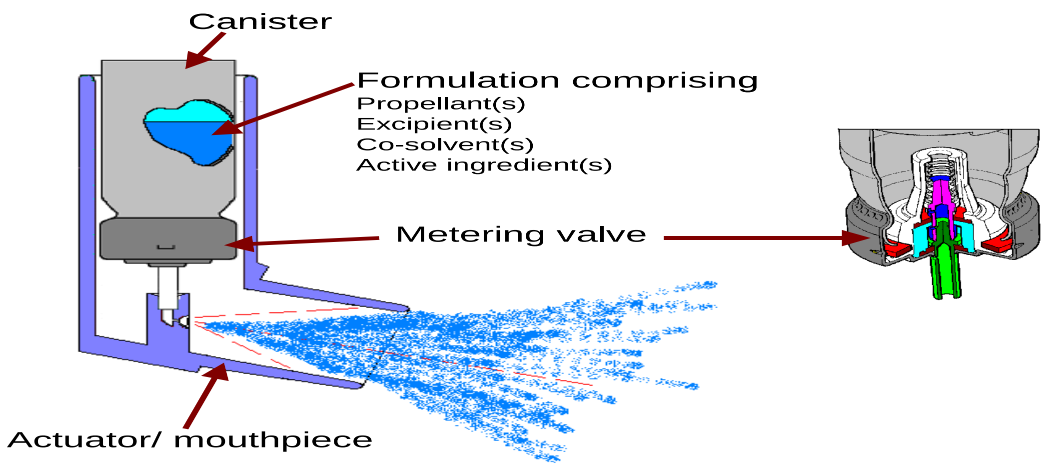


Figure (3-2): A Spray used by respiratory asthmatic patients

Source: Ministry of Health, Pharmaceutical companies

3-3-3Maintenance and repair of refrigeration and air-conditioning equipment Sector:

Egypt has developed a strategy that aims at phasing out importation of CFC's substances depleting Ozone layer used in maintaining refrigeration and air conditioning equipment. Cooperation protocols were signed with relevant stakeholders such as Control Authority on Exports and Imports and Customs Authority to activate laws prohibiting importation of such substances. For implementing this strategy EEAA cooperated with the National Railways Authority to replace refrigeration units for rail carriages, as well as refrigeration units of a public sector company for foodstuff to operate with ozone friendly alternatives instead of the depleting ones. Total execution of this strategy will be achieved by the end of 2011. Figure (3-3) shows the gradual reduction of imported CFC's substances.

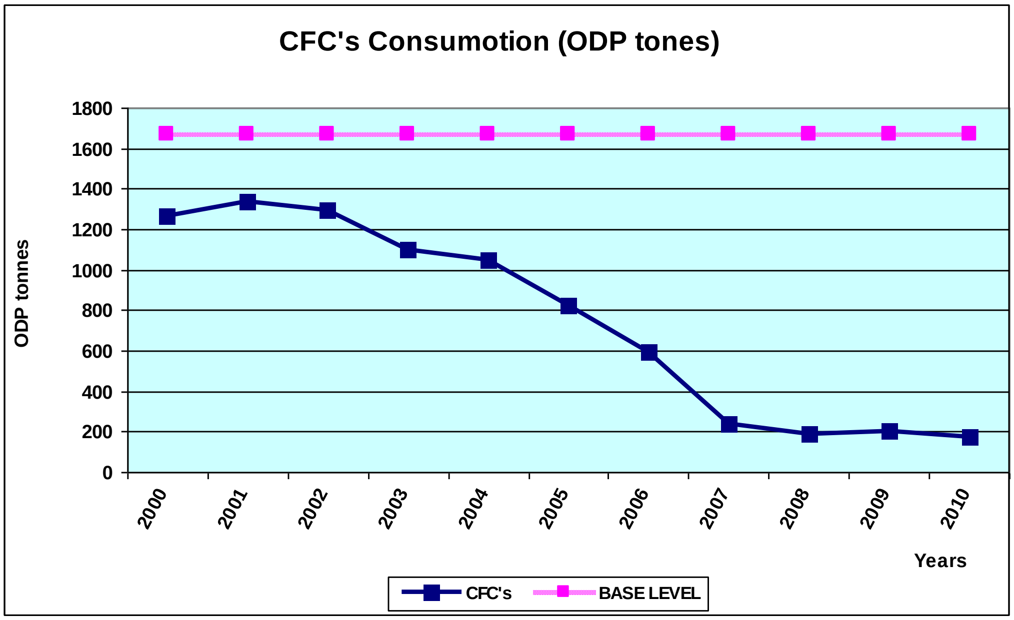


Figure (3-3) shows the gradual reduction of imported CFC's substances
Source: Ozone Unit

3-3-4Methyl Bromide alternative project :

1. Second phase of the project, extends until 2013, will achieve final phase out of methyl bromide for the treatment of soil, grains, spaces and warehouses.
2. During 2010, Methyl Iodide which is the latest alternative to Methyl Bromide will be applied within an area of 30 feddans on crops of (peppers, sherry tomatoes, herbs and cut flowers). During 2011 it will be applied on strawberry crop in nurseries and commercial plantations to prove its effectiveness in combating grass.
3. Eco2fum substance is applied on the stored grains in barns of Development Bank and Agricultural Credit, which prove effectiveness at a concentration of 600 Ppm, match with that of the Methyl Bromide.
4. Cultivation on rice straw has been developed by using rice straw of last year which was packed in plastic bags with special quality; picture (3-2) shows the outstanding success of this method, which can be applied to small-scale farmers.
5. In July 2010, Paladin, the new alternative internationally registered will be applied; as the project seeks to apply all newly registered and used alternatives.

Table (3-1) Consumption of Methyl Bromide until 2012,

Year	Total authorized amount for importation	Dedicated for grains and spaces	Dedicated for soil treatment	Dedicated for dates treatment	Total consumption reduction
2009	317 tons	51.75 tons	256.75	8.5 tons	-------------
2010	262 tons	51.75 tons	201.75 tons , reduction rate21.43%	8.5 tons	55 tons
2011	222 tons	46.5 tons reduction rate 10.85%	167 tons , reduction rate 17.23%	8.5 tons	40 tons
2012	122 tons	26.5 tons reduction rate 43.02%	87 tons, reduction rate 52.09%	8.5 tons	100 tons

Source: Methyl Bromide alternative project

Picture (3-1) injection of Almidas (Methyl Iodide)

Source: Methyl Bromide alternative project

Picture (3-2) cultivating on bales of Rice Straw

Source: Methyl Bromide alternative project

3-3-5 Egyptian Strategy for phasing out use of HCFC Substances:

HCFC substances are one of the most important substances used in several sectors, among which foam and heat insulation industry, refrigerators, cooling and air conditioning sector and solvents sector. Although these substances have low Ozone Depleting Potential "ODP", they have high Global Warming Potential "GWP", contribute to aggravate Global Warming. A national strategy for phasing out use of such substances in various fields is being developed.

Table (3-2) shows schedule of phasing out use of the Ozone Depleting Substance "HCFC" in Article 5 countries (including Egypt) of Montreal Protocol.

Table (3-2) Schedule of phasing out use of the Ozone Depleting Substance "HCFC"

Substance	Base Level	Production/Consumption Rate Control
First group HCFC substances	Average consumption rate 2009-2010	Freezing production/consumption levels (1st January, 2013)
		10% reduction (1st January, 2015)
		35% reduction (1st January, 2020)
		67.5% reduction (1st January, 2025)
		100% reduction (1st January, 2030) with possible exemptions for necessary uses.

Source: Protocol Montreal provisions

3-4 Future Vision:

Phasing out ozone depleting substances needs exerting lot of coordinated efforts among all institutions, governmental/private or civil society organizations, and cooperation among various categories of the international community at all national and regional levels.

Because ODS cause depletion of the stratospheric ozone layer, their production and consumption are under control of the Montreal Protocol to protect ozone layer. Subsequently, they are gradually phased-out due to efforts of developed and developing countries parties to the Montreal Protocol.

A national strategy will be developed during next stage to freeze and phase-out HCFC's from all sectors. Ministry of State for Environmental Affairs depends on the following steps to achieve complete phase out of ODS:

1. Facilitate compliance with Montreal Protocol for protecting Ozone Layer without impeding development programs or affecting priorities set by the state to achieve sustainable development.
2. Provide assistance to adapt conditions of national companies using HCFC's to replace these substances with non-ODS alternatives.
3. Cooperate with all control authorities in the country, provide them with equipment to analyze refrigerants and organize training programs on how to use such equipment.
4. Sustain execution of ODS recovery and recycling programs.
5. Intensify awareness campaigns directed to all categories of the society with environmental friendly alternatives.
6. Impose restriction on importation of HCFC's and equipment depend on ODS substances, by 2013.

Chapter four

Noise

4-1 Introduction

Technological progress and steady increase of world population resulted in many environmental pollution problems including noise. Noise exhausted humans not only in cities but also in villages due to the spread of its different sources. Consequently communities exposed to many humanitarian and financial damages. Nervous tension is one of the most important negative health impacts resulting from exposure to high noise levels. A study indicates that one of four men and one of three women are suffering from neurological diseases caused by noise. Initial results of a scientific study conducted by the World Health Organization revealed that among the dangerous impacts human being exposed to as a result of noise are the annual infliction with heart attack with about 3%that cause death of thousands of world population.

Results of the National Network for Noise Monitoring indicate the increasing noise levels all over Greater Cairo; they exceed the permissible limits set forth in the Executive Regulation of Environment Law.

Noise emitted from roads and vehicles is the main source of increased noise levels due to the annual increase in vehicles numbers with an average of 15% annually, or the insufficient capacity of roads and infrastructures to cope with this annual increase. Noise levels increased as a result of lack of vehicles' maintenance, use of outdated vehicles especially heavy trucks, population growth and their associated activities within specific areas and non-application of sound urban planning that integrate environmental dimension while adopting any increase in activities.

4-2 Noise Monitoring network

Monitoring program of noise levels during 2010 in most parts of Cairo governorate and some regions in Helwan governorate were completed. Monitoring results in regions with different activities in Cairo Governorate compared with results of 2009 to determine improvement rate in noise reduction, activate proposed recommendations to reduce noise and prepare contour maps of environmental noise levels for some important districts in Cairo.

During 2010, monitoring of noise levels has been initiated in 7 districts in Giza governorate, 3 regions in Kaluobia governorate and 2 locations in 6 October governorate. All monitoring sites were selected to cover different activities in each governorate to determine noise levels, sources and prepare programs to reduce noise levels in these regions.

4-3 Rates of noise levels in Greater Cairo

4-3-1 Cairo Governorate

1. Noise levels in main squares of Cairo Governorate

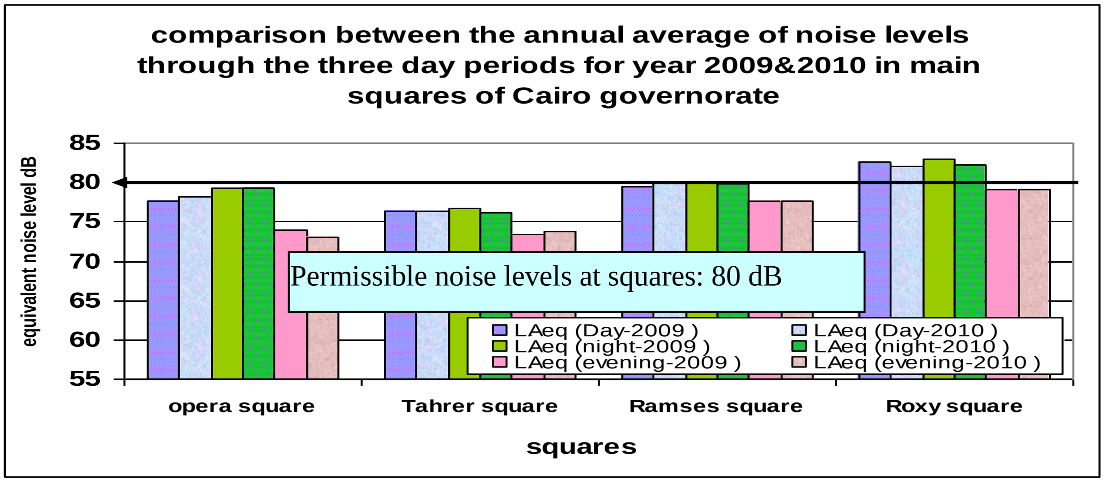


Figure (4-1) Equivalent noise levels during three day periods for main squares of Cairo governorate at 2009-2010

Source: MSEA, Noise Monitoring Network

Picture (4-1) Monitoring terminal located in Tahreer square

- Figure (4-1) shows no remarkable change in noise levels in main squares of Cairo during 2010 from those of 2009 during the three day period.
- Noise levels in all monitoring sites in Tahreer, Opera and Ramsis squares were within the permissible international limits, while an increase was monitored in Roxy square for the day and evening periods.
- Two noise monitoring terminals have been transferred by the end of 2010. The first is the terminal in Ramsis square, it has been transferred because of the reconstruction process conducted in the square; the second is the terminal in Opera square, it has been transferred because monitoring process which continued more than three years has been finalized .Those two terminals installed in new cities (6 October and El-Sherouk) to determine noise levels for these new cities and prevent establishment of any activities that may increase noise levels in these cities to preserve them as eco- friendly cities.

2. Noise levels in industrial areas

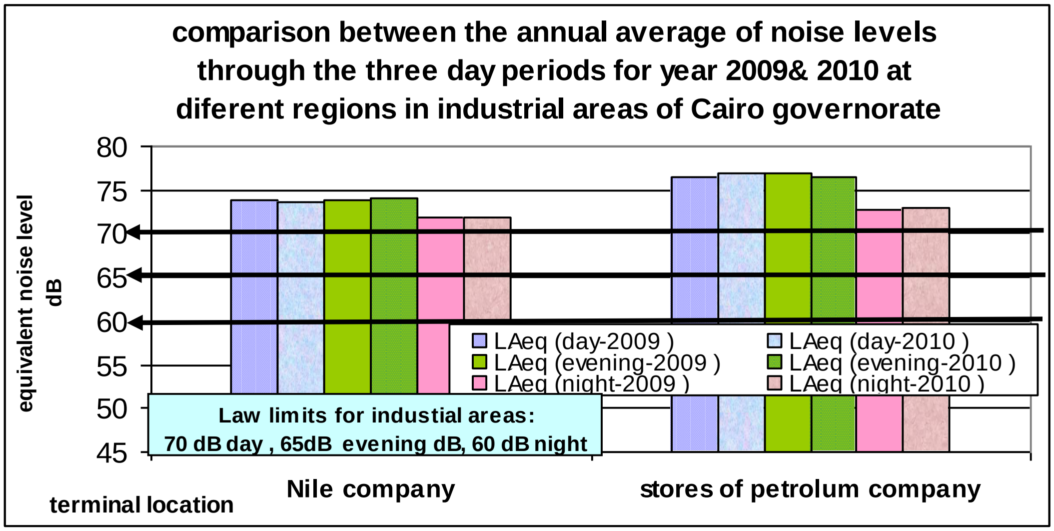


Figure (4-2) Equivalent noise levels during the three day periods in industrial areas of Cairo governorate

Source: MSEA, Noise Monitoring Network

Picture (4-2) Monitoring terminal located in Stores of Petroleum Company- El Sharabia

- Figure (4-2) shows no remarkable change in noise levels during 2010 than those of 2009. Results of noise levels in the two industrial areas of Cairo Governorate (El Amereya and El Sharabeya) indicate their exceeding of the permissible limits set forth in the Executive Regulation of Environment Law during the three day periods.
- 2010, noise levels in those two sites ranged between (73-77) dB at day and evening while (71-73) dB at night. Emitted noise from traffic in El-Sawah Street and Petroleum companies' street considered the main source of noise in these sites.

3. Noise levels in commercial and administrative areas

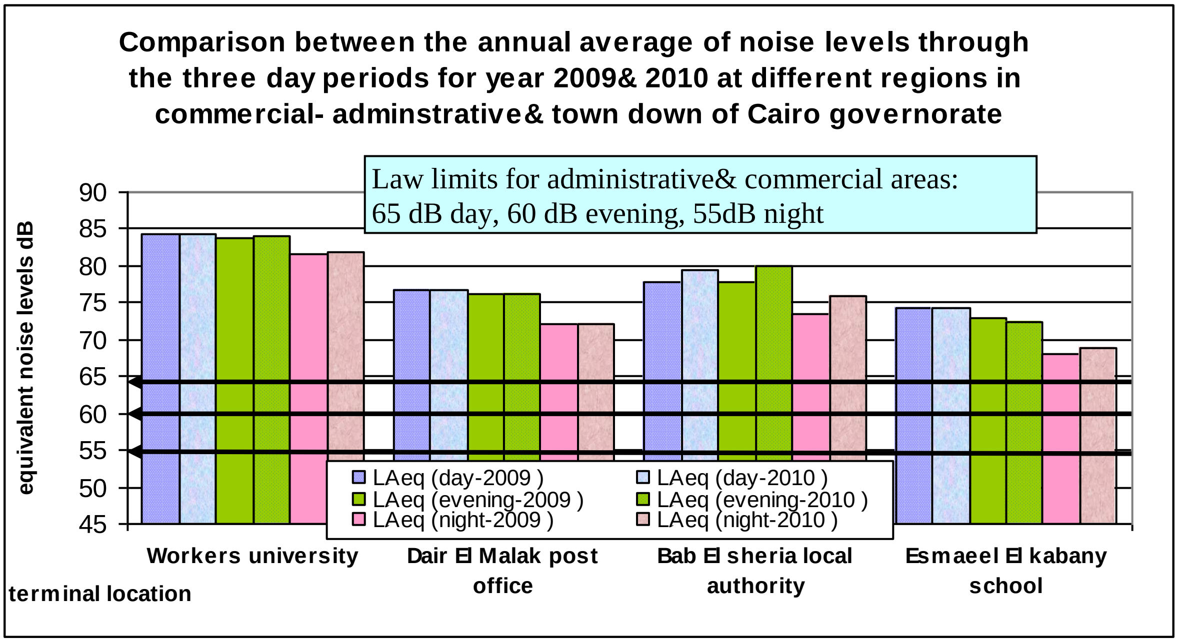


Figure (4-3) Equivalent noise levels during the three day periods in Commercial and Administrative areas of Cairo governorate

Source: MSEA, Noise Monitoring Network

Picture (4-3) Monitoring terminal located in Dair El Malak post office

- Figure (4-3) shows high noise levels at all monitoring sites exceeding the permissible limits set forth in the Executive Regulation of Environmental Law. During 2010, remarkable increase was monitored in the terminal location of Bab El-Sharia Local Authority at Port Said Street than previous year with about (2-3) dB during the three day periods. This is due to the construction process of Bab El-Sharia underground station. No remarkable change was monitored in the remaining monitoring sites during 2010 than those of 2009.
- 2010, noise levels ranged between (73- 84) dB at day and evening, (69-82) dB at night.

4. Noise levels in areas located on main roads

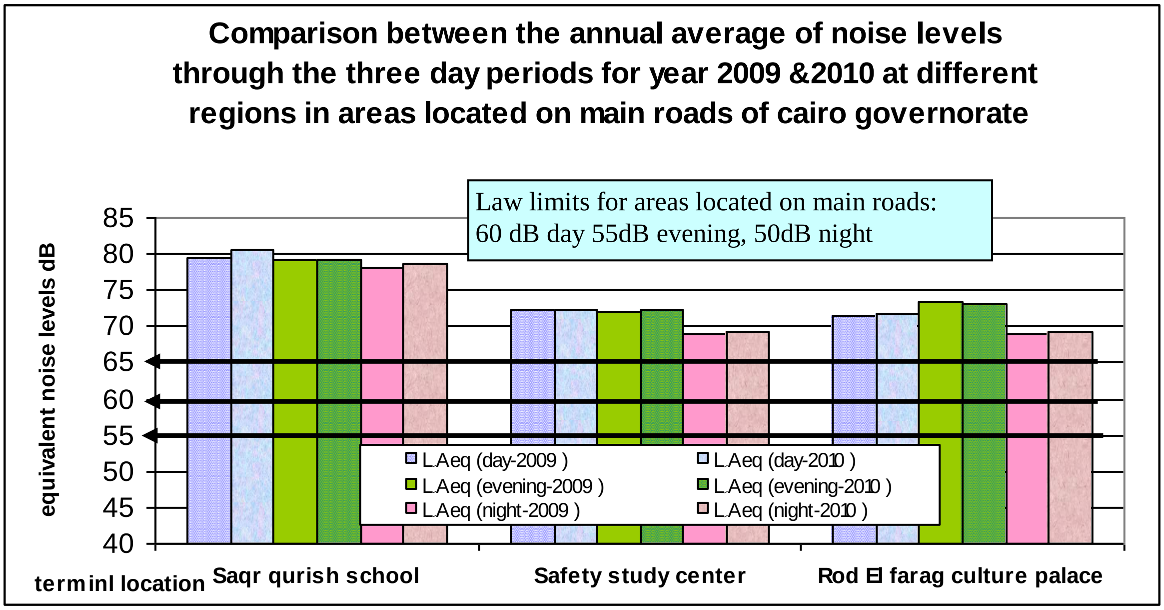


Figure (4-4): Equivalent noise levels during the three day periods in areas located on main roads of Cairo governorate

Source: MSEA, Noise Monitoring Network

Picture (4minal located in Rod El-Farag Cultural Center

- Figure (4-4) shows high noise levels at all monitoring sites exceeding the permissible limits set forth in the Executive Regulation of Environment law no.4/1994. Monitoring results of 2010 did not record remarkable change in these sites than those of 2009.
- Results of noise levels for sites locating on main roads (Rod El-Farag Street, El-Hegaz Street and Autostorad road) ranged between (72-80) dB at day and evening, (69-78) dB at night.

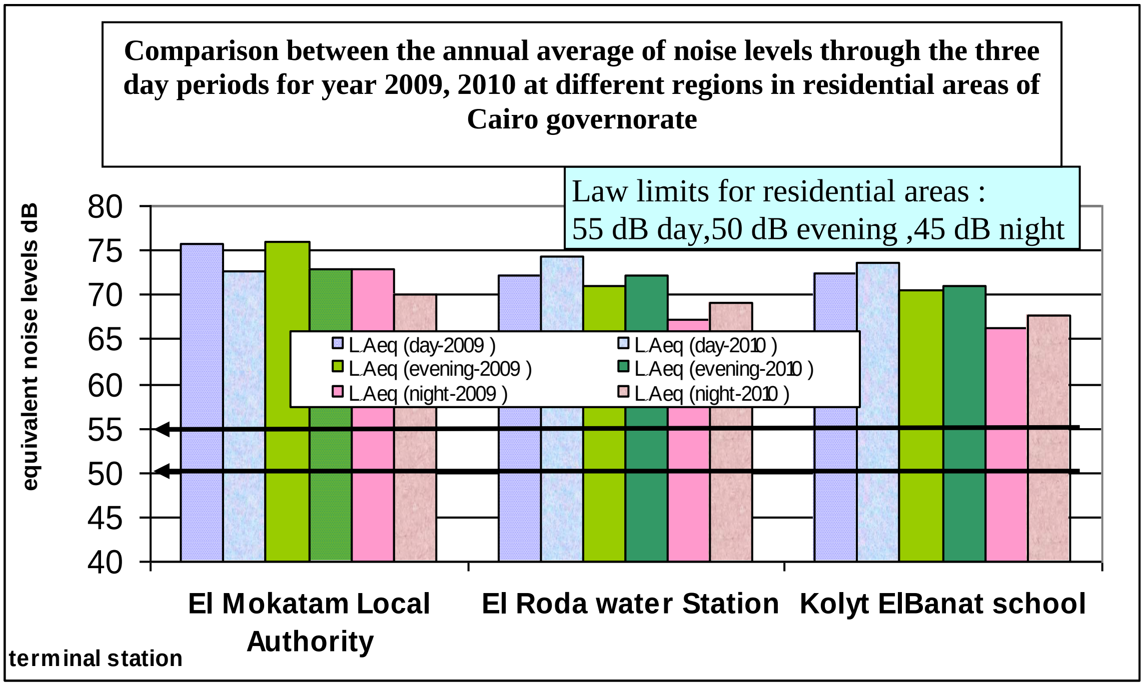


Figure (4-5) Equivalent noise levels during the three day periods in residential areas of Cairo governorate

Source: MSEA, Noise Monitoring Network

Picture (4-5) Monitoring terminal located in El Mokatam Local Authority

- Figure (4-5) shows decrease of noise levels at the monitoring terminal located in El-Mokatam Local Authority in 2010 than previous year with about (3 dB) during the three day periods. This is due to controlling microbuses' movement near the building. An increase was recorded in locations of El-Roda water station and Koliat El-Banat School than previous year with about (1-2 dB) due to the annual increasing numbers of vehicles in Cairo governorate.

- The figure indicates increasing noise levels in all sites, which represent residential areas only (with limited activities) exceeding the permissible limits set forth in the Executive Regulation of the Environment law no. 4 / 1994. Noise levels in these sites ranged between (71-74) dB at day and evening and (68-70) dB at night.

4-3-2 Helwan Governorate

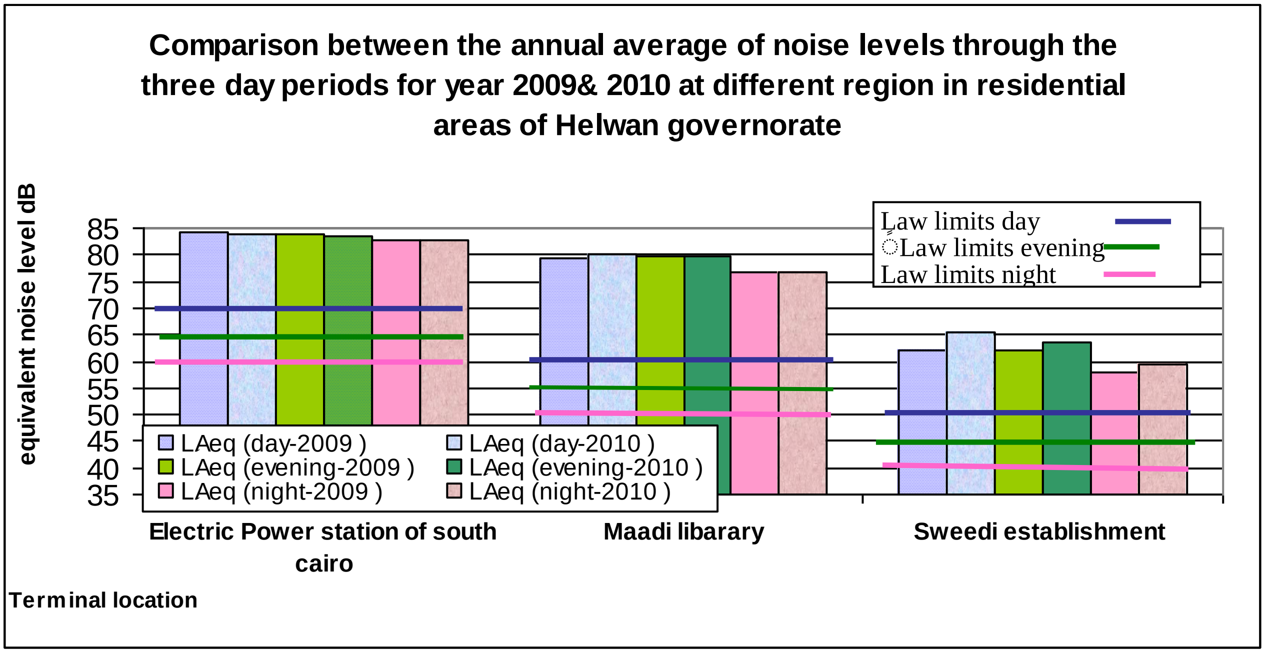


Figure (4-6) Equivalent noise levels during the three day periods in the industrial, main road and residential areas of Helwan Governorate

Source: MSEA, Noise Monitoring Network

Picture (4-6) Monitoring terminal located in Maadi Library

- Figure (4-6) refers to high noise levels in all monitored areas exceeding the permissible limits set forth in the Executive Regulation of Environment law no. 4 /1994 , during the three day periods. Three different regions in Helwan governorate were monitored. The monitoring terminal located in El-Sweedi Establishment in the third settlement of new Cairo which represents residential areas, recorded an increase than pervious year with about (2-3) dB . This is due to the construction activities conducted in this region. The monitoring terminal located in Maadi library at El-Nasr Street represents residential areas located on main roads, while the monitoring terminal located in the electric power station south of Cairo in Maasra represents industrial areas. Monitoring results for the three sites ranged between (62-84) dB at day and evening, (60-82) dB at night.
- 2010, recorded no remarkable change in these monitoring sites than previous year.

4-3-3 Giza Governorate

1. Noise levels in the administrative & down town regions

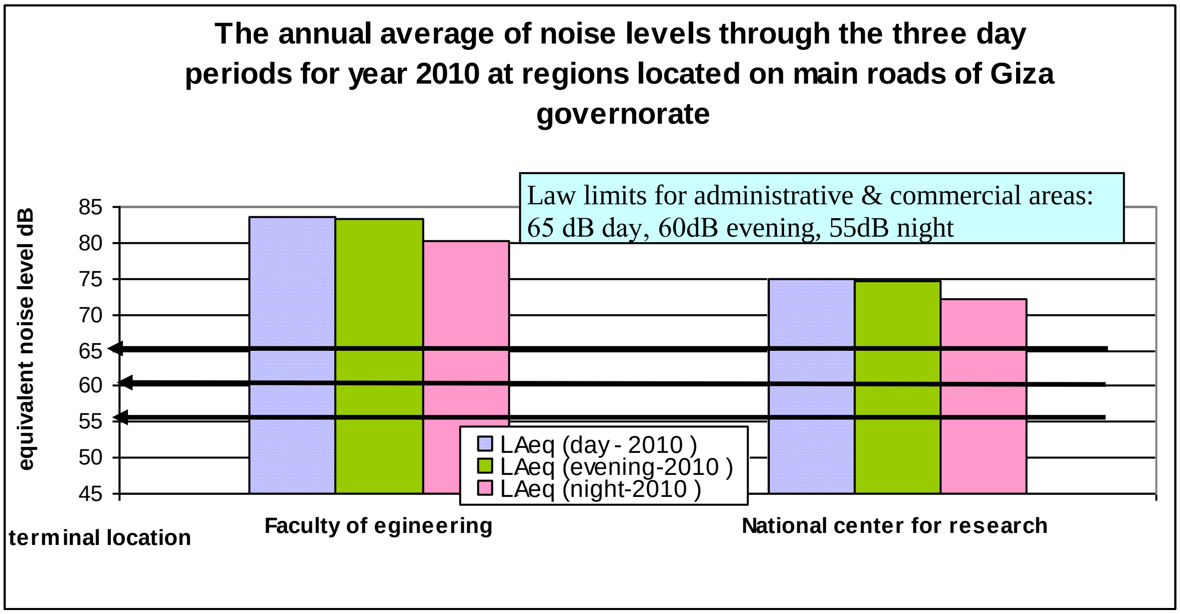


Figure (4-7) Equivalent noise levels during the three day periods in the administrative &down town areas of Giza governorate

Source: MSEA, Noise Monitoring Network

Picture (4-7) Monitoring terminal located in the Faculty of Engineering- Cairo University

- Figure (4-7) shows results of noise levels in two sites representing administrative & commercial areas in Giza governorate. It refers to high noise levels during the three day periods exceeding the permissible limits set forth in the Executive Regulation of Environment law no. 4 / 1994. 2010, noise levels ranged between (74-83) dB at day and evening, (72-80) dB at night.

2. Noise levels in areas located on main roads

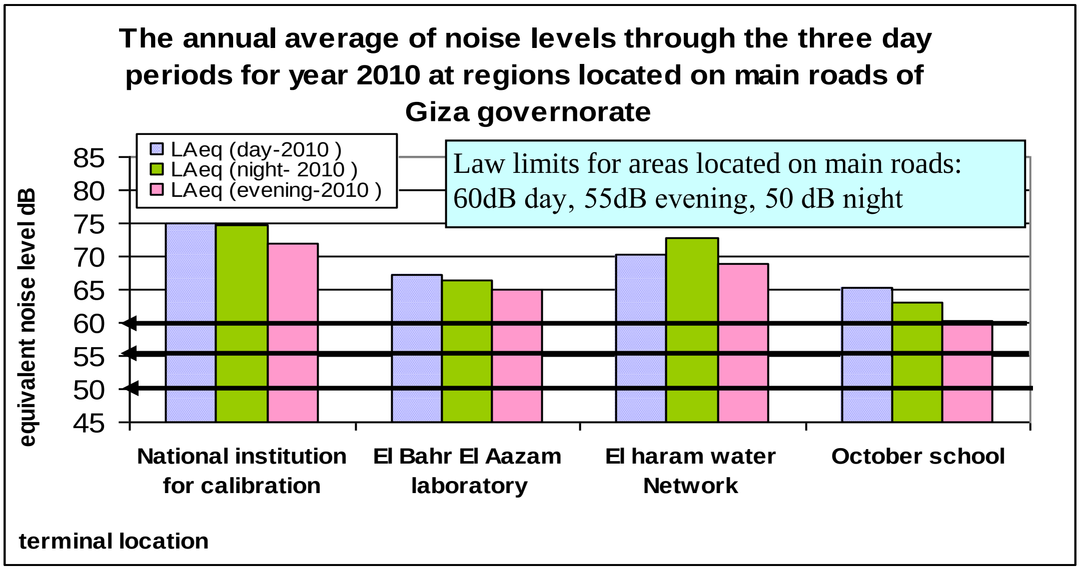


Figure (4-8) Equivalent noise levels during the three day periods in areas located on main roads of Giza governorate

Source: MSEA, Noise Monitoring Network

Picture (4-8) Monitoring terminal located in the National Institute for Measurement and Calibration

- Results of noise levels measured in 4 sites representing residential areas located on main roads in Giza governorate indicates increased noise levels in these sites exceeding the permissible limits set forth in the Executive Regulation of Environment Law no. 4 / 1994, as shown in figure (4-8). It ranged between (63-75) dB at day and evening, (60-72) dB at night.

4-3-4Kaluobia governorate

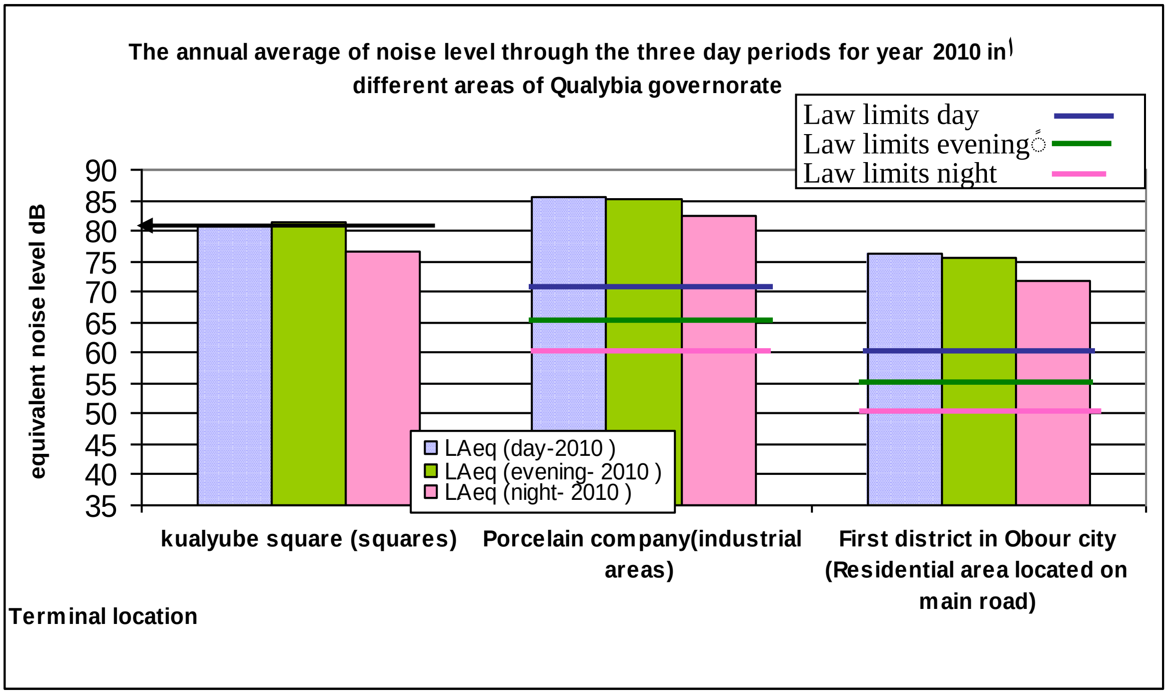


Figure (4-9) Equivalent noise levels during the three day periods in Squares, industrial and residential areas located on main roads of Kaluobia governorate

Source: MSEA, Noise Monitoring Network

Picture (4-9) Monitoring terminal located in The Porcelain Company in Mostorod

- Figure (4-9) shows noise levels at Kaluob square did not exceed the permissible limits set forth in the Executive Regulation of Environment law no. 4 / 1994 during the three day periods; while increased in other two locations exceeding the permissible limits, the first at the first district in Obour city which represents residential areas located on main roads, and the second in the Porcelain Company in Mostorod which represents industrial areas. Noise levels

- Note: Permissible limits for noise levels at Kaluob Square were considered 80 dB during the three day periods according to the international standards for squares and roads where citizens are not existent permanently.

4-3-5 6th October Governorate

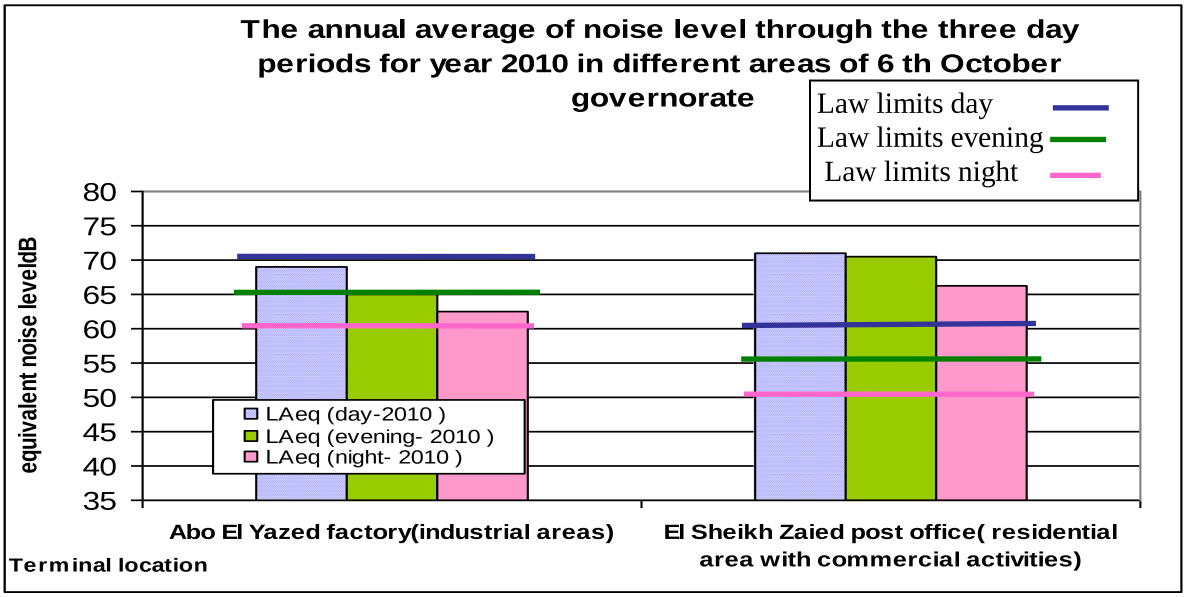


Figure (4-10) Equivalent noise levels for the three day periods in (industrial- residential in town) of 6th October governorate

Source: MSEA, Noise Monitoring Network

Picture (4-10) Monitoring terminal located at Sheikh Zayed post office

Source: MSEA

- Results of noise levels measured in two different sites at 6 October governorate, the first locates at Sheikh Zayed post office which represents residential areas with some commercial activities, while the second locates at Abu El-Yazid factory which represents industrial areas. Fig (4-10) shows compatibility of noise levels in the surrounding area of Abu El-Yazid factory with limits of the Executive Regulation of Environment Law no. 4/1994 during the day and evening periods. Noise levels ranged between (62-69) dB at day, evening and night. This is due to the good planning of the industrial area in 6 October governorate.
- The figure indicates high noise levels during the three day periods, at the location of Sheikh Zayed post office, exceeding the permissible limits set forth in the Executive Regulation of Environment Law 4/1994. This is due to the commercial shops and cafes illegally established down the residential buildings, which is considered violation of the regulations organizing establishments in new cities. Results of noise levels ranged between (66-71) dB day, evening and night.

By analyzing monitoring results of noise levels in Greater Cairo governorates, the following results were observed:

- In 2010, noise levels in most squares of Cairo governorate were within the permissible international limits; while levels were still high and exceeding limits set forth in the Executive Regulation of the Environment Law in all locations of industrial, commercial, administrative, residential areas and suburbs in Cairo and Helwan governorates. By comparing monitoring results for 2009 & 2010, it was clear that there is no remarkable change in noise results during the three day periods in most regions than previous year. But 2010 recorded decrease in Mokatam region due to the control of microbuses movement and prevent their unofficial parking , while an increase recorded in Bab El-Sharia region due to digging and construction processes of the third line of the underground project.
- During 2010 monitoring of noise levels in Giza, Kaloubia and 6 October governorates initiated so that 2010 is considered their base year for noise levels indicators. Results refer to high noise levels in most locations exceeding limits set forth in the Executive Regulation of Environment Law.
- Results refer to compatibility of noise levels in the industrial area of 6October governorate with limits set forth in the Executive Regulation of Environment Law 4/1994, this is due to the good planning of this new industrial area; while results refer to increasing noise levels in some areas at new cities due to the establishment of some commercial shops down residential buildings, such as the area surrounding the terminal located at Sheikh Zayed post office, which is considered violation of the regulations organizing establishments in new cities.

4-4 Monitored violations within working environment (industrial-commercial -tourism) by EEAA's Regional Branches

Table (4-1) number of different facilities inspected during 2010 by EEAA Regional Branches

Branch	No. of violating establishments	No. of complying establishments	Total no. of inspected establishments
Alexandria	61	88	149
Cairo	21	4	25
Tanta	40	125	165
Assuit	16	12	28

Aswan	1	15	16
El Mansora	6	21	27
Hurghada	18	28	46
Suez	8	10	18
Total	171	303	474

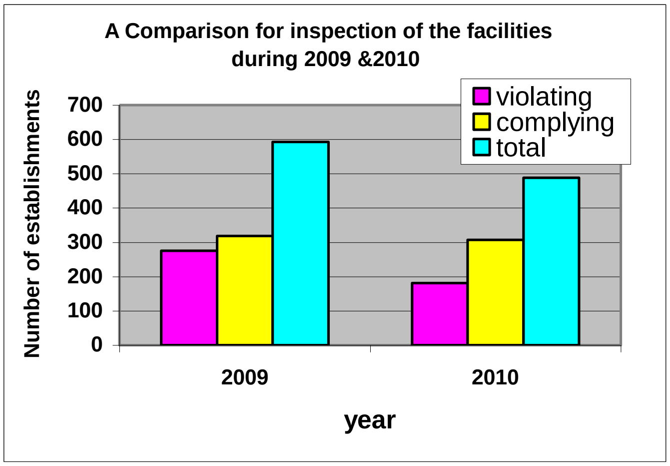


Figure (4-11) Comparison between results of noise levels measurements inside facilities during 2009 &2010.

- Results of noise levels in working environment indicate that total number of inspected facilities (according to emitted noise) by EEAA's Regional Branches 2010 were 474 facility distributed as shown in table (4-1) . Percentage of complying facilities 64% and violating facilities 36% which recorded high noise levels exceeding the permissible limits set forth in the Executive Regulation of Environment Law 4/1994; legal procedures were taken against violators.
- It has been observed that percentage of violating facilities during 2010 were less than those of 2009.

Source: EEAA regional branches, General Directorate of Environment Police

4-5 Vehicles' Noise

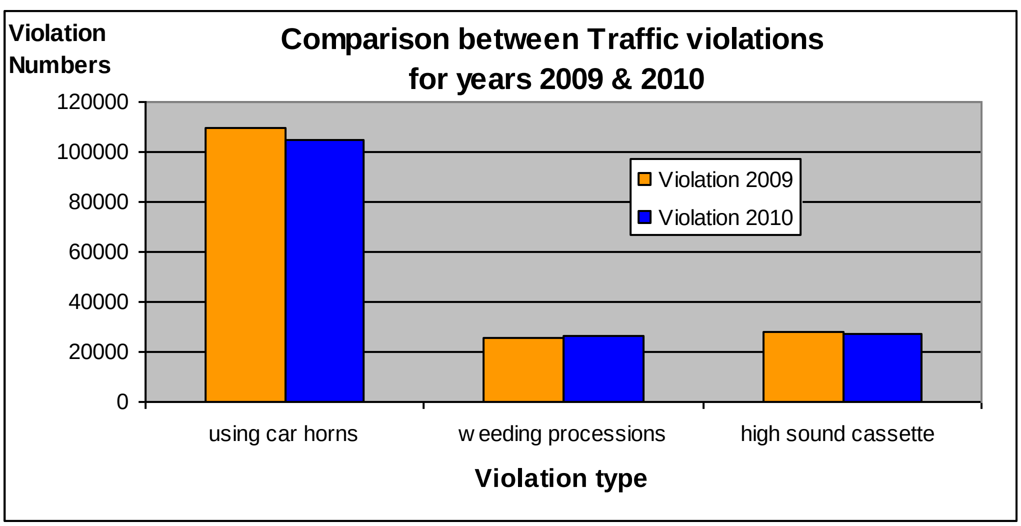


Figure (4-12) Noise resulting from traffic violations in 2009 & 2010

Source: Ministry of Interior, General Directorate of Traffic.

Figure (4-12) shows slight increase (2%) in traffic violations resulted from wedding processions during 2010 compared to those of 2009. This is due to celebrations' culture and traditions in Egyptian society which is still depend on noisy methods. While traffic violations of using car horns and high sound cassette decreased during 2010 compared to 2009 .This may be due to the strict enforcement of the new Traffic Law, the interest directed by General Traffic Department, (Ministry of Interior) to this type of violations and the increased awareness with bad and negative impacts of exposure to noise.

4-6 Future vision

Future vision for noise reduction includes the following measures:

1. Develop and update Environmental Noise Monitoring Network, increase number of mobile terminals to cover all governorates of the country especially in resorts (Hurghada, Sharm El-Sheikh and Luxor). This aims to provide database with monitoring results, draw contour maps to develop technical plans for reducing noise in areas suffering from high noise levels from which the ministry receives many complaints.
2. Follow up implementation of the National Noise Reduction Plan approved by representatives of concerned ministries to activate stated measures for noise reduction and controlling its sources. Ensure commitment of each ministry with their respective role and finalize the database of all measures taken by different governorates to reduce noise.
3. Coordinate with Ministries of Interior, Commerce and Industry to establish Noise Measuring Stations to measure emitted noise from vehicles and comparing them with permissible limits , as a prerequisite to license any vehicle; in activation of the added standards to the Executive Regulation of the amended Environment Law no. 9/ 2009 .
4. Develop and sustain cooperation plans with both Traffic and Environment police, in terms of intensifying inspection campaigns on facilities emitting noise and taking legal actions against violators.
5. Continue implementation of awareness campaigns regarding noise reduction in schools, universities, sporting clubs and NGOs.
6. Continue implementation of training courses in noise measurements field for the technical staff in concerned ministries and agencies, to activate facilities' self-monitoring and increasing awareness with noise reduction.

4-7 Terminologies

Noise: Unwanted sounds
Environmental noise: harmful, unwanted sounds emitted by all human activities including noise from transportation means, airports, industrial activities, and any other activities in the surrounding environment.
L_{Aeq}: continuous equivalent noise level during an interval time at the measurement level A.
L_{day} : continuous equivalent noise level during daytime.
$L_{evening}$: continuous equivalent noise level during evening time.
L_{night} : continuous equivalent noise level during nighttime.
dB: noise measurement unit.
A-weighted(Curve): represents the method human auditory system respond to pure tones.

References:

1. World Health Organization: http://www.who/ noise guidelines
2. Environnemental Noise, Bruel & Kjaer www.b&ksv.com
3. Berglund B & Lindvall .T.Schewela,D(2000)"Guidelines for community noise" WHO
4. Environment law no.4/1994 and its Executive Regulation

Data Source

1. Noise Monitoring Network, EEAA.
2. Regional Branch Offices (RBOs), EEAA.
3. Ministry of Interior (General Directorate of Traffic).

Part Two

Water

Chapter five

Fresh water

5-1 Introduction

With the beginning of the third millennium, water became one of the main and critical issues that attracts concern of the whole world and determines relations between countries sharing in one watercourse. There are 261 international river basins; among them Egypt shares the Nile River Basin with 10 African countries including South Sudan. Fresh water proportion from rivers and lakes represents about 1% of the total amount of global water and distributed irregularly, this exposes many regions to face water shortage and scarcity. Due to this fact and the steady increase of population in addition to limited water resources, the importance of the optimal use of available fresh water resources and conservation of each drop obligates applying of modern technologies to safely reuse treated wastewater instead of wasting them to seas, oceans or the surrounding environment without treatment.

Pollution and irrational consumption of water are the main two problems, negatively affect water resources.

Water pollution is one of the main issues concerns scientists and experts in the environmental protection field. Due to the necessity of water for all biological and industrial processes, it is not surprising the studies conducted to address this issue are more than those addressing other environmental branches. Biochemistry proved that water is necessary for all reactions and transformations that occur within bodies of living organisms. Water forms about 60-70% of the higher organisms including humans and 90% of the lower organisms; so that water pollution can cause serious damage and threat the living organism and disturb the ecological balance which would be meaningless and invaluable if the properties of its main component (water) are spoiled.
Irrational consumption of water, leads to waste clean fresh water instead of its consumption in different usages, which negatively impact economic and environmental development, taking into account the unequal distributions of potable water allover the world.

Egypt suffers from scarcity of water like other countries of North Africa, due to its limited water resources, it depends mainly on the Nile River as the main source for freshwater. Egypt's fixed share of Nile water, while its population and economic development rates are increasing steadily exposes it to the decrease of water average per capita.
Nile River is considered the main source of fresh water in Egypt, conserving its water quality and quantity is considered a national duty.

Nile River is 3.3 million Km^2 covering about eleven African countries, and according to the Nile Convention in 1959 between Egypt and Sudan, Egypt's share is about 55.5 billion cubic meters annually. Because the Nile River has the utmost importance, one of the main objectives of Egyptian Strategy for the development of water resources and improve its management .To strength the relations between Egypt and the Nile Basin countries, Ministry of Water Resources and Irrigation has implemented several major projects for the peoples of the Nile basin countries including the following:

- The Egyptian-Ugandan project to combat aquatic weeds.
- Drilling 180 wells in the arid areas of Kenya and agreement to drill another 20 wells is going on.
- Drilling 30 wells in Tanzania, in addition to signing a cooperation agreement with Tanzania for drilling 70 new wells.
- Drilling 10 wells for the people of Darfur (Sudan), in addition to the agreement to drill 50 wells. Number of projects are currently under implementation in southern Sudan, including drilling wells for drinking water, purification of waterways in El Ghazal river Basin, preparation of feasibility studies for the construction of a dam to generate hydroelectric power on Bahr Algabal , construction of water quality laboratory in Goba , rehabilitation of measuring stations and training and capacity building.

On the other hand, the Egyptian Fund for African Technical Cooperation intensifies its efforts with Africa for the current and coming stages to increase Egyptian institutes' presence in the Nile Basin countries. The fund introduces humanitarian and logistics aids (food, medicines, computers, clothes, agricultural seeds, SUV, tents...), conducts several training courses in different fields of (agriculture, irrigation, health, etc.) and delegates experts in different fields such as health, teaching, engineering, pharmacy and sports trainers etc.

5-2 Available Fresh water quantities in Egypt:

First: Conventional water resources

The available traditional water resources is 59 billion cubic meters / year, including 55.5 billion cubic meters / year from Egypt's quota of Nile water , 2 billion cubic meters of non-renewable underground water, 1.3 billion cubic meters of rains and floods, as well as 0.2 billion cubic meters of desalinated water.

Second: Non-conventional water resources

The gap between water needs and available water resources is covered through several non-traditional resources, the most important source is the reuse of agricultural and industrial wastewater which is estimated with about 16 billion cubic meters / year, in addition to using the shallow water reservoir in the valley and Delta which is approximately 6.2 billion cubic meters.

5-2-1 Current status of water needs:

In 2010, water needs reached 81.2 billion cubic meters / year, (drinking water 9 billion cubic meters, industry 2 billion cubic meters, agriculture 67 billion cubic meters, losses resulting from evaporation and networks' leakage 3 billion cubic meters, environmental balance 0.2 billion cubic meters).

5-2-2 Drinking water and sanitation sector

This sector still occupies a great importance in the government's list of priorities. During last years the importance of providing all regions in Egypt with sanitation services emerged because of its direct impact in maintaining citizens' public health, preserving water resources from pollution and to take advantage of each drop of water. Because of the increased rates of population in Egypt, the government focused on completing plans of sanitation coverage during the period 2007 - 2012, through directing financial investments to this sector and providing additional financial resources to implement stalled projects and encourage private sector to invest in this sector. As a result of the cooperation between Ministry of Housing, Utilities and Urban Development (Executive Agency for Drinking Water and Sanitation) and the Ministry of Finance (Central Department for Private Sector Partnership) the first project in this framework has been publicly invited to tenders, which is financing the establishment and operation of new Cairo sewage plant with capacity of 250.000 m^3 / day.

5-2-3 Current status of drinking water coverage systems

Several projects have been implemented to deliver pure drinking water to all governorates of Egypt, reaching a coverage rate of almost 100% since

2009, and then the trend directed towards improving the delivery service to citizens as follows:

1. Percentage of population accesses pure drinking water 24-hours is 98.68%.
2. Percentage of population access pure drinking water in alternation is 0.4%
3. Percentage of population access pure drinking water through public taps is 0.2%
4. Percentage of population access pure drinking water through water tickets is 0.5%, while percentage of the un-serviced population in slums is 0.2%, as shown in figure (5-1).

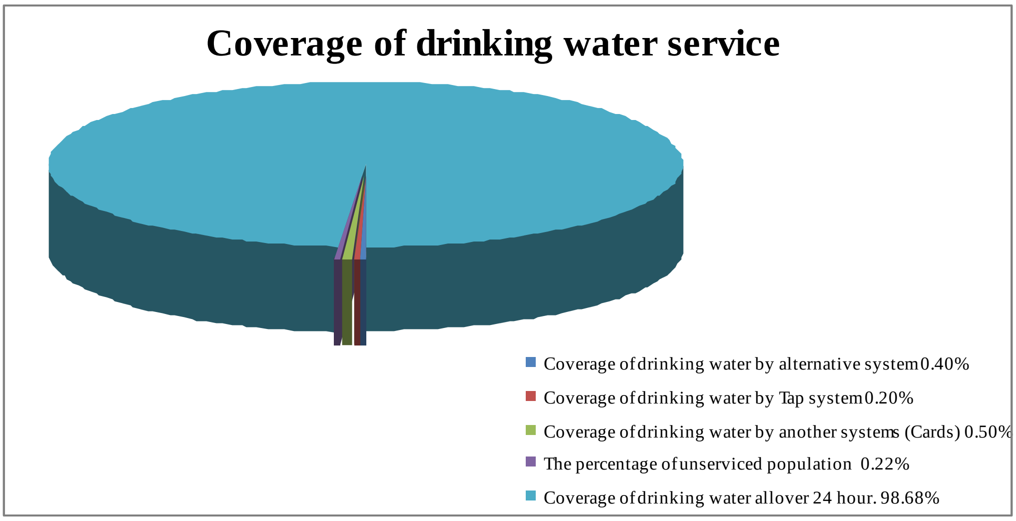


Figure (5-1) Percentage of the five coverage indicators of drinking water service during 2009
Source: Holding Company for Drinking Water & Sanitation

5-2-4 Current situation of sanitation coverage

According to data released by the Holding Company for Drinking Water and Sanitation for the financial year 2008 / 2009, the coverage rates for sanitation services were 90% for cities and 12% for villages during 2010 as shown in figure (5-2).

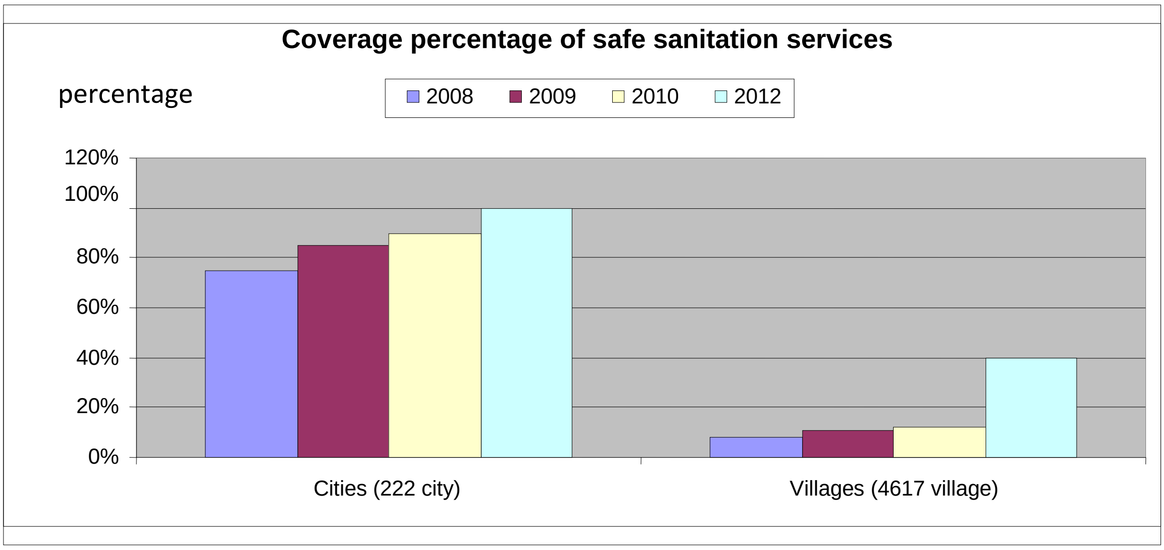


Figure (5-2) Coverage percentage of safe sanitation services

Source: Holding Company for Drinking Water & Sanitation

The Egyptian Water Regulatory Agency has been established to conduct the following:

1. Monitor quality of drinking water and efficiency of sewage treatment.
   2. Prepare questionnaire lists to review technical equipment and human capacities of laboratories in stations, central and subsidiary laboratories in companies to determine operation status of networks, labs and to evaluate various stages of treatment process.
   3. Ensure and follow-up the availability of drinking water and sanitation services with the required quality allover Egypt.
2. Follow up implementation of the corrective actions' recommendations.
3. Investigate complaints related to drinking water and sanitation quality services.
   6. Develop policies of drinking water and sanitation sector through updating Egyptian standard specifications for water quality and treated sanitation services.
4. Evaluate the technical, financial and economic performances of the companies providing drinking water and sanitation services.

Ministry of Housing begins several projects under its policy to cover all governorates of Egypt with sanitation services as soon as possible and the following are some of those projects:

1. Project of financing, constructing and operating 6 October sewage station with capacity of 150 thousand cubic meters / day.

2. Project of financing, constructing and operating the extension of Abu Rawash sewage station with capacity of 1.2 million cubic meters / day.
3. Project of financing, constructing and operating the sewage plant west of Alexandria with capacity of 680 thousand cubic meters / day.
4. Project of financing, constructing and operating the sewage plant in Giza with capacity of 400 thousand cubic meters / day.
5. Project of financing, constructing and operating the sewage plant in Helwan with capacity of 500 thousand cubic meters / day.
6. Project of financing, constructing and operating treatment sewage plants in different villages with priority to villages lie on the two banks of Nile River, canals and drains which terminate into the River.

5-3 Current status of water quality of the Nile River

Monitoring results of 2010 published by the Center of Environmental Monitoring and Working Environment Studies - Ministry of Health, as well as results of the Central and Branches' Laboratories -EEAA, which is conducted periodically on the water quality of Lake Nasser and River Nile in all Egyptian governorates located on the Nile were as follows:

5.3.1 Water quality in Lake Nasser

In spite of the different development activities that may affect the quality of freshwater in Egypt, monitoring results clarify that, water quality of Lake Nasser is still not affected by any of the development activities surrounding the lake. So that water quality in the lake is considered as a reference point for water quality in Nile River, due to being the first recipient of water coming from Sudan. The following are the monitoring results of water quality in the lake:

1. PH values ranged between 7.6 - 7.8 with an average of 7.6 which considered a normal values for all uses of water.
2. Dissolved oxygen (DO) concentration was higher than the minimum allowed limit (5 mg / L) in all monitoring points during the year, ranging between (5.7 to 6.6 mg / L). Figure (5-3) shows comparison between average concentrations from 2004 to 2010 which shows an increase in the average minimum limit during

2010 than previous year, which indicates an improvement in the quality of water in Lake Nasser.

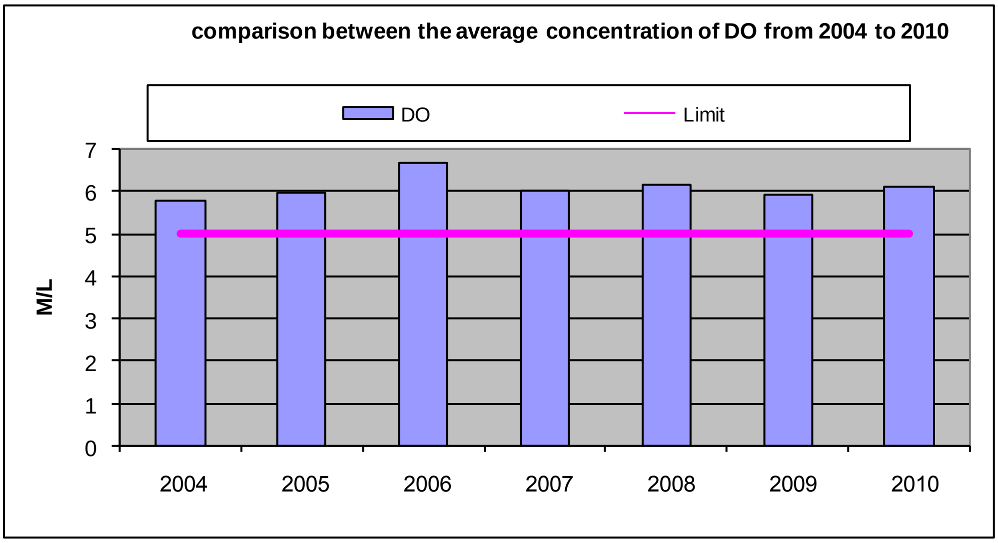


Figure (5-3) Comparison between average concentrations of dissolved oxygen in Lake Nasser from 2004 – 2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

3. Concentration of organic matters represented in the biological oxygen demand (BOD) did not exceed standards of the water quality of the Nile River (6 mg /L), where the average concentration ranged between (4.6 - 6 mg / L). Figure (5-4) compares between the average values of (BOD) in Lake Nasser from 2004 -2010.

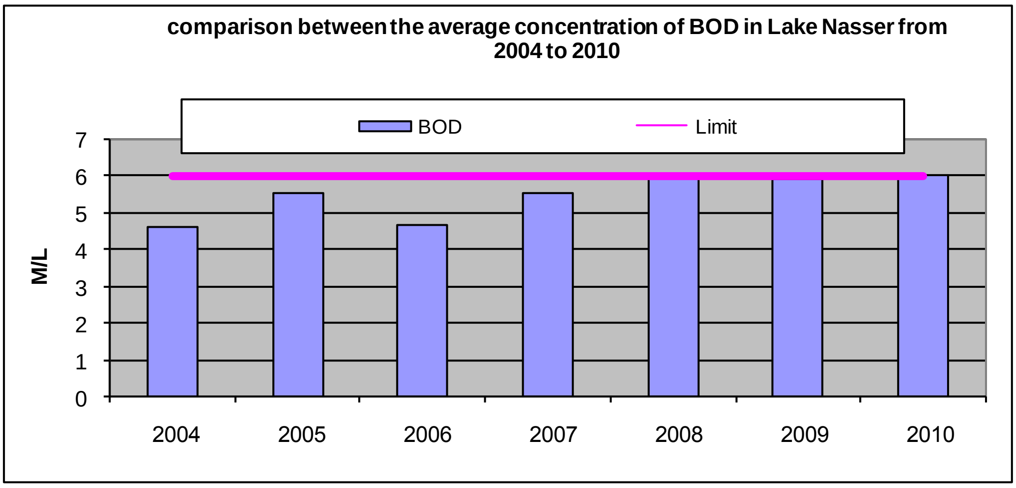


Figure (5-4) Comparison between the average concentrations of BOD from 2004 - 2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

4. Concentration of organic matters represented by the chemical oxygen demand (COD) did not exceed water quality standards of the River Nile (10 mg / L). It ranged between (8.6 to 9.6 mg /L), which clarifies decrease in the overall average concentration of chemical oxygen demand during 2010 than previous year. Figure (5-5) shows comparison between average values of concentration in the lake from 2004 - 2010.

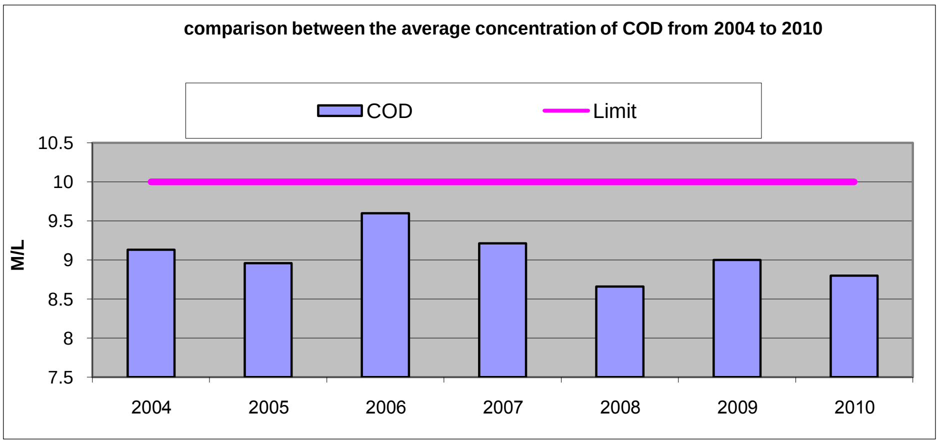


Figure (5-5) Comparison between average concentrations of chemical oxygen demand (COD) in Lake Nasser from 2004 – 2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

5. Concentration of dissolved salts ranged between (164 to 170 mg / L), these results are less than the allowed limit by the law (500 mg / l).

6. Concentrations of nutrients (ammonia, nitrite, nitrate and phosphate) were less than the reading of the devices used in the analysis.

7. Presence of the majority of heavy metals was not monitored, and all values of the concentrations of iron and manganese were less than the reading of the devices used in the analysis.

The above clarify that water quality in Lake Nasser enjoys high quality, so it should be conserved from pollution. Programs of development around the lake must be carefully studied by conducting environmental impact assessment studies and adopt sustainable development principles to ensure water quality in the lake, as it is considered the strategic reservoir for drinking water and different uses of all development sectors in Egypt.

5.3.2 Water Quality in the Nile River

Monitoring results of Nile River's water quality in the different governorates from Aswan to Greater Cairo during 2010 indicate the following:

1. PH values ranged between (7.3-8.2) as water slightly tends to be alkaline.

2. Average concentration of dissolved oxygen (DO) in all governorates from Aswan to Greater Cairo was higher than the minimum allowed for water quality (5 mg /L). It ranged between (5.9 - 8.5 mg / L), which indicates the vitality and good quality of water, as shown in figure (5-6).

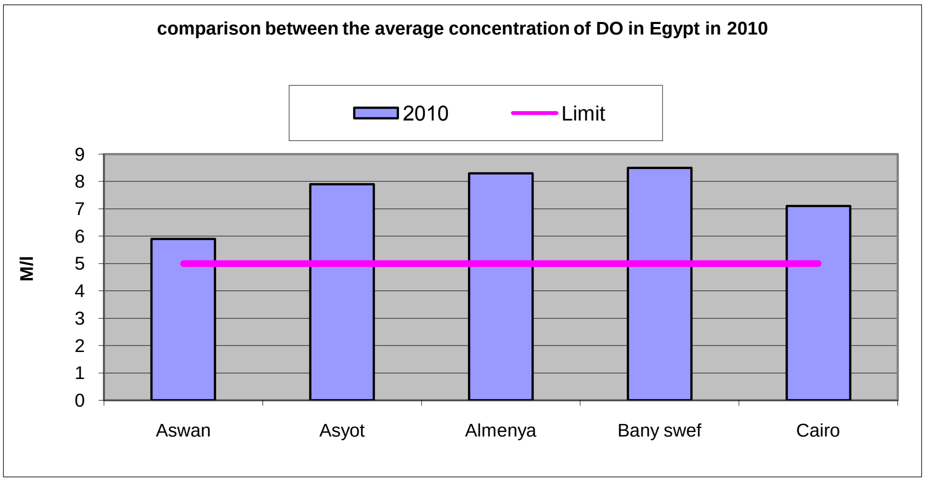


Figure (5-6) Comparison between average concentrations of dissolved oxygen among governorates of Egypt during 2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

Figure (5-7) shows that average concentration of dissolved oxygen from 2007 - 2010 were higher than the minimum allowed in all governorates from Aswan to Greater Cairo.

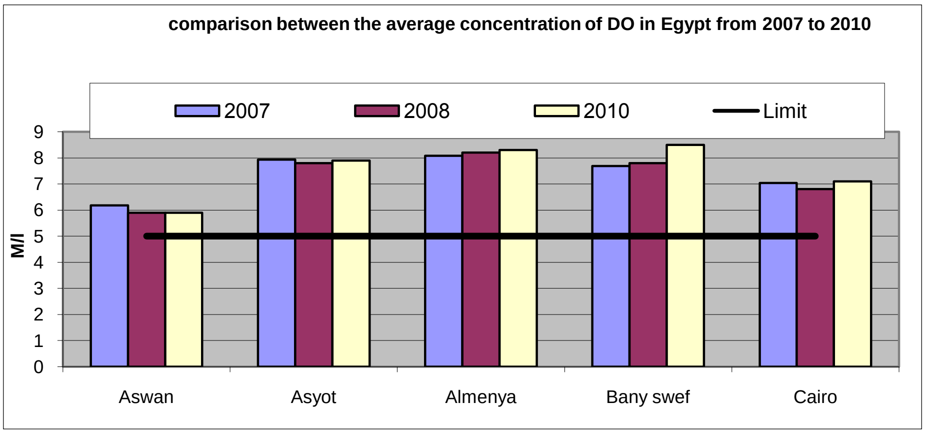


Figure (5-7) Comparison between average concentrations of dissolved oxygen in Egypt from 2007 – 2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

3. Average concentration of organic matters represented in biological oxygen demand (BOD) was less than the allowed limit (6 mg / L) of the water quality in the River Nile in all governorates from Aswan to Greater Cairo. It ranged between (2 -5.9 mg / L) as clarified in figure (5-8). This is due to exerted efforts to reduce the discharge of sewage water into the Nile or drainages terminate to it.

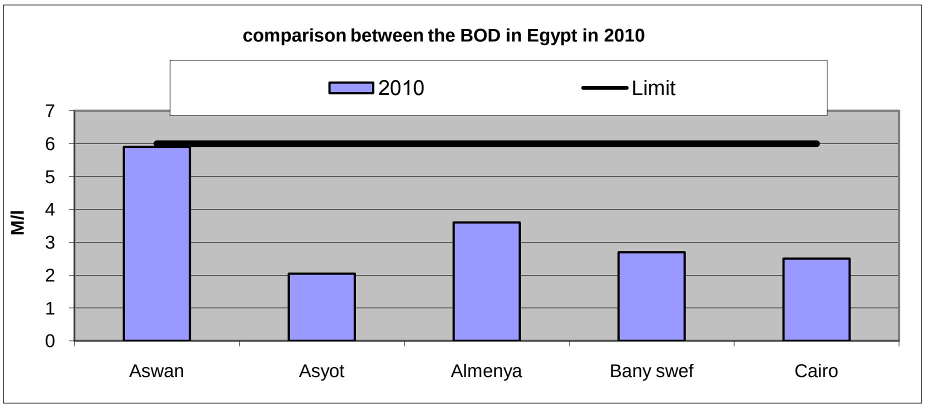


Figure (5-8) Comparison between average concentrations of BOD in Egypt in 2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

The comparison of the average concentration of BOD among governorates locating along Nile riverbanks from Aswan to Greater Cairo clarifies that it is less than the allowed limit. Average values during 2010 were less than that of 2009 in most of the governorates, as shown in figure (5-9).

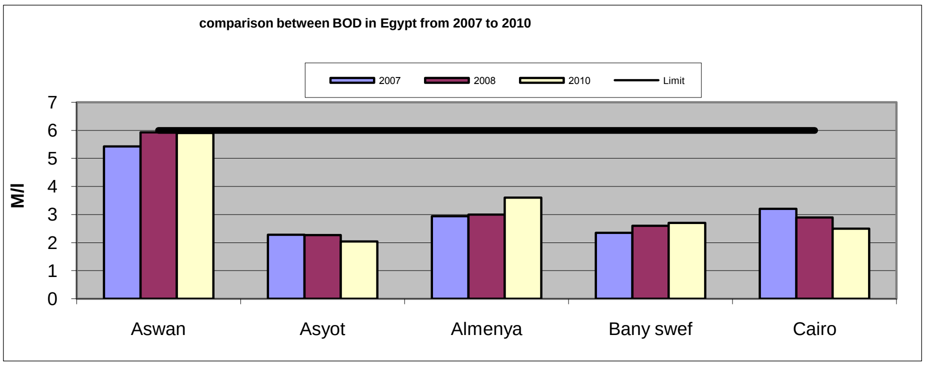


Figure (5-9) Comparison between average concentrations of BOD in different governorates of Egypt from 2007 -2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

4. Average values of chemical oxygen demand (COD) were less than the allowed limit (10 mg / L) in most governorates from Aswan to Greater Cairo. It ranged between (3.6-10.6 mg / L). Beni Suef recorded slight increase. Figure (5-10) compare between average values of COD in different governorates during 2010.

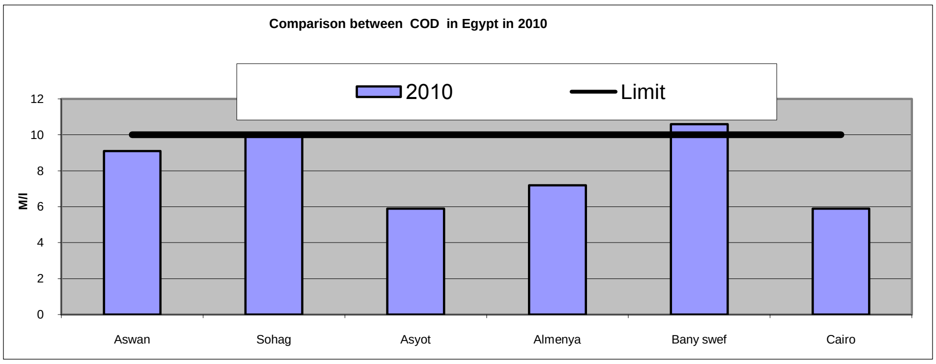


Figure (5-10) Comparison between average concentrations of COD in different governorates of Egypt during 2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

Figure (5-11) compares between average concentrations of chemical oxygen demand (COD) from 2008 - 2010 in different governorates from Aswan to Greater Cairo. The figure clarifies clear improvement and reduction in (COD) concentration during 2010 than previous year.

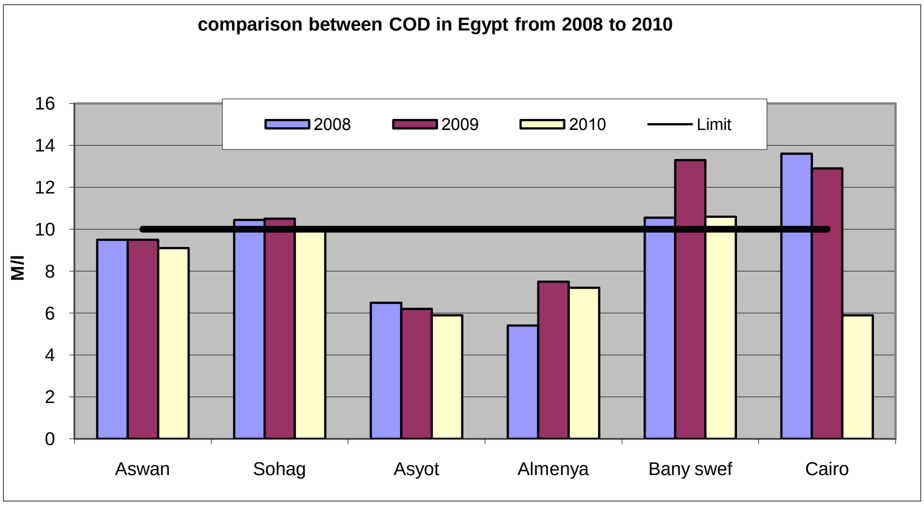


Figure (5-11) Comparison between average concentrations of (COD) in Egypt from 2008 – 2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

5. Average concentration of nutrients are within the permissible limits (0.5 mg / L, 45 mg / L, 0.1 mg / L) for each of ammonia, nitrate and phosphate, respectively. Concentration of ammonia ranged between

(0.08 - 0.17 mg / L), nitrate (0.003 - 0.007 mg / L) and phosphate (0.016 - 0.1 mg / L). Figure (5-12) shows the average concentrations in various governorates of Egypt 2010.

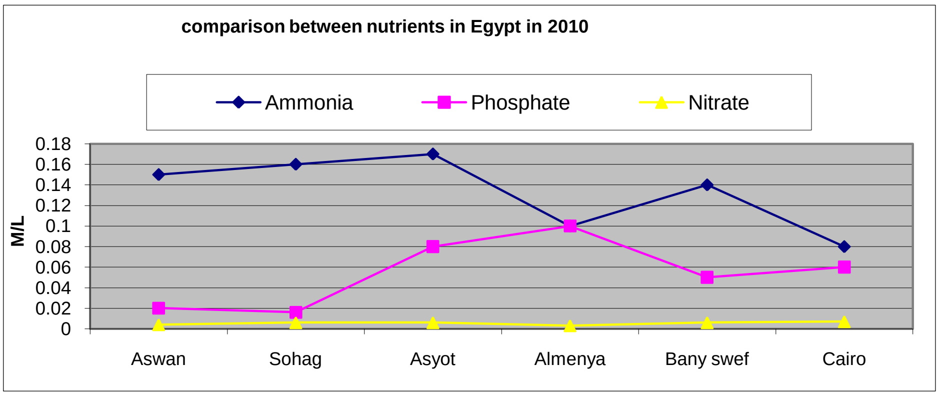


Figure (5-12) Comparison between average concentrations of nutrients in Egypt during 2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

6. Average concentration of dissolved solid salts ranged between (142 - 255 mg / L) which is less than the allowed limit (500 mg / L), this indicates the appropriateness of water for all uses, and figure (5-13) clarifies this case.

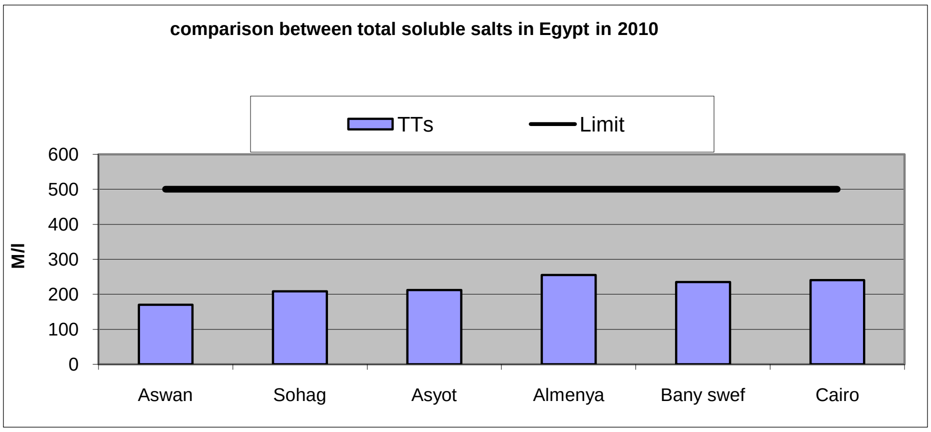


Figure (5-13) Comparison between average concentrations of total dissolved salts in Egypt during 2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

7. Average concentration of fluoride was less than the allowed limit at all monitoring points (0.5 mg / L) ranged between (0.13 - 0.46 mg / L).

8. Average concentration of sulfate was less than the allowed limit (200 mg / L) in all monitoring points ranged between (31.9 - 32.2 mg / L).

9. Average concentration of iron was less than the allowed limit (0.5 mg / L) in all monitoring points in all governorates ranged between (0.04 - 0.14 mg / L).

10. Average concentration of manganese was less than the allowed limit (0.2 mg / L). It ranged between (0.008 - 0.1 mg / L), concentration of manganese in most of the monitoring points in different governorates was not recorded.

11. Average concentration of heavy metals (silver , arsenic , aluminum ,cadmium , chromium ,copper , mercury ,nickel , lead ,selenium , tin and zinc) was less than the allowed limits along the river.

The above clarify an improvement in water quality of the Nile River from Aswan to Cairo during 2010 than previous years, as a result of exerted efforts to reduce Nile pollution caused by industrial or sewage discharge. In general, results indicated the vitality of water, its ability of self-purification and nonexistence of pollution indicators exceeds the allowed limits for each of organic matters, heavy metals and nutrients.

5-3-3 Water quality in Rosetta branch

1. Concentration of dissolved oxygen (DO) along Rosetta Branch was higher than the minimum permissible limit of water quality (5 mg / L). It ranged between (6.2 – 7.11 mg / L). By comparing concentrations from 2003 – 2010, an improvement has been monitored in the middle of the Branch during 2010 than previous years, as figure (5-14) clarifies.

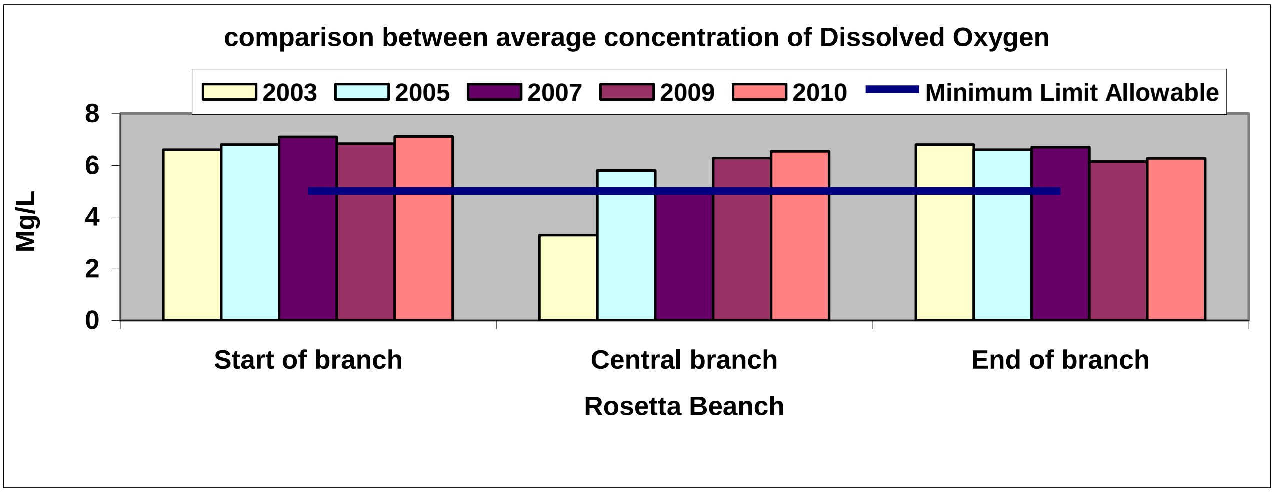


Figure (5-14) Comparison between average concentration of dissolved oxygen in Rosetta Branch from 2003-2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

2. Average concentration of organic matters represented in chemical oxygen demand (COD) was within the permissible limit (10 mg / L) in most points. It ranged between (6.8 - 11.2 mg / L), while it slightly exceeded the limits at the beginning of the branch but it is still less than that of last year, which indicates the improvement of water quality in general. By comparing concentrations from 2003 - 2010, a remarkable decrease was monitored along the Rosetta branch, during 2010 than previous years, as figure (5-15) clarifies.

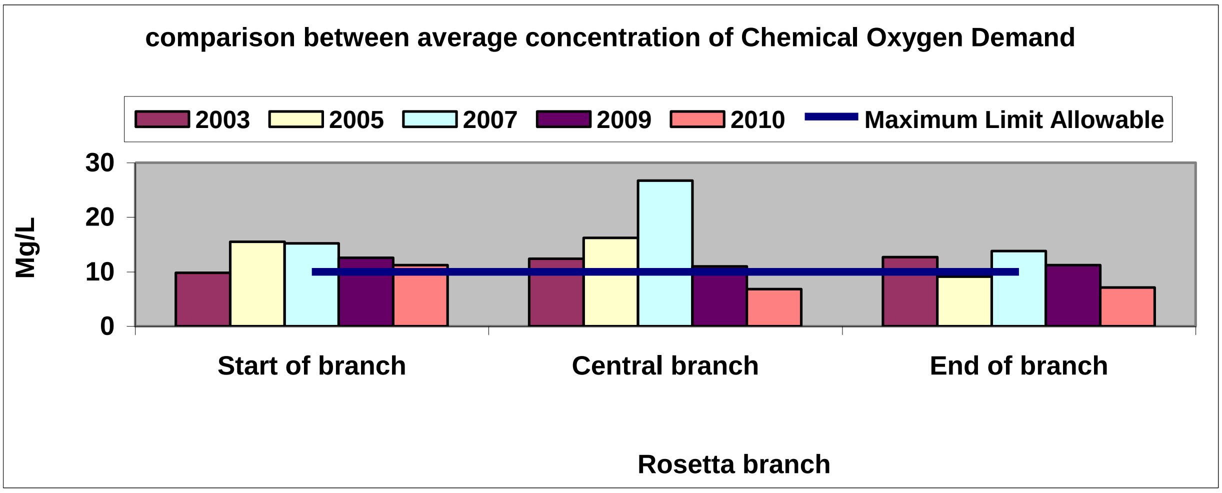


Figure (5-15) Comparison between average concentration of chemical oxygen demand (COD) in Rosetta Branch from 2003-2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

3. Average concentration of organic matters represented in biological oxygen demand (BOD) was less than the permissible limit (6 mg / L) by a large rate along the Rosetta branch. It ranged between (1.7- 2.5 mg / L). By comparing concentration from 2003 - 2010, gradual decrease was recoded along the Rosetta Branch during that period, as shown in figure (5-16).

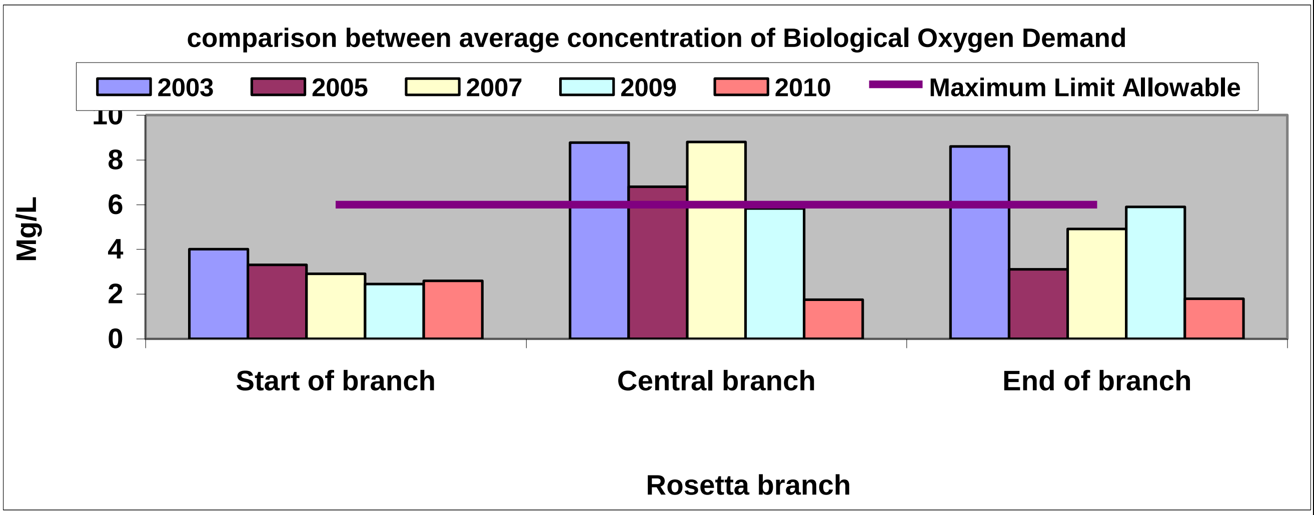


Figure (5-16) Comparison between average concentration of biological oxygen demand (BOD) in Rosetta Branch from 2003-2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

4. Average concentration of ammonia was less than the allowed limit (0.5 mg / L) along the Rosetta branch. It ranged between (0.05, 0.48 mg / L), and a remarkable decrease was recorded during 2010 at the end of the branch than previous years. Despite the remarkable increase recorded in middle of the branch (where Kafr El- Zayat industrial zone locates) than the beginning and end of the branch but it is still less than the allowed limit, as shown in figure (5-17).

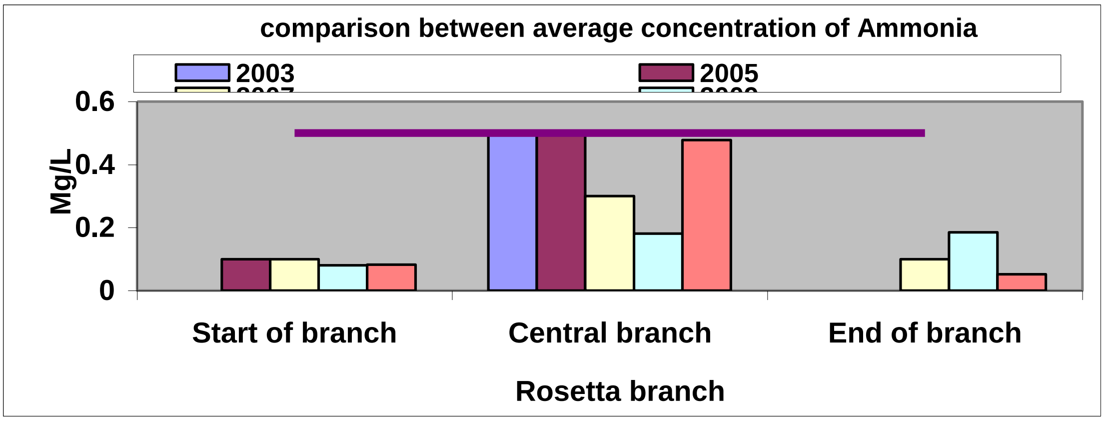


Figure (5-17) Comparison between average concentration of Ammonia in Rosetta Branch during 2003-2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

5- 3-4 Water quality in Damietta Branch

1. Average concentration of dissolved oxygen (DO) was higher than the minimum allowed limit for water quality in Nile River (5 mg / L), it ranged between (6.25 - 7.11 mg / L), which is a sign of the vitality of water and its ability of self-purification, as as shown in figure (5-18) .

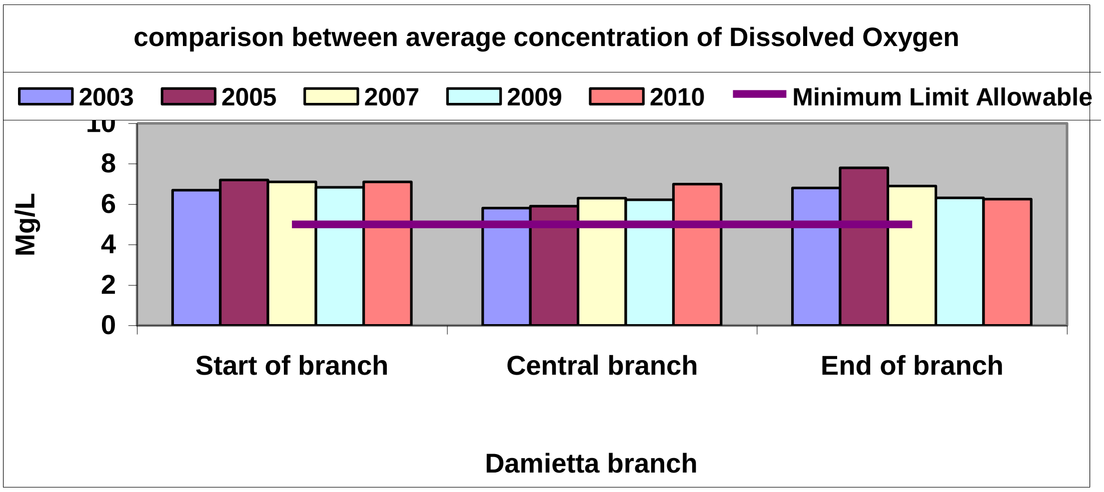


Figure (5-18) Comparison between average concentrations of dissolved oxygen in Damietta Branch during 2003-2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

2. Average concentration of organic matters represented by chemical oxygen demand (COD) ranged between (3.2 -16.5 mg / L). Despite the slight increase in the average concentration at the beginning and end of the Branch than the allowed limit (10 mg /L) .The improvement was remarkable during 2010 than previous year, as shown in figure (5-19).

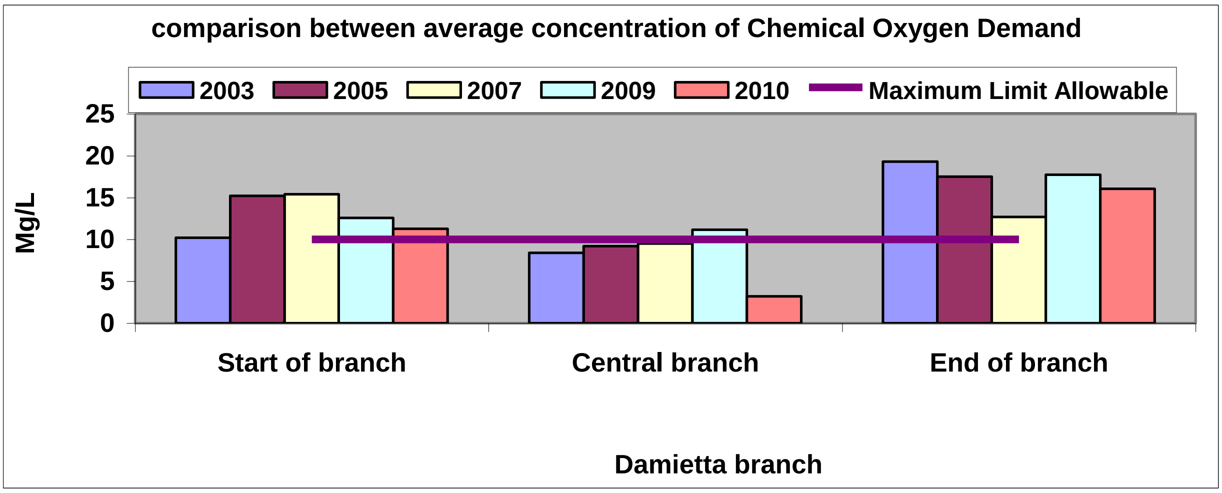


Figure (5-19) Comparison between average concentration of chemical oxygen demand (COD) in Damietta Branch during 2003-2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

3. Average concentration of organic matters represented by the biological oxygen demand (BOD) during 2010 and previous years were less than the allowed limit for water quality in Nile River (6 mg/ L). It ranged between (1.05, 4.25 mg /L). But remarkable improvement was recorded in the middle of the Branch during 2010 than the previous year, as shown in figure (5-20).

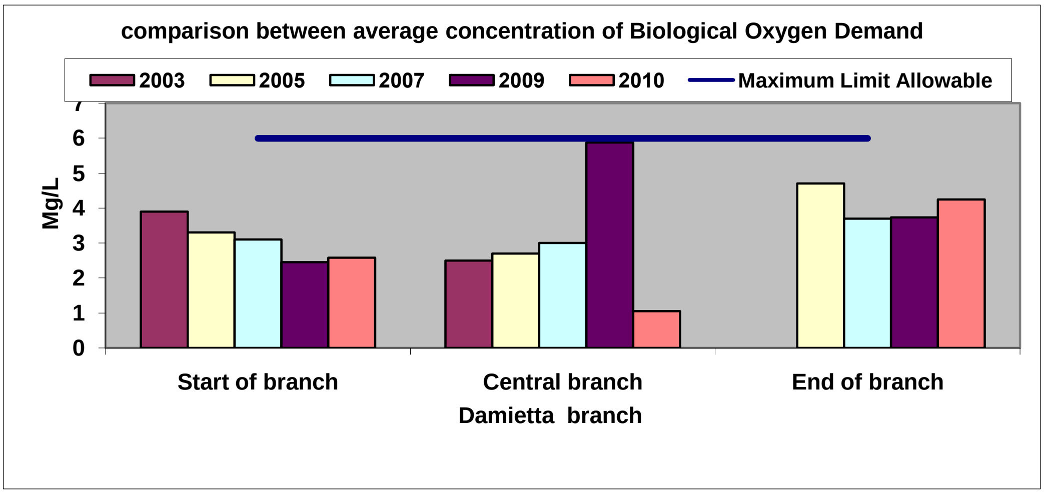


Figure (5-20) Comparison between average concentrations of biological oxygen demand (BOD) in Damietta Branch from 2003-2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

4. Average concentration of nutrients (ammonia) was less than the allowed limit (0.5 mg / L) along Damietta Branch during 2010 and previous years, as shown in figure (5-21).

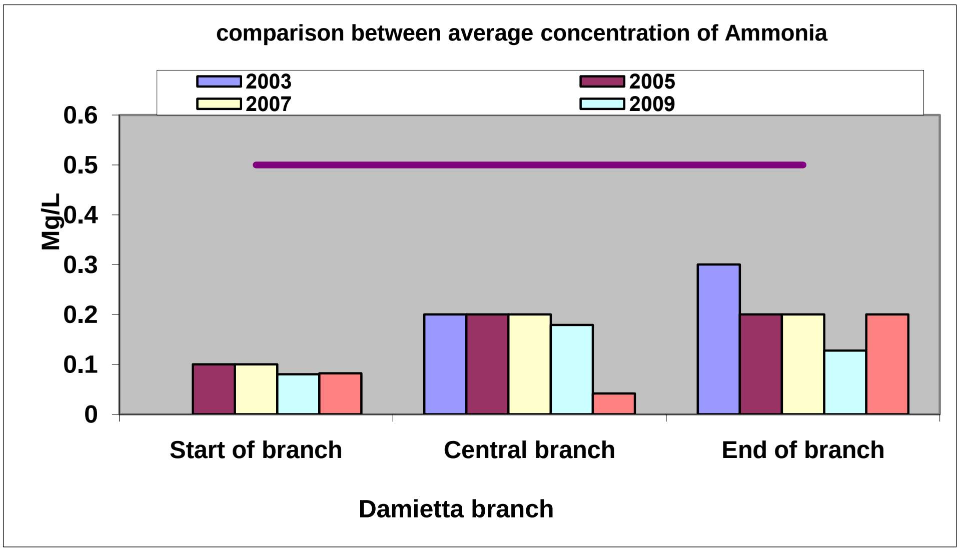


Figure (5-21) Comparison between average concentration of Ammonia in Damietta Branch during 2003-2010

Source: Environmental Monitoring & Working Environment Studies Center- Ministry of Health, EEAA Central Lab.

5-4 Egyptian Lakes

5-4-1 Introduction :

Lakes and wetlands located in the coastal region of the Delta represent an important ecosystem for migratory water birds; they are the winter habitat for thousands of migratory birds like Seagull, Flamingo and Sea crow .

Egyptian Lakes produce about 39% of the total fish production in Egypt and characterized with their vast areas, beauty, and containment of many types of fish which are considered one of the main sources of an important protein required for human health .

Egyptian lakes differ according to their salinity, they ranged between being freshwater lakes to high saline lakes. They also classified according to their location, whether interior lakes (Nasser, Rayan and Qaruon) or coastal lakes, where seven lakes are located on the Egyptian coast of the Mediterranean Sea and the Gulf of Suez. They are divided as follows:-

1. Five lakes known as "northern lakes" including four on the Nile Delta (Manzala, Burullus, Edku and Mariout) and one lake on the east of the Suez Canal (Bardawil). These lakes represent a very economic importance for their fish production; they produce about 77% from the total fish production of all Egyptian lakes.
2. Two lakes linked with the navigation waterway of Suez Canal "El-Morra Lakes and El-Temsah Lake ".

Due to the shallow depths, quiet water motion and high fertility of the Egyptian lakes, they are considered natural nursery and hatchers for various economic species of fish, not only within these lakes but also to the all coasts of the Mediterranean Sea in Egypt. So, they are considered important factor for Egyptian society and economy. Steady growth of population, necessitates conserving lakes from pollution and takes all required measures that could prevent different kinds of violations such as drying, and achieves their sustainable development.

Lakes especially the northern (Mariout, Manzala, Edku, Burullus and Bardawil) had been exposed during previous decades to many violations, such as drying huge parts, over fishing or encroachment on fish fry. At present, lakes are exposing to agricultural discharge which may be loaded with some of the industrial and sewage waste that could negatively impact their water quality and consequently their fish production. So, this status necessitates the urgency of developing mechanism and strategy for the Integrated Management of these lakes.

Ministry of State for Environmental Affairs pays great interest to develop a Strategy for the Integrated Management of Lakes. As a result of the lack of periodical program to monitor water quality and sediments in these lakes, the ministry sets within its priorities implementation of the National Program for Environmental Monitoring of Egyptian Wetlands in collaboration with the National Institute of Oceanography and Fisheries. It aims to conduct periodic follow-up for these lakes through monitoring water quality, sediment, phytoplankton and Zooplankton. As well as tracing sources of discharges and standing on the environmental conditions and pollutants affecting lakes in different times and places to develop a national program to reduce impact of these pollutants, stop continuing deterioration of lakes, set up future plans to protect them , solve their problems and achieve their sustainable development through a National Integrated Strategy .

Implementation of this program initiated during July 2009 by conducting periodic monitoring for Northern Lakes (Burullus ,Bardawil ,Edku , Mariout and Manzala) through four field trips during (August, November; February and May) during the fiscal year (2009/2010) . This program includes the following objectives:

1. Develop updated map for each lake clarifying the different affecting environmental conditions .
2. Prepare database about status of lakes including geographic, ecological and biological data.
3. Evaluate status of lakes, rates of lakes' losses and their impact on the ecosystem and its integration; as well as human and urban activities around lakes.
4. Set a national standards for water quality of these lakes to improve their water quality

5. Develop a national program for the integrated management and development of these lakes, to reduce pollutants and stop the continued deterioration of aquatic environment .

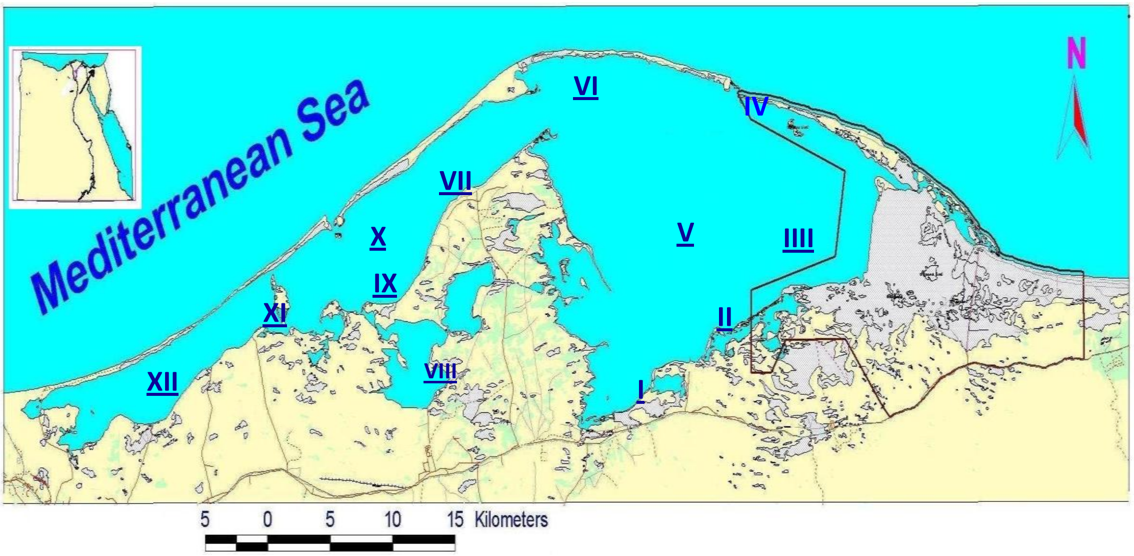
Some other lakes have been added to the “National Program for Periodic Environmental Monitoring of Egyptian Wetlands” in the current fiscal year (2010 / 2011),"El-Morra Lakes and El-Temsah Lake”.The remaining Egyptian lakes will be included in this program, respectively.

5-4-2Monitoring results of water quality in Egyptian Lakes:

Monitoring results of water quality in Egyptian Lakes during the four seasonal field trips (for each lake) in 2010, collect water samples from specified fixed locations along each lake and conduct field and laboratory measurements for the "physical, chemical and bacteriological" indicators, which indicate the following :

5-4-2-1 Bardawil Lake

Bardawil Lake is one of the most important Egyptian lakes, it is the most pure one among northern lakes. It contains high-quality fishes, which mostly exported, with annual average production of about 2.3 thousand tons per year (represents about 1.5% of the total fish production of Egyptian lakes). Bardawil Lake located south of the Mediterranean coast in North Sinai governorate. It extends for about 85 km east of the Suez Canal with maximum width of about 22 km and area of about 650 km^2. It is a shallow lake (its depth varies between 0.3-3 meters) and characterized by high salinity. A strip of sand with width ranged from 100 m to 1 km separates the lake from the Mediterranean Sea. The lake is one of the most important areas attracting migratory birds during winter. It connects with the Mediterranean Sea through two artificial straits through which the tides process exchanges water between the lake and the Sea. Each of the following table no. (5-1) and map no. (5-1) indicates the number and names of monitoring sites.



Map (5-1) locations of monitoring sites in Bardawil Lake

Source: National Program for Environmental Monitoring of Egyptian Wetlands

Table (5-1) Names and sites of monitoring sites in Bardawil Lake.

No.	Name of monitoring site	Governorate
1	El-Telol	North Sinai
2	El-Rodh	
3	El- Zaranik	
4	Boughaz II	
5	El-Telol M.	
6	Masqut-Eplis	
7	El-Gals	
8	El-Rewak	
9	N. El-Rewak	
10	Boughaz I	
11	El-Nasr	
12	Raba'a	

Source: National Program for Environmental Monitoring of Egyptian Wetlands

Monitoring results of water quality:

Monitoring results of water quality in Bardawil Lake during 2010 indicate the following:

1. Water characterized by high transparency as sun rays penetrate to the most bottom of the Lake.
2. PH values tends to alkaline, ranged between (8.07 - 8.25) with an annual average (8.18) which is compatible with the US standards limits (7.2 - 9).
3. Temperature degrees were appropriate to the life and growth of living organisms and fishes; they ranged between (18.4°C –27.25°C) with annual average (24.32°C).
4. Bardawil Lake characterized by high salinity compared with sea water. This is due to its shallow depth and evaporation process as well as little amounts of rainfall. The salinity ranged between (38.8-67.7 g / L) with an average (48.08g / L). Salinity differs according to the time of the year and the place with respect to the distance from the Straits.
5. Dissolved oxygen ranged between (6.2-7 mg / L) with an annual average (6.5 mg / L). This indicates the vitality of the water in the lake and its suitability for living organisms, all values of (DO) were compatible with US standards limits (4.2 -12.6 mg / L). Figure (5-22) shows average concentration of dissolved oxygen in Bardawil Lake during 2010.

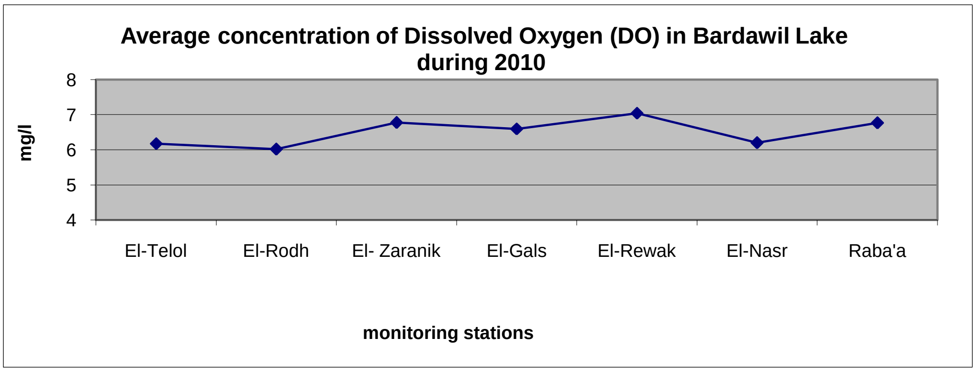


Figure (5-22) Average concentration of Dissolved Oxygen (DO) in Bardawil Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

1. Concentration of organic matters represented in the biological oxygen demand (BOD) was very low. Where the highest value did not exceed (2.35 mg / L) , which indicates the good quality of water and nonexistence of sewage pollution. Concentration ranged between (1.44 - 2.35 mg / L) which is compatible with US standards limits (3-6 mg / L) as figure (5-23) clarifies.

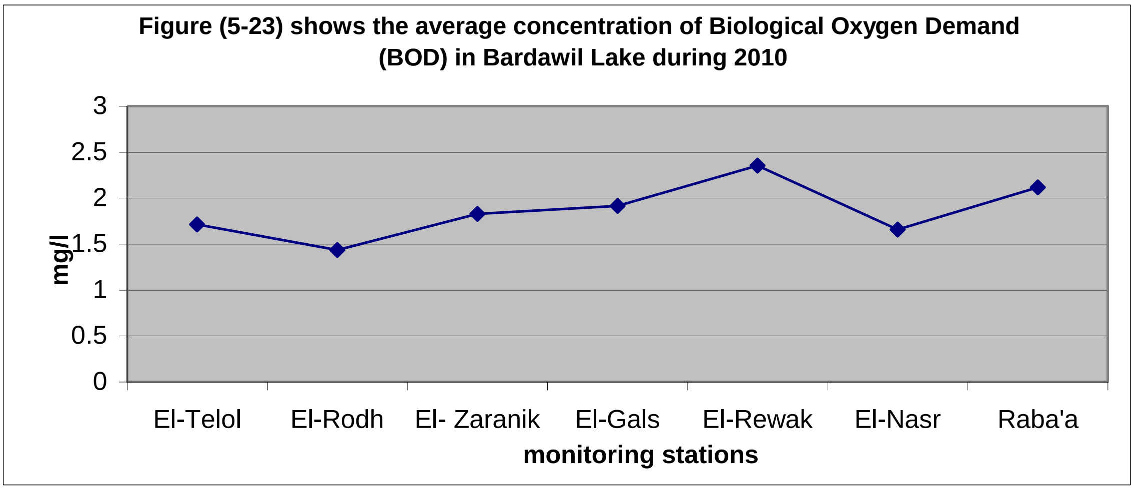


Figure (5-23) Average concentration of Biological Oxygen Demand (BOD) in Bardawil Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

2. Concentration of Chemical Oxygen Demand (COD) was low, but it relatively increased at (El-Telol and El-Nasr stations), that may be due to the presence of fishing activities.

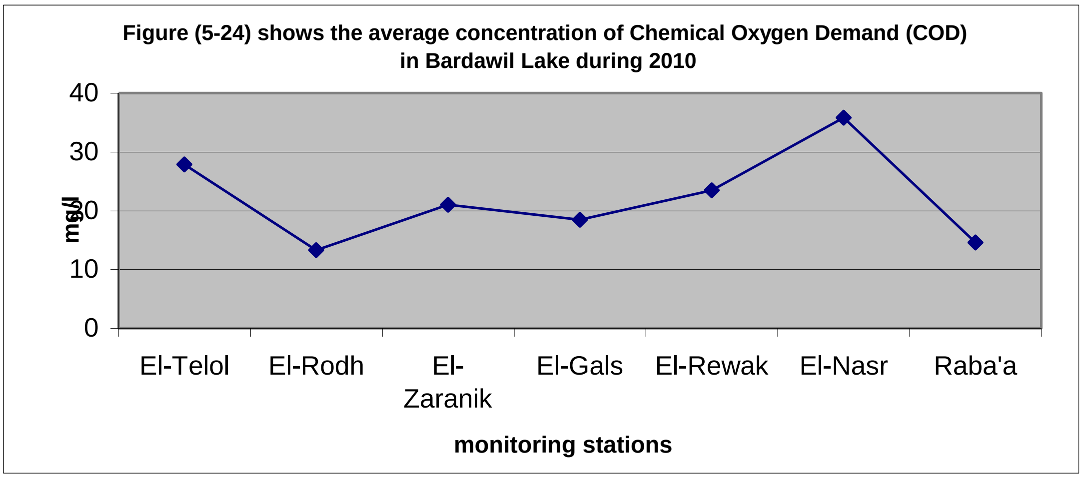


Figure (5-24) Average concentration of Chemical Oxygen Demand (COD) in Bardawil Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

3. Concentration of nutrients were ranged between (0.48 - 0.165 mg / L with average 0.08 mg / L), (1.62 - 2.59 mg / L with average 1.96 mg / L) and (0.023 - 0.048 mg / L with average 0.033 mg / L) for ammonia, total nitrogen and total phosphorus respectively. These concentrations were low and indicate nonexistence of pollution and the suitability of these concentrations for the growth of the fauna and flora in the Lake.

4. In general, average concentration of all heavy elements was very low with exception of the increasing rates of iron and zinc, as they are natural components of lake's sediments; figure (5-25) indicates these concentrations.

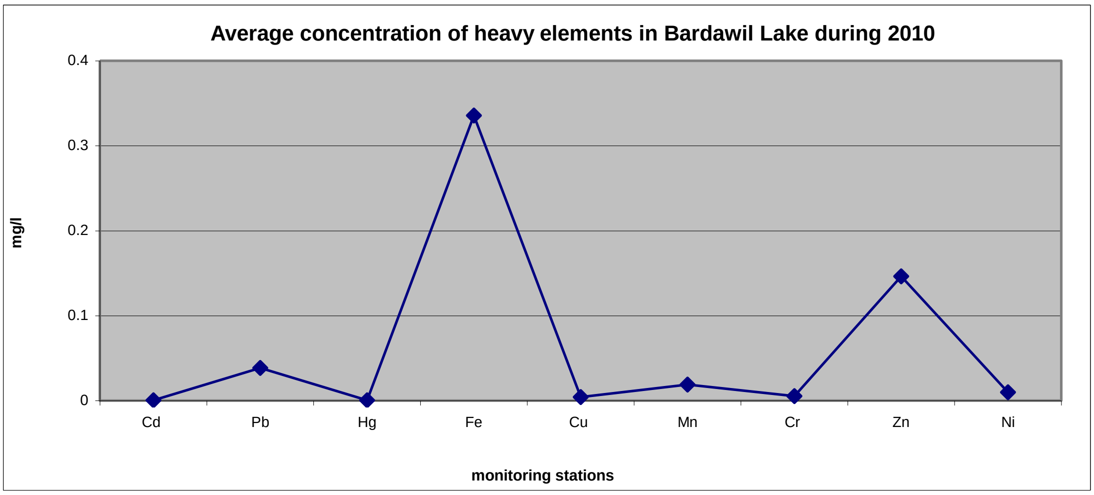


Figure (5-25)Average concentration of heavy elements in Bardawil Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

The above results clarify that, Bardawil Lake is one of the most pure lake among the northern lakes in Egypt where no pollution exist as it does not receive wastewater from any industrial or agricultural drainages.

5-4-2-2 Edku Lake

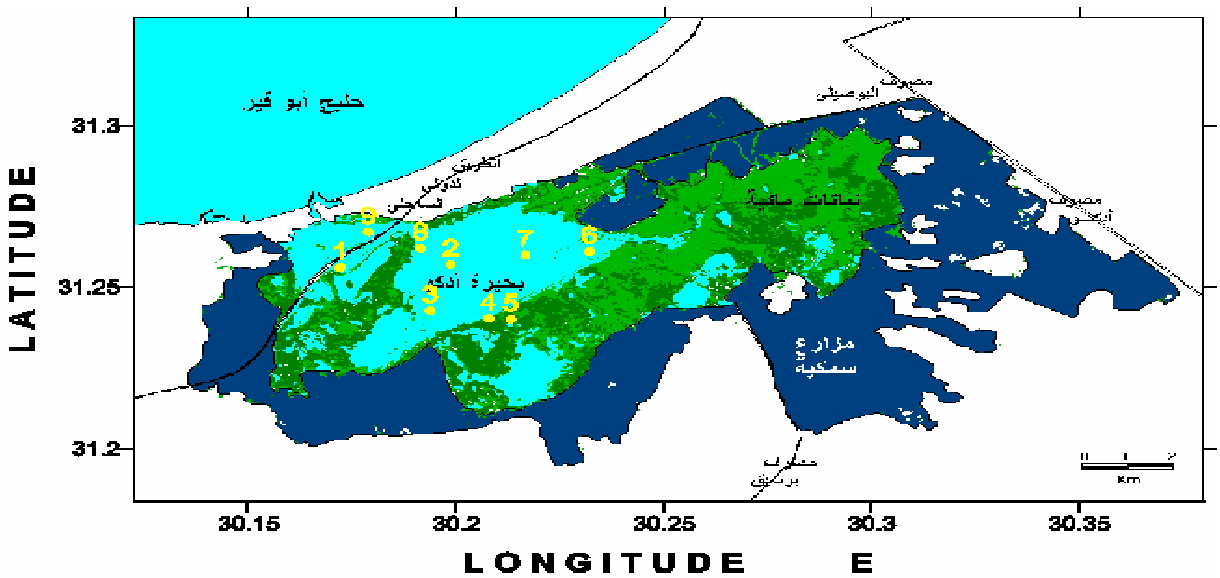
Edku Lake is a shallow basin located at the south of the Mediterranean coast, water depth varies between 30-420 cm. Total area of the lake is about 16000 feddens of which plants cover about (68.74%) and water covers the remaining part (31.26%). The lake connects with the

Mediterranean Sea through El-Madeya strait. It bordered by some fish farms and agricultural lands which feed the lake with water. The lake receives about 1.738 billion cubic meters annually from the main drains (El-bossaly, Khairy and Edku from the north, and Barsiq from the south). Water quality of the lake is monitored through number of sites and names are shown in table (5-2) and map (5-2).

Table (5-2) Names and sites of monitoring sites in Edku Lake

No.	Name of monitoring site	Governorate
1	Bab-Zaiton (in front of the intake and drain of fish farms)	Behara
2	In front of the intake and drain of fish farms	
3	El-Nagaa (waterway for moving between north and south of the lake)	
4	Karn Diab (in front of Barsiq drain)	
5	El-Berka area (the deepest place in the lake)	
6	In front of El-Khairy drain	
7	Bab-Harb (south of the international road)	
8	North of the international road	
9	Strait	

Source: National Program for Environmental Monitoring of Egyptian Wetlands



Map (5-2) locations of monitoring sites in Edku Lake

Source: National Program for Environmental Monitoring of Egyptian Wetlands

Monitoring results of water quality:

Monitoring results of water quality in Edku Lake during 2010 were as follows:-

1. Water of the lake slightly tends to be alkaline, concentration of hydrogen ion ranged between (7.9 – 8.4) with annual average of (8.24) which is normal according to US standards limits (7.2 - 9).

2. Temperatures ranged between (15.5°C – 27.8°C) which is normal change with respect to different seasons.

3. Salinity varied between (0.96 - 6.19 g / L), according to the distance from the strait or drains.

4. Concentration of dissolved oxygen ranged between (6.3 - 12.6 mg / L), this indicates water ability of self-purification to get rid of pollutants. These values are compatible with US standards limits (4.2- 12.6 mg / L). Figure (5-26) shows average concentrations of dissolved oxygen (DO) in Edku Lake during 2010.

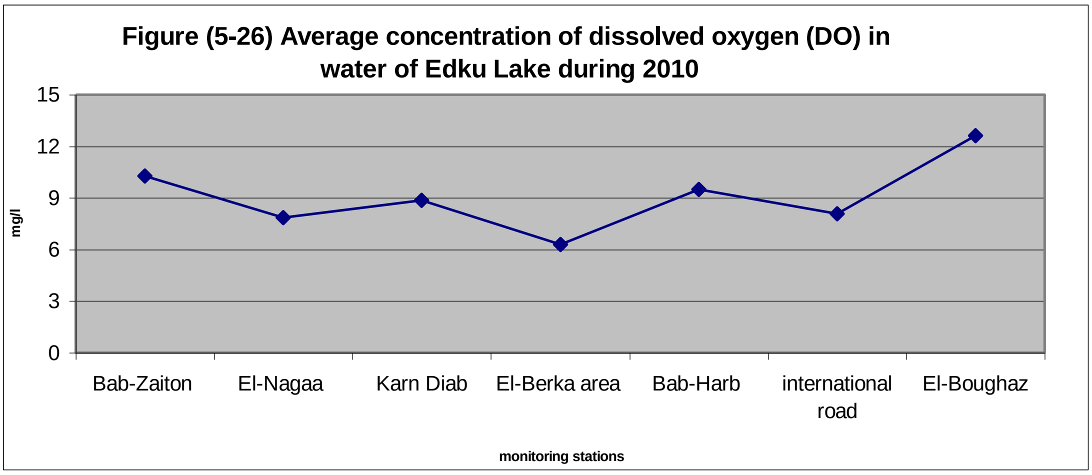


Figure (5-26) Average concentration of dissolved oxygen (DO) in Edku Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

5. Concentrations of organic matters represented by biological oxygen demand (BOD) ranged between (8.36 - 11.55 mg / L) with an average (9.6 mg / L) which significantly exceeds US standards limits (3-6 mg / L. This may be due to the discharges of the agricultural drains .

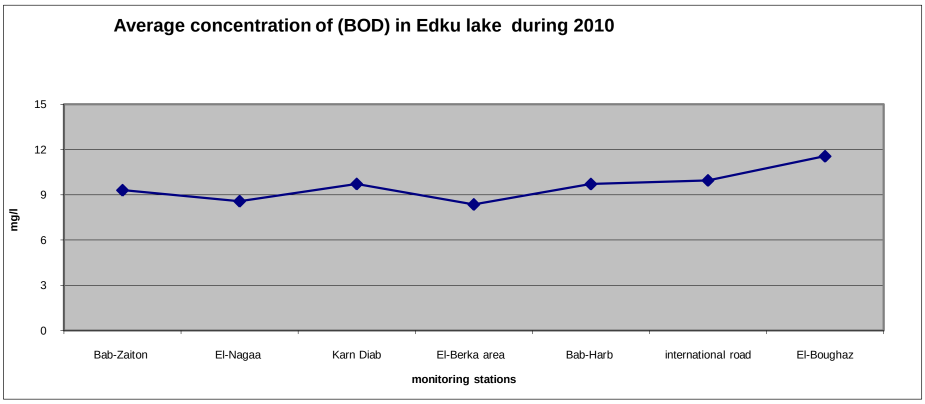


Figure (5-27) shows biological organic concentrations in the different monitoring sites during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

6. Concentrations of organic matters represented by chemical oxygen demand (COD) ranged between (35.26 - 43.4 mg / L) ,while increased to (70.37mg/L) at Bab-Zaiton station located near fish farms drain . This increase may be attributed to its increased

concentrations in drains discharging into lake .Figure (5-28) indicate these concentrations.

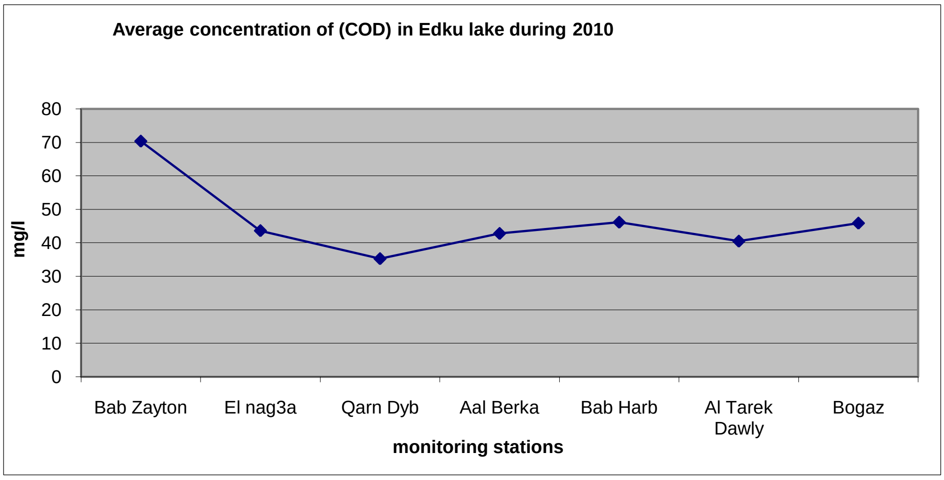


Figure (5-28) Average concentration of (COD) in Edku Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

7. Concentration of ammonia ranged between (0.7 - 1.15 mg /L), which is less than the Canadian standards (1.4 - 2.2 mg / L), while the average concentrations of total nitrogen ranged between (5.1 to 7.6 mg / L).

8. Total phosphorus concentration ranged between (0.3 - 0.5 mg / L).

9. Concentrations of polychlorinated biphenyls (PCBs) ranged between (0.7 - 0.17 micrograms /L), values were high at (Bab-harb and Al-Najaah stations), because both of them are near to Khairy and fish farm drains respectively. Figure (5-29) clarifies concentrations of (PCBs) in Edku Lake during 2010.

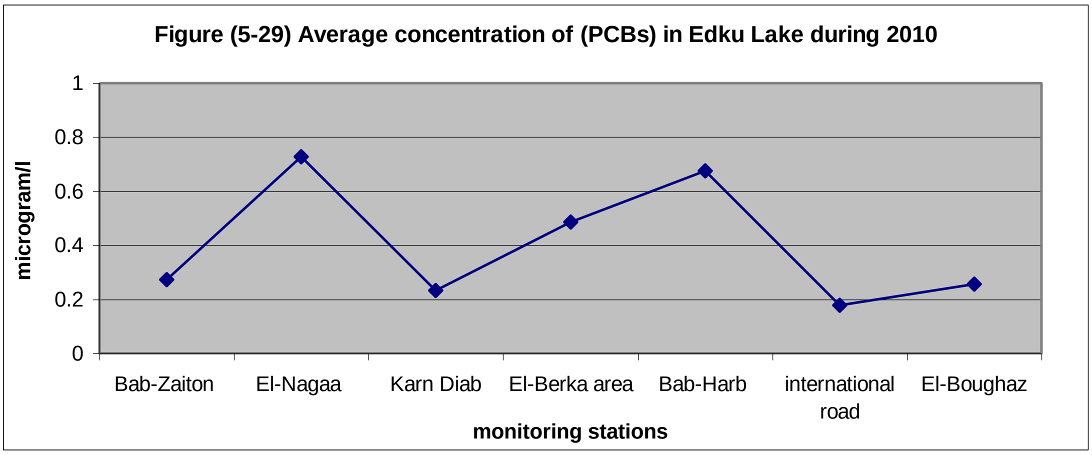


Figure (5-29) Average concentration of (PCBs) in Edku Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

10. Concentrations of total pesticides (TP) ranged between (0.56 - 1.57 micrograms / L).

11. In general, concentration of heavy elements was very low. Despite the significant increase in both zinc and iron concentrations, this is due to being natural component of lake's sediment. Figure (5-30) indicates concentrations of heavy elements in Edku Lake during 2010.

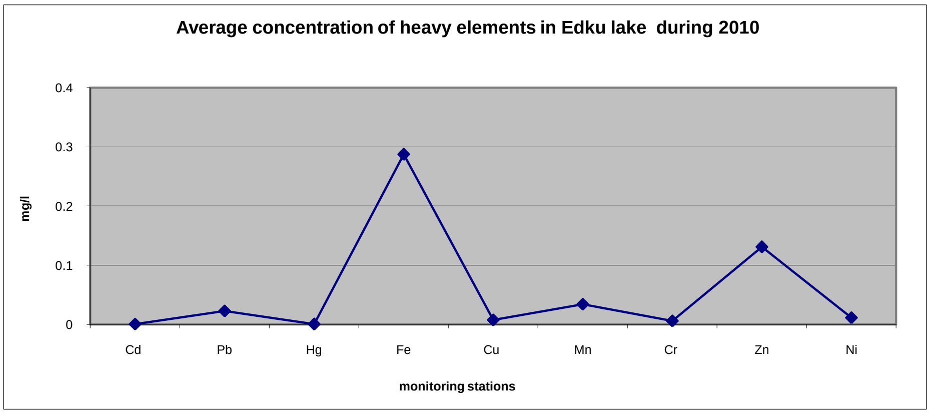


Figure (5-30) Average concentration of heavy elements in Edku Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

5-4-2-3 Burullus Lake

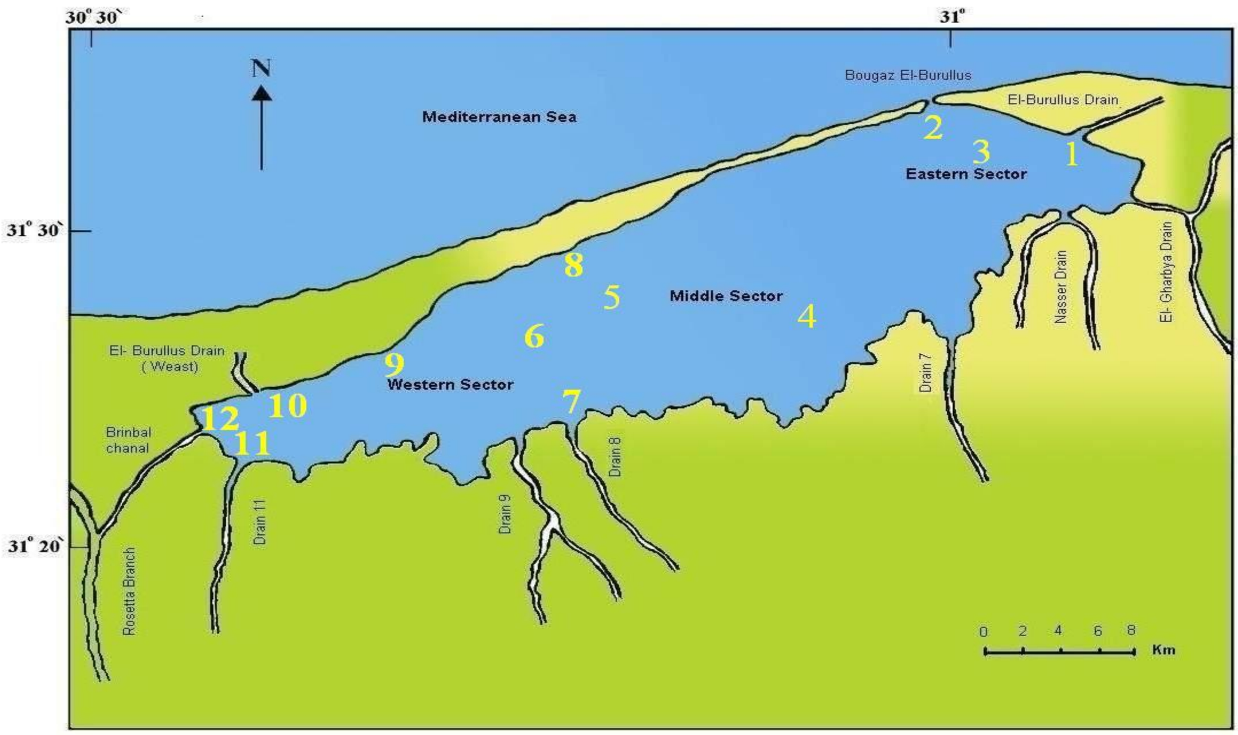
Burullus Lake is one of the oldest Egyptian lakes, located at the north-east of Rosetta branch, its length extends for about 70 km and its width varies from (6 to 17 km). The current area of the lake is about 110 thousand Feddans, and its depth ranged between 0.4 to 2 meters. Burullus Lake is the second largest natural lake in Egypt. It is linked with the Mediterranean through "Burullus strait" and with the Nile River through the "Brembal canal" which is the main source for feeding the lake with abundant quantities of freshwater and fresh water fish. Average fish production of the lake is about 49,000 tons per year. Eight drains locating on the east and south of the lake, namely, (drain 3 - Kitchener , Baher Tera , Baher El-Batala , drain 7 ,Neshrat drain , drain 9 and El-Moheet drain) are discharging their water into the lake .

Burullus Lake is characterized with salt marshes, reed bed and sandy plains in addition to high sand dunes which are located on coasts of the Lake. It is considered a natural habitat for nearly 135 aquatic / wild plant species and suitable habitat for migratory birds. Names and locations of monitoring sites are identified in table (5-3) and map (5-3).

Table (5-3) Names and monitoring sites in Burullus Lake

No.	Name of monitoring site	Governorate
1	In front of East Burullus drain outlet	Kafr El-Sheikh
2	In front of the strait	
3	West of the strait with about 5 km.	
4	In front of drain 7 outlet	
5	El-Zanqa (middle of the lake- the remotest station from pollution sources)	
6	El-Tawila (middle of the lake- north of drains 8 and 9- an area rich with immersed plants)	
7	El-Shakhlawia (in the middle between drains 8 and 9 outlet)	
8	Mastro, north of the lake and very close to the international road.	
9	Abu Amer (north-west of the lake)	
10	El-Berka (in the middle of the western sector of the lake)	
11	Al-Hoks (In front of drain 11 outlet)	
12	In front of Brembal canal drain	

Source: National Program for Environmental Monitoring of Egyptian Wetlands



Map (5-3) Locations of monitoring sites in Burullus Lake

Source: National Program for Environmental Monitoring of Egyptian Wetlands

Monitoring results of water quality:

Monitoring results of water quality in Burullus Lake during 2010 were as follows:-

1. Temperature of water ranged between (12.9°C - 27.6°C), which is a natural change with respect to seasons.
2. Water Transparency ranged between (16 - 24.67 cm). It decreased in some areas of the lake due to the large amounts of discharged water from agricultural drains in east and south of the lake.
3. Water Salinity ranged between (1.22 - 32.25 g / liter), this large difference is due to the location of some monitoring stations near to the Mediterranean Sea (near the strait) and others near to drains with low salinity.
4. Burullus Lake tends to alkaline where pH values ranged between (8.38 - 8.76) during the whole year which is normal according to US standards limits (7.2-9).

5. Concentration of dissolved oxygen (DO) ranged between (5.9 - 7.9 mg / L) with an average (6.7 mg /L), which clarifies water ability of self-purification. These values are compatible with US standard limits (4.2 -12.6 mg / L).Figure (5-31) shows the average concentrations of (DO) in Burullus Lake during 2010.

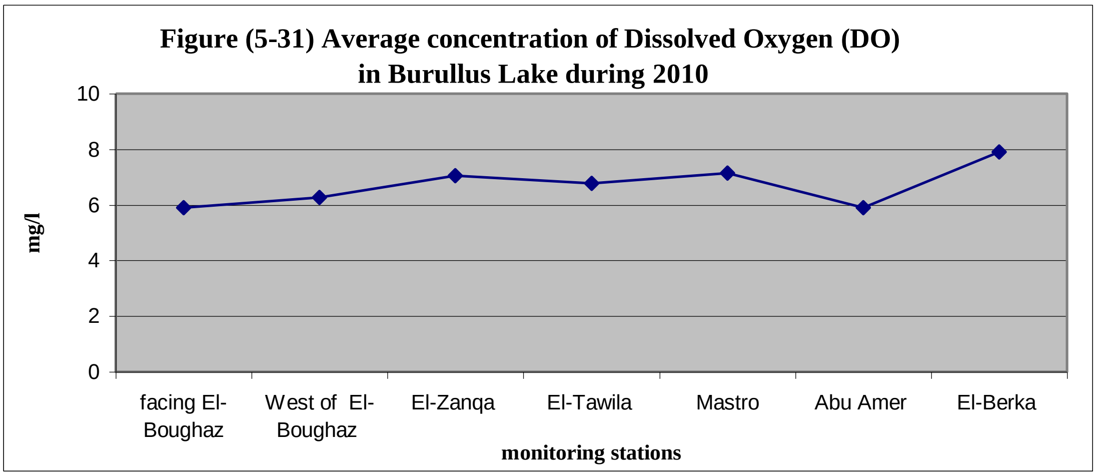


Figure (5-31) Average concentration of dissolved oxygen (DO) in Burullus Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

6. Average concentration of biological oxygen demand (BOD) ranged between (5.2 - 8 mg / L) in most of the monitoring stations. Theses values slightly exceeds the US standards limits (3-6 mg/ L). The increase was recorded at (El-Tawila and West EL-Boughaz stations) as both of them are locating near the outlets of drains 8 and 9.

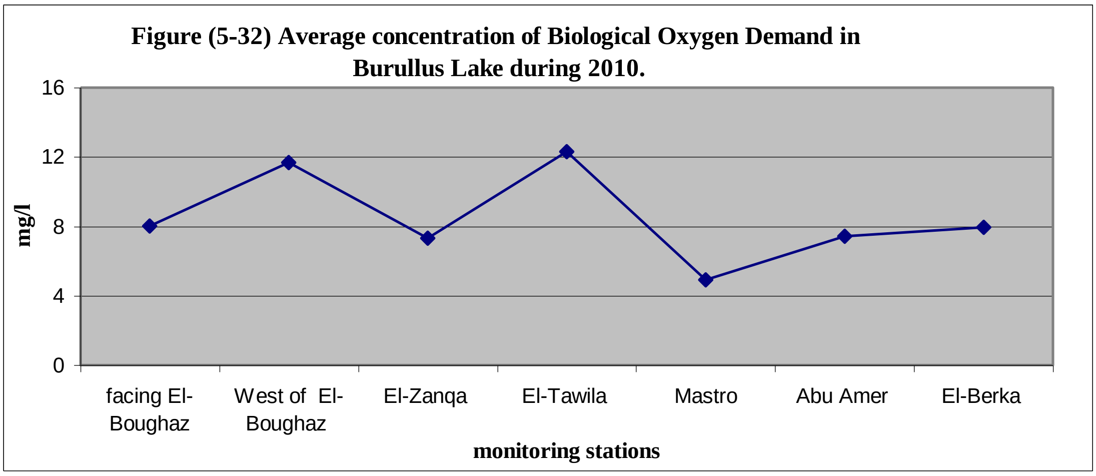


Figure (5-32) Average concentration of Biological Oxygen Demand in Burullus Lake during 2010.

Source: National Program for Environmental Monitoring of Egyptian Wetlands

7. Average concentration of chemical oxygen demand (COD) ranged between (12.3 - 24 mg/L). Figure (5-35) indicates these concentrations during 2010.

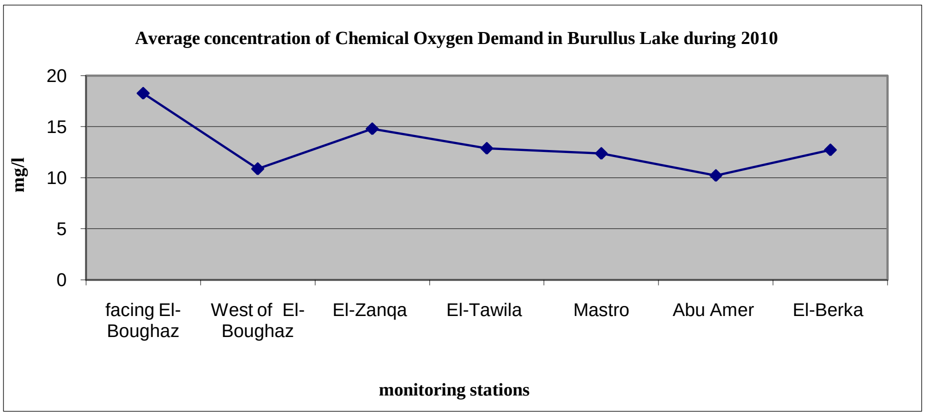


Figure (5-33) Average concentration of chemical oxygen demand in Burullus Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

8. Average concentration of ammonia ranged between (0.61 - 2.38 mg /L) at all stations except at (El-Tawila station) where a significant increase was recorded because of its location near the outlet of agricultural drains 8 and 9 as shown in figure(5-34) .

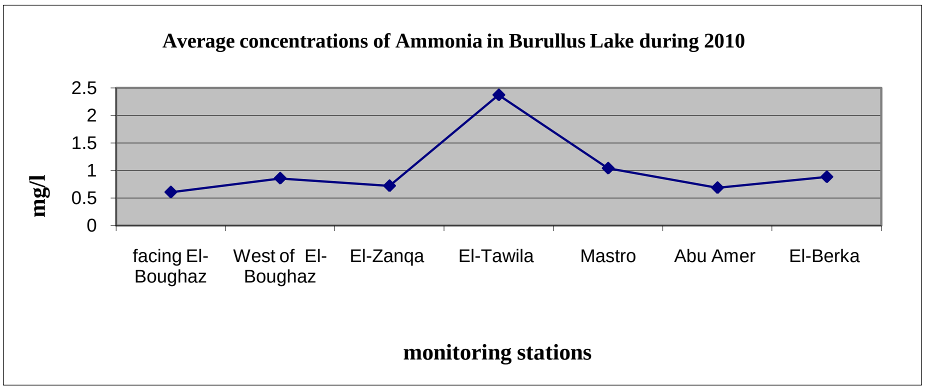


Figure (5-34) Average concentration of Ammonia in Burullus Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

9. Concentration of total nitrogen ranged between (3.44 - 8.38 mg/ L) and values of total phosphorus ranged between (0.16 - 0.71 mg/ L).

10. Concentrations of total pesticides (TP) were very low in all monitoring stations. But a slight increase was recorded at Abu Amer station (north-west of the lake) due to drain 11 (Al-Hoksa) which is locating near to the station.

11. Concentration of Polychlorinated Biphenyls (PCBs) ranged between (0.024 - 0.068 micrograms / L) with an average (0.04 micrograms / L), as shown in figure (5-35).

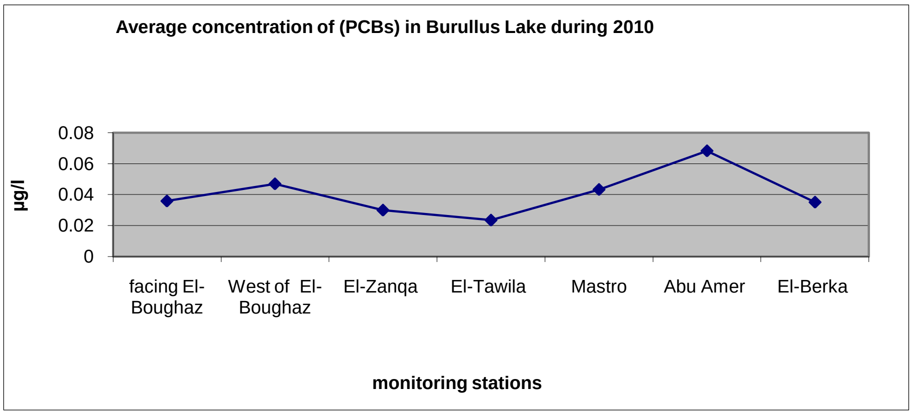


Figure (5-35) Average concentration of (PCBs) in Burullus Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

12. In general, concentrations of heavy elements are very low, but a significant increase of both zinc and iron concentrations was recorded, due to being natural component of lake's sediments. Figure (5-36) clarifies concentrations during 2010.

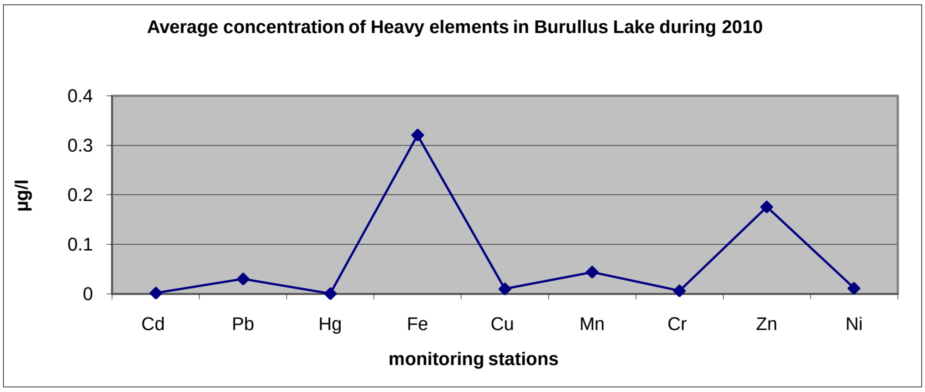


Figure (5-36) Average concentration of heavy elements in Burullus Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

5-4-2-4 Manzala Lake:

Manzala Lake is one of the largest Egyptian lakes. It lays at the north-eastern part of the Delta south of the Mediterranean coast, within borders of five governorates "Dakahlia, Damietta, Port Said, Ismailia and Sharkia". It represents about 60% of the total area of Lakes in Egypt. Suez Canal is bordering it from the east, Damietta branch from the west and Mediterranean Sea from the north. Its area is about 100 thousand feddans and depth about 1.15 meters; therefore it is one of the shallow Lakes. Its maximum length is 47 km, width 30 km and coastal line 293 km.

The Lake is linked with the Mediterranean Sea through three straits enable it exchanging water and living organisms, (EL- Gamel strait, Baghdadi strait and New Gamel strait). They are separated with a sandy coast of height ranged between (0.5 - 2 meters) extends along the coast of the lake. It is linked with Suez Canal through Alkaboty strait and Damietta branch through El-Ratama and El-Safara canals. Fish farming activity occupies large areas in the south and north-west of the lake, therefore it is considered one of the main sources of fish production in Egypt.

Annually, the Lake received about 7500 million cubic meters of wastewater from agricultural drains loaded with sewage and industrial waste (Bahr El-Bakr, Hadous, Ramses, Sarw and Faraskour drains). This amount decreased to 4000 million cubic meters after the establishment of Al-Salam Canal. The Lake is surrounded by some fish farms, agricultural lands “of adjacent villages” and Al-Salam canal. Water quality of the lake is monitored through sites, their names and location are shown in table (5-4) and map (5-4).

Table (5-4) Names and monitoring sites in Manzala Lake

No.	Name of location	governorate
1	In front of Bahr El-Bakr drain	Port Said
2	In front of El-Gamil strait	
3	West of El-Bashtear	Dakahliya
4	El-Temsah	Port Said
5	Legan	Dakahliya
6	Deshdy	
7	Al-Hamra (far north of the lake)	Port Said
8	Abwat El-Kabear (north of Sarw drain)	Dakahliya
9	Al-Dabjo (south of Sarw drain)	
10	El-Zarka (near Faraskour drain)	Damietta
11	El-Ganaka (in front of Hadous' drain)	Dakahliya

Source: National Program for Environmental Monitoring of Egyptian Wetlands

Map (5-4) Locations of monitoring sites in Manzala Lake

Source: National Program for Environmental Monitoring of Egyptian Wetlands

Monitoring results of water quality:

The monitoring results of water quality in Manzala Lake during 2010 were as follows:-

1. PH values ranged between (7.82 - 8.57). This indicates the lake is slightly tends to alkaline, which is compatible with US standards limits (7.2-9).
2. Water temperature ranged between (12.3 °C – 23.2 °C), which are appropriate for the living and growth of fish during monthes of the year.
3. Transparency of water ranged between (26.67 - 50 cm), lack of transparency was recorded in some areas, due to the effect of the turbidity resulting from the discharges of Hadous and Bahr El-Bakr drains.
4. Results showed relative differences between salinity of the water, inside the lake it recorded (9.05 g / liter) near the Mediterranean Sea (at the strait), and at the rest sectors of the lake (1.65 g / L).
5. Average concentrations of dissolved oxygen (DO) range between (5.57 - 7.2 mg/L) in all monitoring points in the lake which is compatible with the US standard limits (4.2 – 12.6 mg / L). Concentration of (DO) decreased at the "West of El-Bashtear" station which locates in front of Hadous drain , it reached to (1.8

mg / L) due to pollutants of the drain effect . Figure (5-37) clarifies average concentration during 2010.

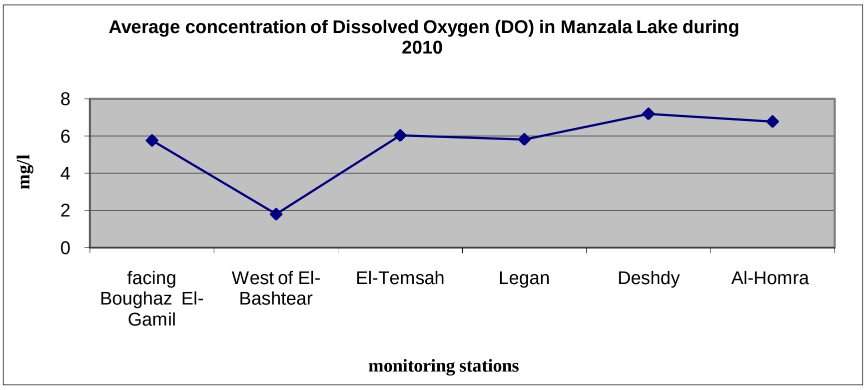


Figure (5-37) Average concentration of dissolved oxygen (DO) in Manzala Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

6. Ammonia concentration ranged between (0.28 - 1.67 mg / L) with an overall average (0.7 mg / L), its highest concentration recorded at the "West of El-Bashtear" station locates in front of the Hadous drain , as figure (5-38) clarifies.

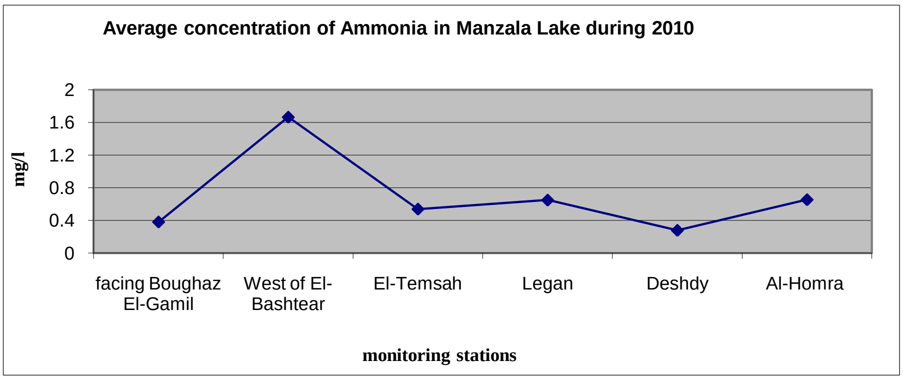


Figure (5-38) Average concentration of Ammonia in Manzala Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

7. Concentration of total nitrogen ranged between (3.07 - 6 mg / L) with an average of (4.5 mg / L). Average concentration of total phosphorus ranged between (0.13 - 0.53 mg / L) with an overall average (0.3 mg / L) which are small values.

8. Concentration of organic matter represented by biological oxygen demand (BOD) ranged between (8.45 -9.3 mg / L) in most of the monitoring points. These values slightly exceeded the US standards limits (3-6 mg / L). Concentration increased slightly at the "West of El-Bashtear" and "In front of El-Gamil strait " stations reaching to (15.9 mg /L) because they are located near outlet of the drains, as figure (5-39) clarifies.

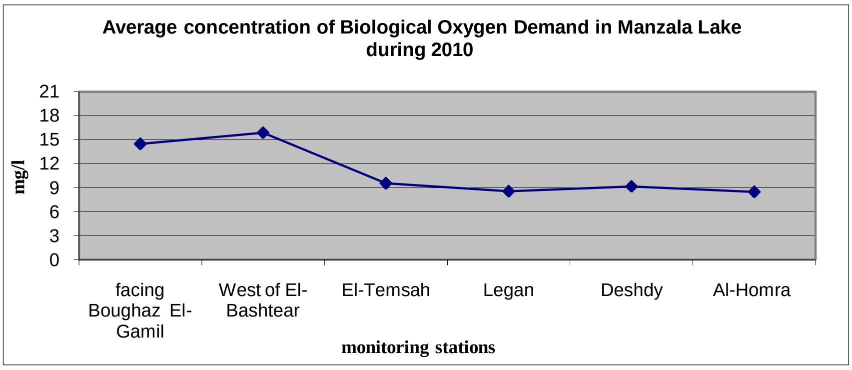


Figure (5-39) Average concentration of biological oxygen demand in Manzala Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

9. Concentration of organic matters represented by chemical oxygen demand (COD) ranged between (57.75 - 147.3 mg / L) may be attributed to the amounts of drainage, as shown in figure (5-40).

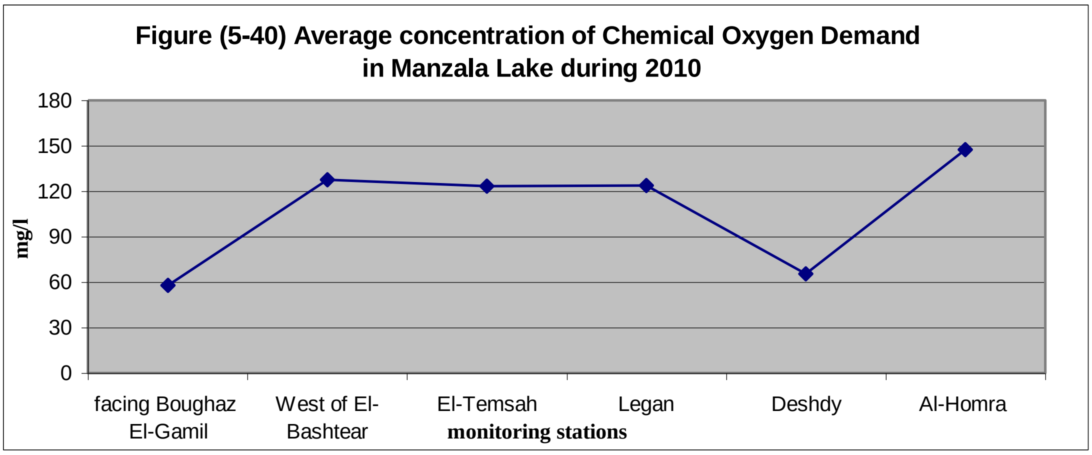


Figure (5-40) Average concentration of chemical oxygen demand in Manzala Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

10. In general, concentration of all heavy elements was very small, while a remarkable increase was monitored in the concentration of

both iron and zinc as they are natural components of the lake's sediment, as shown in figure (5-41).

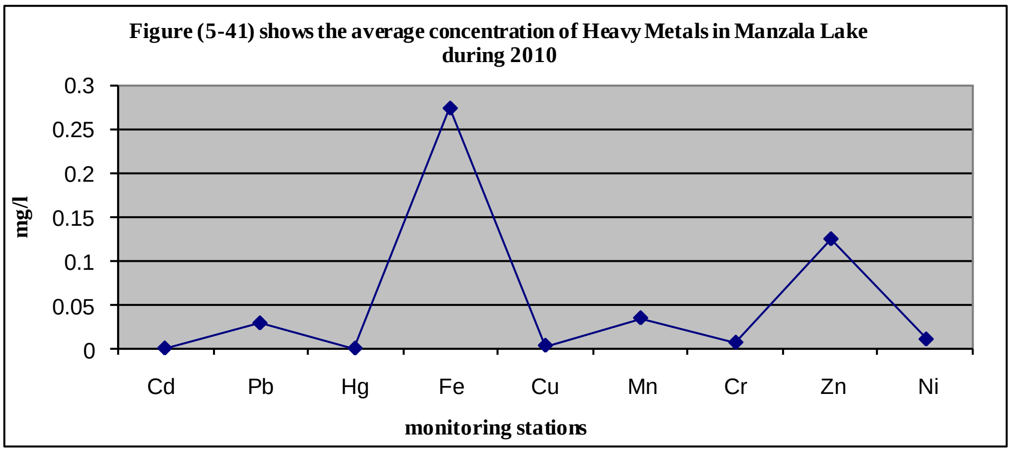


Figure (5-41) Average concentration of heavy metals in Manzala Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

5-4-2-5 Mariuot Lake:

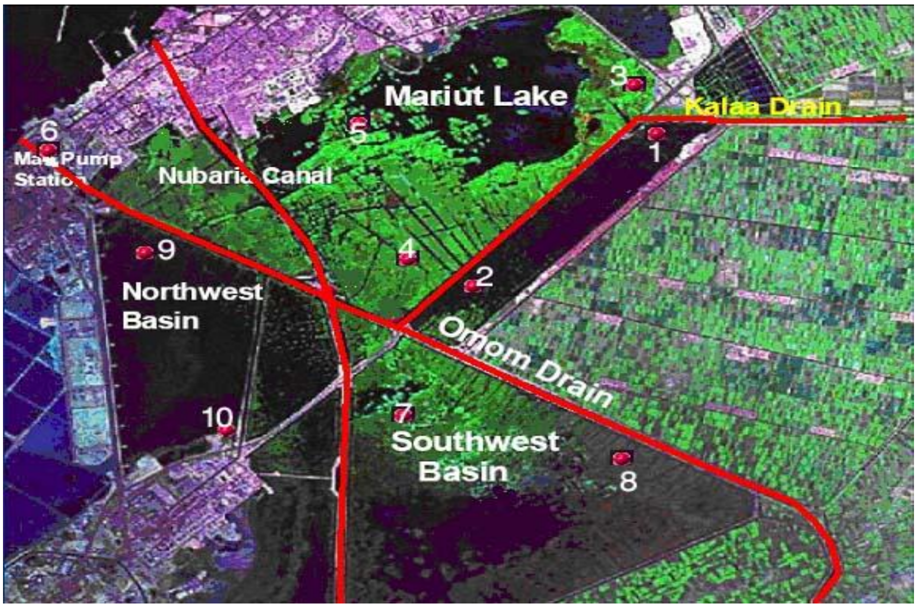
Mariuot Lake is one of the smallest lakes in North Delta. It is a small shallow basin located south of Alexandria city and is not linked with the Mediterranean Sea directly. It is divided into four different basins (fish farms basin, main basin, western basin and southern basin). Area of the lake is about 16 thousand feddans and its depth ranges between (0.3 - 6.3 meters), vegetation coverage represents about 63.1% of the total area of the lake. Average fish production estimated with about 4700 tons annually, tilapia and catfish are the famous kinds produced by the lake.

The lake receives large amounts of agricultural discharges loaded with sewage and industrial waste water from several drains which considered as the main sources of water reaching the lake (El-kalaa, El-Omoum and Nubaria drains). Water quality monitoring is conducted through sites clarified in table (5-5) and map (5-5):

Table (5-5) Names and monitoring sites in Mariuot Lake

No.	Name of location	Governorate
1	Start of the farm 1000 feddans (Shader El-Samak)	Alexandria
2	End of the farm 1000 feddans (Happassat)	

3	In front of El-Kalaa drain	
4	North-east Abu El-kheir bridge	
5	Middle of basin 3000 feddans	
6	In front of Maks pump	
7	Start of basin 5000 feddans	
8	End of basin 5000 feddans (in front of Shrarba village)	
9	In front of western purification	
10	Middle of basin 2000 feddans	



Map (5-5) Locations of monitoring sites in Mariuot Lake

Source: National Program for Environmental Monitoring of Egyptian Wetlands

Monitoring results of water quality:

Monitoring results of water quality in Mariuot Lake during 2010 were as follows:

1. Temperature ranged between (14.6 °C – 27.2 °C) which is appropriate to the living and growth of fish during the year.
2. Water Transparency ranged between (21 - 63.5 cm), transparency decreases near outlets of drains.
3. Salinity ranged between (2.7 – 7.8 g / L). Significant increase was recorded in the main basin of the lake.
4. Average pH ranged between (7.83 - 8.37), as water slightly tends to alkaline.
5. Concentrations of dissolved oxygen (DO) ranged between (6.4 - 8.14 mg / L) which is normal rates according to US standard limits (4.2 – 12.6 mg / L). Concentration decreased to (3.7 mg / L) at the station of "north-east Abu El-kheir Bridge", as it locates near the outlet of El-Omoum drain, as shown in figure (5-42).

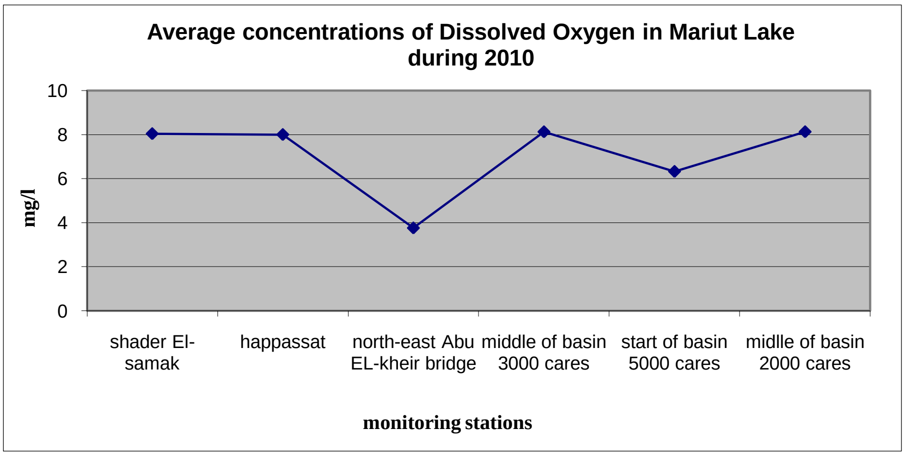


Figure (5-42) Average concentration of dissolved oxygen in Mariuot Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

6. Average concentration of ammonia ranged between (1.45 - 3.65 mg / L), while the average concentration of total nitrogen and total phosphorus were between (4.82 - 15.4 mg / L), (0.08 - 1 mg / L), respectively.
7. Concentrations of all heavy metals were low in all monitoring points except an increase of both iron and zinc were recorded as a

result of being natural component of lake’s sediment , as shown in figure (5-43).

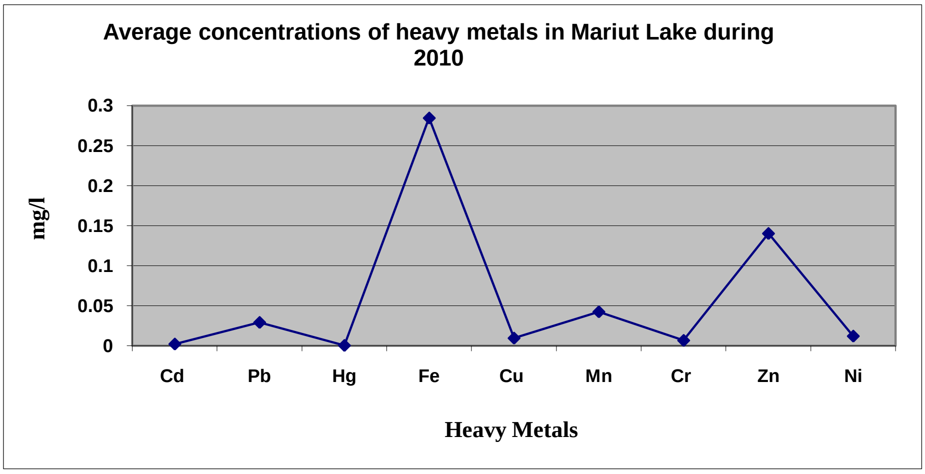


Figure (5-43) Average concentrations of heavy metals in Mariuot Lake during 2010

Source: National Program for Environmental Monitoring of Egyptian Wetlands

8. Average concentration of polychlorinated biphenyls (PCBs) ranged between (0.13 - 1.87 micrograms / L); while the average concentration of total pesticides (TP) ranged between (0.35 - 2.11 micrograms / L).

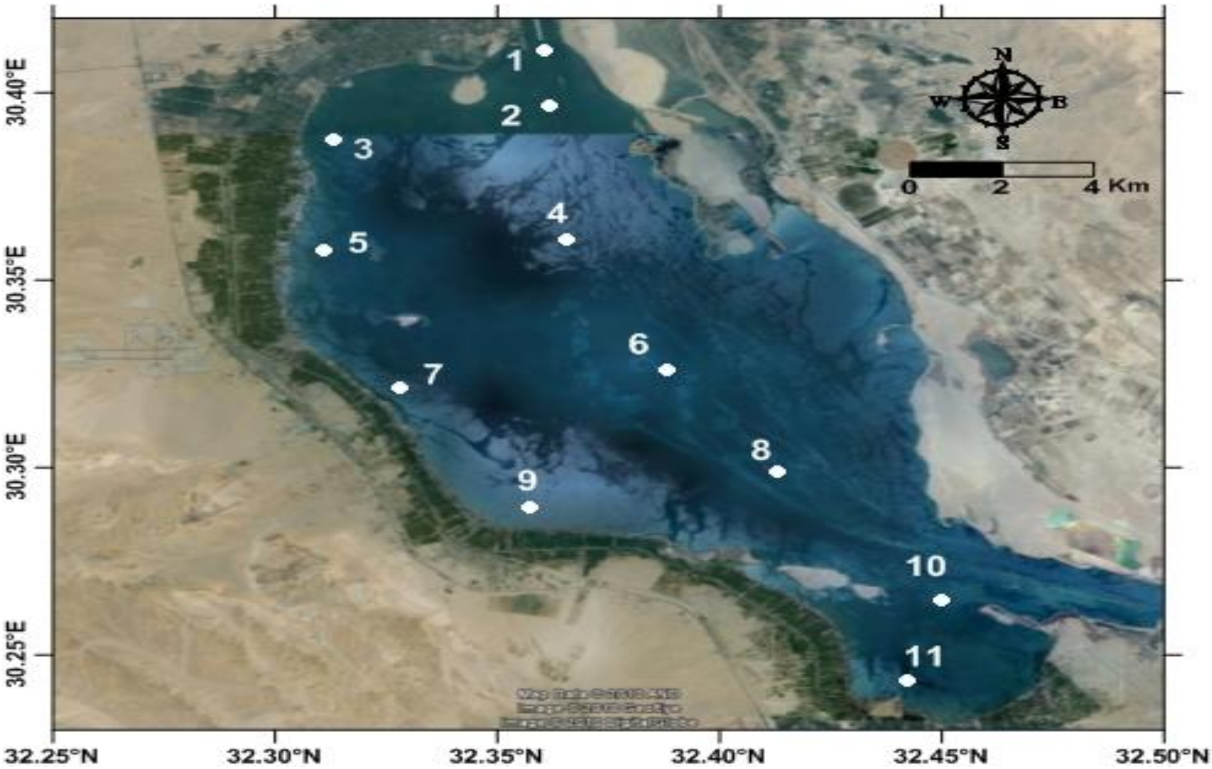
5-4-2-6 El-Morra Lakes (large and small):

El-Morra Lakes are considered part of the navigation waterway of Suez Canal. They pass through Suez Canal waterway for about 38 km (from 97 Km to 135 Km). Coasts of El-Morra Lakes are extending for about 50 km from Defreswar north of Ismalia governorate to Kabreet in the south. Small El-Morra Lakes are about 40 Km^2 (about 9525 feddans). They are sharing Suez and Ismailia governorates with their borders. Large El-Morra Lakes located within Ismailia governorate with an area of about 46190 feddans. They are affected by the direct discharge coming from Malaria drains 1, 2, 3, 4, as well as the Main and Al-sail drains. Water quality of the lakes is monitored. Their names and locations are identified in table (5-6) and map (5-6).

Table (5-6) Names and monitoring sites in large and small El-Morra Lakes.

No.	Name of monitoring site	Depth	Governorate
1	Defreswar (located in the navigation waterway of the Suez Canal in the north waterway of El-Morra Lake Lakes	15 meter	Ismailia
2	Abu Sultan (located near the navigation waterway in front of Abu Sultan power station)	13 meter	
3	Abu Sultan (shore station which is affected by the discharged cooling water from Abu Sultan station)	2.5 meter	
4	Fayed (located near the navigation waterway)	12. 5 meter	
5	Fayed (shore station, affected by drains of some resorts)	2 meter	
6	Fannara (located near the navigation waterway)	13 meter	
7	Fannara (shore station affected by Fannara drain)	2. 5 meter	Suez
8	Abu Rummana (located near the waterway navigation)	14 meter	
9	Abu Rummana (shore station affected by Abu Rummana drain)	3 meter	
10	Kabreet (located near the navigation waterway and far from any source of pollution)	14 meter	
11	Kabreet (shore Station)	3 meter	

Source: National Program for Environmental Monitoring of Egyptian Wetlands



Map (5-6) Locations of monitoring sites in large and small El-Morra Lakes.

Source: National Program for Environmental Monitoring of Egyptian Wetlands

Monitoring results of water quality

Monitoring results of water quality in El-Morra Lakes deduced from the field trip conducted during November 2010 were as follow:

1. Increase in water transparency, which indicates the low concentration of suspended matter that permits light to transmit into bottom of the lakes.
2. Salinity concentration ranged between (17.25 - 40.35 g/L). It varied according to nearness or remoteness of the monitoring point from drains or navigation waterway, as well as according to seasons of the year.
3. PH values ranged between (7.17 -8.11) which is considered normal rates, according to US standards (7.2-9).
4. Dissolved Oxygen (DO) values were in their normal rates. They ranged between (4.5 - 7.67 mg/L), according to US standards (4.2

to 12.6 mg/L), Figure (5-44) clarifies concentration of dissolved oxygen in El-Morra Lakes.

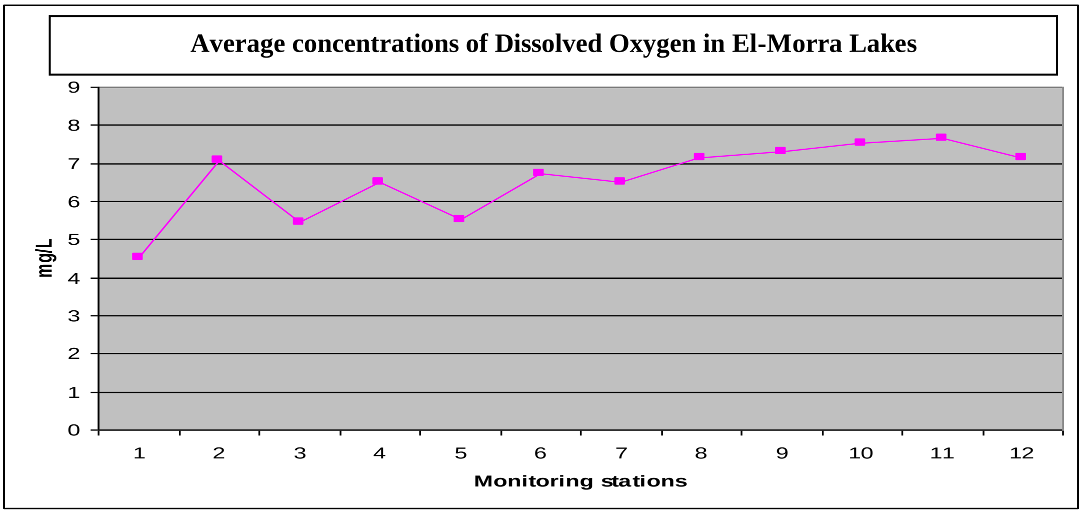


Figure (5-44) Average concentration of Dissolved Oxygen in El-Morra Lakes

Source: National Program for Environmental Monitoring of Egyptian Wetlands

5. Concentrations of organic matters represented by chemical oxygen demand (COD) ranged between (7.25- 15.5 mg/L) in most stations, while the concentration increases up to (21.76 mg/L) at the monitoring station No. 9, which is affected by Abu Rummana drain, as it is clarified in figure (5-45).

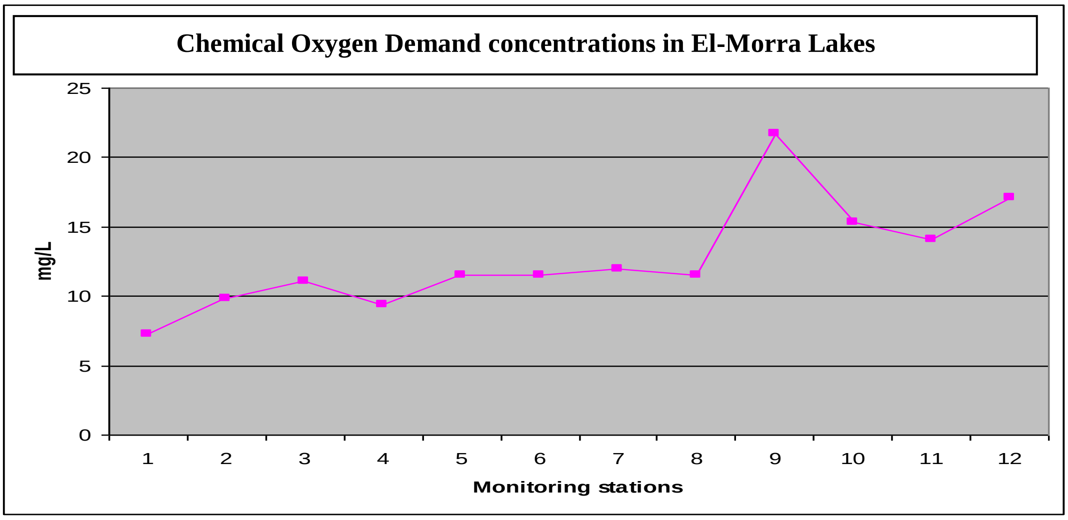


Figure (5-45) Chemical oxygen demand concentration in El-Morra Lakes

Source: National Program for Environmental Monitoring of Egyptian Wetlands

6. Concentration of organic matters represented by the biological oxygen demand (BOD) ranged between (0.20 -1.53 mg / L), these values are very low , in comparison with US standards (3-6 mg / L); this indicates nonexistence of sewage pollution.

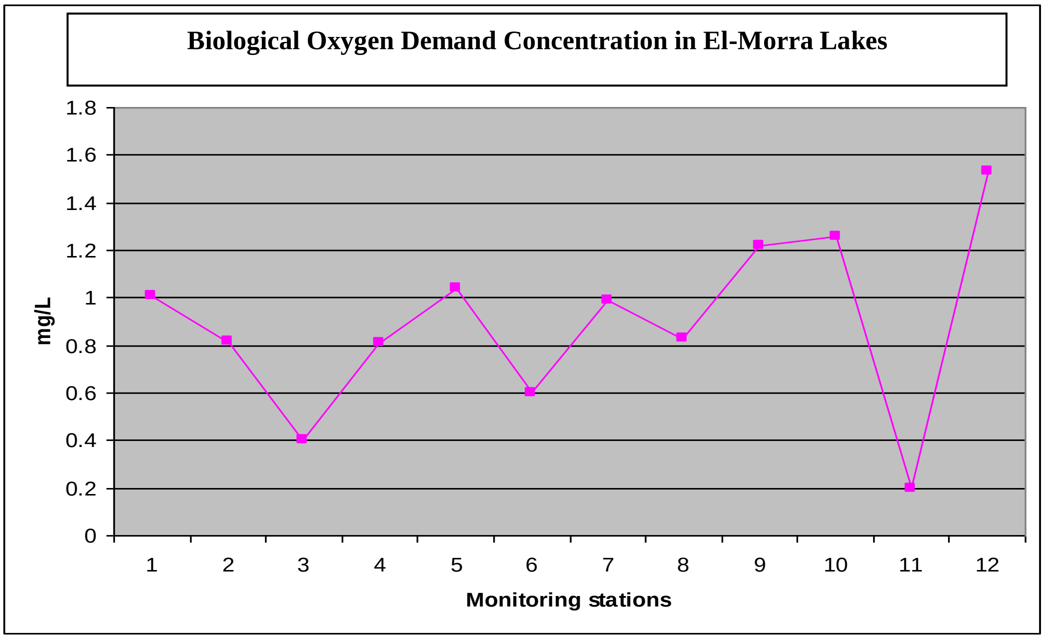


Figure (5-46) Concentration of biological oxygen demand (BOD) in El-Morra Lakes

Source: National Program for Environmental Monitoring of Egyptian Wetlands

7. Ammonia concentration was within natural limits. It ranged between (0.02 -0.15 mg/L), which is less than the Canadian standards (1.4 to 2.2 mg /L).

8. Average concentration of phosphorus was also within normal limits. It ranged between (24 - 51.6 µg/L) which is less than US standards (25-100 µg/L) .It is suitable for the growth of fauna and flora phytoplankton.

9. Concentrations of heavy metals did not exceed normal standards of heavy metals permitted internationally; figure (5-47) clarifies average of those concentrations.

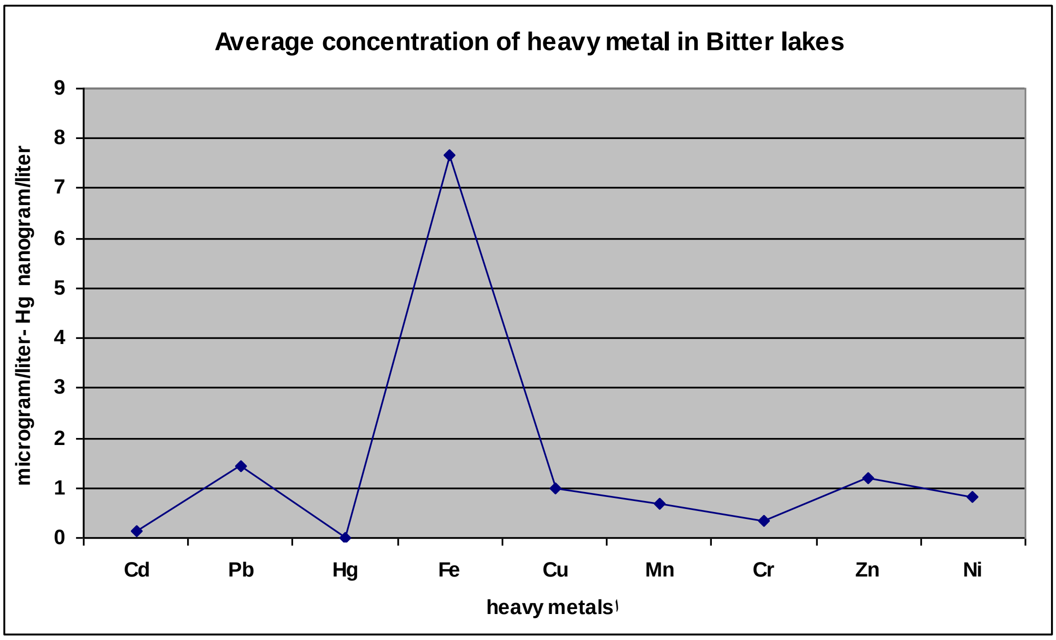


Figure (5-47) Average concentration of heavy metal in El-Morra Lakes

Source: National Program for Environmental Monitoring of Egyptian Wetlands

10. Total Pesticides (TP) and Polychlorinated Biphenyles Compounds (PCBs) recorded with small amount and did not exceed the permissible international standards.

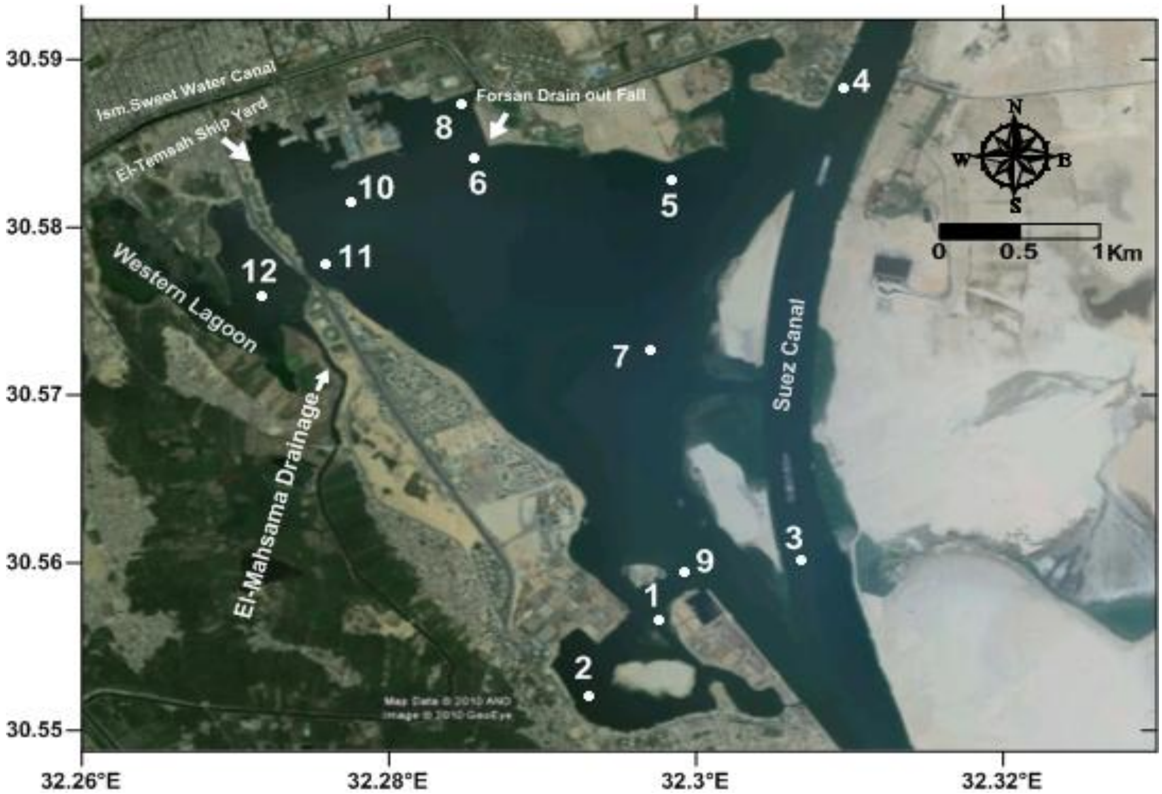
5-4-2-7 Temsah Lake:

Temsah Lake is characterized by its unique environment. It has an economic importance for its fish production and as a touristic center for picnics and trips. The Lake is linked with two water surfaces (El- Berka El- Garbiaa) known by Berket El- Sayaden and the navigation waterway of Suez Canal. Temsah Lake is located in Ismaillia governorate with an area of about 15 km ^{2} (about 1900 feddans) .It is a natural basin with an average depth of 10 m and contains approximately 90 million cubic meters of salty water. It receives direct discharge from El-Mahsma and Al-Waddey drains as well as indirect discharge from Albhtimy and Abujamos drains which discharge into Al-Mahsma drain. This is in addition to the excess water from the Ismailia Canal (to conserve water level of the canal) which discharge in the western part of the lake at the connection of Forssan island drain. Table (5-7) and map (5-7) clarifies the names of monitoring sites and their locations.

Table (5-7) Names and monitoring sites in Temsah Lake.

No.	Name of monitoring site	Depth	Governorate where the monitoring point is located
1	Located in the far eastern-south of the lake	6 meter	Ismailia
2	Shore station in the southern part of the lake	3 meter	
3	Located in the navigation waterway of the canal at the southern entrance of the lake.	15 meter	
4	Located in the navigation waterway of the canal at the northern entrance of the lake	15 meter	
5	Located in front of Etap Hotel	7 meter	
6	Located at the end of El-Helwa canal	1. 5 meter	
7	located almost in the middle of the lake	12 meter	
8	Located in front of the building of Suez Canal Authority and affected by El- Helwa canal	7 meter	
9	Located in the side navigation waterway in the southern entrance of the lake	11 meter	
10	located in front of El-Temsah company for building ships	8 meter	
11	Located in front of Berket El-Saydeen bridge	3 meter	
12	Located in Berket El-Sayden	1. 5 meter	

Source: National Program for Environmental Monitoring of Egyptian Wetlands



Map (5-7) Locations of monitoring sites in Temsah Lake.

Source: National Program for Environmental Monitoring of Egyptian Wetlands

Monitoring results of water quality:

Monitoring results of water quality in Temsah lake during 2010 were as follow: -

1. Transparency value indicates low concentration of suspended matters that permits light to transmit into bottom of the lake.
2. Salinity ranged between (1.8 - 35.1 g/L). It varied according to seasons of the year; it decreased near drains and increased near the navigation waterway of Suez Canal.
3. PH value of water was within their normal rates, according to U S standards slightly tends to alkaline, giving an average of about (8.08).
4. Concentration of dissolved oxygen (DO) ranged between (6.4 – 16.2mg/L) with overall average (9.3 mg/L), these values were within the normal according to U S standards (4.2-12.6 mg/L).

Figure (5-48) clarifies concentration of (DO) in different monitoring sites.

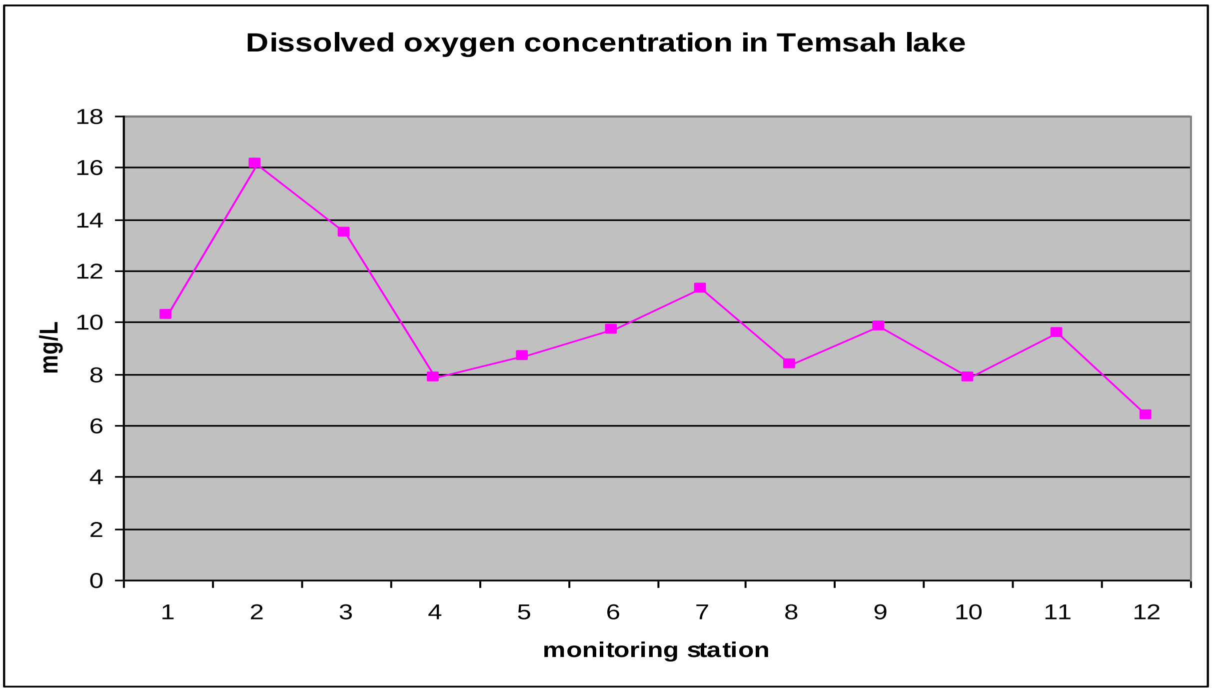


Figure (5-48) Dissolved Oxygen concentration in El-Temsah Lake

Source: National Program for Environmental Monitoring of Egyptian Wetlands

5. Concentration of organic matters represented by chemical oxygen demand (COD) ranged between (9.54 - 15.2 mg / L). While concentration at the monitoring sites No. 11 and 12 recorded an increase reached to (18.8) (24.92) mg/L respectively which is clarified in figure (5-49).

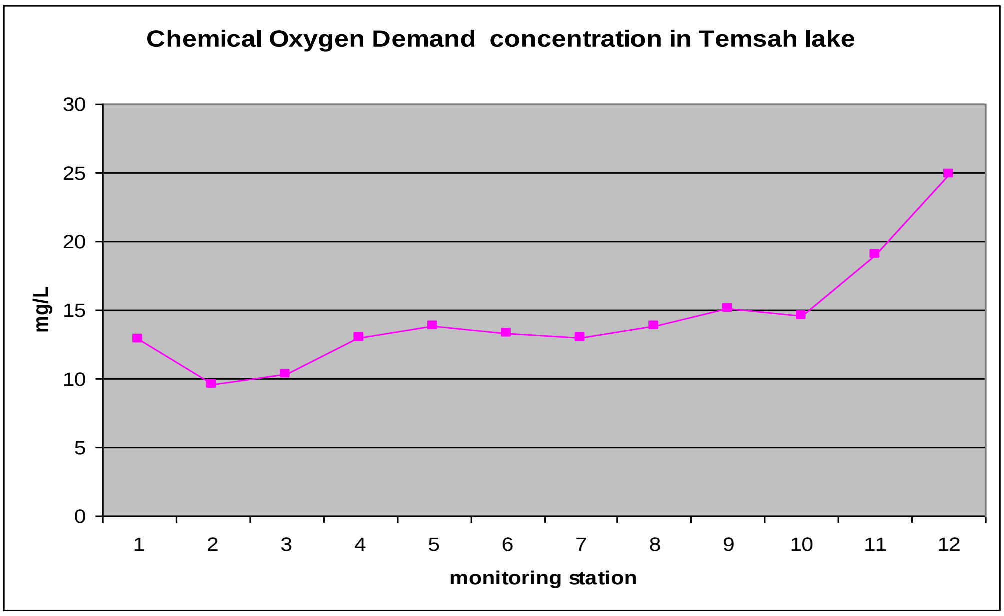


Figure (5-49) Chemical Oxygen Demand concentration in Temsah Lake.

Source: National Program for Environmental Monitoring of Egyptian Wetlands

6. Concentration of organic matters represented by the biological oxygen demand (BOD) ranged between (1.5 - 3.8 mg /L), which did not exceed US standards (3-6 mg / L). This indicates nonexistence of sewage pollution. Figure (5-50) clarifies these concentrations in monitoring stations.

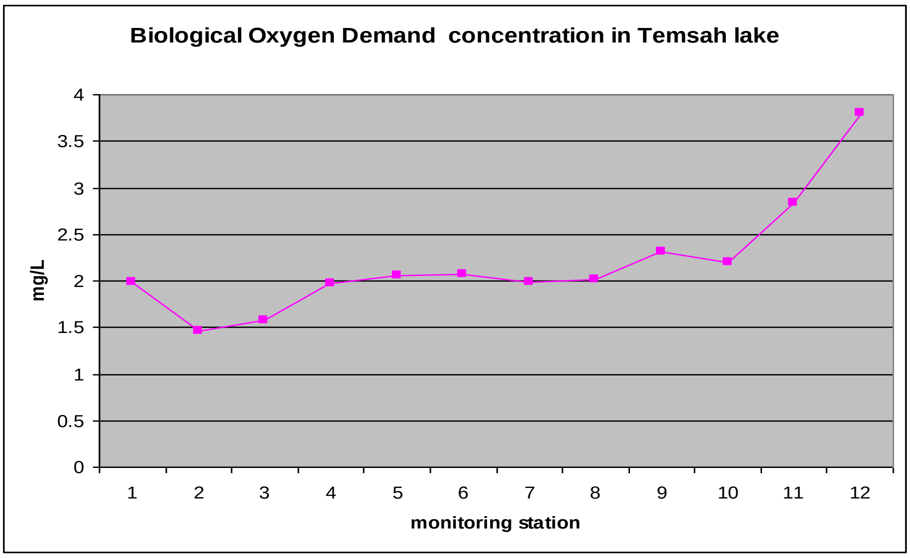


Figure (5-50) Biological oxygen demand concentration in Temsah Lake.

Source: National Program for Environmental Monitoring of Egyptian Wetlands

7. Ammonia concentration ranged between (0.07, 0.68 mg / L) with an overall average (0.27 mg / L). They are normal values in comparison with the Canadian standards (1.4 -2.2 mg / L).

8. Total phosphorus concentration was within the US permitted standards in most stations. It ranged between (99.8 -110 micrograms / L), while a relative increase was recorded reaching to (151, 396 µg/L) at station No. 11 near El-Berka station and station No. 12 which locates in Berket El-Sayaden, where many agricultural drains discharge .

9. Concentrations of heavy metals did not exceed the international permissible limits. Figure (5-51) shows average concentration in different monitoring stations.

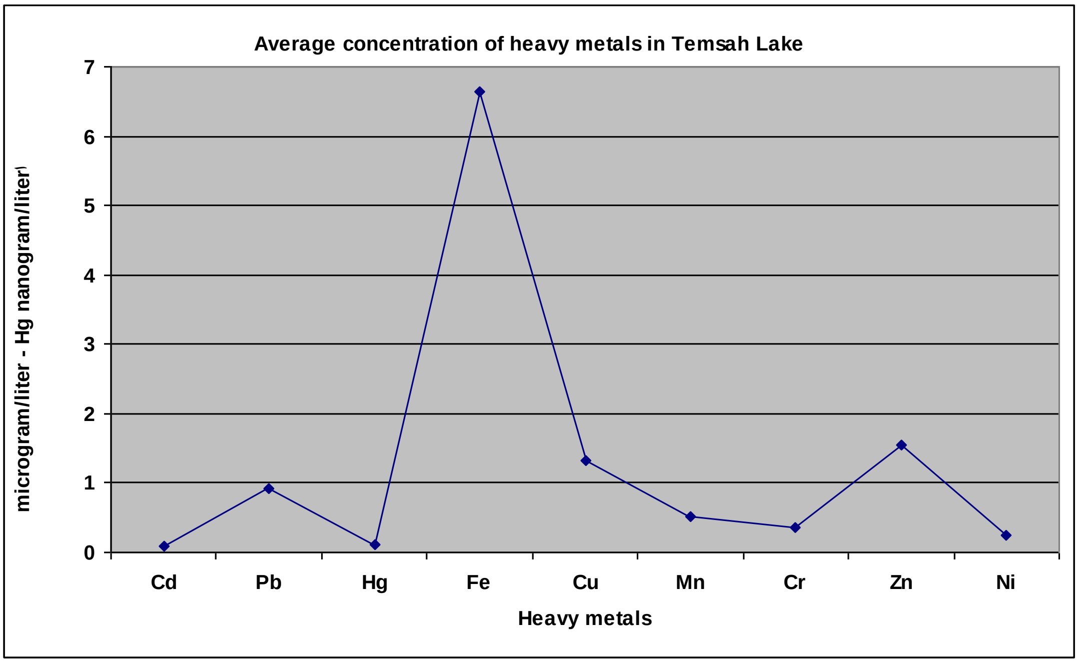


Figure (5-51) Average concentration of heavy metal in Temsah Lake

Source: National Program for Environmental Monitoring of Egyptian Wetlands

10. Concentration of Polychlorinated Biphenyls (PCBs) ranged between (0.01 -0.1 µg /L), while concentration of Total Pesticides (TP) ranged between (0.04 -0.6 micrograms / L).

Chapter six

Coastal Water, Marine and Coastal Zones

6-1 Introduction

Egypt coasts extend to about 3000 Km, along the Mediterranean Sea with about 1150 km from Sallum in the west to Rafah in the east, and 1850 kilometers on the Red Sea, with 1200 km on the main basin of the Red sea and 650 km on the Gulfs of Suez and Aqaba.
Egypt's coastal zone defined according to article 1/39 of Environment Law No.4/1994 amended by law No.9 /2009 as follows , (The area extending from the coasts of Arab Republic of Egypt encompasses the territorial sea, exclusive economic zone and continental shelf, and extending landward to areas of active interactions with the marine environment for that not exceeding 30 km in the desert areas, unless major topographical features interrupt this stretch, while in Nile Delta would extend up to contour (+3m).)

Most of coastal areas in Egypt are characterized by the unique diversity of natural habitats and environmental ecosystems in both the Red Sea coasts represented in (coral reefs, mangrove trees etc ...) and the Mediterranean costs represented in (wetlands, marshes and sand dunes, etc. ...) . As a result of the conflict between interests of beneficiary entities , the different environmental problems from one area to another and pressures confront costal zone management, the Ministry of State for Environmental Affairs developed the National Strategy for Integrated Coastal Zone Management. It aims to achieve the integrated management of coastal zones, their sustainable development and activate Article 5 of Law No. 4 / 94 amended by Law No. 9 / 2009.

Seaports play an important role in achieving economic development, and as a result of the rapid development in world trade volume and what it may cause by increasing amounts of pollutants and waste discharged into marine environment. MSEA conducted a study to identify sources of marine pollution from ports and methods to raise environmental awareness to increase ports' capacities to prevent pollution caused by ships, as it is responsible about realizing environmental protection and conserve its resources from marine pollution damages.

6-2 Threats facing coastal and marine zones:

Rates of economic growth and climate change are considered the most important social and environmental challenges that integrated coastal zone management are facing. Human activities such as: (organic nutrition, heavy metals, organic pollution, oil pollution, invasive species); and land-based activities (urban development due to population increase, industrial and agricultural activities); and tourism development are among the most important pressures facing execution of the integrated coastal zone management.

Marine pollution accidents are the most important source of marine environmental pollution. During 2010, 31 accidents had occurred, including only one did not cause any environmental damage and the other have caused damage to the marine environment. compensation for such damages estimated with 20 million pounds, other than fines prescribed according to law No. 4 /1994, amended by Law No. 9 / 2009.

MSEA collects data on such accidents in terms of their location, reasons and the damage water area exposed to as a result of the accident. After studying and analyzing collected data of 2010 , the following has been clarified:

1. 50% of accidents caused by oil derivatives (15 accidents).
2. 30% of accidents caused by oil waste.
3. 16.6% of accidents caused by crude oil.
4. 3.4% of accidents caused by dead animals.

Figure (6-1) clarifies number and percentage of the quality of materials causing marine pollution during 2010.

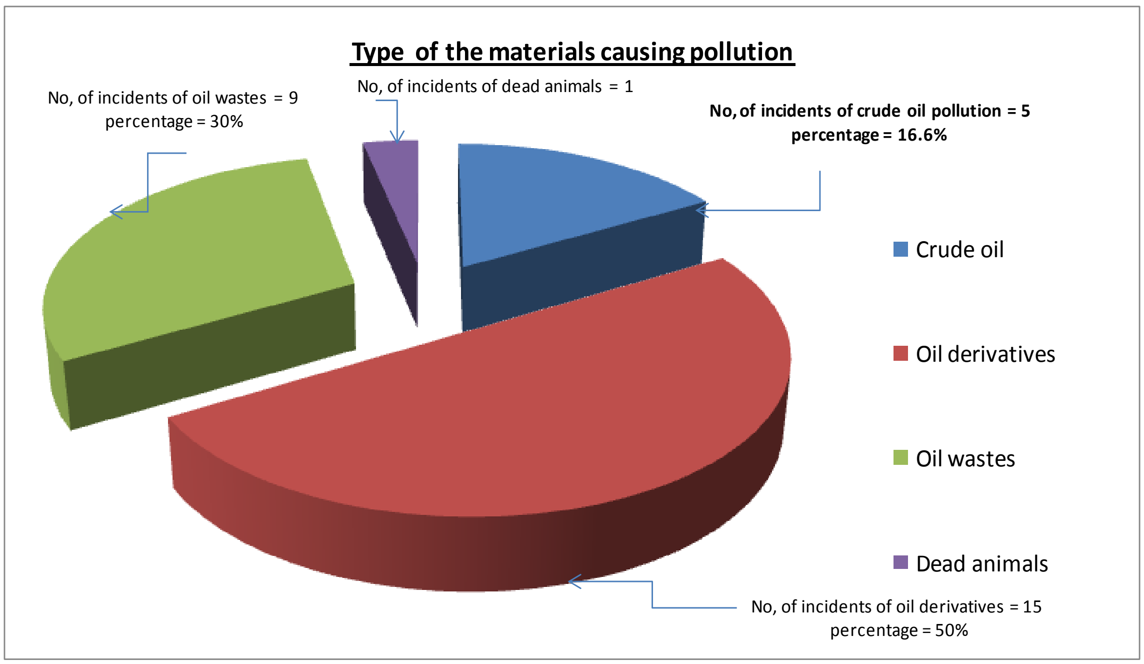


Figure (6-1) Percentage of the types of materials causing marine pollution during 2010.

Source: EEAA, General Department for Marine Pollution and ports.

Seaports recorded the highest percentage of areas that were damaged, where 12 accidents were recorded in El-Dekhila and Alexandria ports, then marina yacht, marine environment and River Nile. Figure (6-2) illustrates number and percentage of locations of marine environment contaminated during 2010.

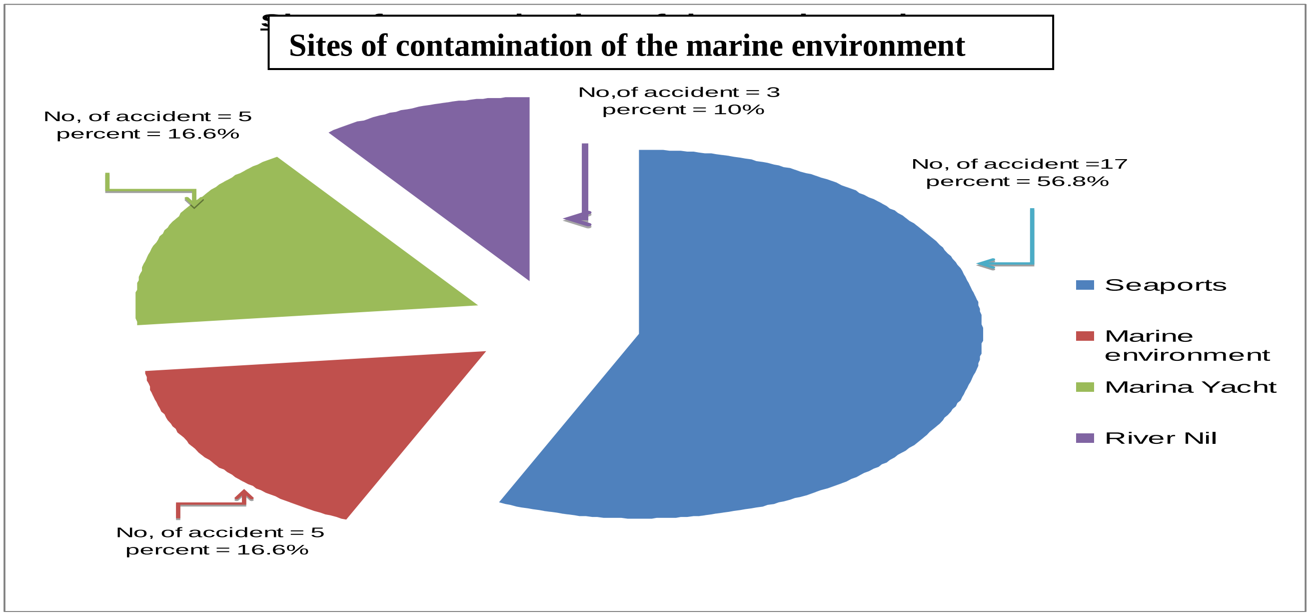


Figure (6-2) number and percentage of locations of marine environment contaminated during 2010

Source: EEAA, General Department for Marine Pollution and ports.

Main causes of accidents are as follows:

1. Deliberate dumping of waste from ships (12 accidents, 40% of the total accidents).
2. Human errors.
3. Lack of maintenance for equipments in ports or marine units.
4. Bad weather.

Figure (6-3) illustrates number and percentage of causes of marine environment pollution during 2010.

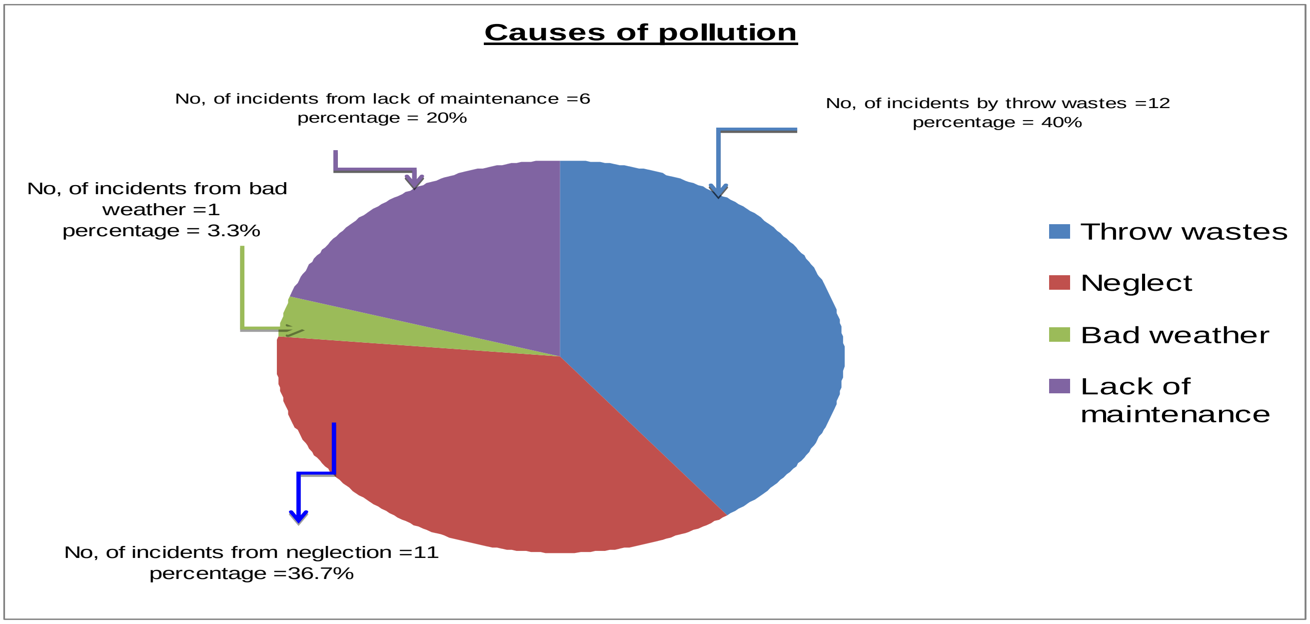


Figure (6-3) number and percentage of causes of marine environment pollution during 2010.

Source: EEAA, General Department for Marine Pollution and ports.

Number of marine environment accidents was 27, including 13 incidents in the Mediterranean and 13 in the Red Sea and one in the Suez Canal. Figure (6-4) illustrates number and percentage of pollution accidents in every water bodies during 2010.

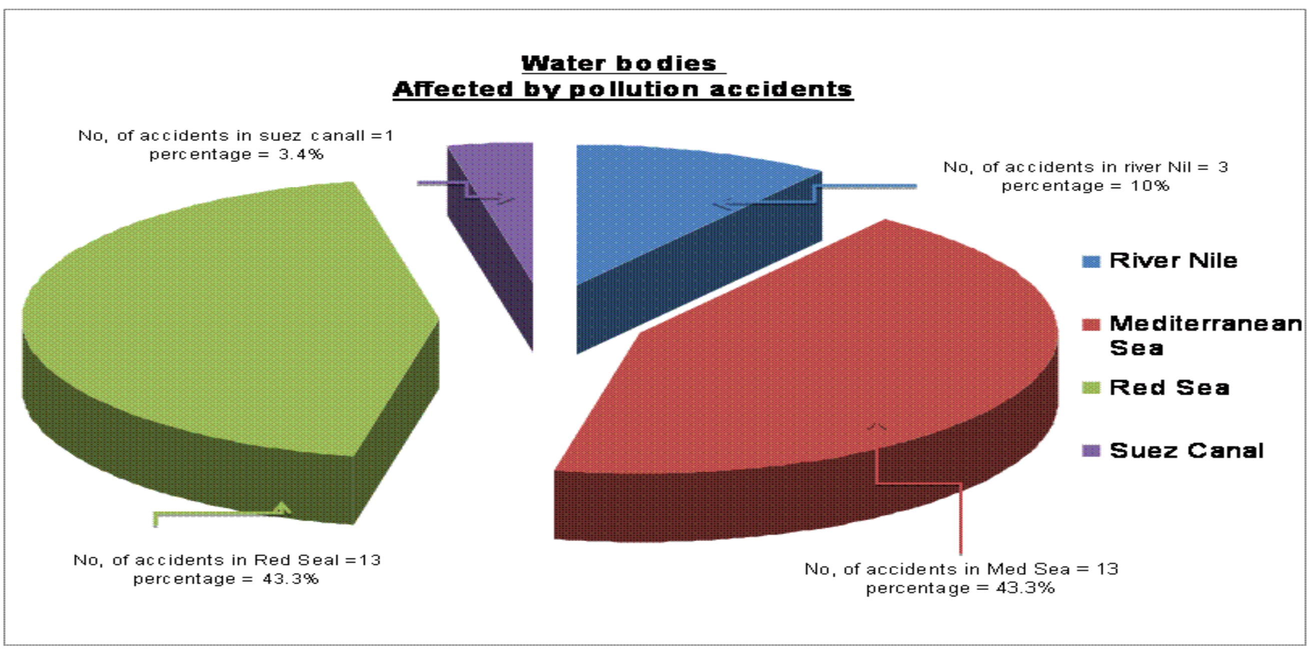


Figure (6-4) Percentage of pollution accidents in every water body during 2010

Source: EEAA, General Department for Marine Pollution and ports.

6-3 Conservation procedures taken by the General Directorate of Marine and Coastal Zones.

MSEA exerted great efforts to avoid pollution of coastal areas and ensure sustainable development, which includes the following:

1. Develop integrated management plan for the coastal zone located between Marsa Matrouh and Salloum in cooperation with Matrouh Governorate , Spanish Cantabria University and relevant entities (National Institute of Oceanography and Fisheries, Egyptian General Authority for Tourism Development, Shoreline Research Institute, General Authority for Remote Sensing and Space Sciences and General Authority for Urban Planning), through conducting the following:

   a. Adopt Geographic Information Systems "GIS" through developing database to support decision-making.

   b. Analyze use and zoning of costal areas subjected to conflict of interests, and giving priority to “sustainable development, agriculture, tourism, and industry .... etc." according to the characteristics of each region.

   c. Assess capacity of each region through evaluating limits of development to maintain quality and quantity of coastal resources.

2. Develop the National Strategy for Integrated Coastal Zone Management "ICZM", to integrate decision-making in development projects of coastal zones, to achieve sustainable development and conserve natural resources, according to Article 5 of Environment Law No. 4 / 1994 amended by Law No. 9 / 2009. The strategy identified the following three objectives :

   a. Strengthen ICZM policy at the national and regional level for enhancing local development policies with an integrated vision in decision-making process.

   b. Sustainable planning for the exploitation of coastal resources through preparing Integrated Coastal Management Plans (every coastal governorate or number of governorates share the same environmental characteristics) to improve management of resources in the coastal zone and avoid conflict of interests between beneficiaries and users of that region.

   c. Raise awareness among relevant entities at all levels (universities, schools and civil society) and involve them in decision making process.

3. Develop standards and criteria for the use of chemical dispersants in combating oil pollution to reduce negative impacts of such substances; by choosing suitable substance according to the quality of oil and circumstances

of each accident. These standards aim to develop unified mechanism about (national and imported dispersants) according to international standards.

4. Develop Integrated Coastal Management Plan for the Delta region in cooperation with the National Institute of Oceanography and Fisheries through "People for Ecosystem-based Governance in Assessing Sustainable Development of Ocean and Coast (PEGASO)" project.

5. Cooperate with Shoreline Research Institute and National Center for Water Research affiliated to the Ministry of Irrigation and Water Resources to develop plan for "adaptation of Nile Delta with Climate Change and sea-level rise" through the Integrated Coastal Zone Management. This aims to enhance Egypt's adaptation with climate change, sea level rise and raise capacities of relevant entities with issues related to erosion, sedimentation and integrated management of coastal zones.

6. Prepare an integrated study about " the possibility of storing carbon dioxide under seabed" include the following :

    a. Possibility of gas storage in geological tectonics or depleted oil wells in the seabed and identify risks associated with that action.

    b. Determine controls that must be followed in the process of transport and storage of carbon dioxide gas under the seabed.

    c. Assess environmental impacts resulting from transport and storage of carbon dioxide gas on the marine environment.

7. Issue number of guidelines to reduce negative environmental impacts resulting from maritime , river transport and ports, such as :

    a. Guidelines for environmental impact assessment of ports and marinas.

    b. Guideline for the application of environmental management system in seaports.

    c. Guideline for the prevention of pollution from ships.

    d. Guideline for the application of environmental management in ports, marinas and mobile river units.

8. Develop study to assess environmental status of all kinds of sea ports (commercial, petroleum, fishing, mining, tourism ......) aims to implement environmental management system.
9. Enhance institutional capacities of directors of environmental affairs in ports and fishing marinas.
10. Implement the National Program of Coastal Water Monitoring since 1998 until now.

6-4 The National Program for Coastal Water Monitoring:-

The National Program for Coastal Water Monitoring has been started in 1998, to create a database for coastal water quality in Egypt and improve data quality through training staff of research institutes responsible about monitoring. DANIDA funded it until 2004 and due to the importance of sustaining this program, EEAA funded it since 2004 till now.
This program implemented four seasonal trips during (March - May - July and September) to monitor sea water quality, the following are measured:

1. Visual observation (oil spills, solid and hazardous waste.... etc.)
2. Hydrographic conditions, such as (temperature, dissolved oxygen, salinity, electrical conductivity, pH),
3. Bacterial count (Total coliform bacteria - Escherichia coli bacteria - Streptococcus bacteria), these bacteria live in the intestines and stomach of human and living organisms and their presence in water is an indicator for presence of sanitation pollution. Results are compared with European standards / 1988 and the Egyptian standards / 1996 which are as follows: -
    a. 500 cells / 100 ml for total Coliform bacteria.
    b. 100 cells / 100 ml for Escherichia coli bacteria.
    c. 100 cells / 100 ml for fecal streptococcus bacteria.
4. Hydro chemical variables (chlorophyll a, suspended matter, transparency), nutrients (total nitrogen, nitrate, nitrite, ammonia, active phosphorus, total phosphorus and active silicate).

All these variables are used as indicators through which we can predict the quality of coastal water and their affecting conditions during different times and locations, the following results were monitored during 2010:

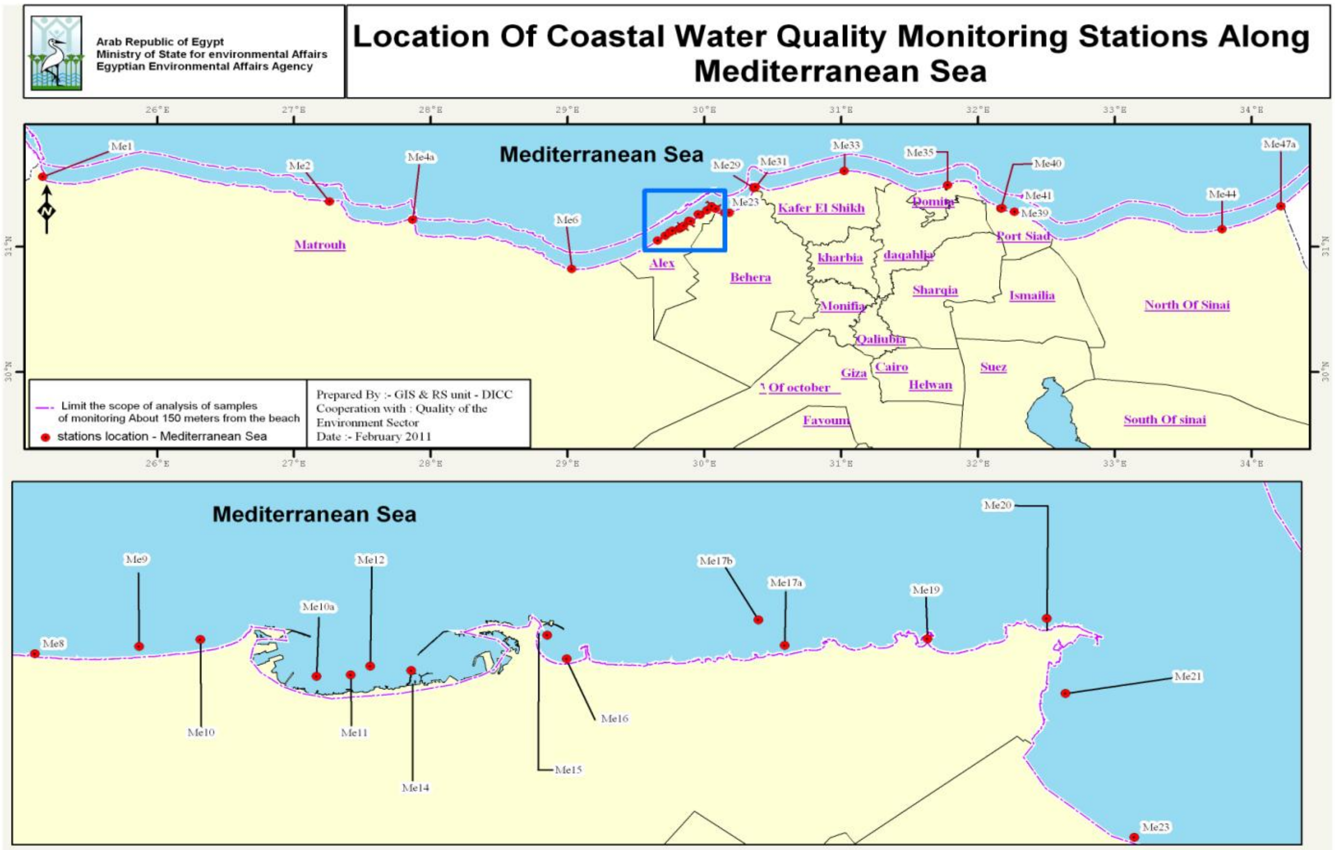
6-4-1 Water quality of the Mediterranean:

The monitoring program is conducting in each trip by taking samples from 30 site along the Mediterranean coast, covering all affecting activities in residential areas, ports, industrial companies and tourist villages, in addition to some reference stations, table (6-1) and map (6-1) clarify names of monitoring stations.

Table (6-1) Names and symbols of monitoring stations along the Mediterranean coast

Name	Symbol	Name	Symbol
Sallum	Me1	Sidi Gaber	Me17b
Mersa Matrouh	Me2	Montaza	Me19
Bagoush	Me4a	Abou Quir W.	Me20
Marina	Me6	Abou Quir E.	Me21
Sedi Kerir	Me7a	Electric station	Me23
Nobareia	Me8	Maadia	Me25
Hanoville	Me9	Rashid -1	Me29
El Bitach	Me10	Rashid -2	Me31
El Dikhelia	Me10a	El Burg	Me33
El Mex	Me11	Damietta	Me35
Alex. E. Harbor	Me12	El -Gamil W.	Me39
National Institute for Oceanography and Fisheries	Me14	El -Gamil E.	Me40
Eastern part of the E. Harbor	Me15	Port Said	Me41
Western part of the E. Harbor	Me16	El Arish	Me44
Shatby	Me17a	Rafah	Me47a

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute



Map (6-1) Locations of monitoring stations of Mediterranean water quality

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

Results of monitoring Mediterranean water quality were as follows:-

1. Physical Measurements :

a. Concentration of dissolved oxygen (DO) in all stations was higher than the minimum allowable limit for coastal water, internationally recognized (4 mg / L). It ranged between (4.2- 7.9 mg / L). Most of the values were higher than those of previous year. Figure (6-5) shows comparison between average concentrations during 2008 - 2010 along the Mediterranean coast.

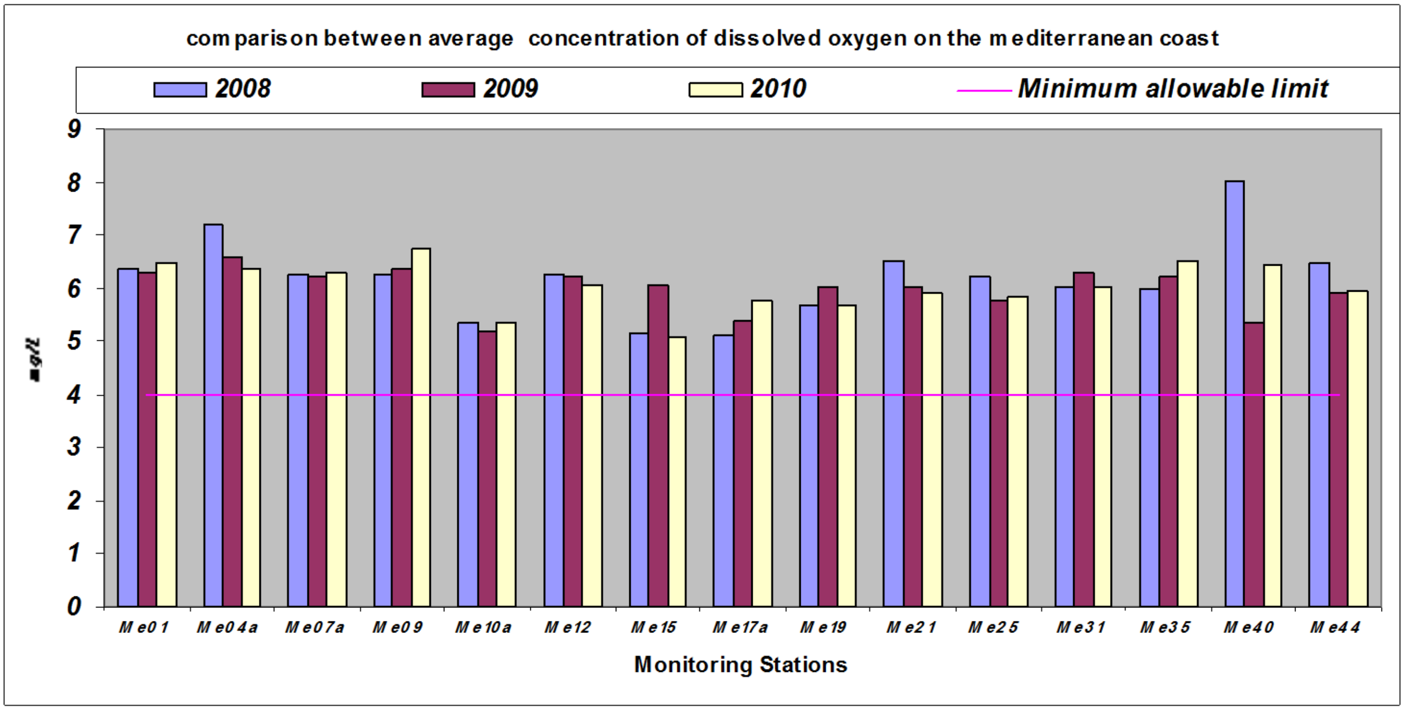


Figure (6-5) comparison between average concentrations of Dissolved Oxygen (DO) along Mediterranean coast during 2008-2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

b. Salinity values ranged between (28.15 - 39.28 g/l) during 2010.

c. The highest transparency of water recorded in the western sector extending from Sallum to Bitash west of Alexandria, while the lowest transparency was in the Delta and this because of its nature of being in front of the estuaries of the river.

d. PH values ranged between (6.3 - 7.2) which is natural due to the quality of sea water.

e. Temperatures ranged between (19.8 - 31) which is the natural limits of water in different seasons.

2. Chemical Measurements

a. Concentration of total nitrogen recorded gradual decrease during the four trips of this year, where the highest value was (0.29 mg / L) in Port Said station during May, and the lowest value was in Baghoush station (0.054 mg / L) during September. By comparing average concentration of total nitrogen, it was remarkable that there is gradual decrease in concentration during the period from 2007 to 2010 reached its maximum during 2010, as shown in Figure (6-6).

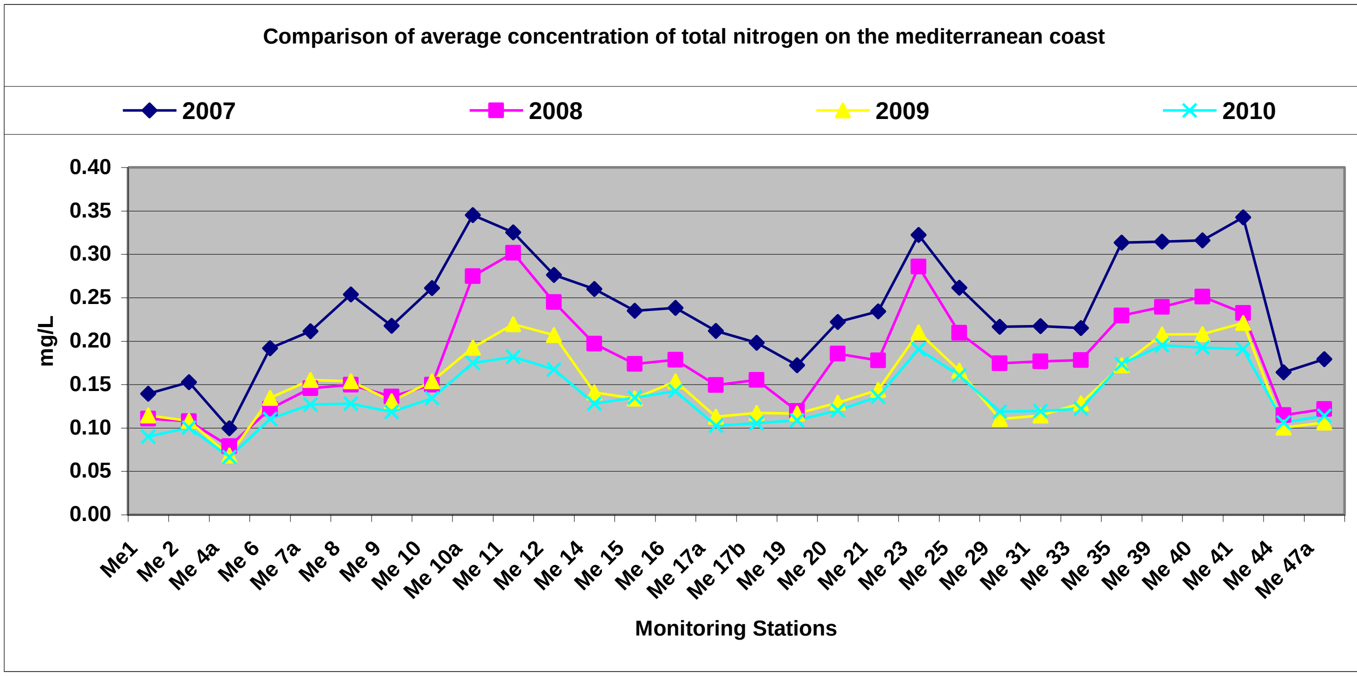


Figure (6-6) comparison between average concentrations of total nitrogen along the Mediterranean coast during 2007 - 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

b. Concentration of ammonia values was low, despite disparity of 2010 values ; it showed remarkable decreasing at the beginning and end of the year in most of the stations. The highest value was recorded at Port Said station (0.44 mg / L) and the lowest value at Baghoush station (0.003 mg / L); figure (6-7) clarifies this case.

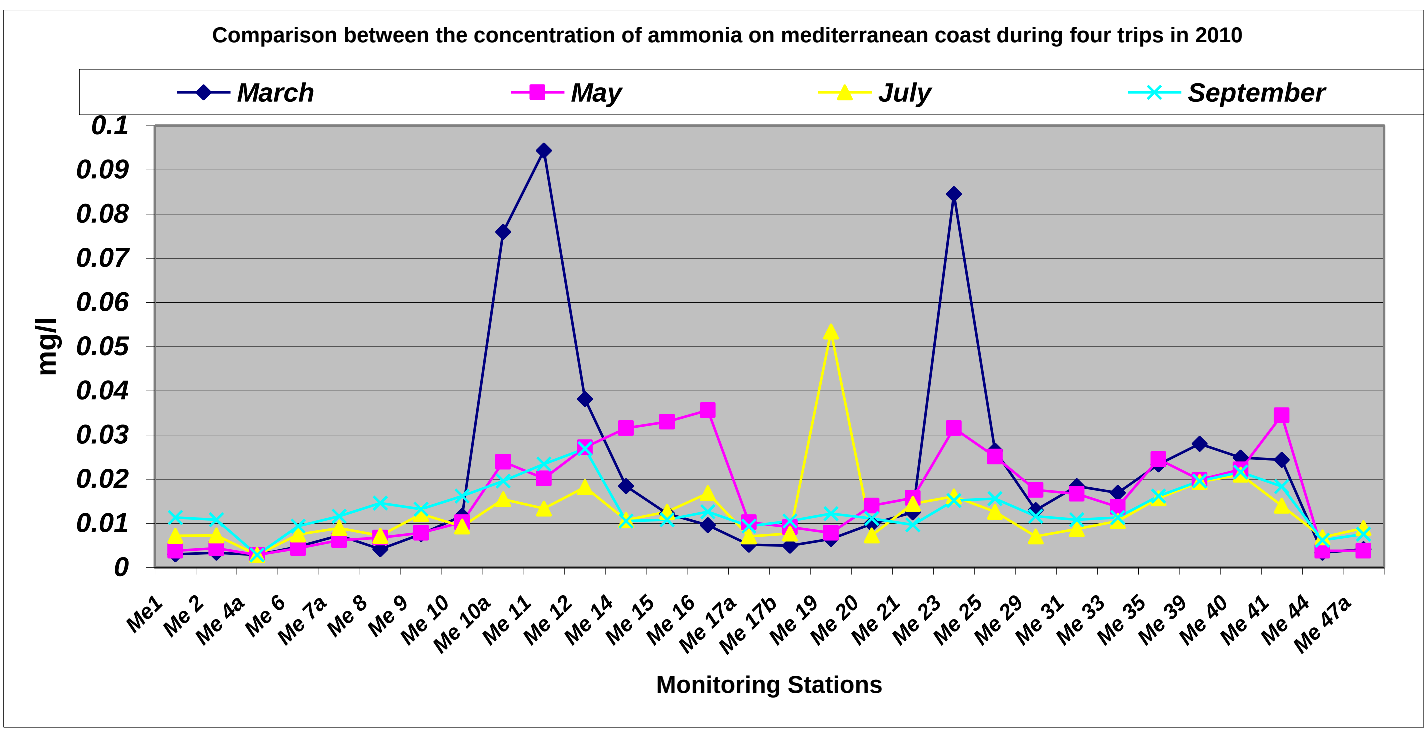


Figure (6-7) comparison between ammonia concentrations along Mediterranean coast during the four trips of 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

Figure (6-8) shows comparison between the average concentrations of ammonia during 2008 - 2010, where remarkable decrease was monitored during 2010 than previous two years in most of the monitoring stations.

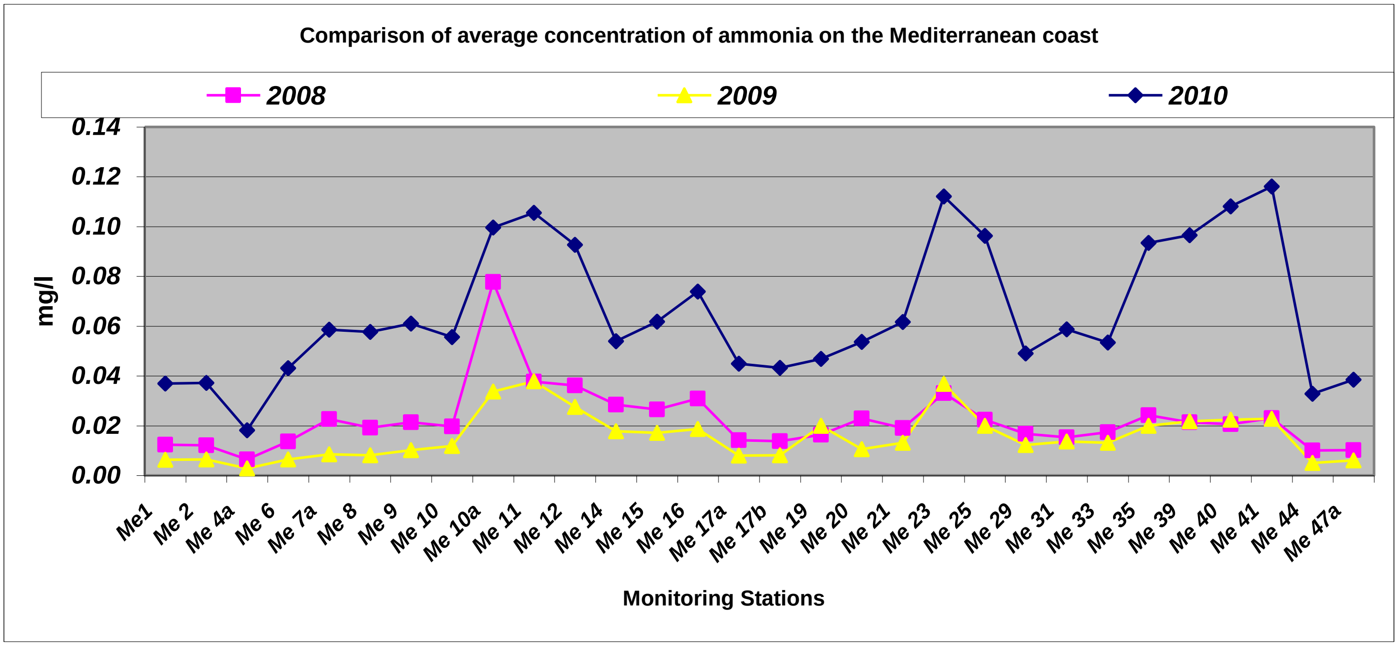


Figure (6-8) Comparison between ammonia concentrations along Mediterranean coast during 2008 – 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

c. Values of chlorophyll a are varied, where the lowest concentration was (0.23 micrograms / L) in Baghoush the reference area, and the highest value recorded in Port Said and West El- Gamil (15.05 - 13.03 micrograms / L), respectively, figure (6-9) clarifies 2010 values .

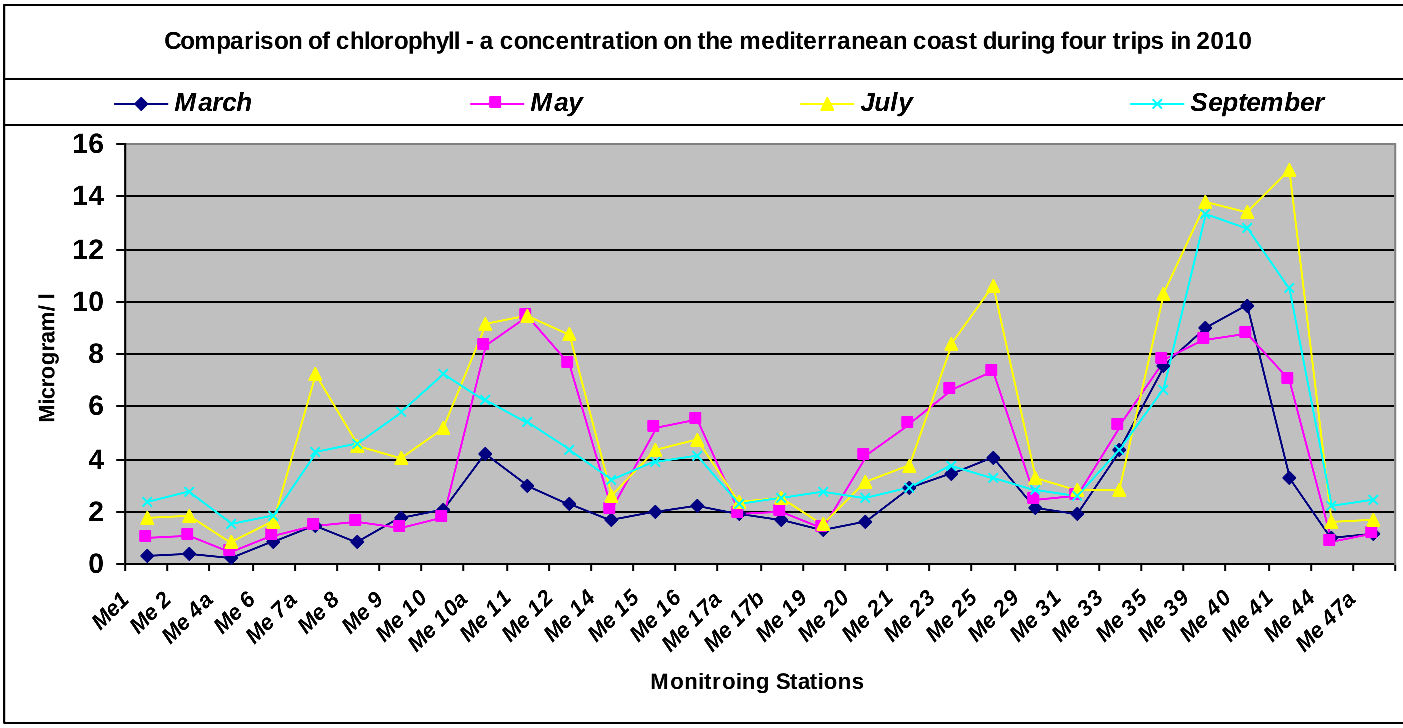


Figure (6-9) comparison between chlorophyll a along the Mediterranean coast during the four trips of 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

By comparing average concentration of chlorophyll a for 2010 with previous two years, remarkable decrease was clarified in 2010 concentrations in most locations, as shown in figure (6-10).

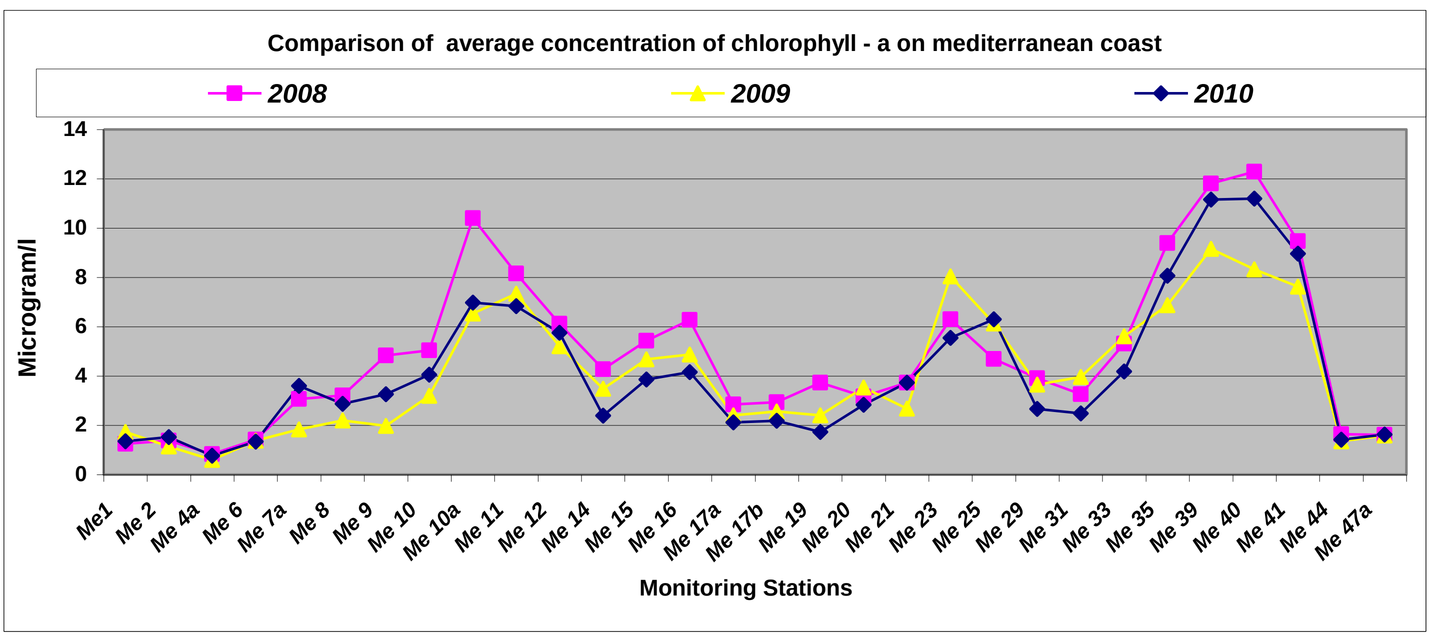


Figure (6-10) comparison between average concentrations of chlorophyll a along the Mediterranean coast during 2008 – 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

a. Concentration of nitrite was very low, where it recorded its highest value in the Eastern Harbor Station (0.03 mg / L) and the lowest value in Salloum station (0.001 mg / L).
b. Concentration of nitrate ranged between (0.007, 0.115 mg / L).
c. Concentration of total phosphorus was very low, ranged between (0.015, 0.078 mg/L); the highest concentration was in the Max station and lowest was in Baghoush reference station.

The above mentioned clarifies that concentration of nutrients during the monitoring trips of 2010 decreased in the most monitoring points, which is a sign of pollution reduction .

3. **Bacteriological Measurements.**

Results of bacterial count were good in most stations, which indicate nonexistence of fecal contamination in water, but it exceeded the limits at some monitoring locations (El-Dekhila, Mex, Western Port, and East of Abu Qir, Rashid, and El-Borg), this is due to sewage discharge in those areas.

Figures (6-11) and (6-12) show the bacterial count along the Mediterranean coast during 2010.

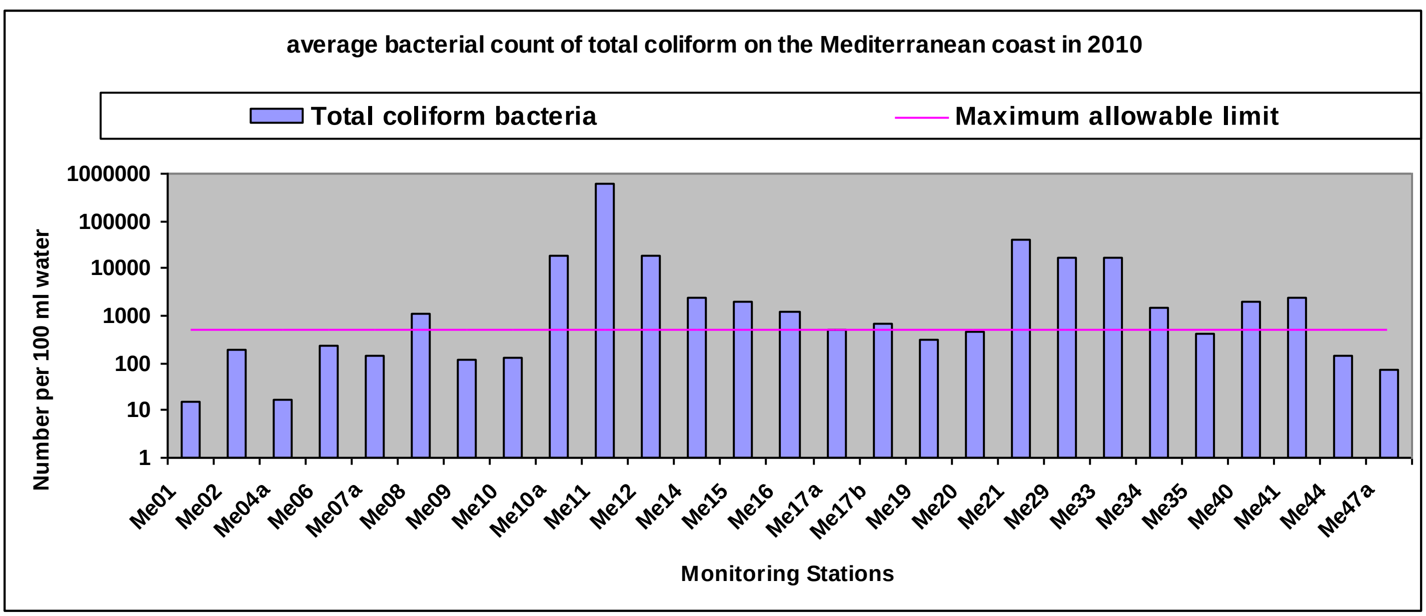


Figure (6-11) Average of bacterial counting for total coliform bacteria along Mediterranean coast during 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

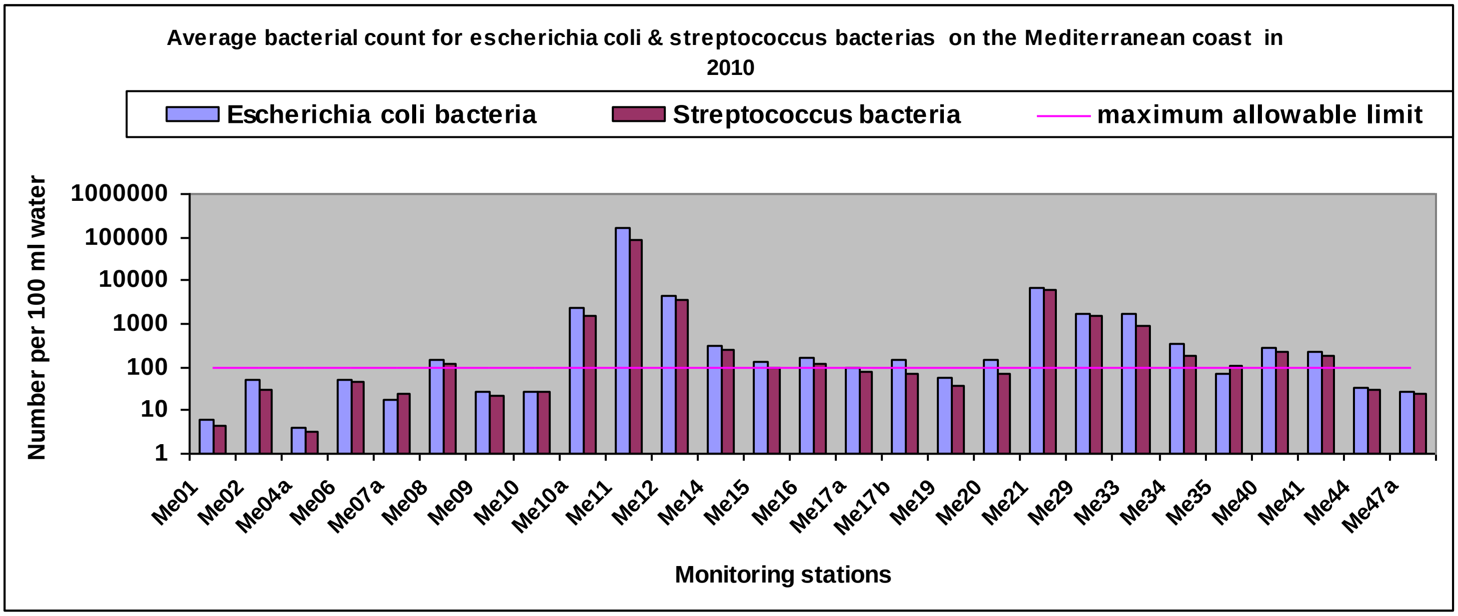


Figure (6-12) Average of bacterial counting for Escherichia coli and Streptococcus bacteria along Mediterranean coast during 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

In general results of different analysis have shown an improvement in water quality of the Mediterranean during 2010 compared to previous years, and this is a result of the exerted efforts through cooperation with relevant entities to intensify monitoring, inspection and implement compliance programs for industrial factories discharge directly or indirectly; as well as implementation of some pilot projects to improve water quality of Mediterranean lakes.

6-4-2 Red Sea and Gulfs of Suez and Aqaba water quality:-

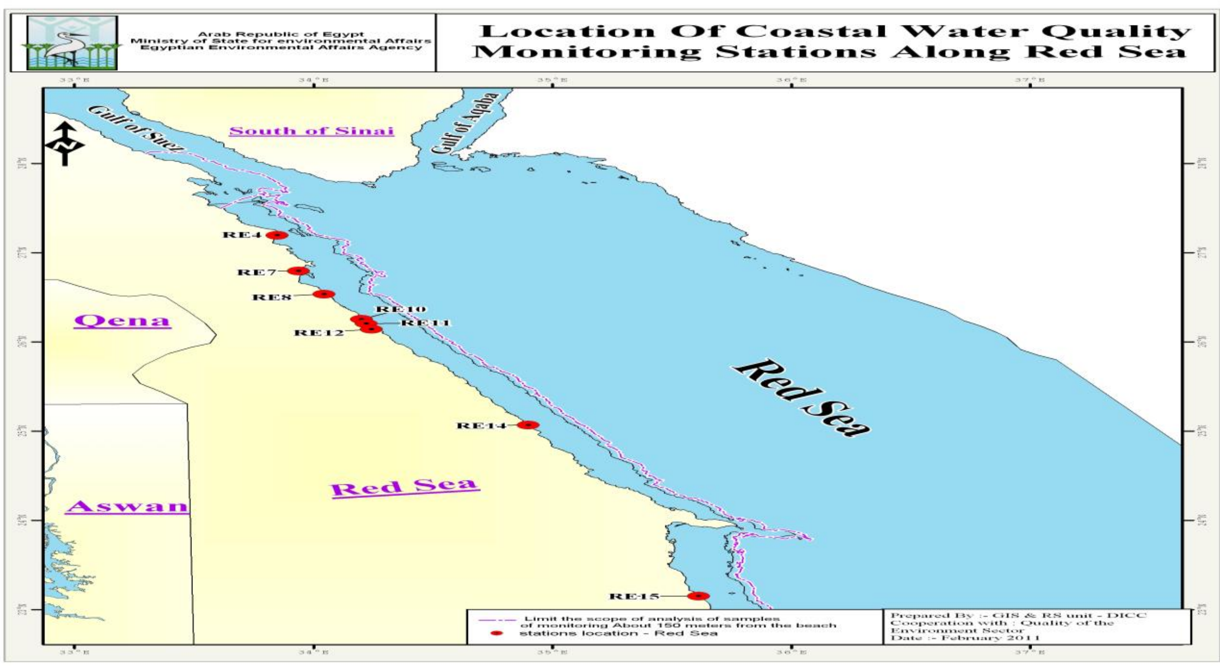
Four trips were conducted during 2010 to monitor water quality of the Red Sea , Gulfs of Suez and Aqaba on a seasonal basis in 22 monitoring stations covering all kind of activities distributed as follows : 8 stations on the Red Sea coast , 8 stations on the Gulf of Suez and 6 stations on the Gulf of Aqaba. Table (6-2) and the two maps (6-2, 6-3) clarify names and locations of these stations.

Table (6-2) Names and symbols of monitoring stations of the coasts of the Red Sea and Gulfs of Suez and Aqaba

Name (Suez Gulf)	Symbol	Name (Red Sea)	Symbol	Name (AqabaGulf)	Symbol
Suez – South of Suez Canal (Port Tawfiq)	SU1	Hurghada-in front of Sheraton hotel	RE4	Sharm El Sheik (Ras Mohamed)	AQ1
Suez- in front of NIOF	SU2	Safaga - North Coast of the city	RE7	Entrance of Sharm El Sheik Harbor	AQ2
In the area of the	SU3	Safaga - In front	RE8	Inside Sharm	AQ3

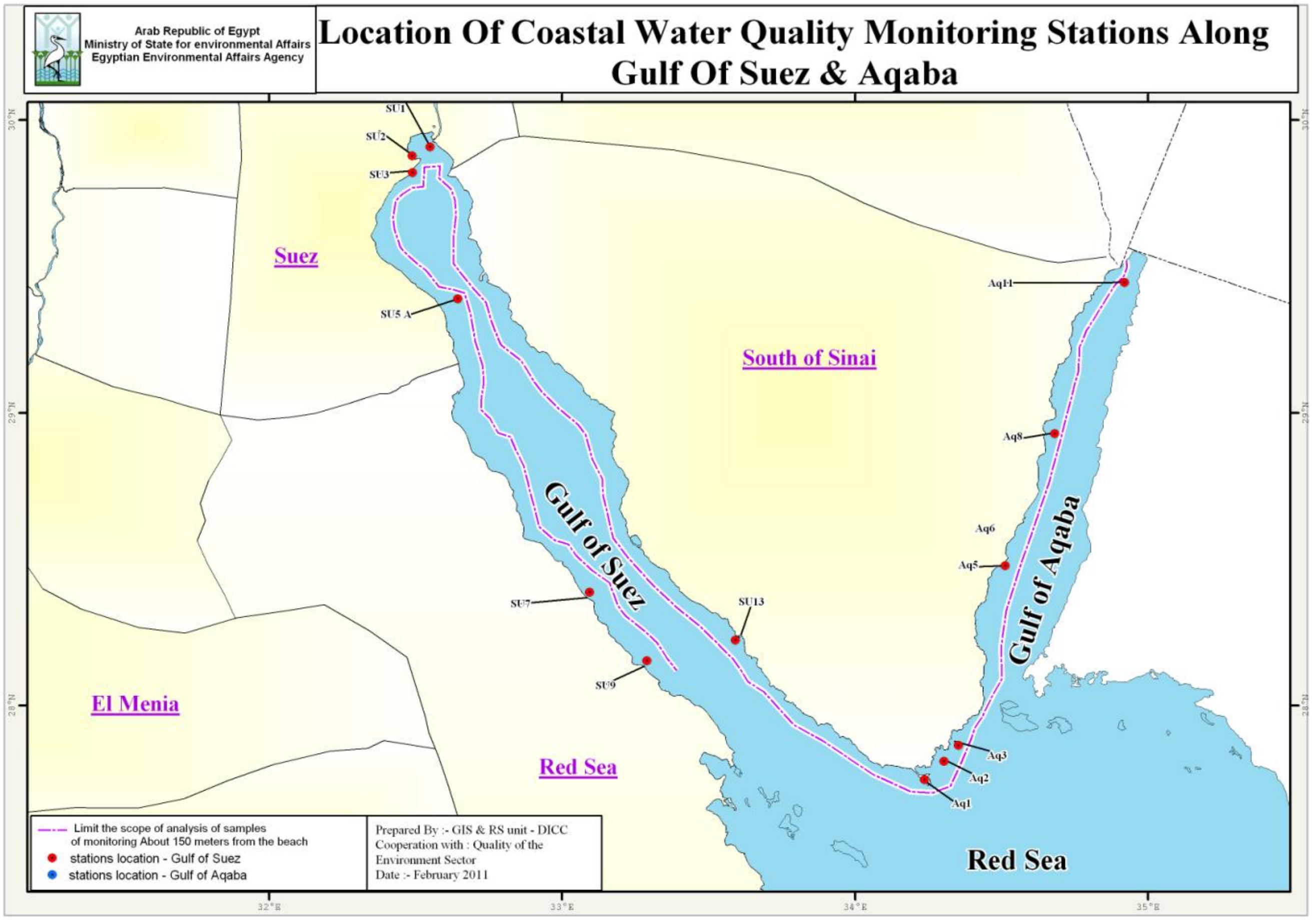
fishing port (Ataka)		of the Red Sea Phosphate Co.		El-Sheikh Harbor	
Ain Sukhna Harbor	SU5-a	El Hamrawein - North harbor	RE10	Nakhlit Eltal- in the protected area	AQ5
Ain Sukhna	SU5	Quseir – In front of phosphate mining area	RE11	Ras Nubar- ouside the tidal zone	AQ8
Ras Gharib - South of the city (oil fields)	SU7	Quseir – In front of the phosphate harbor	RE12	Nuweiba (Miklap harbor) in the protected area	AQ11
Ras Shukeir- in front of harbor	SU9	Marsa Alam - In front of the harbor outside the tidal zone	RE14		
El Tur - The public beach of the city outside the tidal zone	SU13	Bir Shalatin – In front of the fishing port	RE15		

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute



Map (6-2) locations of water quality monitoring stations in the Red Sea

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute



Map (6-3) location of water quality monitoring stations in Gulfs of Suez & Aqaba

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

Monitoring results of water quality during March, May, July and September / 2010 in the Red Sea, Gulfs of Suez and Aqaba indicated the following:

6-4-2-1 Water quality of the Red Sea coast:

1- Physical Measurements:

a. Concentration of dissolved oxygen (DO) was higher than the minimum allowable limit (4 mg / L) in all monitoring stations, recording its highest value (7.8 mg / L) in (RE4) station during March, and its lowest value (5.8 mg / l) in (RE15) station during May. This decrease may be due to the fishing activities in the region. Figure (6-13) shows concentrations of dissolved oxygen through various stations during 2010.

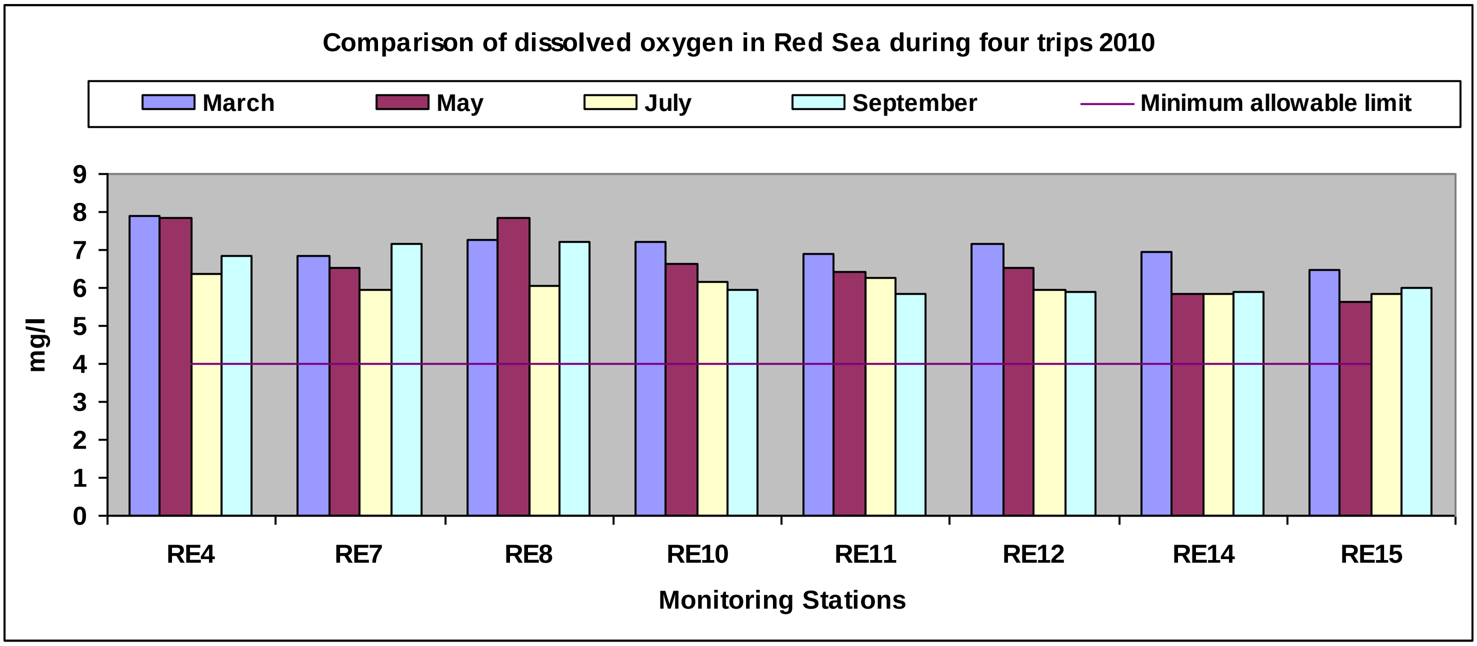


Figure (6-13) Comparison between dissolved oxygen along the Red Sea coast during the four trips of 2010
Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

b. No thermal pollution exists, where temperatures ranged between (19.8 - 35.2), which is the normal levels in various coastal areas during seasons of the year.
c. Minor changes were recorded in the salinity, ranged between (39.4 - 43.7 g / l).
d. PH values ranged between (8.1 - 8.2), taking in consideration the general level of each region.

The above mentioned clarifies that various physical measurements were at their normal levels and the impact of pollutants caused by discharging or human activities in the Red Sea is still limited.

2- Chemical Measurements

a. Total nitrogen concentration recorded general average (0.92 mg / l). Figure (6-14) shows significant decrease in the concentration of total nitrogen during July, this is due to the decreased activities of ports locating along the coast during that period.

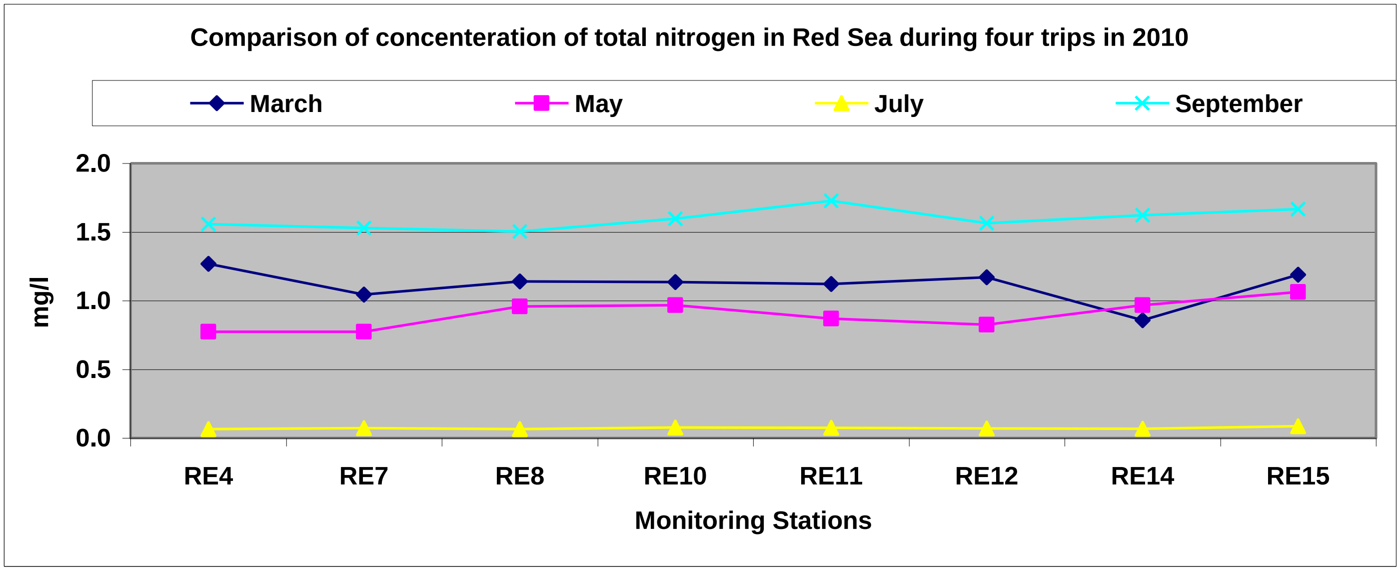


Figure (6-14) comparison between concentrations of total nitrogen along the Red Sea coast during the four trips of 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

b. Concentration of ammonia during 2010 ranged between (0.0004- 0.02 mg / L) and by comparing the average concentration of 2010 with previous year. Significant remarkable decrease was recorded due to the taken actions to reduce discharge of land-based sources. Figure (6-15) clarifies comparison between average concentrations along the Red Sea coast during 2009 - 2010.

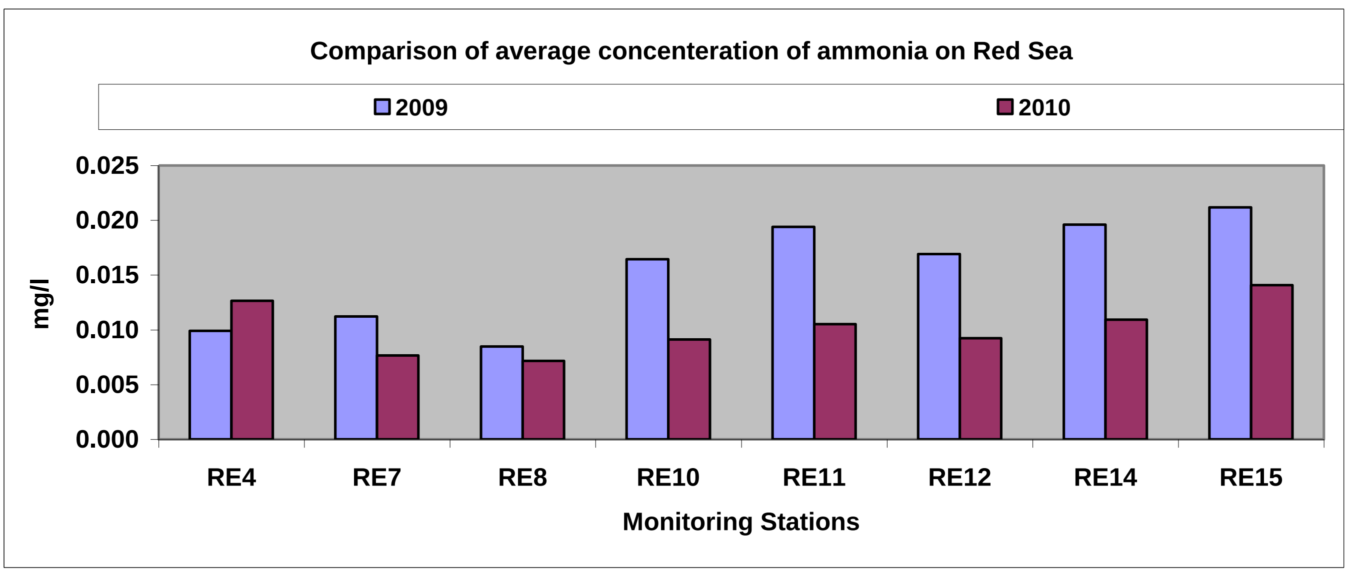


Figure (6-15) comparison between average concentrations of ammonia along the Red Sea coast during 2009 -2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

c. Chlorophyll a which exists as an essential component in the phytoplankton، during 2010 recorded low concentrations than previous year in most stations. This is considered natural result for the decreased concentrations of nutrients in water, as previously explained. Values have been ranged between (0.04 - 1.52

micrograms / L), figure (6-16) shows comparison between the average concentrations of chlorophyll a during 2009 - 2010.

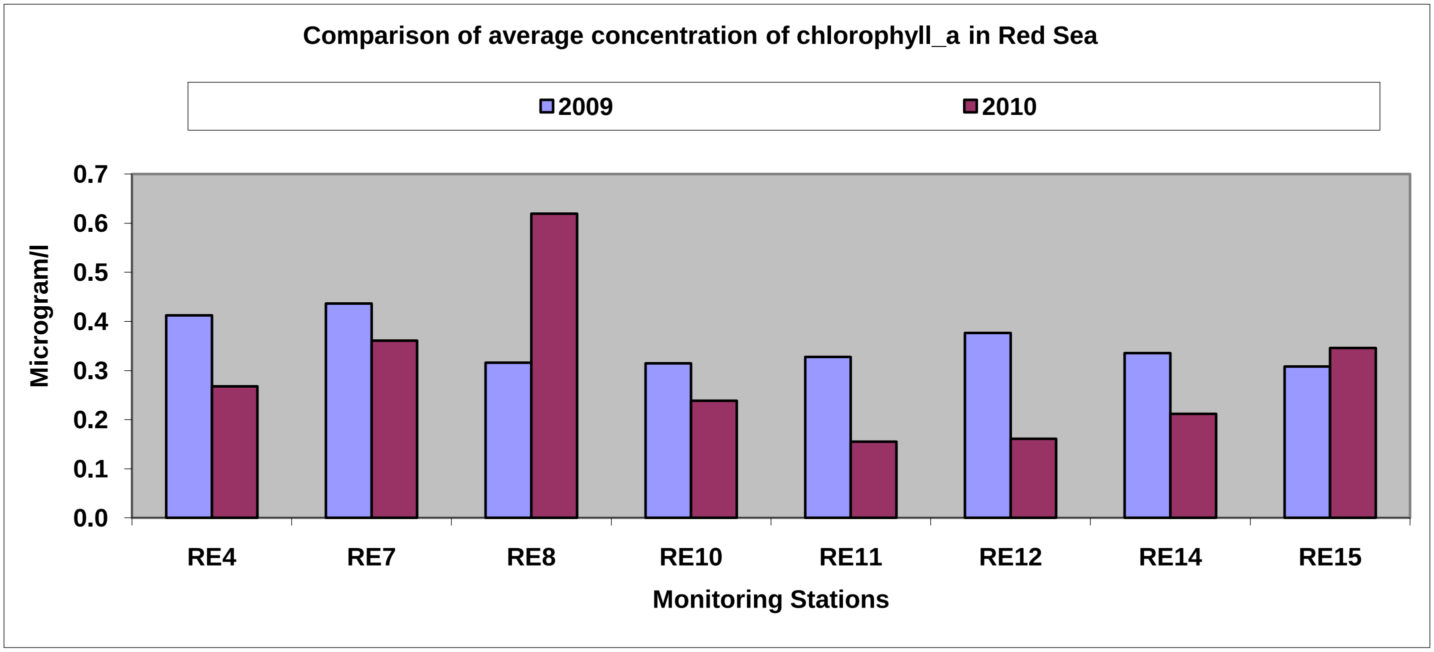


Figure (6-16) comparison between average concentrations of chlorophyll a along the Red Sea coast during 2009 -2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

Variation was recorded in the concentration of total phosphorus from one station to another, where its highest value was (0.116 mg / L) in the (Re10) station during March. The average concentration was less than of the previous year in most of the monitoring stations, as shown in figure (6-17).

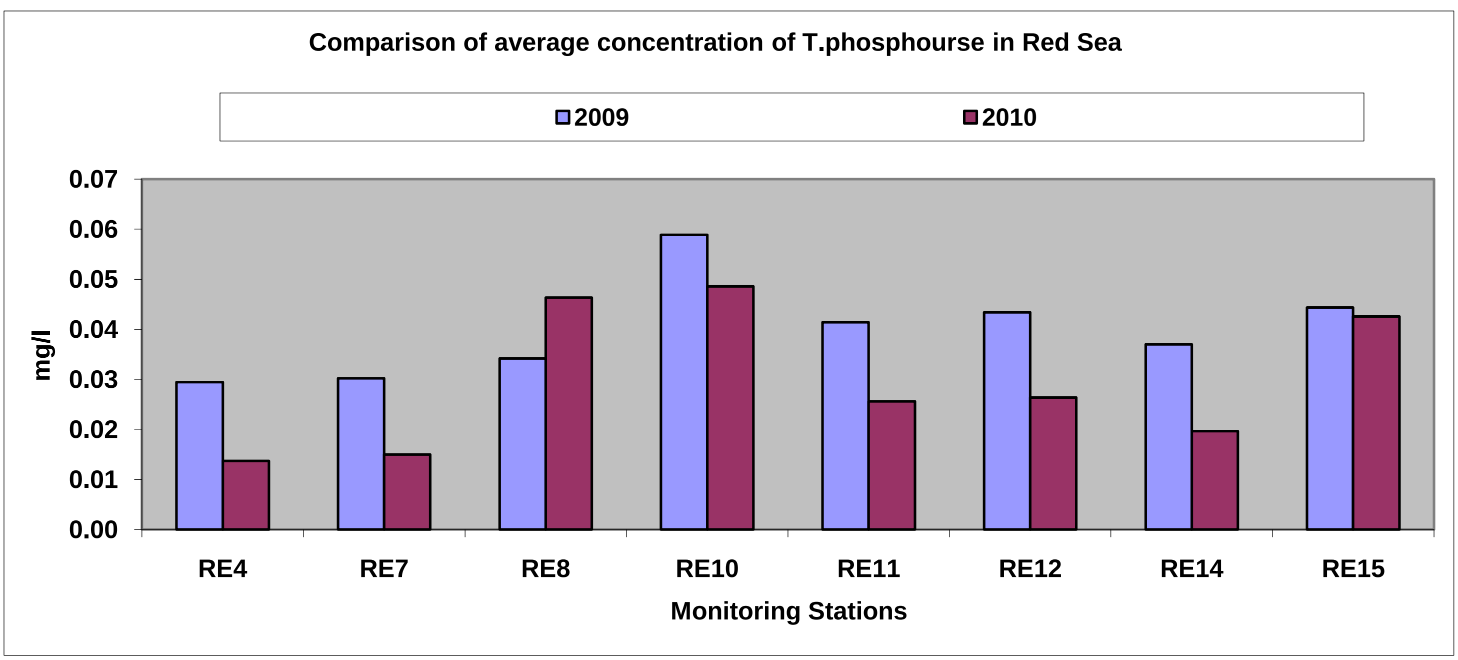


Figure (6-17) comparison between average concentrations of total phosphorus along the Red Sea coast during 2009- 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

3-Bacteriological Measurements

All values of bacterial count ranged between the permissible limits during most seasons of the yea. Although slight increase was recorded in the bacterial count during July in station (Re15), which may be due to the unplanned fishing and the presence of large numbers of primitive boats and the growing number of summer visitors during this time. Figure (6-18) shows the bacterial count for total coliform bacteria and figure (6-19) shows bacterial count for E-coli and streptococcus bacteria.

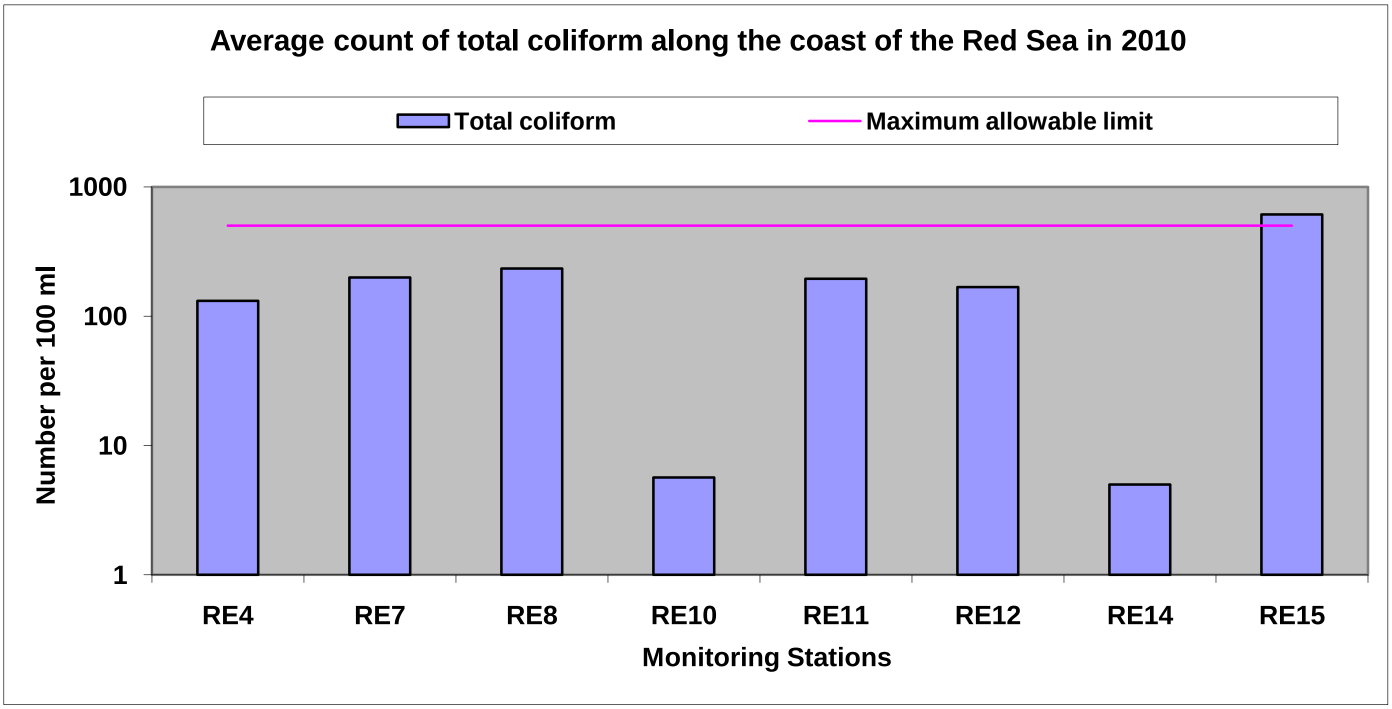


Figure (6-18) average bacterial count for total coliform bacteria along the Red sea coast during 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

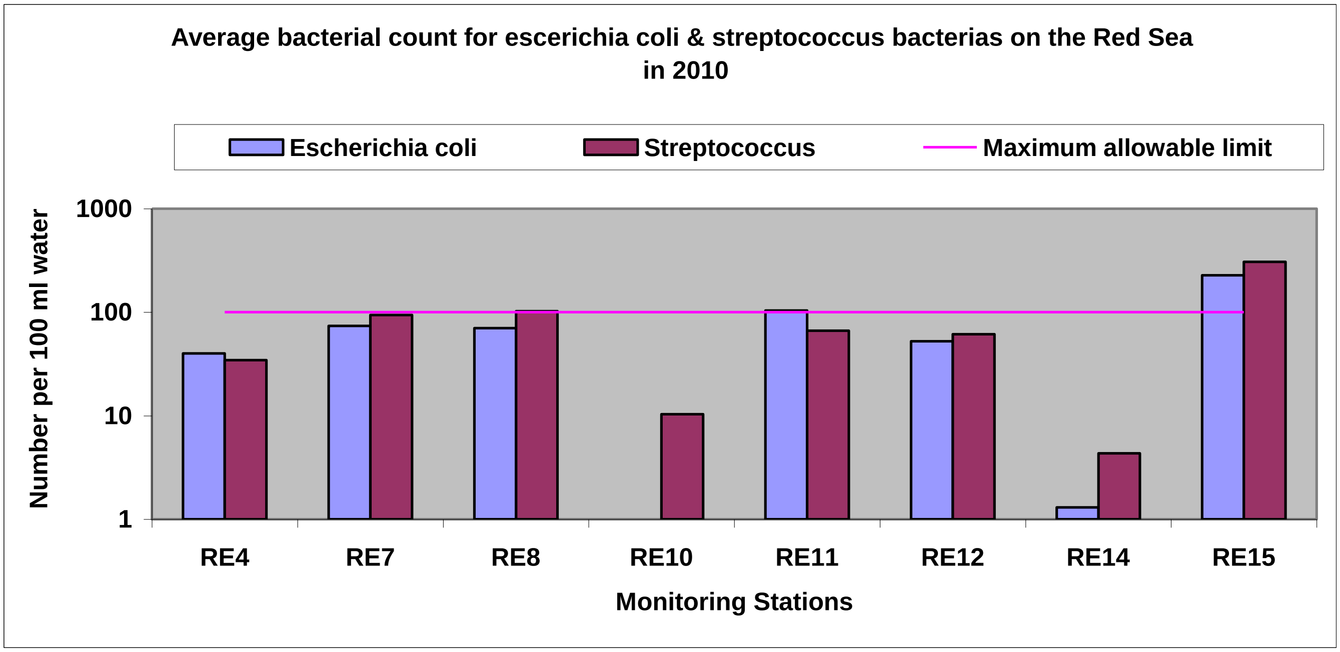


Figure (6-19) Average bacterial count for Escherichia coli & streptococcus bacteria along the Red sea coast during 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

6-4-2-2Water quality of the Suez Gulf coast:

1. Physical Measurements:

a. Concentration of dissolved oxygen (DO) is higher than the minimum allowable limit; the highest value recorded (9.8 mg / L) at (SU3) station during March and the lowest value (4.4 mg / L at (SU7) station during September, which is still higher than the allowable limit. Figure (6-20) shows comparison between concentrations of dissolved oxygen during different seasons of 2010.

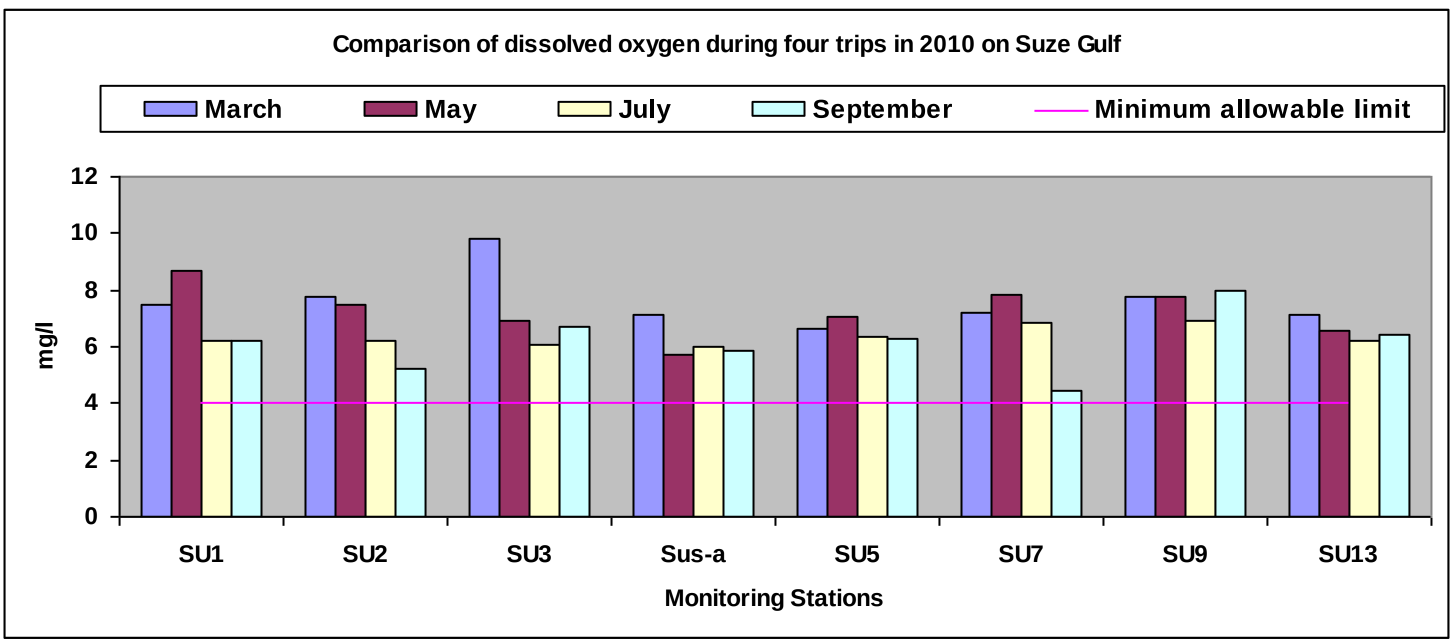


Figure (6-20) comparison between dissolved oxygen along Suze Gulf during the four trips of 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

b. Temperature was within the normal level of coastal water during seasons of the year.
c. Salinity ranged between (39.5 - 42.3 g/l), referring to water natural levels in the region.

2. Chemical Measurements

a. Concentration of total nitrogen was low at all stations during July, which indicates decrease of activities during this time, the lowest value was (0.09 mg / L) at (SU9) station ; the concentration increased relatively in the northern part of the Gulf at (Su1) and (Su3) stations , this is due to exposure of these areas to industrial and sewage discharge. While there was remarkable increase in the concentration (7.5 mg / L) at (SU2) station. Figure (6-21) shows these concentrations during 2010.

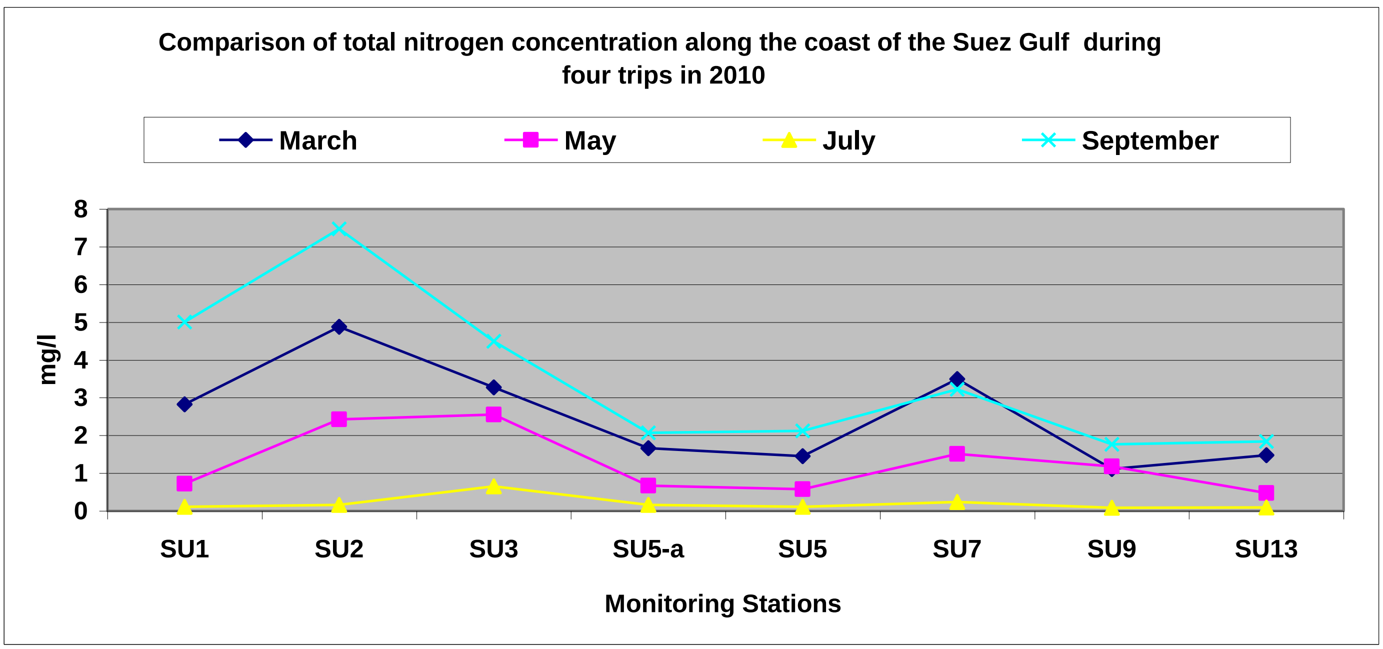


Figure (6-21) comparison between concentrations of total nitrogen along Suez Gulf during the four trips of 2010
Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

b. Results of ammonia concentrations recorded significant decrease in comparison with previous year; this is due to exerted efforts by relevant entities to reduce water discharge on the Suez Gulf. Figure (6-22) shows comparison between the average concentrations of ammonia along the coast of the Suez Gulf during 2009 – 2010.

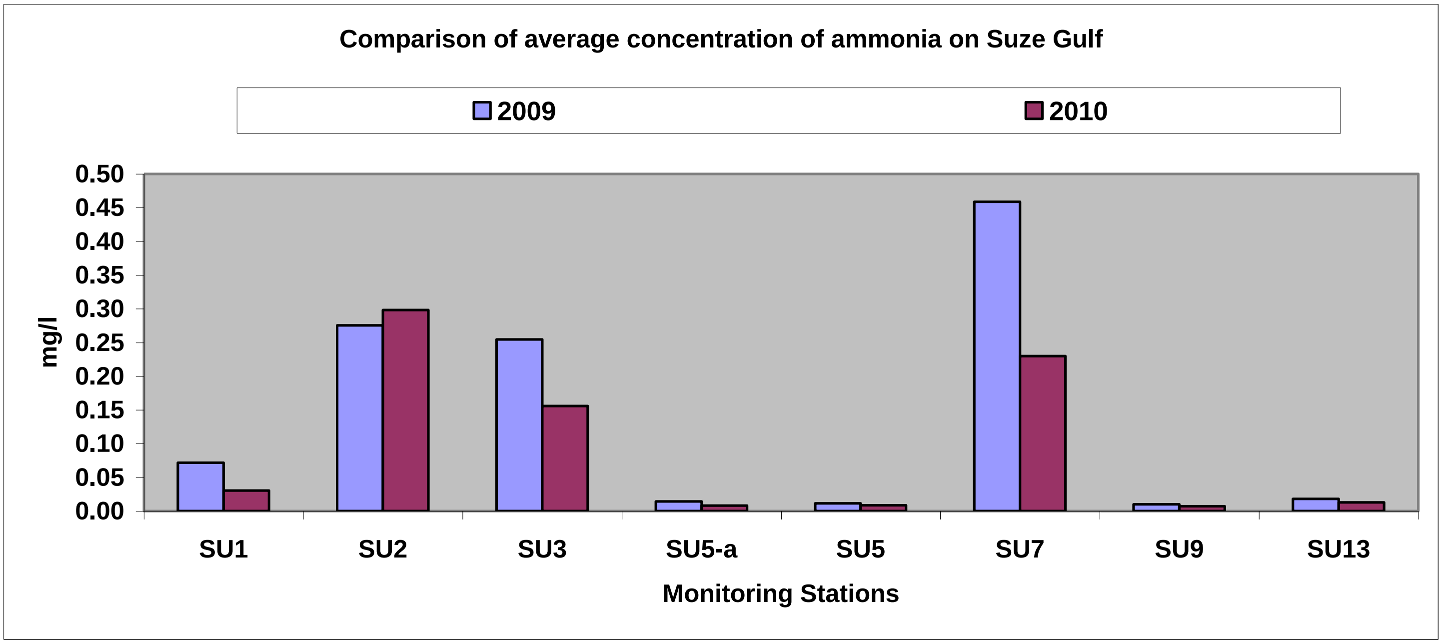


Figure (6-22) comparison between average concentrations of ammonia along Suez Gulf during 2009 - 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

c. Results of Chlorophyll_a values showed decrease in monitoring areas along Suez Gulf coast except the fishing port in (Su3) station, which recorded a significant increase, which may be due to sewage and industrial discharge. Values ranged between (0.12 - 3.5 micrograms / liter). Figure (6-23) shows comparison between concentrations of chlorophyll a in the Suez Gulf during 2010.

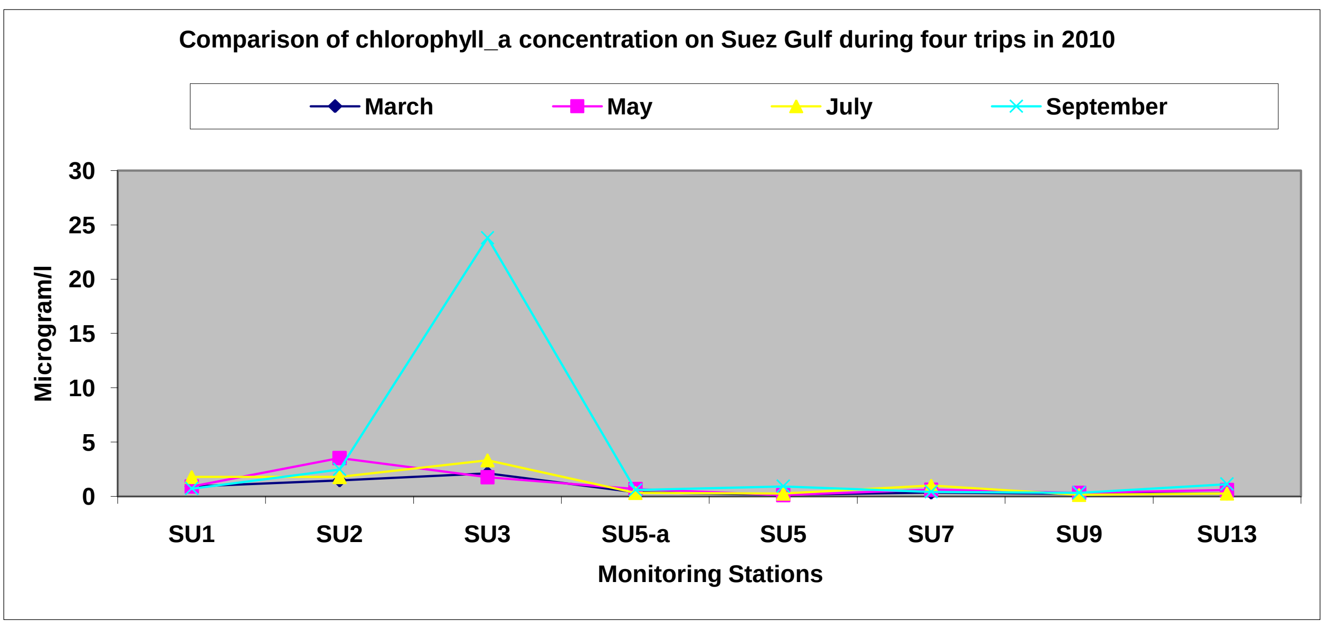


Figure (6-23) comparison between concentrations of chlorophyll a along Suez Gulf during the four trips of 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

d. Results of total phosphate were low than previous year in all monitoring stations of Suez Gulf with the exception of (SU9) station, which recorded slight increase from previous year which may be due to the activities of phosphate port in the region. Figure (6-24) shows comparison between average concentrations during 2009 - 2010.

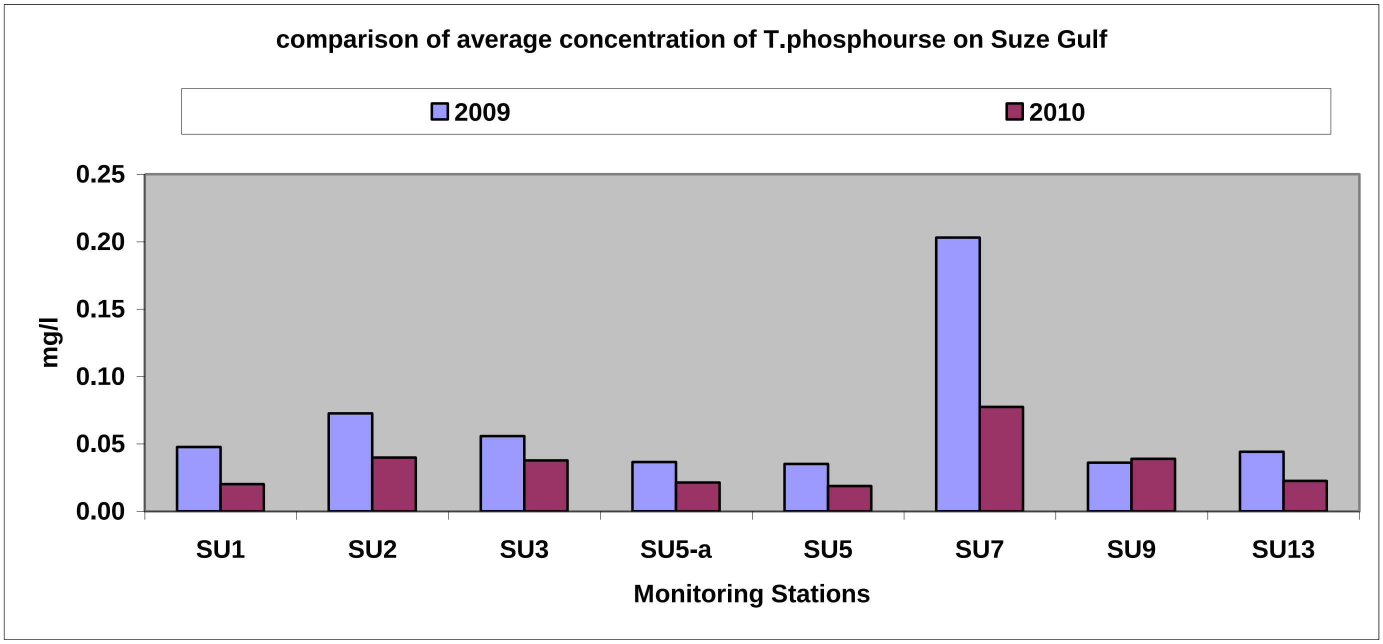


Figure (6-24) comparison between average concentrations of total phosphorus along Suez Gulf during 2009 -2010
Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

In general, all regions of the Suez Gulf recorded low concentrations of nutrients with the exception of the northern region; which is rich with nutrients.

3. Bacteriological Measurements

Monitoring results of 2010 were less than the permissible limits in all stations along Suez Gulf, except (SU7) station. Figure (6-25) shows comparison between the average bacterial counts for the total coliform bacteria along the coast of Suez Gulf.

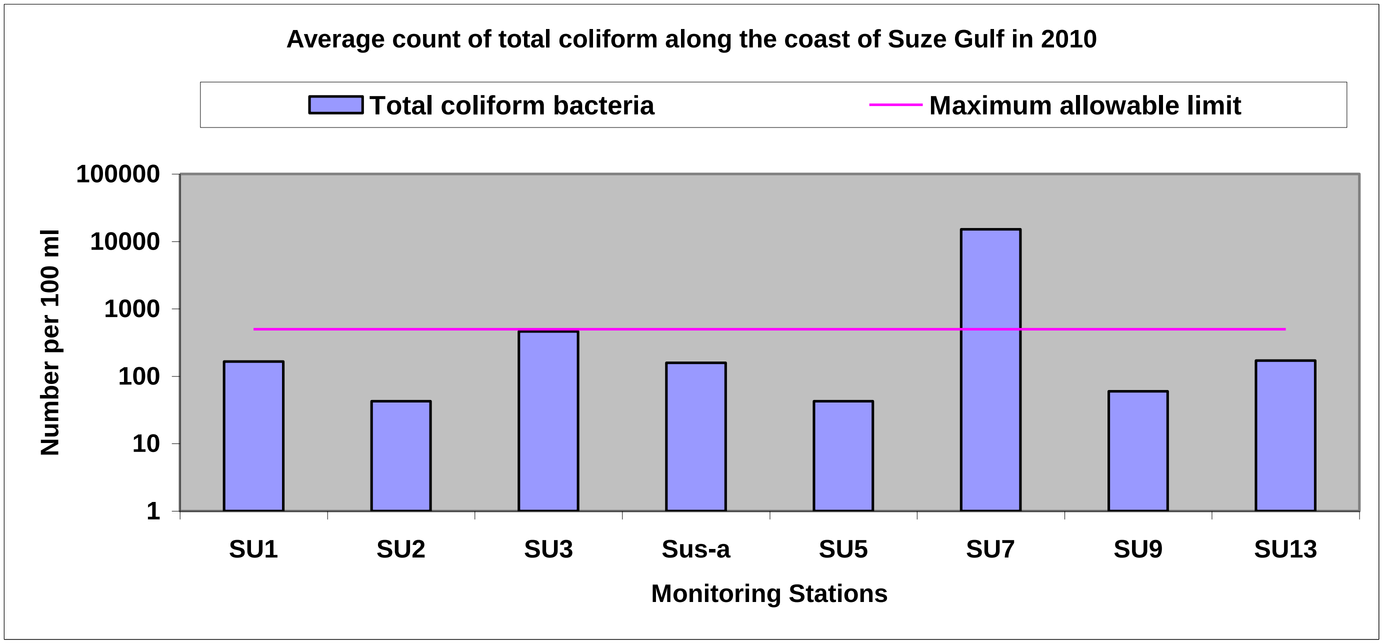


Figure (6-25) average bacterial counts of total coliform bacteria along Suez Gulf during 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

6-4-2-3Water quality of the Aqaba Gulf coast

1. Physical Measurements:

a. Concentration of dissolved oxygen (DO) was higher than the minimum allowable limit, its highest value recorded (7.4 mg / L) during May at (Aq8) station and the lowest value (5.6 mg / L) during July at (Aq2) station, this decrease may be due to the growing tourism activities during this time of the year. Figure (6-26) shows comparison between the concentrations of (DO) during the four trips of 2010.

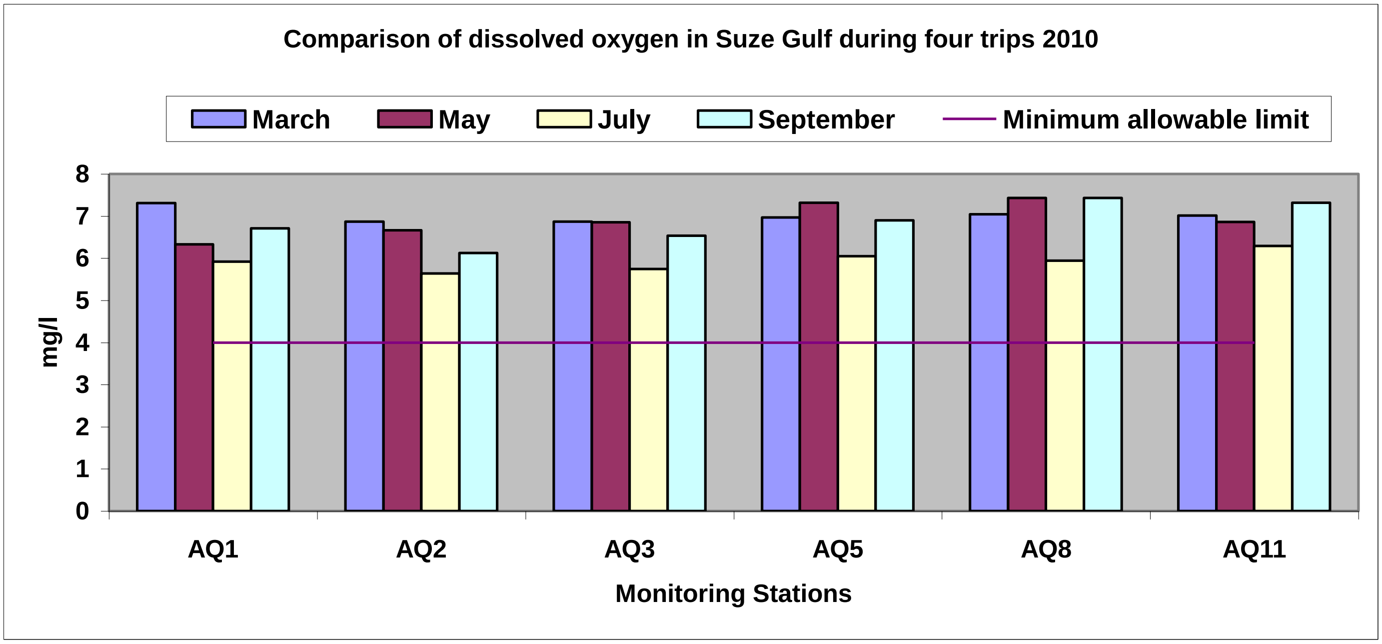


Figure (6-26) concentration of dissolved oxygen along Aqaba Gulf during the four trips of 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

b. No thermal pollution recorded in the Aqaba Gulf, maximum temperature was recorded during July.
c. The pH was within the normal range during the year.
d. Salinity values ranged between (38.24 - 59.91 g / l).

2. Chemical Measurements

a. Concentration of total nitrogen ranged between (0.07 - 3.04 mg / L). Figure (6-27) shows comparison between the total concentrations of nitrogen in the Gulf of Aqaba during 2010.

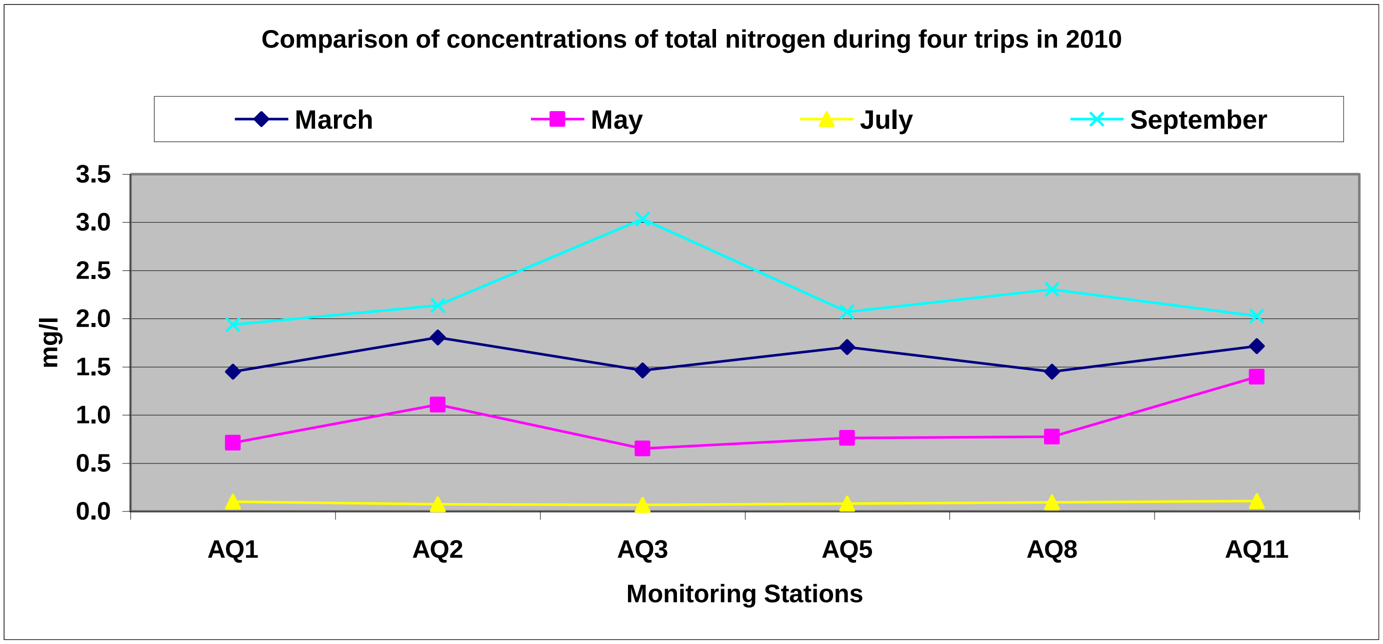


Figure (6-27) comparison between concentrations of total nitrogen along Aqaba Gulf during the four trips of 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

b. Ammonia concentrations recorded remarkable decrease in all monitoring stations along Aqaba Gulf coast, values ranged between (0.001 - 0.043 mg / L) as a result of the decrease of affecting external activities. Figure (6-28) shows comparison between the average concentrations of ammonia along the coast during 2009 - 2010.

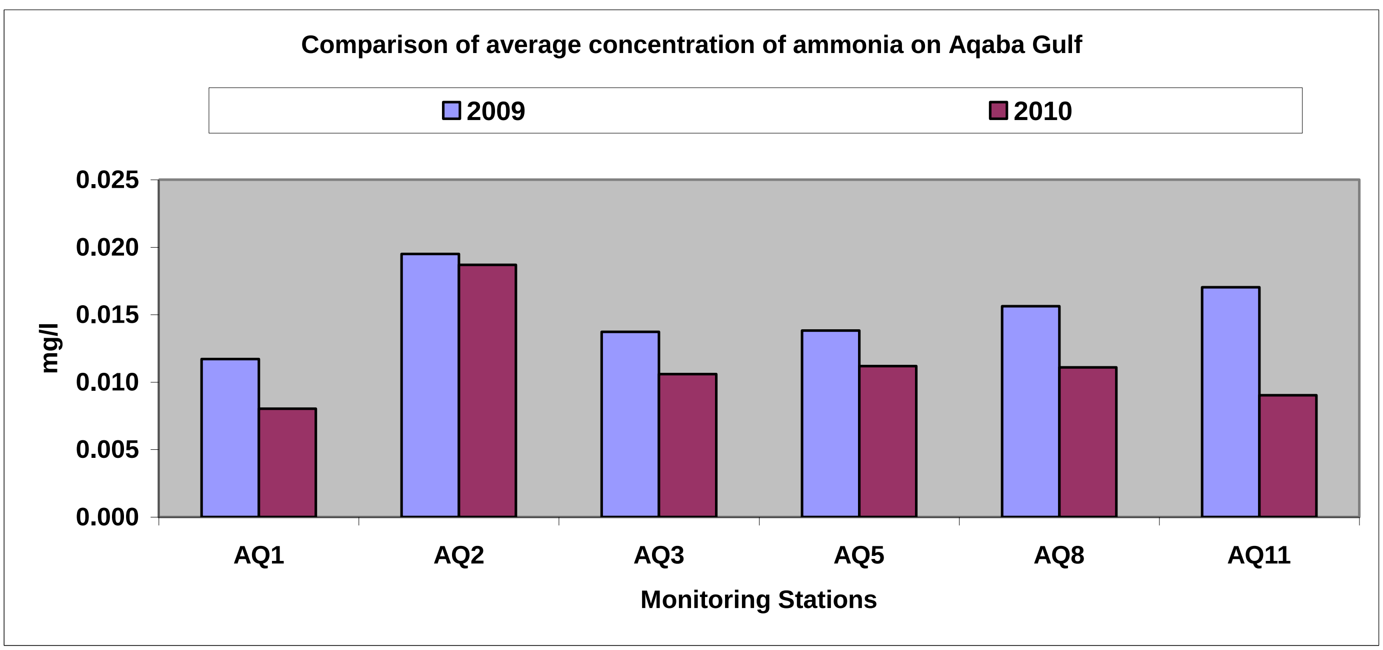


Figure (6-28) Comparison between ammonia concentrations along Aqaba Gulf coast, during 2009-2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

c. Results of chlorophyll a values in all monitoring stations were low compared to the previous year; this has been accompanied with decrease in concentration of suspended solids (22.1 mg / L) and increase in the transparency of water column (6 meters). But an increase was recorded in the concentration at AQ3 station, which may be due to the increase in the development activities in that region. Figure (6-29) shows comparison between the average concentrations of chlorophyll a during 2009-2010 .

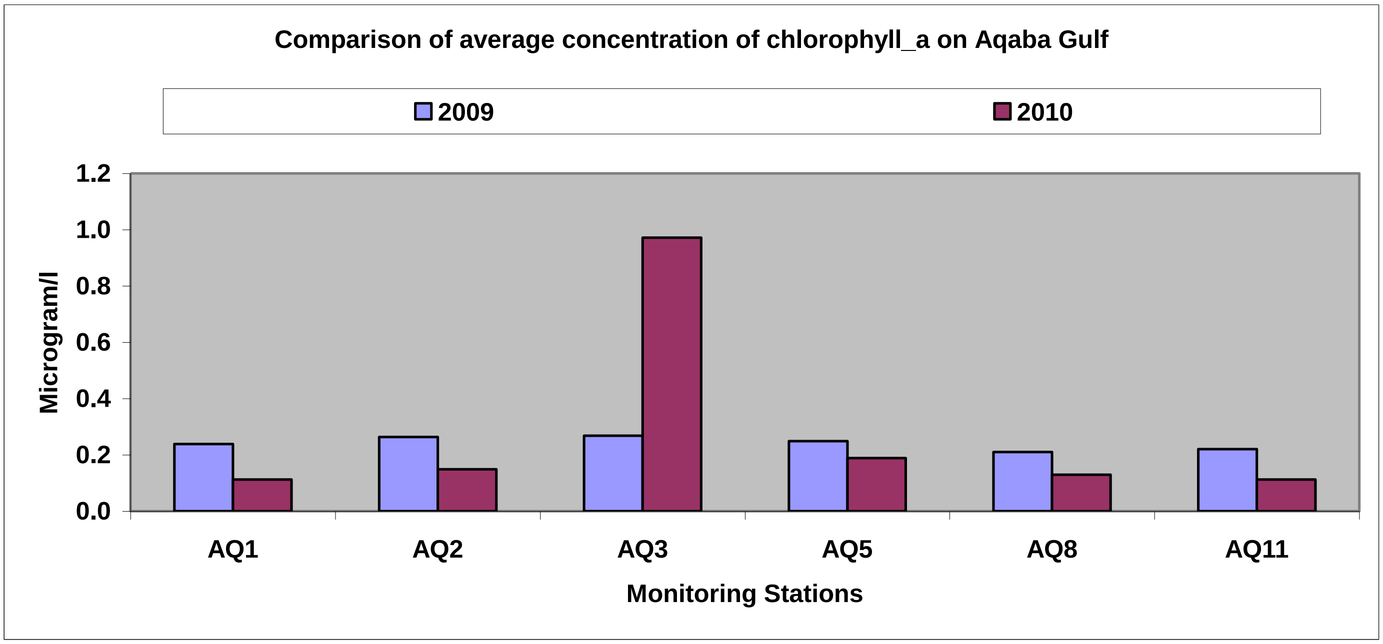


Figure (6-29) comparison between average concentrations of chlorophyll a along Aqaba Gulf during 2009-2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

d. Average concentration of total phosphate showed clear decrease from the previous year, due to the exerted efforts to reduce sources of pollution in the Aqaba Gulf. Figure (6-30) Shows comparison between average concentration of total phosphorus during 2009 - 2010

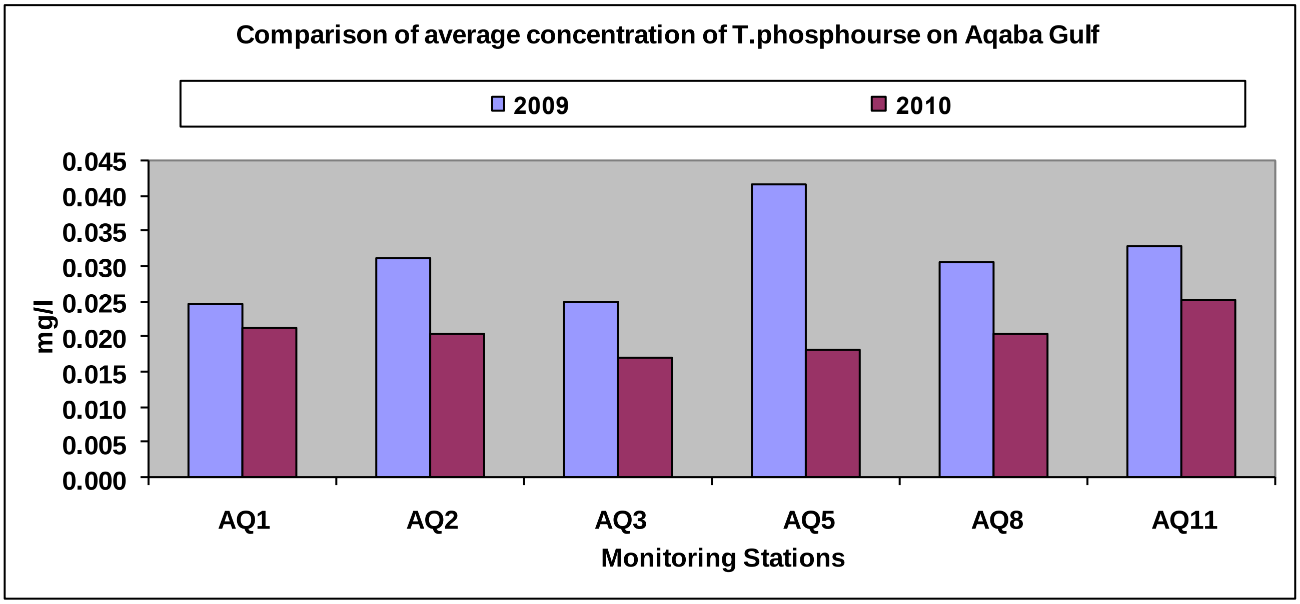


Figure (6-30) comparison between average concentrations of total phosphorus along Aqaba Gulf during 2009 – 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

3. Bacteriological Measurements

Results of bacterial counting was less than the allowable limits, which indicates non-existence of bacterial pollution in all stations (areas of natural protectorates), except the two stations of (Aq2 and Aq11) , where they recorded numbers of bacteria more than the allowable limit for each of E-Coli & streptococcus bacteria . This is due to the tourist activity and increasing numbers of diving boats and divers. Figures (6-31) and (6-32) show the average counting for each of the total coliform, E-Coli bacteria and streptococcus bacteria along the coast of the Aqaba Gulf in 2010.

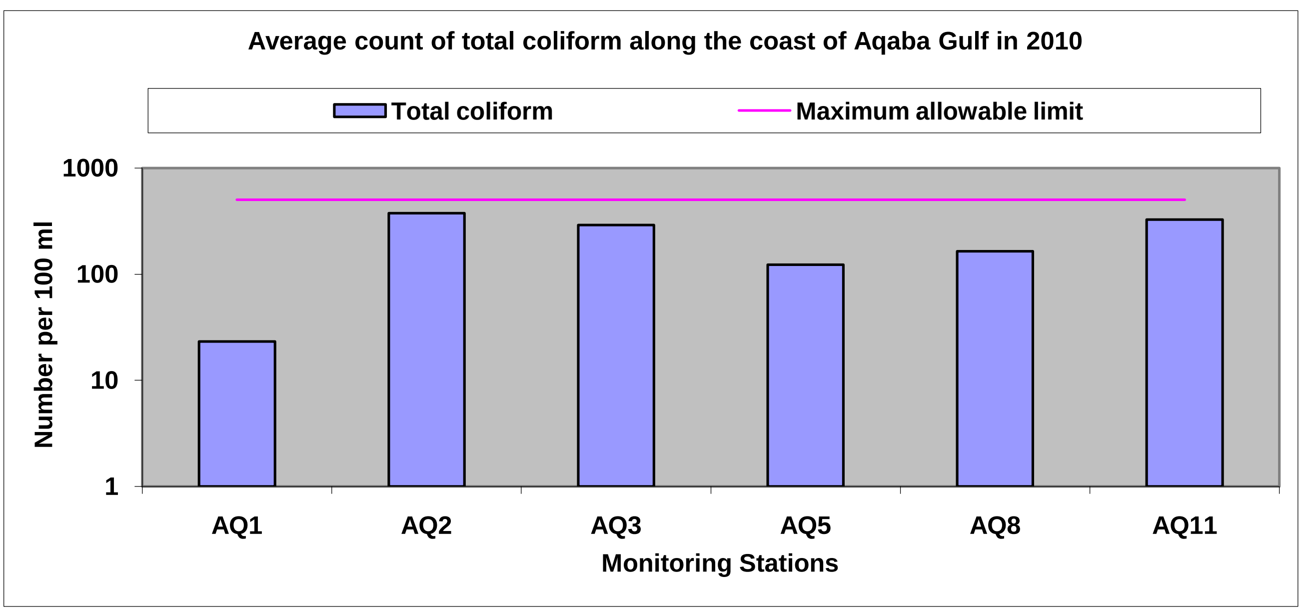


Figure (6-31) average bacterial count for total coliform bacteria along Aqaba Gulf in 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

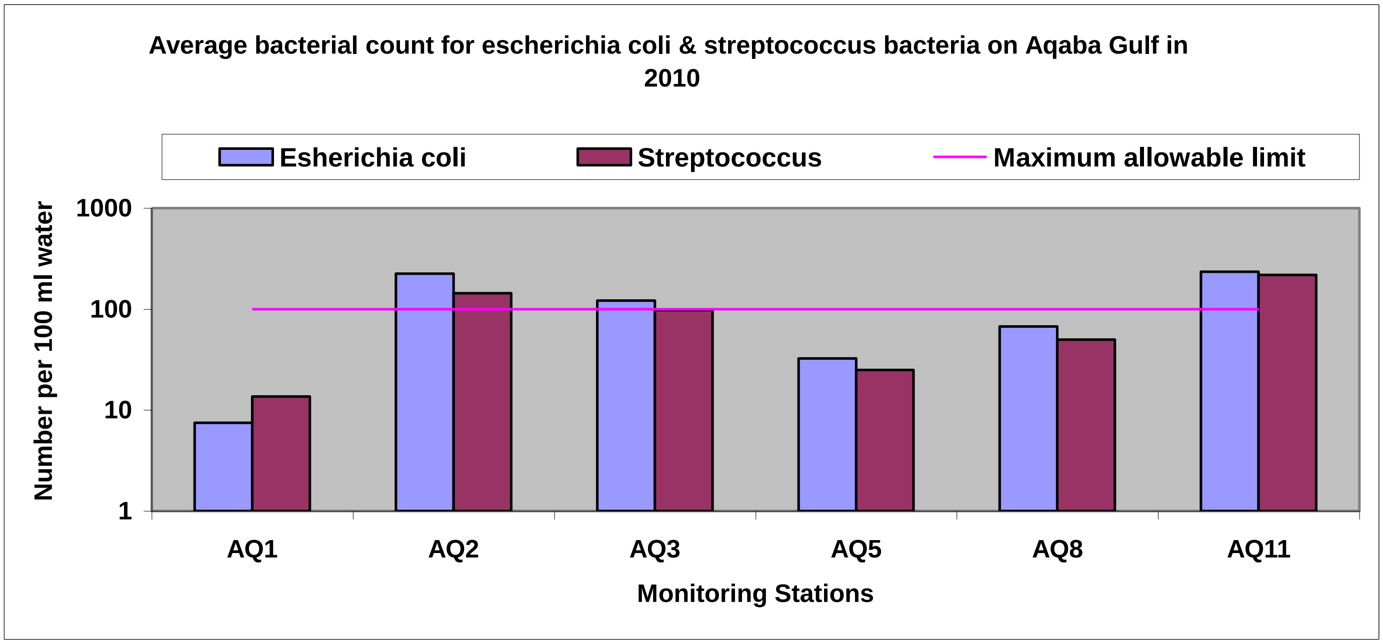


Figure (6-23) average bacterial count for Escherichia coli & streptococcus bacteria along Aqaba Gulf during 2010

Source: EEAA, National Institute of Oceanography, Alexandria Advanced Studies & Research Institute

The above mentioned , clarifies that results of various water quality monitoring measurements for coasts of the Red Sea and the Gulfs of Suez and Aqaba , were good in terms of rates of nutrients and public health (bacterial count of different types of bacteria).

6-5 Exerted efforts to reduce negative impacts on marine environment:

1. Issue guidelines for adopting environmental management system in ports, reducing negative environmental impacts resulting from activities of marine and river transport and prevent ships' pollution.
2. Prepare a questionnaire classifying seaports in Egypt (commercial, petroleum, fishing, mining and tourism) to adopt an environmental management system in ports through surveying the environmental status of ports. Finalize environmental database for each port for adjusting their environmental conditions.
3. Develop descriptive report about the current environmental status of seaports , to develop an action plan enable seaports to adjust their environmental conditions (Safaga for maritime purposes, Safaga for mining purposes , Abu Tartor for phosphate, Alras Alahagria , Hamrawein , Abu Ghosun, Port Said for maritime purposes, Port Said for fishing purposes , Port Said for tourism purposes , the Egyptian Company for LNG in EDCO , Sidi Krir port (Sumed), El-Anfoushy eastern harbor , Damietta Port , Al-Atka).

4. Implement training program for Managers of Environmental Affairs in fishing ports and marinas ; to identify them with the legislative framework of adopting environmental management system in fishing ports ,marinas and specialized ports .
5. Participate in activities of the Permanent Committee of specialized ports in the maritime transport sector.

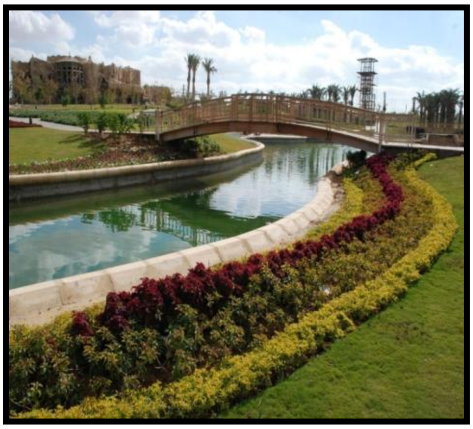
6-6Future Vision:

1. Finalize the integrated coastal management plans for the Egyptian coasts. The management plan for coastal areas of Port Said and Matrouh had been prepared; work is going on for preparing the same plan for other coastal areas such as (Alexandria - Delta).

2. Achieve environmental compliance in all types of ports and marinas by preparing integrated studies according to the environmental management system.

3. Prepare guidelines for adopting environmental management system in shipyards and marine workshops of building and maintenance of marine and river units.

4. Use mathematical models to assess environmental damages.



Part Three

Land

Chapter seven

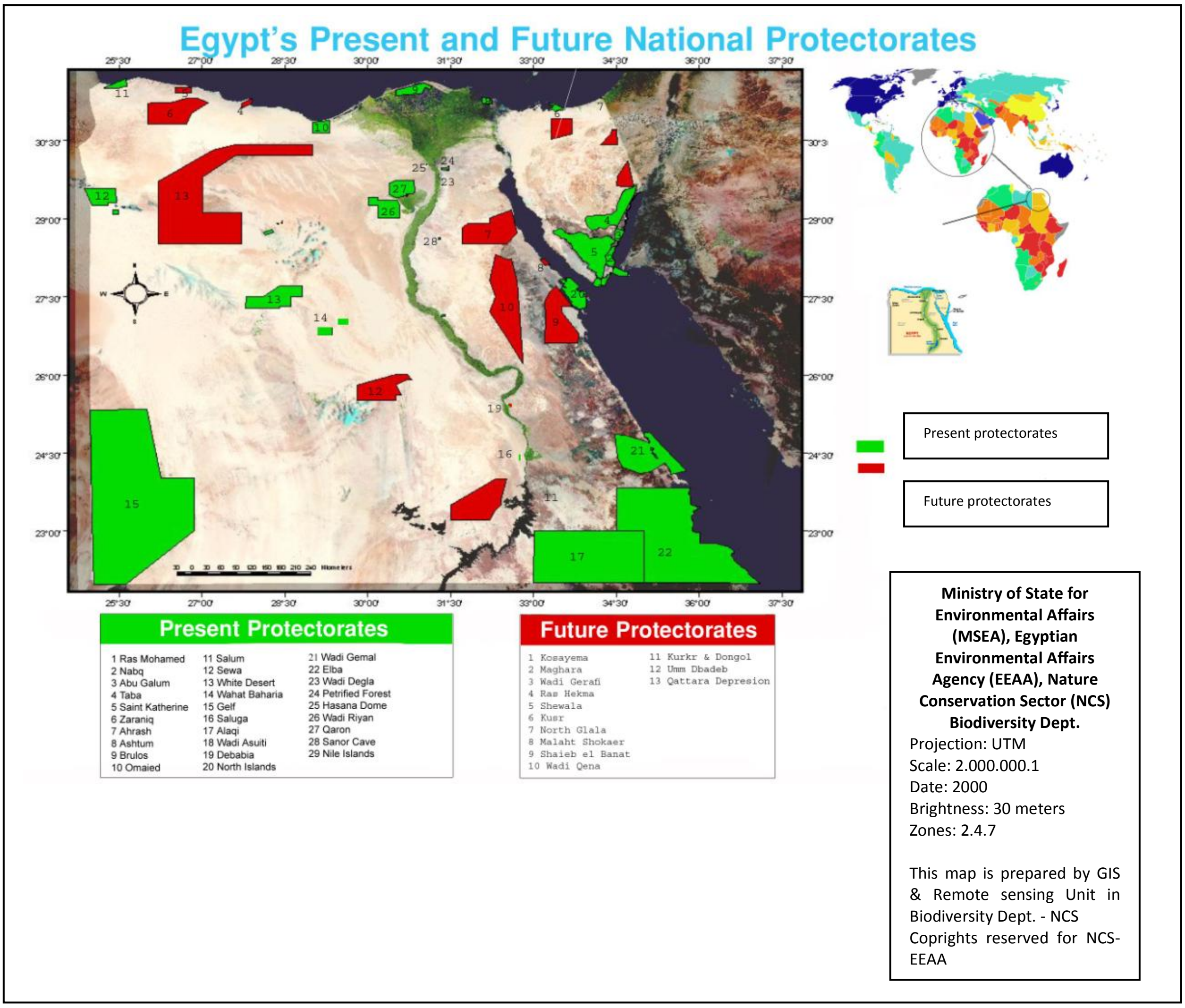
Biodiversity

7 - 1 Introduction:

Egypt issued many laws addressing the protection of environment and conservation of natural resource of fauna and flora species. Most important of these are: Law No. 53 /1996, of Ministry of Agriculture, Law No. 102 /1983 for the establishment and management of natural protectorates, Law No. 124 /1983for the regulation and management of fisheries and law No. 4 /1994, amended by Law No. 9 / 2009 for environment protection, that prohibits hunting of wildlife and controls their exploitation.

In correlation with these efforts the National Action Plan has been issued with participation of all relevant entities and non governmental organizations, where environment protection initiatives integrated within all economic and social sectors to support sustainable development of our resources from 2002 – 2017 . These are in parallel with what has been adopted by the Strategy of Biodiversity Conservation and in light of the emerged variables such as: climate change, desertification, genetically modified organisms and all other components that have not covered appropriately in the current strategy, necessity increased to update it.

Ecosystems and biodiversity are facing many challenges and difficulties represented in habitat degradation, invasive species, violated hunting and over harvesting, especially for medicinal plants, in combination with unplanned coastal development. So importance increased to assess environmental impact of these variables, their constraints and to prioritize work to address them and identify the actual economic value of our genetic resources and biological diversity; for their accurate estimation and taking them into account while adopting various development policies.

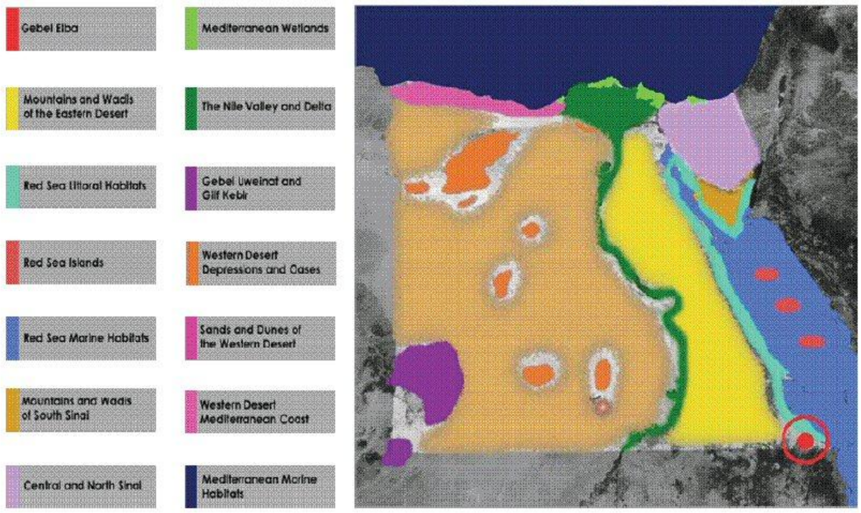


Map (7-1) Present and future protected areas in Egypt

Source: Nature conservation sector

7-2 Vitality of Ecosystems:

The Egyptian habitats map includes 22 main groups such as urban areas, islands, hattiya, oasis, sand dunes, metamorphic and sedimentary rocks, open water, fresh water lakes, marshes, warm springs (El-Ain El-Sokhna, Oyoun Mousa), coral reefs and mangrove trees. Every habitat subdivided into divisions, depending on morphological characteristics and important inhabiting groups of fauna and flora.



Map (7-2) Egyptian environments

Source: Nature conservation sector

After preparing Egyptian habitat's map, records for each species have been prepared in relation to its distribution, time and frequency of record. Advanced prediction program was prepared to identify geographic distribution of species according to soil quality, topography, temperatures, type of habitat and actual recorded distribution. An example of that, is the prediction of Egyptian gazelle, which used to live in many places, now it is restricted to 3 areas (eastern and western desert and south Sinai) .Prediction of species' distribution is important as it refers to the ability of recognizing threats facing fauna and flora, so special measures and arrangements can be taken to reduce rate of biodiversity loss, such as providing more protection in Protected Areas (PAs) or implementing captive breeding programs for endangered species.

7-2-1 Coral Reefs:

Studies indicated that coral reefs status inside protected areas is better than elsewhere. Sites which are far away from human activities witnessed increase in coral reefs (41%) compared with areas with human activities (5-7%), due to pollution or unfavorable environment where soft corals have been increased at the cost of hard ones. In other areas there was a clear deterioration in the environment of coral reefs as in (Al-Fanadir area and Sabina corals).

Picture (7-1) coral reefs attract tourists

As number of tourists continues to increase, capacity of coral reefs ecosystem was rated, particularly in diving areas near Hurghada and Sharm El-Sheikh. Patterns of annual and monthly distribution of recreational activities, and impacts resulting from the environmental status of coral reefs have been identified in 40 zones in Ras Mohammed. Visitors’ numbers for diving or surface swimming (snorkeling) ranged in every region between several thousands to more than 70 thousand dive a year. So, diving areas were divided into different groups in terms of the impact of recreational activities on the environment of coral reefs. The study showed that 6 diving areas were more utilized than the global average (15 thousand dives per year), while other areas ranged between moderate to less than moderate averages. The study also showed that studied diving areas represent 60% of coral reefs areas while the other areas (40%) were closed and protected.

7-2-2 Mangrove:

Mangroves ecosystem in the Red Sea is one of the most important habitats. Therefore EEAA participated in several studies for its protection with many universities and research centers. The result provides huge amount of information about the environment of mangroves in terms of their species, location, size, fauna and flora, density, environment of mangrove trees, social and economic status of local inhabitants, the impact of human activities on the environment of mangrove trees and the successful culture attempts that have been conducted over the past few years.

There are two types of mangroves in the Red Sea which are *Avicennia marina* and *Rhisophora mucronata* .The *Avicennia marina* is the most abundant trees where it was recorded in 28 areas along the coast and islands of the Red Sea and the Gulf of Aqaba in Ras Mohammed and Nabq PAs, while the second type *Rhisophora mucronata* was recorded in the southern region only (in and around Shalateen) and beyond the Egyptian borders. The most important areas with mangrove trees are islands of Monkar and Qaysom, Wadi El-Gemal , Hamata and the southern coast of Safaga.

7-2-3 Mountains' biodiversity:

Recent studies proved that high mountains area of St. Catherine's plays an important role in the genetic segregation between valleys, which represent the main reason for the diversity of many species of the same family. These act as a normal barrier to the transfer of genes through pollen and seeds, which increase isolation of individuals of the same species. On the other hand the study showed that insects like bugs have no significant differences between its individuals of the different populations within valleys because of its high ability for movement and spread between valleys. The study also clarified, concomitant relationship between the rate of increase “71% “between (Alloped) plant and the Alontrawfora insect. The study did not show any concomitant relationship between Ahargel plant and bugs.

The following are the major threats affecting biodiversity in the mountains: human activities (hunting - logging - trafficking in species - urban development); in addition to alien invasive species, climate change and natural disasters (mainly flooding).

7.2.4 Factors affecting degradation of natural habitats in Egypt:

Land degradation is the change in components of organic and inorganic features, leading to the disturbance of their normal balance, which consequently reduce their productivity or even complete loss. The process of land degradation is a complex process caused by various physical, chemical and biological factors. Studies estimate that 15% of the total area of land in the world has deteriorated with varying degrees due to human activities. Among these areas about 55% due to water erosion, 28% due to wind erosion, 12% due to chemical agents (water saturation and increased salinity, etc.). The main reasons for land degradation are overgrazing (causing 34%), deforestation (causing 29%), inappropriate agricultural activities (causing 28%), over-exploitation of land (causing 7%), and other non-agricultural activities (causing 2%). Land degradation in arid and semi-arid regions called desertification. It has been estimated that about 30% of the grazing areas in these regions have been affected by desertification with varying degrees.

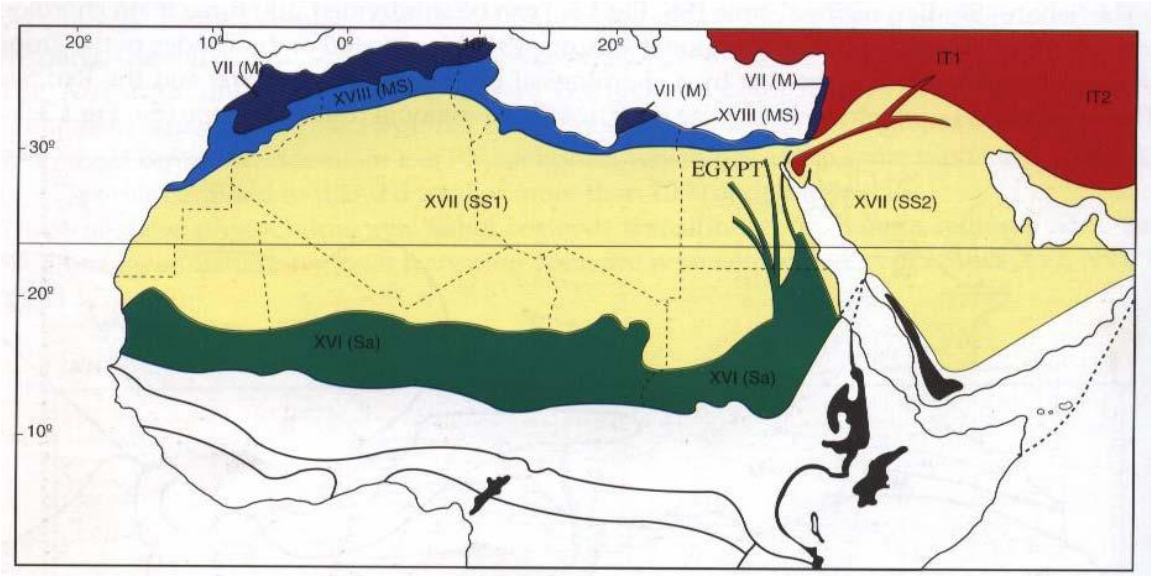
The cause of land degradation in the northern coast of Egypt is due to overgrazing, where the grasslands are converted to seasonal agriculture. Other causes are air and water erosion in addition to inappropriate techniques of land management, limited and ineffective popular participation. This area suffer from landmine problem that exist along large areas of the north coast and the western desert (left after World War II in El-Alamein reaching to the western Egyptian borders) with nearly 17.5 million mines occupied more than quarter million feddan suitable for agriculture. As well as the establishment of several developmental projects that had a deep impact on biodiversity.

Also, there are many other threats such as, overgrazing of plants, especially medicinal
Plants, hunting wild animals outside protected areas, logging in the Eastern and Western Desert for fire, increased urban development and safari tourism in unpopulated areas; in addition to climate change that led to more droughts, increased temperatures and decreased rainfall rates.

7-3 Status of habitats:

7.3.1 Habitats' diversity

Egypt attracts explorers and scientists’ interest because of its unique location between Africa and Asia, its long coastlines on the Mediterranean Sea in the north (970 km) and the Red Sea in the east (1100 km). Egypt has a great variety of habitats and micro-climates containing a wide variety of plants and wildlife in addition to local communities. It also enjoyes terrestrial and aquatic habitats, desert areas, mountains, plains, cliffs , salt marshes, wetlands, freshwater and marine waters.



Map (7-3) Plant areas in North Africa and Southwest Asia

Source: El-Hadidi & Hosny, Flora Egtptiaca 2002

For example, Egypt includes four zones of plant habitats (El-Hadidi and Hosni 2000):

1. The Mediterranean habitat - the Sahara regional transitional zone (Mediterranean-Sahara regional transitional zone - MS - XVIII) which includes the area around the Mediterranean, represented by the northern coast of Egypt;
2. Sahara-Sindian regional zone (SS - XVII), which includes the greater part of Egypt;
3. Irano-Turanian regional center of endemism (IT), which includes the massive Sinai mountain in Sinai and some areas in the Eastern Desert of Egypt (for example El-Galala Mountains);
4. Sahel regional transitional zone (Sa-XVI), which includes Elba mountain in southeastern Egypt (after El-Hadidi and Hosni 2000).

7-3-1-1 Marine environment (Mediterranean and Red Seas)

Marine environment of both Mediterranean and Red seas is distinguished by many habitats and threatened species especially all marine mammals (17 species), marine turtles (4 species), sharks (more than 20 species) mangrove trees and many birds (white eyed gulls, sooty falcons, ospreys). This is in addition to the great marine biodiversity (more than 5000 species) represented in 800 species of seaweeds, 209 species of coral reefs, more than 800 species of molluscs, 600 species of crustacea, 350 species of echinodermata, in addition to hundreds of species that have never been discovered until now especially in the Exclusive Economic Zone in the Red Sea and the Mediterranean.

Sharks attacks in the Gulf of Aqaba-Red Sea:

According to the study prepared by the Protection of the Environment of the Red Sea and Gulf of Aden (PERSGA) about shark species in the Red Sea, it indicated the presence of 33 species. While recent studies conducted by the Red Sea PAs indicated that recorded species are 17 only, despite the availability of recent monitoring equipment such as appliances of diving, photography and measurement of water chemistry. These results showed loss of sharks' diversity up to 30% of the recorded species during past fifty years. This is due to several factors which can be summarized in the following points: Steady increase in the interactions between human and sharks over the past years; increase in sea water temperature; Feeding fish and sharks by tourists; Over-fishing; Nature of the bottom of the Red Sea and Gulf of Aqaba and Dumping of ships and boats' wastes crossing the Tiran Strait.

EEAA report concluded with the following recommendations to address the phenomena of sharks' attacks along beaches of Sharm El-Sheikh : raise tourists awareness, train hotel staff, numbering sharks, prepare and implement research program for sharks, implement emergency and medical treatment protocol, enforce international laws and regulations to be followed by ships

7-3-1-2 Coral reefs:

Monitoring of coral reefs in Egypt has been started since 2001 until 2010 in more than 120 sites in the Red Sea and Gulf of Aqaba, using environmental indicators such as (rate of living/non-living coral reefs, number of species and other indicators such as fish and vertebrates). Studies indicated that coral reefs status inside protected areas is better than elsewhere. In addition, sites which are far away from human activities had witnessed increase in coral reefs (14%) compared with areas with human activities (5-7%), where soft corals have been increased at the cost of hard ones.

Field trips surveyed 8 sites on the Red Sea (Alphenston - House reef Marsa Shagraa ree - Samadai reef – Ncari reef - House reef Shams Alam - Ras Baghdadi - Shleynaat Wadi El-Gemal) to indentify coral reefs' status regarding their exposure to bleaching and diseases. Line Transect method was used at length of 10 meters then repeated for 3 times at a depth of 5-10 meters for each site. Observed data were collected in the data sheets that were developed by the Great Barrier Reef Marine Park Authority.

Percentage of coral cover was ranged between 31-100 %, which is high if compared with sites in the northern area of the Red Sea; this indicates the high density of coral cover in the southern region which is supported by many studies and researches that were conducted on the Red Sea. These studies showed that there is an increase in the density of coral cover in the southern part of the Red Sea compared to the northern part, due to the nonexistence of human impact in the southern region, which necessitates preserving natural resources located in the southern part of the Red Sea. Capacity of coral reefs ecosystem were rated , particularly in diving areas , through studying patterns of annual and monthly distribution of recreational activities in more than 60 dive site. Visitor numbers in diving areas have been ranged between several thousand to more than 70,000 dives annually which are more than the international rate (15000 dive/year). An analytical study has been conducted for estimating coral reefs' violations during past 10 years, the results were 600 violations for hotels, other tourism establishments, ships and individuals. These violations have led to the destruction of coral reefs in many sites.

Picture (7-2) Coral reefs is one of the most important marine ecosystems in the world

Field surveys conducted in areas of extracting ornamental fish (more than 50 species) clarified degradation of coral reefs if compared with similar and near areas; there was significant decrease in types and numbers of fish, therefore actions were taken to ban fishing and exportation of ornamental fish.

<u>7-3-1-3 Mangrove trees:</u>

Studies conducted by remote sensing and field testing proved that total area of mangrove trees increased to 700 hectare by the end of 2009, compared with 525 hectare in 2002. This is due to stopping encroachment, protection of mangroves and implementing transplantation program for mangrove trees in many areas along past years, where more than 50 feddan were cultivated with more than 50 thousand seedlings of its both types (*Avicennia marina* and *Rhisophora mucronata*), and the establishment of nurseries in Nabq, Safaga ,Wadi El-Gemal and Shalatin . In addition,

Picture (7-3) Mangrove trees in Red Sea PAs

Source: Nature conservation sector

biological study was conducted on mangrove trees (height, volume, density, fruit production, flowering period). Studies proved that mangrove habitats are characterized by high biodiversity, including algae (36 species), insects (40 species), crustacean (82 species), echinoderms (17 species), and fish (22 species) with economic importance, mangrove trees are considered a habitat for providing protection and food for small fish.

<u>7-3-1-4 Wetlands:</u>

Wetlands perform important ecological and biological functions through maintaining the ecological balance as they are the permanent suitable place for distinct groups of fauna and flora, especially migratory water birds that depend on wetlands for rest and supply of food necessary to continue their journey to the south to Central Africa.

About 120 species of flora have been monitored in Burullus Protected Area (flora of islands and of sand coast trapped between the Mediterranean and the lake where the international road passes by), from November 2009 and until May 2010, due to rainfall and the appearance of perennial plants. Also flora of Wadi El Rayan PA were monitored (areas of springs and Rayan lakes) which did not result in a significant change in the status of species as 56 flora species were monitored due to weather stability and lack of large amount of rain. During December 2010, rains heavily fall for a long period, so monitoring shall be started at the beginning of spring 2011 in order to determine the extent of change in the state of plant within the PA.

By monitoring flora within the northern PAs (wetland areas), the following has been clarified:

1. 7 monitoring activity were conducted, where 50 flora species belonging to 41 types and 24 families were monitored out of the 77 total numbers of flora species registered in Ashtoom El-Gamil.
2. 11 monitoring activity were conducted, where 114 flora species out of the 196 total flora species registered in Burullus protected area.

By monitoring birds within northern PA (wetland areas), the following has been clarified:

1. 12 monitoring activity were conducted, where 53 bird species were recorded representing 37 species and 22 families, including 39 (73%) water birds' species and 15 (27%) land birds' species out of the total 118 species registered in Ashtoom El-Gamil and the 223 species registered in different references.
2. 11 monitoring activity were conducted in Burullus PA resulted in recording of 95 bird species out of the total 117 species.

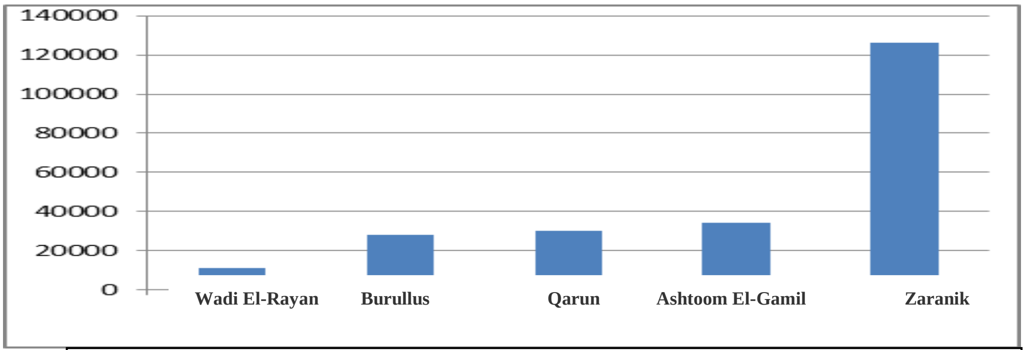


Figure (7-1) Comparison between the total number of birds in different PAs (Zaranik - Ashtoom El-Gamil - Qarun - Burullus - Wadi El-Rayan)

Source: Nature conservation sector

Monitoring of biodiversity in wetlands PAs were sustained in (Zaranik - Ashtoom El-Gamil - Burullus - Qarun - Wadi El-Rayan - Siwa - Saluga and Ghazal – Wadi El-Allaqi) , where as indicated in figure (7-1) number of monitered birds during 2009 in Zaranik PA reached to 126.000, Ashtoom El-Gamil 34.000 ,Qaroun 30.000, Burullus 28.036 and Wadi El-Rayan 11,000. From the previous data, it is clear that Zaranik monitered the largest number of birds due to being located in the heart of migratory route from Asia and North Europe.

Figure (7-2) indicates the change in numbers of migratory birds that were monitored in

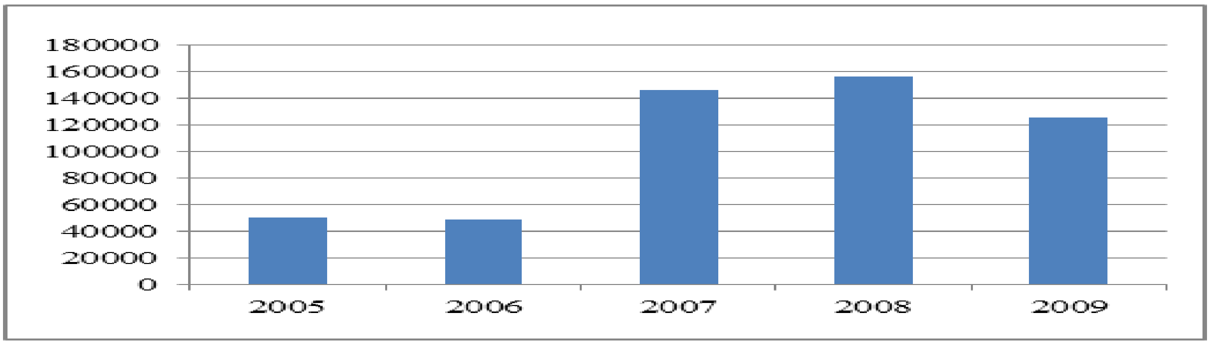


Figure (7-2) change in total number of birds that were monitored in Zaranik PA from 2005 - 2009

Source: Nature conservation sector

Zaranik PA from 2005 to 2009; it has shown a steady increase in numbers of birds from 2005 to 2008 due to several factors such as: accurate monitoring ,banning bird hunting since 2006 until now and the steady increase in some migratory species. During 2009 the number of birds decreased in comparison to 2008 due to the decresed number of soaring birds (particularly White Stork) because the sirocco blowing did not occur during April as usual The following table shows types and numbers of birds in Zaranik PA during 2010.

Table (7-1) Number of spices and total number of birds from January to May 2010

Month	Jauary	February	March	April	May
Number of species	67	60	86	84	80
Total	13662	9277	15566	10584	6863

Source: Nature conservation sector

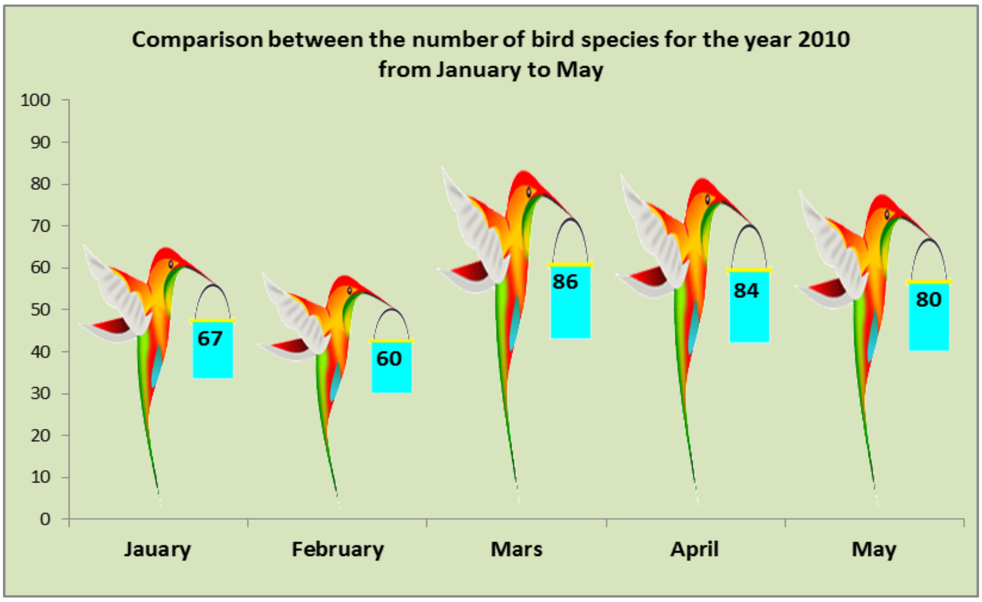


Figure (7-3) Number of birds' species from January to May 2010

Source: Nature conservation sector

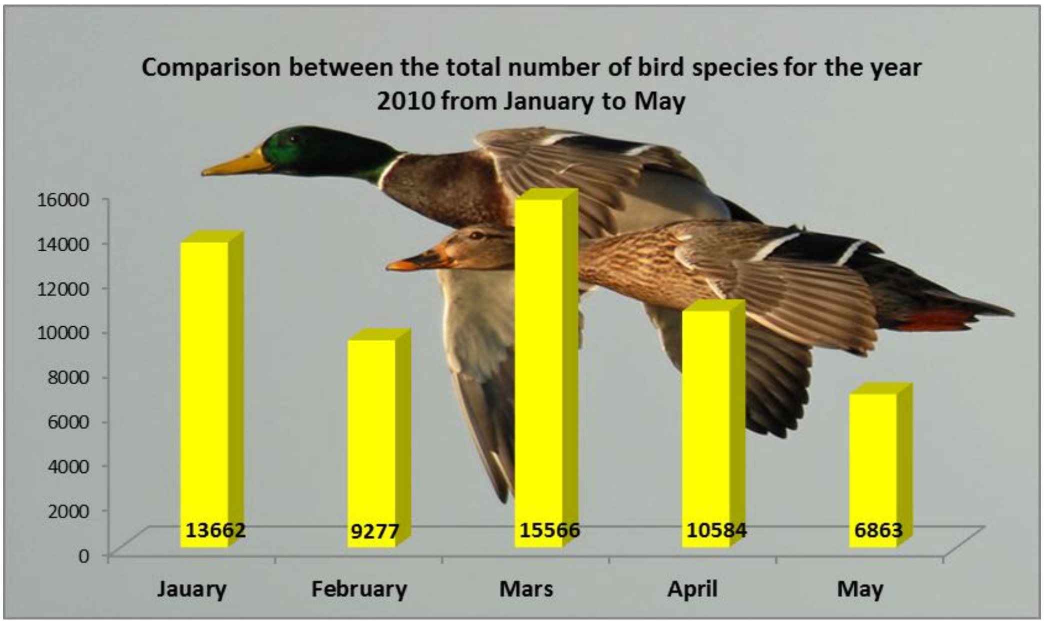


Figure (7-4) Total number of birds from January to May 2010

Results of monitoring birds in Qarun PA indicated the existance of large nesting concentrations of both *Larusgenei* and *Stena* albifrous , which is considered the biggest if compared with different sites in Egypt . percentage of hatching was more than 90% in the first while decreased a little in the second due to improved protection measures taken by the protected area during nesting period .

7-3-1-5 Pasturelands:

Pasturelands existing in Elba and Wadi Allaqi PAs in the south and in El-Omayed PA and Sinai in the north are the most important areas of grasslands in Egypt. For example, the local communities located in Elba Mountain, used to stay in aggregates (Madareb) where their houses are located nearby houses of the larger family and the families gather in tribes. Each tribe prefers to stay near a well to avoid any interference by any intruders or strangers. The word (Madareb) means areas which inherited from grandparents and parents where boundaries are defined and recognized. The use of resources within these properties is governed by the Sheikh of the tribe where he sets up rules for the exploitation of wells' water, and cutting trees used in building houses or for fuel.

Picture (7-4) Pastures' activities in Wadi Allaki PA.
Source: Nature conservation sector

7-4 Status of fauna species

7.4.1 Monitoring

In the framework of monitoring and follow-up programs of national species, natural resources located within different PAs such as coral reefs, mangroves, wracks, sea cucumbers, marine mammals and sea turtles has been monitored . As well as monitoring of many natural phenomena affecting marine environment such as coral bleaching caused by increase in water temperatures . Also environmental monitoring of coral reefs, mangrove, sea turtles, water quality and birds have been continued till 2010.

7-4-1-1 Coral reef environment

First: program of monitoring and follow-up coral coverage

Monitoring program and follow-up of the coral reefs for 2009 / 2010, for the ninth consecutive year, was completed. It started during 2001, using the same method which is (Photo Permanent Quadrates) that rely on photographing squares of each site every year and analyzing them by using software (Image Pro Express 4.0). This year, defined sites during 2001 - 2003 were re-monitored by re-photographing 35 squares in 8 sites in Hurghada area

(OmJmar island , Carlos coral, Al-Fenadir, El-Fanous coral, the small Giftun island, Sabina coral, Keshta coral and Abu Ramada piece) ; as well as 36 squares in 9 locations in south of Safaga till Wadi El-Gemal (Shahr coral, Panorama coral, Al-Fenston, Samadai, Ncara, Keshta piece, Ras Baghdadi, House Reeve Shams Alam and Rocky Island). Percentage of coral coverage varied between 31-100%, which is high if compared with sites in the northern Red Sea, which indicates the increased density of coral coverage in the southern region which is supported by many studies and research that has been conducted on the Red Sea. These studies clarified an increase in the density of coral coverage in the southern part of the Red Sea than in its northern part, due to the nonexistence of negative human impacts in the southern region, which calls for the need to preserve these natural resources located in the south of the Red Sea.

Second: Follow-up phenomenon of coral bleaching in the Red Sea

Follow-up plan of coral reefs bleaching phenomenon in the Red Sea was conducted, through surveying some important areas in the Red Sea where this phenomenon may occur, such as Rocky and Zabrged islands; field trips surveyed coral reefs locating around these islands during July and August, and results clarified absence of such phenomenon. As well as 310 questionnaires were distributed on diving centers and safari boats inquiring about this phenomenon , 195 questionnaires were received where all of them did not record this phenomenon.

7-4-1-2 Sea Turtles:

During 2009/2010 numbering of marine turtles along the Egyptian coast of the Red Sea was completed. This year witnessed numbering of 47 green turtles on Zabarged island in addition to monitoring 3 turtles numbered during 2006, bringing the total number of numbered turtles on Zabarged Island to 121 one . Surveying process of different regions conducted during 2010, recorded 1960 old nest and 1347 new nest in Zabarged Island, which is considered one of the most important nesting areas of the green sea turtle, Chelonia medas, on the Egyptian coast.Hatching of 4 Hawksbill turtle (*Eretmochelys imbricata)* was observed on the Giftun Island and 30 in Zabargad Island. These numbers decrease on the coast, where coastal tourism activities increased and significantly reduce turtles nesting in Ras Hankurab, Umm El-Abs and Kulaan during past years.

7-4-1-3 Fish sharks

Plan was implemented to monitor sharks in the Red Sea through distributing questionnaires on dive centers and safari boats to cover most of the diving areas in the Red Sea, 294 questionnaires were distributed among which 201 questionnaires were received recording appearance of 6 species of important sharks in the Red Sea in Islands of Al-Akhawayen, Abu Kisan, Rocky, Al-

Fenston coral and Sharm coral, which are considered areas with an international reputation for the presence of sharks.

7-4-1-4 Whale shark:

According to increased international interest to monitor whale shark, current year witnessed implementation of the program to follow up presence of whale shark in the Red Sea by distributing 190 questionnaire to dive centers and safari boats, among which 92 were received indicating all not watching it. It is worth mentioning that thirty five whale sharks were watched since 2003 until 2008 in Dahab, Sharm El-Shikh, Ras Mohamed, Hurghada, Quseiur, Marsa Alam, Port Ghaleb and El-Sayal islands. The highest record was during spring time and at the end of summer.

7-4-1-5 Dugong

Follow-up plan to monitor dugong in the Red Sea has been implemented through distributing questionnaires on dive centers and safari boats to cover most of the diving areas in the Red Sea. 195 questionnaires were distributed among which 102 were received mostly recording observations of dugong in Abu Dabab Gulf due to the presence of their natural environment rich with marine grass.

7-4-2 Egyptian deer monitoring program

Red Ghazal (Gazella dorcas) is one of the most important components of Egyptian desert ecosystems. It is one of the (browsers) contributes in pruning scattered plants in the area of its presence; on the contrary to (grazers) which destroy most of the vegetation coverage. Being capable of adapting with desert harsh conditions, it acts as an indicator of the soundness of the environmental ecosystem.

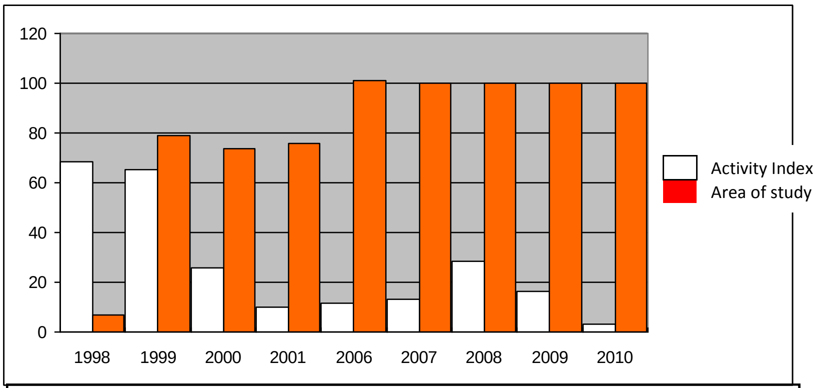


Figure (7-5) Activity index of Gazella dorcas in the area of study till 2010

Studying and monitoring area is located (2200 km^2) in Sahel El-Kaa which occupies an area of 3,300 km^2 South Sinai; it extends along the coast of the Suez Gulf up to Ras Mohamed and is bounded from the east by St. Catherine Mountain. Activity index shows drastic reduction in activity of the deer within different areas of the study, compared to previous years, especially in north areas which were considered the most important areas of Ghazal existence. It is remarkable that there is sharp decline in feces balls which reflects the status of Ghazal in the area of study. This is due to the increasing effect of human activity in the region, such as expansion in land reclamation in some areas of Sahel El-Kaa.

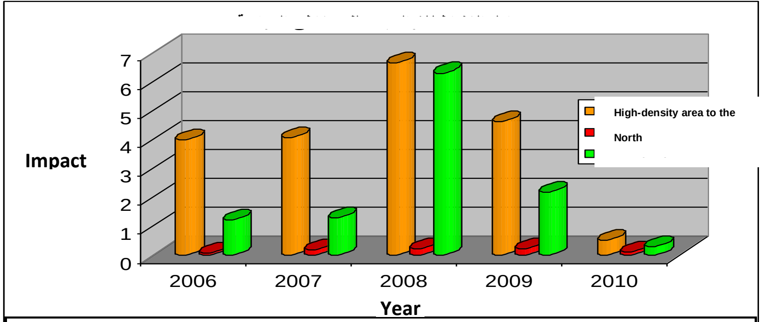


Figure (7-6) shows the parameter of Gazella dorcas' activity in various layers of the study area from 2006 until 2010

Activity Index. This parameter is used to express deer activity in the region. It is calculated depending on the ratio between the number of deer footprints in each transect to the length of transect in kilometers. An average is taken of the total transect.

Picture (7-5) Egyptian Gazella dorcas

Source: Nature conservation sector

7- 4 - 3 Flora survey program.

Flora surveys had been conducted during previous years 1998, 2003 and 2004, in the high mountains of St. Catherine PA (northern sector) to identify and follow-up status of its vegetation coverage and prepare a complete database about plants in the PA. This includes the scientific name, botanical family, economic importance, geographic distribution, negative impacts on wild plants and the most appropriate environment for the growth of plant species; then downloads all these data on geological maps and geographic information systems. Surveying program is divided into the following three phases: 1- data collection, and input into a database data analysis, preparing output database of the protectorate. The first phase was completed in 2009 while the second phase was initiated by entering some data and preparing it for final analysis. The study targeted five plant species, including four endemic species and one semi-endemic, as follows:

1. **Awarwar (*Hyoscyamus reticulatus)***, it is a perennial shrub of the Lamiaceae family, its height ranges between 30 to 120 centimeters. This shrub is endemic in South Sinai in Egypt, especially in the high mountains of St. Catherine PA. It is one of the great endemic species in their number and spread.

2. **El-Lbeina (Euphoabia spp.),** perennial, endemic and rare. Its height ranges between 10-35 cm

3. **El-Zaytia**, herbal perennial plant and semi endemic. It exists almost in Sinai, and northwest of Saudi Arabia. This plant belongs to the Lamiaceae family which is characterized by its medical importance and their richness with oils. It prefers canopy environments and rocky soil.

Picture (7-6) Cultivation of seeds During November and December 2009.
Source: Nature conservation sector

7 - 4 – 4 Breeding and propagation

Monitoring team in Elba PA continue observation of seeds, where they recorded germination of 17 seeds from Hglig plant that were planted during November out of 36 seeds, with success rate of 48% . Germination of 20 seeds from the same Heglig plant *(Balanties aegptiaca) was* planted during December out of 40 with success rate of 50%. Germination of 2 seeds from Araak plant (*Salvadora persica*) out of 20 seeds planted during December 2009. The team also transferred 50 seedlings of Acacia tree *(Acacia reddiaana)* form valleys of Al-Markoan, and Karam Hendeb, as a result of rain fall to the greenhouse of the Environmental and Community Service Unit affiliate to Elba Sector in preparation to transfer them to different sites inside the PA. During field trips, the team monitored high density of Alsnamka plant, Hglig trees *(Balanties aegptiaca)* and Acacia *(Acacia reddiaana)*. The team recorded on an altitude of about 600 meters from Elba in Aidyb valley some plants such as Saymouk (*Ficus cordata*) and Hashaab plant (*Acacia senegal*)which is known as Arabic Gum trees at an altitude of about 400 meters; in addition to Eigab plant (*Aerva lanata*)and trees of Yassar El-Baan, which is one of the most important trees for their medical importance at altitudes of up to 400-500 meters. The team passed over Maket valley south of the Adeldeeb village, where they observed high density of Chanan (*Anabasis sp.*)and Danoun plants (*Cistanche phelypae*a).

Picture (7-7) Shehab Plant

Picture (7-8) Danoun Plant in the middle of Chanan Plant
Source: Nature conservation sector

7-4-5 Preserving and monitoring Ombt trees (2009/2010) in Elba Mount

Monitoring team of flora species during 2010, conducted trip to the Drawina Toyouit valley, where they found scattered Ombt trees and the estimated rate of their dead and dry trees reach up to 35%.

Picture (7-9) Registration of Ombt trees in Elba Mount

Picture (7-10) Monitoring of Ombt trees
Source: Nature conservation sector

7-5- Red list:

7-5-1- Mammals:

Global environmental reports expected that about one quarter of world mammals will be endangered during next 30 years. In Egypt there are many spices of desert mammals already extinct during first half of the 20 century; there are 111 mammals' spices in Egypt 40 of them are included in the IUCN Red list which represents one third of the Egyptian mammals. Rodents, bats and carnivores are the most popular families in Egypt, 17 spices of them need protection such as:

Ammotragus lervia: *Egyptian Barbary sheep, Gazella leptoceros: selender horned gazelle,*

Mustela subpalmat: *Egyptian weasel, Equu sasinu: wild ass, Allactaga* ***tetradactyla*****:** four toed jerboa, *Spalaxa egyptiacus: Egyptian mole rat, Merions* ***shaw:*** *shaw's jird, Marionss acramenti: najaf jird, Pachyuromysd upras: fat-tailed jird,*

Gerbillus flower:*flower's gerbil, Gerbillusa nersoni: Anderson's gerbil,* ***Dipodillus mackilligini:****Mackilligin's dipodil, Dipodillus simony: Simon's dipodil, Barbastellal eucomelas:Sinai barbastelle, Hypsugo ariel: fairy pipistrelle , Crocidura floweri: Flower's shrew, Crocidurasu aveolenss: Egyptian pygmy shrew.*

The 40 spices of Egyptian mammals listed in the IUCN Red list are classified as follows:

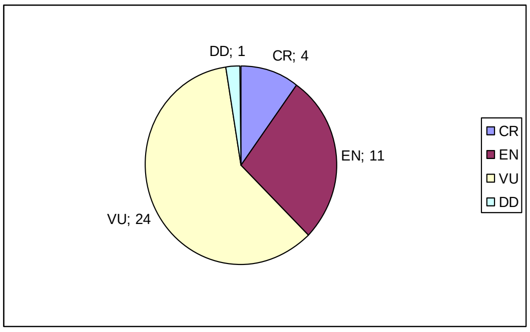


Figure (7-7) Egyptian mammals listed in the IUCN Red list

Source: Nature conservation sector

1. 4 CR species are in critical situation: leopard, cheetah, wild ass, Barbary sheep.
2. 11 EN species are endangered: including one of the bats, five types of rodents, two carnivores and two types of deer such as: Nubian ibex, four toed gerboa, slender , horned gazelle and Egyptian mole rat
3. 24 Vu species.
4. One Dd species of marine mammals: dugong, no sufficient data is available about it but it is also listed on CITES convention.

Some species are listed under other conventions which clarifies exerted efforts by Egypt to protect theses species such as:

1. Slender horned gazelle listed on the CMS annex I
2. Barbary sheep : listed on Cites annex II

Egyptian mammals such as: Sinai dormouse, mole rat, four-toed jerboa which are globally important for they are evolutionarily distinctive &globally endangered (EDGE).

7-5-2- Birds:

Birds are considered to be of the most important and distinguished components of biodiversity in Egypt, where variant habitats are available. Egypt is the only terrestrial passage between the 3 continents Asia, Europe and Africa; so it is the most important fly way in the world where millions of birds pass each spring and autumn. A lot of birds spend winter in wetlands of Egypt so it is an important international winter resort for water birds.

New research studies highlighted that gases of global warming and climate change resulted in extensive loss for fauna and biodiversity around the world.

According to the most recent IUCN reports one quarter of world birds are threatened, where the assessment of birds of the IUCN Red list during 2009, shows that 1226 species of birds were listed threatened and 190 species are critically threatened.

During the last 10 years , drought and harsh weather conditions became a repeated phenomena, in addition to the deterioration of water surfaces , dryness of spring wells , decrease of surface water , water of lakes , deforestation , uncontrolled hunting ,pesticides, industrial pollutants and uncontrolled human activities such as urbanization , investment, economic and social development ; all of these resulted in dramatic decline in birds' spices to the level of extinction and most of birds became globally extinct . Egyptian bird red list was updated and 43 species were assessed during 2010, as clarified in figure (7-8).

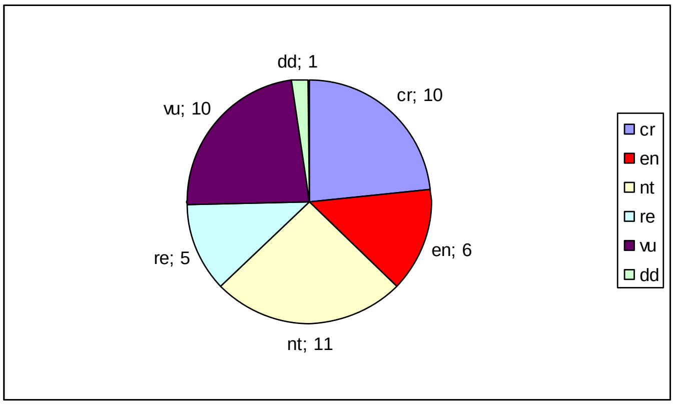


Figure (7-8) Classification of Red List birds assessed during 2010

Source: Nature conservation sector

Table (7-3) Egyptian critically endangered and threatened birds

Scientific name	English name	Egyptian Red List
Marmaronetta angustirostris	Marbled Duck	**CR**
Gypaetus barbatus	Lammergeyer	**CR**
Gyps fulvus	Griffon Vulture	**CR**
Terathopius ecaudatus	Bateleur	**CR**
Aquila chrysaetos	Golden Eagle	**CR**
Chlamydotis undulata	Houbara	**CR**
Numenius tenuirostris	Slender-billed Curlew	**CR**
Rynchops flavirostris	African Skimmer	**CR**
Oenanthe moesta	Red-rumped Wheatear	**CR**
Vanellus gregarius	Sociable Plover	**CR**
Neophron percnopterus	Egyptian Vulture	**VU**
Buteo rufinus	Long-legged Buzzard	**VU**
Aquila clanga	Spotted Greater Eagle	**VU**
Aquila heliaca	Imperial Eagle	**VU**
Falco naumanni	Lesser Kestrel	**VU**
Falco biarmicus	Lanner	**VU**
Falco pelegrinoides	Barbary Falcon	**VU**
Alectoris chukar	Chukar	**VU**
Crex crex	Corncrake	**VU**
Turdoides squamiceps	Arabian Babbler	**VU**

Egypt is located within the annual migratory routes of 125 species of water birds, among which two species were classified by IUCN&AEWA as threatened by extinction (Marbled Duck and Pelican).

7-6 Alien and invasive species:

Ministry of State for Environmental Affairs exerted efforts to control invasive species, transported by seas and ballast water, and to obtain information about current status of marine alien-invasive species, in collaboration with many relevant agencies. Within the framework of implementing the International Convention for the Control and Management of Ballast water, MSEA conducted a study about invasive micro-organisms transported by ships' ballast water passing ports and territorial waters of the Egyptian Red Sea. Many steps have been developed to achieve this:

1. Conduct monitoring program and biological survey of Red Sea ports, to take necessary measures conserving marine environment and prevent risks caused by marine alien organisms transported by ballast water, through implementing a project to study alien microorganisms' invaded Red Sea ports. The Cost of this project is about million and five hundred thousand pounds.
2. Organize the first ex
3. ploration trip to develop work plan of monitoring program and biological survey of the three ports of Suez Gouna (Port Tawfik-El Zaitia-El Adabiya), which is the first phase of the project, in addition to specify four stations for monitoring and sampling.
4. Held national training program about clean management of ships' ballast water, in coordination with The Regional Organization for the Conservation of the Environment in the Red Sea and Gulf of Aden "PERSGA" - and the International Maritime Organization IMO. The program targeted to explain the International Convention for Ballast Water Management and how to implement it.
5. Prepare the national strategy for Ballast Water Management in the Red Sea and form the Task Force concerned with preparation of its draft version.
6. Prepare a list of alien invasive species as shown in table (7-4)

Table (7-4) alien invasive species

taxonomic group	invasive alien species of land	invasive alien species of water	Total
Plants	40	44	84
Crustaceans	0	16	16
Insects	26	0	26
Arachnids	1	0	1
Fish	0	29	29
Mammals	3	0	3
Birds	5	0	5
Reptiles	0	1	1
Amphibians	0	1	1
Viruses	17	0	17
Fungi	8	0	8
Bacteria	6	0	6
Nematodes	5	0	5
Mollusks	0	5	5
Echinoderm	0	1	1
Gastropods	0	1	1
Annelida	1	1	2
Total	112	99	211

Source: Nature conservation sector

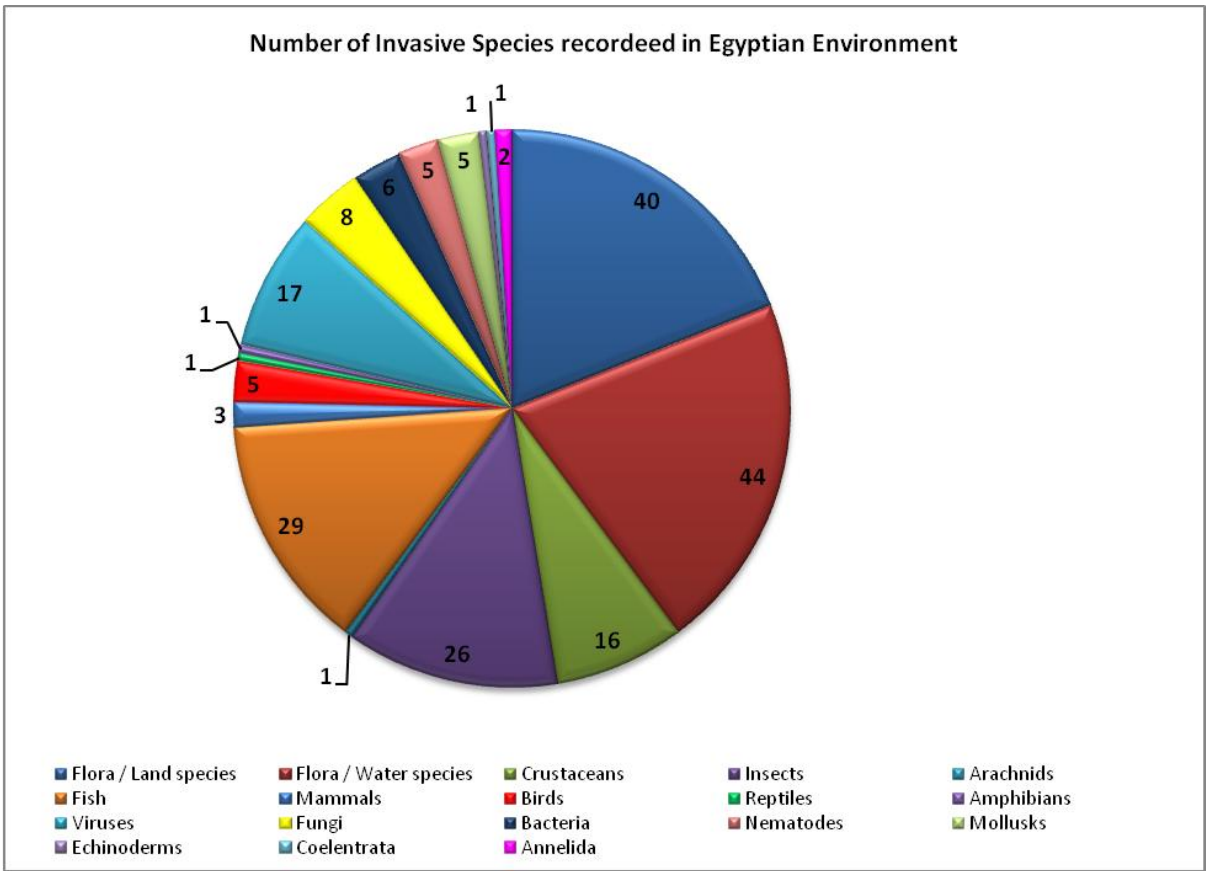


Figure (7-9) The worst hundred invasive species in the world

Source: Nature conservation sector

The world program of invasive species has developed a list of the worst 100 alien invasive species that represent the entire world; some of these species invaded certain region with probability to expand their range, causing further damage. Some of these species are already spread on a large scale globally, causing great damage and threats to the biological diversity and the global economy.

Among 211 species recorded in the Egyptian list of alien invasive species, 21 were recorded in the worst world list. No reliable data or information are available about most of these species, their spread and negative impacts on the Egyptian environment and economy; which is considered serious indicator about weak capacities in facing existing or probable damages that may occur in case of the spread of these species on a large scale.

Table (7-5) Recorded species in the Egyptian environment and mentioned in the worst global list

Aquatic Plants		
1	Water hyacinth	*Eichhorniacrassipes*
2	Caulerpa, Killer alga	*Caulerpataxifolia (algae)*
3	Cogon grass	*Imperata cylindrical*

4	Giant reed	*Arundodonax*
5	Black mimosa	*Mimosa pigra*
6	Honey mesquite	*Prosopisglandulosa*
7	Lantana	*Lantana camara*
8	Horse tamarind - Leucaena	*Leucaenaleucocephala*
Crustaceans		
9	Green crab	*Carcinusmaenas*
Insects		
10	Khapra beetle	*Trogodermagranarium*
11	Sweet potato whitefly	*Bemisiatabaci*
Fish		
12	Common carp	*Cyprinuscarpio*
13	Nile perch	*Latesniloticus*
14	Western mosquito fish	*Gambusiaaffinis*
15	Mozambique tilapia	*Oreochromismossambicus*
16	Large mouth bass	*Micropterussalmoides*
Mammals		
17	House mouse	*Musmusculus*
18	Black rat - Ship rat	*Rattusrattus*
Amphibians		
19	Cane toad	*Bufomarinus*
Viruses		
20	Bunchy top virus	*Banana bunchy top virus*
21	Rinderpest virus	*Rinderpest virus*

Source: Nature conservation sector

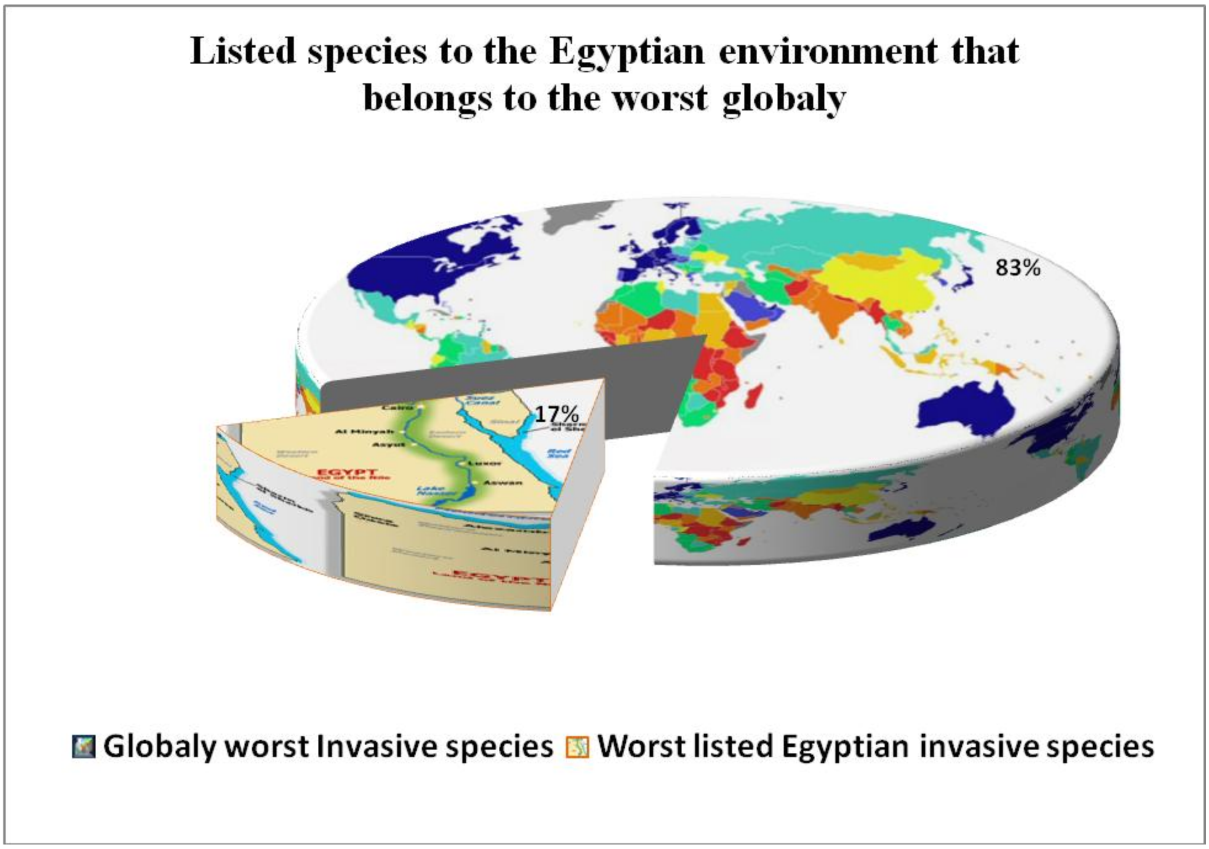


Figure (7-10) Recorded species in the Egyptian environment and mentioned in the worst global list
Source: Nature conservation sector

7-7 Social and economic status of biodiversity

7-7-1 Biodiversity economics

7-7-1-1 Protected areas (PAs) and financial sustainability

Many people still believe that protected areas are obstacles in the way of achieving development and do not recognize their role in realizing sustainable development, which aims to achieve a pattern of growth that provides better living conditions for future generations balanced between economic, social and environmental aspects.

Egyptian environmental policy is based on supporting sustainable environmental management, development of PAs and protection of biodiversity. Biodiversity plays an important role in achieving sustainable development and combat poverty as it provides food, water, energy, medicine, jobs and income for local communities. Hunting and wildlife provide an annual income for some of local communities. Use of medicinal plants and wild fruits are essential sources for local inhabitants .In addition to Bedouins' small industries greatly depend on the sustainable use of biodiversity and natural resources and for which sustainability can not be achieved unless PAs are linked with local, national and regional development priorities.

Financial sustainability of PAs can be defined as (the ability to secure adequate, ongoing and long-term funding sources allocated appropriately and timely; as well as ensure efficiency and effectiveness of management without conflicting with protection objectives and other goals).

PAs in Egypt are rich with different and diverse environments that contain unique natural resources, if properly exploited, can achieve very high economic benefits. Many economic instruments can be used to increase revenues of PAs. Use of economic instrument depends on several factors such as type, nature, classification of PAs and socio-economic conditions in the country. The followings are among the most important of these instruments: permits and licenses, usufruct, tax incentives, fines, fees for ecosystem services, income from business activities established and managed by PAs.

7-7-1-2 Examples of economic instruments applied by protected areas in Egypt:

1. **Entrance fees:** entry fees ranging between 3-5 pounds for Egyptian and 3 - 5 dollars per foreigners in some PAs. The total collected during 2009/2010 was more than 26 million pounds. So that these fees are one of the most important types of financial mechanisms, which are adequate to cover costs of PAs, especially in case of PAs receiving large number of visitors.

2. **Concessions:** collected from beneficiaries, in the form of specific amounts of money or percentage of revenues, such as tourist hotels and cafeterias for specified period and resources generate more than LE 3.7 million per year.

3. **Photo and film permits:** about 116 thousand LE is the total collected amount form photo and film permit in Ras Mohammed, White Desert, Wadi El-Rayan, Wadi Digla and Giftun.
4. **Partnership with local community (benefit sharing):** such as handicrafts programs in Nabq and St.Catherine PAs and employment programs for South Sinai Bedouins PAs.

7-7-1-3. Economic assessment of ecosystem benefits

Most of environmental decisions require balance between different aspects of the problem, principally benefits against costs. There are several types of ecosystem benefits some of them are easy to identify, others unknown or un-concrete. Values can be divided as shown in following table:

Table (7-6) Total economic value and different types of values

Types of Values	Examples
Direct use values (extractive)	• Foodstuff • Construction material • Pharmaceuticals and other industrial chemicals
Direct use values (non-extractive)	• Tourism and recreation • Education and scientific research
Indirect use values	• Biological support • Carbon sequestration • Coastal protection
Non-use values	• Genetic resources • Known and unknown future uses of the functions above

7-8 Threats:

During the tenth COP of Biodiversity Convention hold in Nagoya – Japan, most parties highlighted that the following five major pressures are still affecting global biodiversity around the world:

1. Habitats degradation;
2. Over-exploitation and unsustainable use;
3. Climate change;
4. Invasive alien species;
5. Pollution.

The fourth national reports provided by countries indicated the importance of facing many obstacles that are still exist, to better achieve objectives of the convention; these obstacles can be summarized as follows:

1. Limited capacity within the developed and developing countries especially matters related to financial, human and technical resources.
2. Absence or limited access to scientific data; in addition to lack of awareness about biodiversity among public and decision makers.
3. Limited mainstreaming of biodiversity
4. The process of decision making does not cover the broad context of biodiversity and limited communications between different ministries and sectors.
5. Unavailability of economic assessment for different biodiversity features.

Threats affecting costal and marine areas in Egypt are mainly pollution and unsustainable use of marine resources. Degradation of environmental quality and gradual deterioration of its renewable resources may decrease ecosystem services and finally cause their complete loss. This degradation of coastal and marine areas is mainly resulting from development pressures that exceeded the carrying capacity of these marine ecosystems such as:

1. Unsustainable exploitation of marine resources and unplanned rapid economic development for some areas such as urban development along the coast of the Suez Canal, and the northern coast.
2. Deterioration of fish stocks due to overfishing and deterioration of its breeding and nursery areas in many areas, especially in the Mediterranean Sea. The deterioration of fish stocks in the Red Sea is lower than in the Mediterranean Sea due to declaration of some protected areas along coasts and islands of the Red Sea. This forced some Egyptian fishing companies to go fishing in international waters of some neighboring countries within the Red Sea, such as: Sudan - Eritrea - Djibouti.
3. Commercial ships crossing the Suez Canal and oil leakage from some oil fields in the Red Sea. Sanitation discharged in the Mediterranean Sea and some of its coastal lakes are of the most important sources of coastal pollution in Egypt.
4. Deterioration of marine and coastal environment in Egypt, are resulting from the social pressures on the government to meet needs of the growing population (unemployment, introduction of new patterns of development, competition for exploiting available resources, lack of public awareness with the importance of inherited culture associated with unorganized development plans and threat of investments due to beaches' erosion).

Wetlands in Egypt are facing many threats that lead to their degradation, such as:

1. Excessive expansion in scooping costal lakes for implementing development projects. For example El-Burullus Lake has been shrunk from 57 thousand Km^2 in 1953 to 42 thousand Km^2 in 2000, meaning loss of more than 1/3 of its total area.
2. Intrude of sewage drainage with agricultural water resulting from cities and villages located along costal lakes ; which increase rate of pollutants in coastal lakes such as El-Burullus , Edko and El-Manzala that affect biota and decrease services and resources of these lakes .
3. Sedimentation, alluvium and sand creep are among the natural threats wetlands are exposed to, which threaten to shrink narrow barriers separating each lake from the sea.
4. Climate change, mainly sea level rise.

5. Overgrazing and erosion of vegetation coverage due to the increased pastoral load to meat increased local consumption, in addition to drought episodes associated with low rainfall and poor management of rangelands.
6. Mines spread along large areas of the North Coast and Western Desert, left from the II World War in El-Alamein area, which contains nearly 17.5 million mines occupies an area of more than quarter million feddans suitable for agriculture.

The following are among the threats facing agricultural biodiversity in Egypt:

1. Excessive use of chemical fertilizers and pesticides, which led to the disappearance of most of the wildlife (kite, owl, fox, mongoose and wild cat).
2. Absence of suitable successive agricultural cycles in addition to cultivation of specific crops that have high economic values.
3. Use of surface flooding irrigation methods, which led to land degradation, reduction of soil fertility and increase soil salinity.
4. Groundwater contamination with pesticides and chemicals cause production of unhealthy food due to its containment of these pesticides' traces.
5. Spread of urbanization on agricultural land in spite of the strict legislations facing destruction of agricultural lands.
6. Invasive species, especially palm weevil, grasses and various agricultural pests, which cause significant economic losses.
7. Increased migration from countryside areas to cities increase burden on state resources.

Climate change phenomenon has been documented in St. Catherine Mountains by monitoring its impact on the disappearance of living organisms on peaks of St. Catherine due to temperatures’ increase, which may expose some organisms to be in danger, such as Sinai baton blue (*pseudophilotes*), the smallest butterfly in the world. Its larva feed on buds of Sinai Thyme (*Thymus decussates*), while adult butterflies feed on nectar of its flowers. Studies proved that annual change in temperatures, expedite its exposure to danger of extinction. It is noticed that rate of Sinai Thyme flower (*Thymus decussates*) decreased with about 40% or more during drought years, and if temperature degrees continue its increase, Sinai Thyme (*Thymus decussates*) will continue its decrease, which will expose Sinai baton blue (pseudophilotes) to danger of extinction within very limited period, especially if exposed to human threats, such as over grazing and collection of Sinai Thyme (*Thymus decussates*) for medical purposes.

Many plants and animals were introduced to Egypt during the past two centuries, where some of them had become of great economic importance especially agricultural species such as cotton, some fruits and animal species including fish, poultry and cattle. This has led to neglecting Egyptian species and thus some of them began to deteriorate or almost disappear (agricultural germ plasm). On the other hand, many species had reached Egypt either intentionally (to increase agricultural production, livestock and fish) or unintentionally (Suez Canal, bird migration), which led to the entrance of many invasive alien species that have negatively impacted the agricultural environment (agricultural pests such as palm weevil) , water environment (water hyacinth - freshwater lobster) and thus Egyptian biodiversity exposed to many threats as a result of the introduction of invasive species .

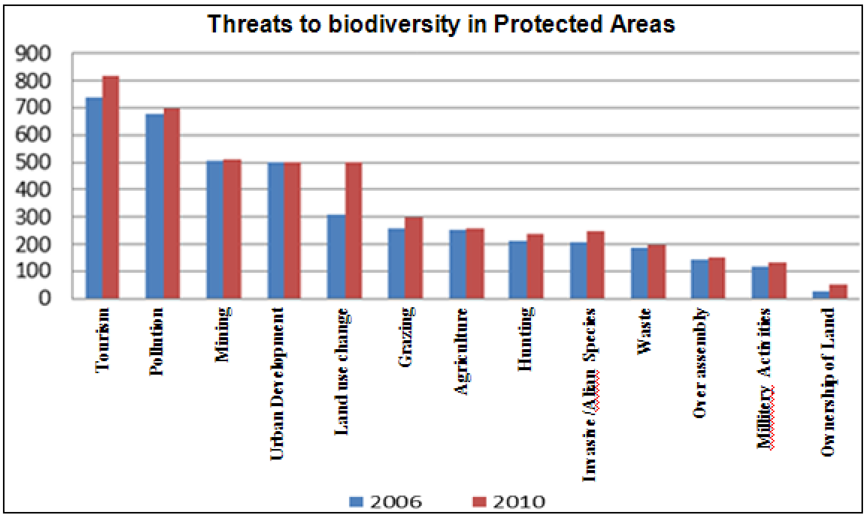


Figure (7-11) Threats PAs biodiversity exposed to

Source: Nature conservation sector

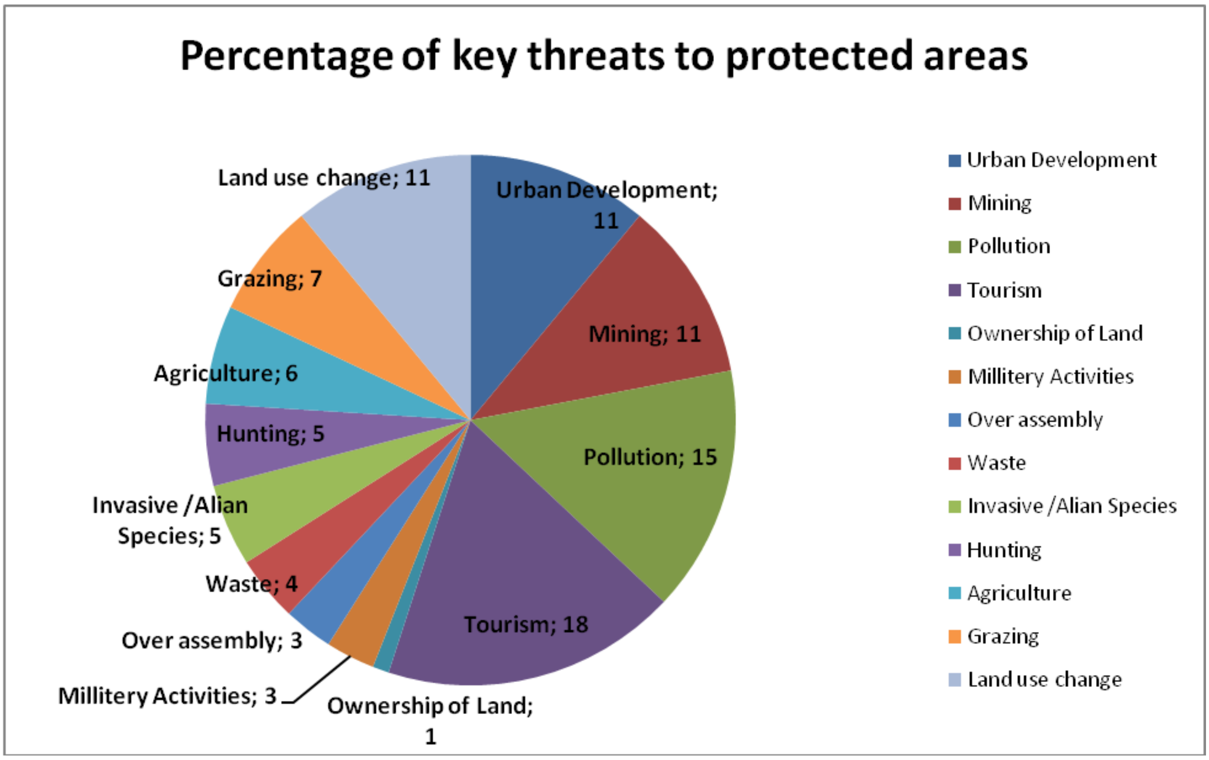


Figure (7-12) Percentage of key threats PAs exposed to

Previous figures indicated that despite declaration of 29 protected areas in Egypt to reduce biodiversity loss; these protected areas are still exposed to many threats that negatively affect their natural resources. It is clear that mass tourism is the biggest threats affecting natural resources which increased as numbers of tourists increased. Also pollution, mining and unplanned urban development are considered of the biggest threats that affect different ecosystems which gradually cause degradation of some environments.

7-9 Management effectiveness of Protected Areas:

7-9-1 Program of evaluating management effectiveness

EEAA had developed and adopted appropriate methods, standards, criteria and indicators to evaluate the management effectiveness of protected areas under the umbrella of the World Commission of Protected Areas (WCPA) within the International Union for Conservation of Nature (IUCN). Starting from 2009, NCS affiliated to EEAA started to use new method for evaluating the management effectiveness of protected areas (Management Effectiveness Tracking Tool -METT). It conducted evaluations using the METT method for seven PAs (Wadi Degla, St. Catherine , Nabq , Ras Mohammed, Northern Islands of the Red Sea, Wadi El-Gemal and White Desert) ; which increased latter on to 11 PAs meaning that Egypt conducted management effectiveness evaluation for 39% of its current protected areas and this percentage goes far beyond the percentage adopted by the Secretariat of the Convention on Biological Diversity during COPs, stated that parties should conduct management effectiveness evaluation for at least 30 percent of their protected areas by 2010.

7-10 Conservation measures and procedures for biodiversity outside protected areas:

Encouragement of biodiversity and habitats conservation is one of the main national priorities in line with the global goal (achieving at least 10% of the effective protection of each ecosystem in Egypt). Current and future planned protected areas, which represent different habitats, have been covered and included within Map of State Land Use of Egypt, to be considered in the future planning of land use processes.

National targets were developed for specific action programs (agricultural biodiversity, inland water, coastal and marine ecosystems, arid and semi-humid and mountains ecosystems) then included within National Environmental Action Plan (2002-2017), relevant national strategies (i.e. wetlands, eco-tourism and medicinal plants).

NCS affiliated to EEAA is working to update its management system of PAs through activating ten priority programs including a program to monitor wildlife, particularly birds, to study biodiversity of resident and migratory wild birds in Egypt, which represents one of the most important routes of the world for migratory birds coming from Central and Western Europe and East Asia to Africa during winter season.

Focus was directed to marine areas, wetlands and mountains (Elba - St. Catherine PAs), arid and semi-arid area. Protection was provided to areas with special interest (fish nurseries, coral reefs and mangroves areas); in addition to areas with endangered species (e.g. Turtles, Gazelle and Dolphins). In the future, focus will be directed to fresh water and agricultural biodiversity.

Picture (7-11) Larus genei

One of the most important site for migratory birds is Zaranik PA where 217 species have been recorded during past five years which represent 89% of the total number of birds species (245 species) recorded since seventies until now; this means that Zaranik PA still retains more migratory birds species, some of which are endangered and with importance at global level, which confirms the importance of the region as one of the most important migration routes for birds in the world.

Port Said and Manzala Lake are of Egypt's most important wetlands (due to their importance for birds, especially migratory water birds). Different sectors of Manzala Lake were surveyed and different water birds species were recorded during 2009, it recorded 45 species of birds belonging to 38 genus and 24 families, including 37 species of water birds (82%) and 8 of terrestrial bird (18%).

In Manzala lake, especially Ashtom El-Gamel PA more than 34 thousand birds during (October, November and December) with monthly average of up to 11 thousand birds from 83 species were monitored, including 6 species of regional and international importance; in addition to recording the second largest breeding colony of Larus genei in Port Fouad (estimated with 6 thousand birds).

Lake Nasser is considered as one of the most important wetlands in Egypt in addition to be a key source of freshwater fishery in Egypt, which contributes with about 25% to 40% of the total production of inland fisheries. During 1992, fishing production was about 26,000 tons of fresh water fish. The most common fish species was Tilapia species which represent 97-98% of the total fish production from the Lake.

Lake Nasser importance increased, as it is the wintering resort for migratory water birds. During winter of 1995 their total number were estimated with about 200,000 individuals, making it one of the most important wetlands in Egypt. Some birds' species are with international importance (e.g. Aythya neroca which is globally threatened) and other species are confined to Lake Nasser; in addition to species of mammals, reptiles and the most famous Nile crocodile. During 2010, Lake Nasser's water birds were estimated with about 150 thousand birds belonging to 56 species, including 6 species globally threatened; this indicates relative stability in water birds population in Lake Nasser, However there is an increasing pressure from agricultural and tourism activities but their adverse impact are relatively limited.

7-11 Future Vision

Many achievements have been realized to improve biodiversity status and develop PAs within the framework of national strategies and efforts of different relative sectors, to meet national and international obligations and achieve effective progress towards reducing biodiversity loss.

However, the next phase requires more efforts to cross the gap between required duties and available capacity to realize sustainable development of PAs and support them for achieving economic and social development, reduction of unemployment and taking social dimension and society values into account while developing National Action Plans. Equip PAs to be model for achieving sustainable development, combating poverty, conserving heritage and intellectual property of local communities and realize partnership with local communities and civil society ; in addition strengthening women role and under-privileged segments of the society through raising their environmental awareness.

Conservation aims to maintain biodiversity, reduce its loss rate through evaluating species' status, development of patterns and conservation programs. Protection of at least 10% of different habitats' areas and the most important flora areas, sustainable management of 30% of them and protecting 60% of endangered wild species at their habitats and 10% outside their habitats.

Strengthen institutional, technical and legislative capabilities to protect nature through raising efficiency of management and services. Develop institutional structure; strengthen human capacities and effective management of PAs. Develop indicators for awarness, follow-up, planning, providing innovative solutions and non-traditional methods for government budget and economic self-financing. Also, use modern technology and communications network to improve and develop information and monitoring systems for PAs and biodiversity.

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Chapter Eight

Afforestation, Forests, Green belts and Landscapes

8-1 Introduction

To secure future generations' right in gaining outcomes of development and keep its sustainability to be able to provide current generation with their basic requirements without sacrificing future generations' rights. It is taken for granted that trees are considered fundamental element of renewable natural resources that endow shadow and protection for people. Trees with its different kinds like shrubs, climbers, indoor plants, flowers and green landscapes are considered one of the necessary renewable natural resources that keep the ecological balance and play an important role in protecting natural environment where they exist. They interact with various environmental components including climate, land, water and ecology to protect all elements of environment.

8-2 Exerted efforts:-

To reduce negative impacts of environmental pollution and using vegetation coverage as a method to mitigate Carbon Dioxide emissions, Ministry of state for Environmental Affairs has developed its strategy to execute many activities to reduce negative impacts of environmental pollution, summarized as follows:

8-2-1 Green belt around Greater Cairo:

In sustaining follow up and maintenance of trees and irrigation networks of the first phase (first priority) of Greater Cairo's green belt, which has been finalized in June 2006, where 65.000 trees were planted during this phase . First half of 2010, 3,000 trees of yellow Acacia geluka, 1700 seedlings of multicolored Bougainvillea glabra were added to the first row of the belt. The infrastructure of reservoirs and main irrigation networks were finalized in preparation for starting plantation in the second priority of the project during which 50.000 trees will be planted, and will be irrigated by drip irrigation system using treated wastewater for environment conservation. Second priority of the project has been scheduled as a CDM Project in addition to injecting EM1 into trees of the first kilo of the project during October 2010.

Picture (8-1) Flowering of Bougainvillea glabra trees planted in the green belt

Picture (8-2) Flowering of Acacia Geluka trees in the green belt

8-2-2 planting timber forests by using treated wastewater:

2010 , witnessed cooperation between the Holding Company for Potable Water and Sanitation – Ministry of Housing, Central Department for Afforestation and Environment - Ministry of Agriculture and Land Reclamation, Egyptian Environmental Affairs Agency-Ministry of State for Environmental Affairs , to survey land spaces specified for timber forests cultivation in 15 governorates in Upper Egypt. After surveying 87,000 feddans, it was found that 2 million m^3 / day is the required capacity of the supplying treatment plants while their actual capacity is 1 million m^3 / day.

About 13,350 feddans have been already cultivated with Jatropha, Jojoba-Simmondsia chinensis, Castorbean-Ricinus communis and Seisabean-Sesbania sesban. The Seisabean-Sesbania sesban trees were tested in producing fiberboard. Triple treatment of wastewater is currently tested for being launched in the new cities to be used in irrigating landscapes and green belts around these cities.

According to Bilateral Education Initiative concerned with enhancing technical education, to provide practically and scientifically well trained technicians on production and technology methods coping with labor market needs. The fourth class has been inaugurated in Luxor timber forest irrigated with treated wastewater.

8-3 Afforestation and cultivation of green landscapes and parks:

1. To preserve genetic resources and biodiversity of different plant species Sinai governorate characterized with, and the importance of botanical Parks; Ministry of State for Environmental Affairs has finalized establishment of Peace Park in Sharm El-Sheikh, on an area of 33 feddans. This park composes of Peace &Environment Museum, Biodiversity Information Centre and Sinai Biodiversity Diorama , where 45 plant species such as palms ,semi-palms, trees ,shrubs , herbs, climbers , hedges and landscapes were planted; in

addition to 38 medical and aromatic plants , also 25 species of Cactus plants and 3000 olive trees , alongside this park a timber forest occupying 25 feddans is established.

Picture (8-3) Sinai Biodiversity Diorama in Sharm El-Sheikh's Peace Park.

Picture (8-4) Overview of Sharm El-Sheikh's Peace Park

Picture (8-5) Overview of olive branch in Sharm El-Sheikh's Peace Park

2. Within the framework of 2010 celebrations with World Environment Day, MSEA supported all governorates with trees and shrubs estimated by 350.000 trees with an average of 12000 trees for each governorate from 22 plant species. These trees were carefully selected according to practical and scientific conditions to provide economical and aesthetical values and cope with climatic conditions of each governorate.
3. Sustain work in establishing and cultivating Family Park in El-Rehab City on an area of 70 feddans, this year has witnessed MSEA exerted efforts to add distinguished gardens to the park, to upgrade its botanical value among international parks to be the park of all segments of the society.

Picture (8-6) Beautifying lake area in El-Rehab City's Family Park

Picture (8-7) Entrance of lake area in El-Rehab City's Family Park

4. Sustain work in developing the Central Nursery and Child Garden affiliated to EEAA, this nursery is considered a permanent source for trees, shrubs, indoor plants used in supporting environmental conditions in schools, central security units, public hospitals, mosques, monasteries and NGOs. The Child Garden is considered the healthy green area for residents of New Cairo. This year witnessed finalizing the establishment of a fence around the added area to the Child Garden, in addition to works of leveling and irrigation networks on the fence in preparation for start its plantation.

5. Contribute in afforestating 175 public schools with 3500 trees; in addition to supporting environmental conditions around mosques, monasteries, public hospitals, and libraries of children gardens, central security units, public squares and NGOs by providing them with 7500 trees.

Before Development

After Development

Picture (8-8) Khalid Ibn Elwalid Primary School

Before Development

After Development

Picture (8-9) El-Ghorfa El-Togariha Experimental School

6. Contribute in planting and beautifying some universities such as Al-Azhar, and Cairo universities, some faculties affiliated to Helwan University such as faculties of Social Work, Applied Arts, Commerce and Management and the National Child Culture Centre.

7. In the framework of "Youth Campaign for Environment Protection" MSEA supported "Helwan , El-Menofia , El-Sharkia , El-Behira , Kafr El-Sheikh , El-Gharbia, Cairo and 6th October governorates with 1000 trees for each governorate; in addition to the environmental awareness convoys in 11 governorates , Tanta university , North of Sinai and Matrouh governorates (1000 trees for each).

Picture (8-10) Youth Campaign for Environment Protection in Helwan

8. Provide Luxor and Beni Suef governorates with 22.000 trees and Sharkia governorate with 5000 olive seedlings. MSEA has finalized afforestation of Suhag Airport way with 5000 trees and providing Luxor governorate with 3200 trees.

9. Finalize the establishment of two public gardens, the first on an area of 700 m^2 in Luxor governorate, and the public garden in Talkha city- Dakahlia governorate.

10. This year witnessed MSEA establishment of a nursery for timber trees, the first in Beni Suef governorate, the second in Fayoum governorate and the third in Northern Sinai governorate. This was conducted within the framework of establishing public and NGOs nurseries in governorates on an area estimated between 1 to 10 feddans for each nursery, due to the stipulated in Environment Law 4 /1994.

8-4 Future vision (until 2012)

Due to the currently increasing quantities of treated wastewater as a result of the establishment of treatment plants throughout Egypt, Ministry of State for Environmental Affairs in cooperation with all concerned ministries are keen on achieving progress and cultivating more timber forests , to achieve the following :

1. Reduce air, soil and water pollution.
2. Wood production.
3. Produce Bio fuel (Jatropha).
4. Planting green belts irrigated with treated waste water is one of MSEA's priorities, whether through finalizing phase II and III of Green Belt around Ring Road of Greater Cairo and by planting green belts on crossing roads with ring road, and around old and new cities.
5. Efforts is sustaining to improve the environment through planting more green landscapes and trees , establishing nurseries , intensifying construction of public parks in old or in new urban communities, afforesting schools and supporting NGOs efforts to ensure providence of great health, aesthetic, environmental and economical values.

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2. Report of the Arab Forum for Environment and Development – 2010: Arab Environment, Water and Sustainable Management of Decreasing Resource.

Chapter nine:

Desertification

9-1 Introduction

Phenomenon of desertification is defined as degradation of land productivity in arid, semi-arid and sub-humid as a result of several factors, including climate change and human activities .Exerted efforts to combat phenomenon of desertification include as conducted activities in arid, semi-arid and sub-humid areas to achieve sustainable development, which aims at:

1. Reduction or minimization of land degradation.
2. Rehabilitation and reclamation of degraded lands.

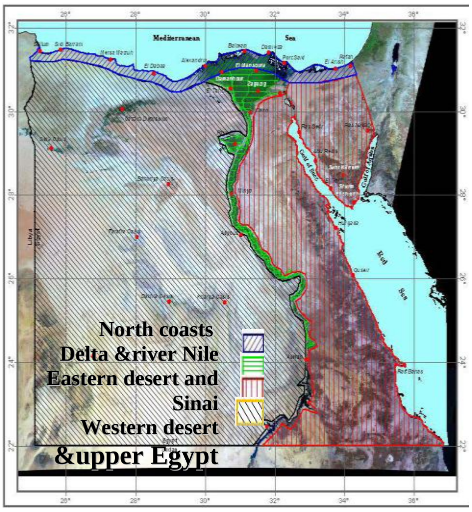
As Africa considered the most vulnerable continent to phenomenon of desertification and land degradation; about 74% of pasture land, 61% of rain fed agriculture and 18% of the irrigated land in 33 African countries are exposed to risks of desertification and declining of productivity. Losses resulting from desertification in Africa are estimated by about 9 thousand million dollars per year.

Egypt geographic location in the north-east of Africa, exposes it to the arid belt, which witnesses scarcity of water resources, intensity of human activity and mismanagement of natural resources (water, soil, etc…). Productive land exposed to dangers of desertification and deterioration of their productivity as 30% of irrigated land in Nile valley and Delta and about 80% of the rain fed areas in the northern coast of Egypt, Sinai Peninsula and Eastern desert are facing dangers of desertification with varying degrees.

9-2 Status of desertification in the Agro Ecological Zones:

Degrees and causes of land degradation are different due to the differences between the four agro-ecological zones in Egypt, which include:

3. Valley and Delta of the Nile River and western and eastern boundaries.
4. North Coast (NC).
5. Eastern desert and Sinai Peninsula.
 Depressions of Western desert and Upper Egypt.



Map (9-1) Division of Egypt, according to the Agro ecological zones

9.2.1 Valley and Delta of the Nile River and western and eastern boundaries

Area of this region estimated to be about 8.5 million feddans including flood plain of the Nile Valley that estimated with about 6.5 million feddans and desert fringes which have been reclaimed and are being cultivated and estimated with about 2 million feddans. This region is characterized by population density and intensive use of land and water resources to provide food for population and achieve stability in the trade and economic balance. In view of the above mentioned situation, this region is exposed to many factors of degradation, which include:

1. **Soil salinity**: Salinity of soil in this region returns to the intense use of irrigation water, application of traditional surface irrigation system and inefficient drainage systems, causing high level of ground water and soil salinity. Reports indicate that 30-40% of the area of the flood plain land is affected by salinity with varying degrees.
2. **Urbanization :** Increase in population density and subsequent increased demand for land to provide needs of population from housing, services and infrastructure have a direct impact on the urban expansion, where the estimated annual rates of urbanization on agricultural land, whether by building or other un-agricultural uses is about 20-30 thousand feddans / year.

3. **Contamination of soil and water**: Intensive exploitation of agricultural land and water resources require increased use of fertilizers and chemical pesticides, which resulted in contamination of soil and water as a result of the increasing concentration of residues of fertilizers and pesticides, as well as the increasing contamination of waterways by sewage and industrial wastewater as a result of failure in disposing and treating them safely and soundly.
4. **Sand encroachment on western boundaries of the Nile valley**: Sand formations are considered one of the main characteristics of arid and semi-arid areas. In Egypt, it covers about 160 thousand km^2, concentrated in the Western desert. These formations move under the influence of the north and North West winds to affect western edges of the Nile valley, some reports estimated that about 1.8 million feddans are negatively affected by sand encroachment and their productivity decreases by about 25%.
5. **Erosion of the northern coast of Nile Delta**: Northern coast of the Nile Delta exposed to erosion due to the decreased load of sediments in Nile water as one of the side effects of the High Dam. Some studies indicate that thousands feddans of Delta coast exposed to erosion during past decades; as well as expected climate change will increase this phenomenon , in case of sea level rise with about 1 meter , one million feddans will expose to erosion and about 6 million people would be displaced .

9.2.2 North Coast :

Northern coasts of Western Desert and Sinai exposed to land degradation, including:

1. **Deterioration of natural pastures:** Natural pastures in this region estimated by about 6.5 million feddans including 3.5 million feddans in the north-west coast and 3 million feddans in the north coastal plain of Sinai Peninsula . Natural pastures in this region exposed to deterioration, as 85% of its area classified as weak and very weak and their carrying capacity ranging between 15-25 feddans per head. Deterioration of natural pastures in this region is due to decrease, fluctuation, and poor

distribution of rainfall and over-grazing due to the increased number of animals compared to the carrying capacity of these areas. Deterioration of pastures in this region reflect the low productivity of meat by about 50% ,dairy products by about 40% and wool by almost 25% .

2. **Use of pasturelands in grains' cultivation**: Shift from traditional systems in cultivation of barley and some fruits, which tolerant drought conditions (fig - olives), to the expansion in cultivating grains especially wheat, (about one million feddans), had negative impact on the fragile ecosystem of this region. This negative impact includes deterioration of natural vegetation and exposure of soil surface to erosion and low productivity.

3. **Water and air erosion:** Mismanagement of land and water resources in Northern coasts and expansion in using agricultural mechanization in this fragile environment for grains' cultivation without applying scientific methods in maintenance of land and water resources, have negative impact on increasing water erosion especially in valleys and wind erosion in areas of pasturelands.
4. **Ownership of land** in this region is characterized by common rights of joint uses, which had great negative impact on deterioration of its vegetation and consequently exposure to air and water erosion and low productivity.

9.2.3 Eastern Desert and Sinai

This region is characterized by fragility of its ecological system as its soil resources are poor with high rate of calcium carbonate and increased salinity, and the water resources are limited and of high salinity groundwater, such resources are poor in agricultural activity. The most important aspects of desertification in this region include the following:

1. **Water and air erosion**: Due to the characteristics of soil surface and low density of vegetation, the region is exposed to wind erosion under the influence of prevailing wind conditions; and in view of the topographic characteristics and spread of the very steep slops of the valleys, these areas are exposed to water erosion as a result of the flash floods that occur once every 5 to 7 years.

2. **Degradation of vegetation and biodiversity:** Some areas of Sinai (St. Catherine) and Eastern Desert (Elba Mountain and surrounding areas) include some plants vulnerable to degradation, whether by over-exploitation or due to the low rainfall, which requires taking appropriate measures for conserving and exploiting these resources sustainably, to produce products with high economic value to contribute in reducing poverty of Bedouin communities and providing jobs for local residents.

9.2.4 Depressions of Western Desert and southern Egypt

Since the beginning of second half of the twentieth century, this region has experienced intensive land reclamation depending on the groundwater from the Nubian Sandstone Aquifer. In light of the intensive exploitation of water resources in cultivating water consuming crops (rice and alfalfa) with the use of traditional surface irrigation systems and poor drainage ,water and land resources have been exposed to degradation as follows:

1. **Deterioration of the aquifer** in terms of quantity and quality ,as groundwater level decreased in some areas (El-Kharga oasis) by about 100 meters below surface of the ground compared to what it was during sixties of the last century, where groundwater static pressure reached at that time +60 m above earth surface, this had a prominent impact on increasing cost of lifting water as well as increase groundwater salinity in some areas ,as a result of the over pumping for irrigating the high water requirements crops.
2. **High level of ground water and soil salinity** as a result of overuse of irrigation water, following traditional surface irrigation system and poor drainage which resulted in deterioration of soil’s physical and chemical properties and productivity.
3. **Sand encroachment** which covers about 145 thousand km 2 under the influence of North-West wind; threatening inhabited areas and population activities in the oases of Western desert , as well as their impact on the mega land

reclamation projects in Al-Farafra, East of El-Ouwainat ,Toshka and Darb El-Arbaean.

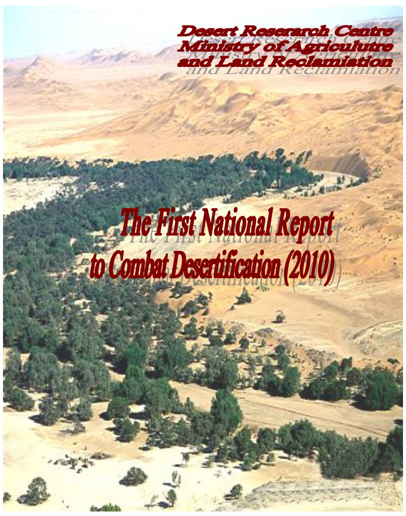
4. **Deterioration of wildlife** (fauna and flora), in view of the intensive and unsustainable exploitation of land and water resources, which is not harmonized with the fragile ecosystem of the depressions of Western desert and southern Egypt.

9-3 National efforts to combat desertification

In view of the environmental and human pressures on the land and water resources that reflect the deterioration of food production and increasing rates of hunger and poverty, the United Nations since the last quarter of the twentieth century highlighted the importance of combating desertification. Consequently, and based on the United Nations Conference held in Nairobi in 1977 and Earth Summit in Brazil in 1992, the International Convention to Combat Desertification (UNCCD) was launched in 1994 and entered into force in 1996 with signature of more than 190 countries. This convention targeting the following:

1. Combating desertification and land degradation.
2. Addressing impacts of drought and desertification, particularly in Africa.

   Eradicating poverty, adopting sustainable management of resources and improving standard of living through cooperation at regional and international levels.
3. Aware with dangers and results of land degradation (desertification) on lack of food supply, increase rates of poverty and unemployment; Egypt participated in the activities of the International Convention to Combat Desertification as follows:



Picture (9-1) the First National Report to Combat Desertification (2010)

a. Signing UN Convention to Combat Desertification in 1995 and Desert Research Center was identified as its national focal point.
b. Formation of the National Committee to follow up activities of this convention, chaired by Minister of Agriculture and membership of representatives of stakeholders . It is authorized to define policies and programs related to the International Convention to Combat Desertification and follow-up its activities.
c. Formation of the Scientific Committee to prepare the National Action Plan to combat desertification.
d. Issuance of the first national report to Combat Desertification (2010) in collaboration with various concerned bodies, institutions and ministries. Measures of its adoption are currently undertaking for sending it to the Convention's Secretariat. This report covers institutional procedures for its execution; as well as national strategies, activities and ongoing efforts undertaken by various bodies, institutions and ministries to combat land degradation. Role of NGOs and financial allocations provided by the State and development partners in this regard.
e. Conduct activities and projects aimed at reducing this phenomenon in the Nile valley and delta and desert areas; such activities include the following:

- Land improvement.
- Control pollution in the irrigation and drainage networks.
- Improve drainage.
- Maintenance of water resources.
- Afforestation of desert boundaries.
- Maintenance of land and water resources in the Egyptian deserts.
- Sand dunes fixation.

These activities conducted by many, national, regional and international institutions and bodies such as:

- Ministry of Agriculture and Land Reclamation.
- Ministry of Water Resources and Irrigation.
- Ministry of State for Environmental Affairs.
- Food and Agriculture Organization(FAO).
- United Nations Development Program (UNDP) German Aid Program (GTZ)

The following will review major exerted efforts to combat desertification, conducted in different fields:

9-3-1 Program of developing natural and human resources in Egyptian deserts

Desert Research Centre - Ministry of Agriculture and Land Reclamation is responsible about this program. It aims at surveying and maximizing use of land, water, plant, animal, and human resources; reduces their degradation in light of climate change and human pressures.

This program includes survey and development of natural resources in

1. Survey natural resources in Al-Girafy Valley area in central Sinai.
2. Survey natural resources in Al-Borouk Valley area in central Sinai.
3. Survey natural resources in southern Egypt - Toshka.
4. Increase the productivity; develop capacities and enhance the economic situation of the Bedouins of some valleys of the Northwest Coast.
5. Conduct technical and economic evaluation to rehabilitate land. reclamation projects in El-Saida Valley.
6. Establish gene bank for Sinai endemic plants.

(Picture 9-2)Planting and developing valleys in the Northern Western Coast

9-3-2 Program of improving degraded agricultural land

Land Improvement Development -Ministry of Agriculture and Land Reclamation is responsible for the implementation of this program, aiming at increase productivity of degraded land, ensure food security and increase farmers' income. These activities include improving the physical and chemical properties of the soil through laser leveling of the soil, deep plowing, and adding agricultural gypsum and clean on farm irrigated canals. Since the establishment of Land Improvement Development, deep plowing of about 6 million feddans, adds about 6 million tons of agricultural gypsum, rehabilitation of water canals in more than 7 million feddans and soil leveling of about 20 thousand feddans by laser were conducted. **Such activities have direct impact on reducing salinity by about 5 and 11 % and reach up to 18% in sub surface layers; as well as reduce the soil (p.H), and maintain the water within range of 90-110 cm. These activities have impact on increasing feddan productivity of key crops with about 15 and 30% by an increase in net yield of feddan to about 200 and 500 Egyptian pounds.**

Pic.(9-3) Laser leveling, deep plowing to improve productivity of degraded land

9-3-3 Program of land protection and conservation of agricultural area

The Department for Protection of Lands and Land Reclamation is responsible for the implementation of this program to conserve the agricultural area from urbanization; as well as following up execution of relevant laws such as law 59 /1973 and subsequent laws 119 /2008, 116 /1983 in addition to harshness penalties for crimes of urbanization on agricultural area.

To achieve intention of the legislator of not prejudicing farming area, the Department of Land Protection exerted efforts to reduce this phenomenon in all its forms, whether through on-going follow-up of protection activities conducted in governorates, take necessary measures to prevent urbanization and remove its causes by administrative remedy at the expense of offenders in coordination with local
government and security agencies.

9-3-4 Program of sub-surface drainage, improvement and development of open drainage

Ministry of Water Resources and Irrigation is responsible for implementing this program. Targets of this program are maintenance of agricultural lands; raise their productivity and rehabilitation of land resources, which contribute to increase agricultural production by about 25%. Activities of this program during the five-
year plan 2007 / 2012 include the following:

1. Expand in implementing sub-surface drainage projects where the plan targets to serve 6.4 million feddans in upper and Lower Egypt among which 5.8 have been conducted at a cost of 3.5 billion pounds. It is expected to finalize the rest area of 0.5 million feddans within the next plan 2007/2012.
2. Replace and renew sub-surface drainage networks, which their supposed life (25-30 year) ended, with rate of 90 thousand feddans per year.
3. Improve and develop surface drainages within 8 million feddans in Lower and Upper Egypt, development of about 7.2 million feddans have been finalized with total cost estimated at 2.4 billion pounds.

These efforts have positive impact on the productivity of different field crops, where different studies indicated an increase in the productivity with rates ranging between 3 and 25%.

9-3-5 Program of improvement, development of irrigation and reduction of water losses

Ministry of Water Resources and Irrigation is responsible for implementing this program, it aims at improving and developing systems and methods of irrigation, raising efficiency of distribution and reducing losses. Activities of this program include the following:

1. **Maximize use of irrigation water** through conversion from shifts system to continuous flow system , formation of Water Users Associations “WUAs”, which will contribute in saving 10-15% of water needs .This activity has been carried out in about 480 thousand feddans at a cost of 1.2 billion pounds.
2. **Program of establish and develop barrages and reservoirs** in Esna , Nag Hammadi, El-Rayah El-Menoufi , El-Rayah El-Abbasi and Esna lock. Total costs of executed work estimated with 4.1 billion pounds.
3. **Replace and renovate lift stations** with cost of 6.8 billion pounds.

4. **Rationalize and manage irrigation systems** to reduce losses from leakage and seepage with cost of 1.2 billion pounds.

9.3.6 Land Reclamation Program

Ministry of Agriculture and Land Reclamation is responsible about implementing this program. This program targets exploitation of natural resources in different regions for the reclamation and cultivation of about 3.4 million feddans by 2017, to increase food production, create new jobs, raise living standards and combat poverty. Reclamation and cultivation of about 1.5 million feddans had been finalized and work is going on in

9.3.7 Afforestation and forest program:-

Ministry of State for Environmental Affairs is responsible for implementing this program. This program aims at using non-conventional water resources (treated waste water) in afforestation and plantation of timber forests. This program includes the following:

1. Establish timber forest, the total area of established forests till 2007 estimated of about 11 thousand feddans distributed over 34 forests in17 governorates. By the beginning of 2008, cultivation initiated in about 17 thousand feddans in 27 forests along 8 governorates. This program included establishing demonstration fields, training the skills and establishment of parks that aim at preserving genetic origins (Peace Park in Sharm El Sheikh), nurseries to provide seedlings and encourage non-governmental organizations and civil society organizations on executing afforestation programs in governorates and desert roads.
2. Cultivation of the green belt around Greater Cairo to protect the capital from wind and dust. Length of this belt is about 100 km and irrigated with treated waste water. Implementation of the project has been launched in 2005 (first phase) which witnessed plantation of about 14 km and work is going on to launch plantation of its second phase.

Picture (9-4) Jatropha trees producing bio-oil in Luxor

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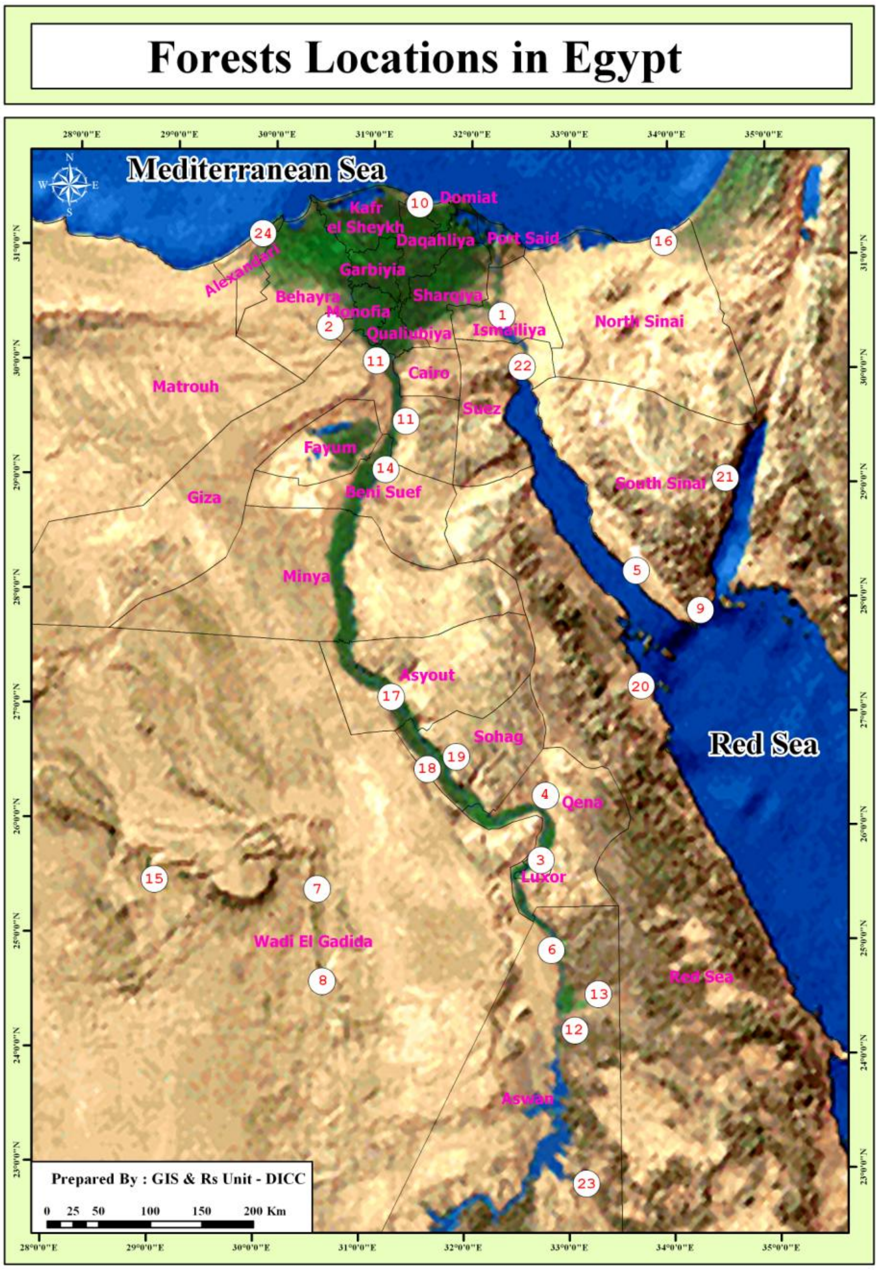


Map (9-3) forests locations in Egypt

Developed by: Ggeographical Information Systems Unit – Central Department of Information
Source: Ministry of State for Environmental Affairs and Ministry of Agriculture and Land Reclamation

9.3.8 Establishing the new villages desert fringes

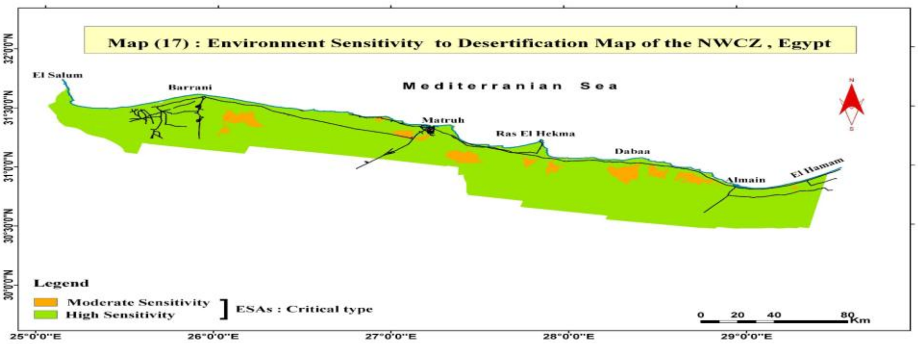
Ministries of Housing and Utilities, Water Resources and Irrigation, and State for Environmental Affairs, as well as the different governorates, are responsible about implementing this program .It aims at providing new areas to absorb population growth within valley and Delta to maintain agricultural land from unplanned urban sprawl .It is planned to establish about 400 new villages, conditioning that 40 villages will be accomplished by 2012. Initial costs of this program estimated of about 110 billion pounds, distributed by 25 million pounds for each village. Establishment of 21 villages had been accomplished in 10 governorates of Upper Egypt.

9-3-9 Monitor and Evaluation and land degradation control program

Desert Research Centre in collaboration with different authorities and research institutions are responsible for implementing this program. This program aims at monitoring and evaluating land degradation in terms of qualitative and quantitative, to take necessary measures to reduce this deterioration.

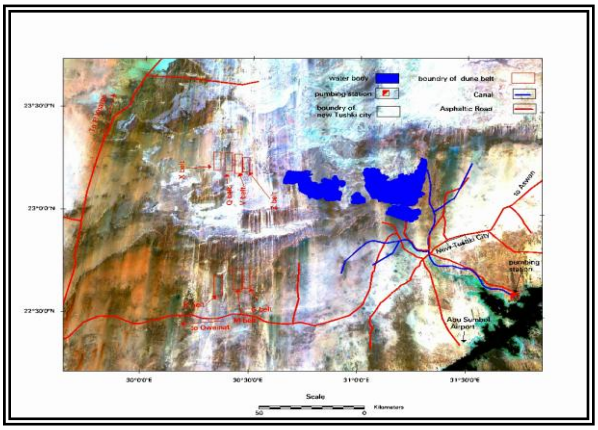
This program included the following:

1. **Issuing map of vulnerability to desertification in the western northern coast** in collaboration with the Remote Sensing Authority, through using satellite imagery, topographic maps and data of climate, soil, water and plant . Results indicate that this sector is with great vulnerability to desertification due to lack of water resources, overuse of vegetation and exposure of most parts of this region to water and wind erosion.



Map (9-4) Desertification vulnerability in northern western coast

2. **Track sand dunes movement on mega development projects** and its components of the infrastructure, which include implementation of the following studies:



Picture(9-5) Sand encroachment in the region of Toshka development projects

9-3-10 Sand encroachment control and sand dunes fixation program

Desert Research Centre in collaboration with some executive bodies are responsible for implementing this program. This program includes conducting studies and executing protection activities for roads, facilities and development projects, **the following are the most important achievements in this regard:**

1. Protection scheme of Dayrout / Farafra road in cooperation with Ministry of Housing, Utilities and Urban Development.
2. Protection and afforestation of El-Salam canal of length of 10 km from Km 24.75 to Km 41 (North Sinai) in cooperation with Ministry of Water Resources and Irrigation and Faculty of Engineering, Cairo University.
3. Protection and afforestation of about 11 km on south Qantara canal from Km 28 to Km 35 (north Sinai) in cooperation with Ministry of Water Resources and Irrigation and Faculty of Engineering, Cairo University.

Picture (9-6) Fixation and exploitation of sand dunes in Siwa Oasis

4. Sand encroachment control in Darb El-Arbaean /Toshka depression in collaboration with the High Dam and Aswan Reservoir Authority.
5. Sand encroachment control on Sheikh Zayed Canal (Toshka) and executing the protection scheme of Sheikh Zayed Canal in

cooperation with Ministry of Water Resources and Irrigation and Faculty of Engineering, Cairo University

6. Fixation and exploitation of sand dunes on an area of 100 feddans in Khamisa area in Siwa oasis in collaboration with Social Fund.
7. Fixation and exploitation of sand dunes in an area of approximately 13 feddans in Siwa oasis, in cooperation with Egyptian Environmental Affairs Agency -Ministry of State for Environmental Affairs.
8. Protection of reclamation areas of Siwa Oasis, in cooperation with Egyptian Environmental Affairs Agency - Ministry of State for Environmental Affairs.
9. Protection and afforestation of treated wastewater station and planting an area of 1000 feddans for establishing timber forest on the treated wastewater (Siwa), in cooperation with Ministry of Housing, Utilities
and Urban Development.

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Chapter Ten

Agriculture

10-1: Introduction:

Agriculture enormously contributes to the environmental system both positively and negatively. As for the negative effect, agriculture initially causes a number of the environmental problems due to the pollution resulting from the manufacturing and excessive use of chemical fertilizers and agricultural pesticides. In addition, the agriculture in Egypt produces 16% of the greenhouse gas emissions as a result of the various agricultural activities (animal breeding- producing fertilizers, especially nitrate fertilizers- burning agriculture waste, organic fertilizers, rice cultivation, and agricultural machinery….etc).

Agriculture is one of the most important factors, affecting and improving climate in the countryside and cities alike. This can be illustrated through the following comparison:

Table (10-1) a comparison between a city with and a city without gardens and plants

A city without gardens and plants	A city with a lot of gardens and plants
• High temperature. • Dry air. • Polluted atmosphere full of gases exhausts and fumes. • An ugly outlook for the city.	• Fresh and cool air. • Some humidity, especially in the early morning. • Healthy atmosphere full of oxygen. • A beautiful outlook for the city.

Regarding the positive effect, the agricultural sector contributes to improving the environment through reducing greenhouse gas emissions, re-storing these gases in the soil. In addition, agriculture provides us with food, a number of raw materials for various industries, and clean energy, also known as biofuel. Therefore, it is necessary to define the ecological role of the agricultural sector through examining the various elements influencing it. The agricultural sector is initially a part of a whole environmental system that changes from one area to another according to every geographical and climate region.

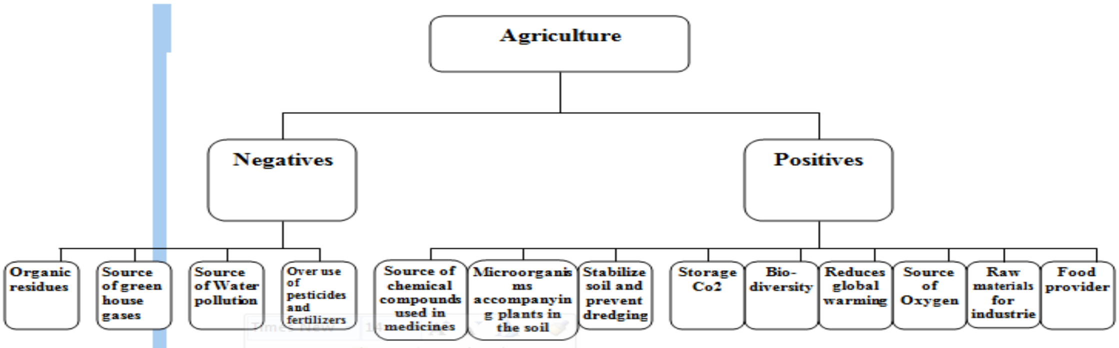


Figure (10-1) Agriculture's positive & negative effects

Agriculture Positives

- Supplies food
- Raw materials for various industries.
- Source of oxygen.
- Reducing global warming
- Biodiversity.
- Storage of Carbon Dioxide.
- Preventing soil erosion.
- Microbes accompanying the plant.
- Source of chemical compounds used in medicines.

Agriculture Negatives

- Excessive use of fertilizers and pesticides.
- One of the reasons for water pollution.
- One of the international sources for greenhouse gas emissions.
- Organic waste

The agricultural sector is influenced and shaped by a number of intertwined elements (water, soil, environmental and weather conditions, human activities, and biodiversity). The current environmental situation, which has never been seen before in human history, resulting from the excessive consumption of natural resources in the late fifty years to meet humanity's needs (nourishment, water, wood, fibers, and fuel,…..etc) necessitates developing human and natural resources, also known as sustainable development. This means developing natural resources while taking into consideration the environmental system as well as the social and economic aspects.

Figure (10-2) Different factors affecting agricultural activity

Hence, we ought to produce more food while using less resources; i.e. sustainable development and improving the agricultural system are now a must in order to meet the growing human needs of food and to save life on the Earth.

10-2 The Agricultural Sector's Environmental Contribution:

Agriculture plays a key role in shaping the environment, for a lot of problems and also solutions are connected to agriculture itself. Hence, agricultural policies must consider new standards such as a comprehensive re-allocation of the use of agricultural lands, searching for new alternatives that are useful in the field of agriculture, the use of energy corps, and the contributions that agriculture can make to economic and environmental development on both the local and the international levels.

There are a number of environmental challenges in the field of agriculture such as maintaining biodiversity, reducing the negative effects of climate change and greenhouse gas emissions as well as the global tendency toward using biofuel. Such challenges require more research for ways through which the current food production system should meet the increasing demands, and for acclimatization procedures to face the effects of climate change and shrinkage of biodiversity. These challenges are also about reducing famines and developing natural resources. The agricultural sector should not only achieve its aims in terms of improving the environment, but also it should help in solving the environmental problems of the cities through recycling organic waste, using the various composting methods like air and biogas by either the antenna or the biogas (Sao Paulo is a very good example for a city which managed to use organic waste as a source of energy) or composting with earth worms on the level of small and big unites, restaurants, hotels, hospitals; and thus reducing the greenhouse gas emissions, overcoming the Urban Heat Island's problem in cities, and providing green areas for city residents through green roofs, i.e. growing plants on buildings' roofs in cities.

10-3 Pesticides:

After the agricultural expansion across Egypt- especially with the enormous increase in plant families of vegetables, fruit, or even field crops which are usually damaged, either partially or completely, either by diseases or pests, sometimes causing such grave economic losses that can be up to billions of pounds, quick intervention to control and combat such plant diseases and pests, through the proper use of pesticides and other safe methods, has become a must. However, in the past few years, there have been discussions over the use of pesticides, with some seeing them as initially and gravely harmful for public health and the ecological system in general, while others consider them as the most effective method in combating these plant diseases and pests that can cause overwhelming famines and epidemics in case pesticides are not used.

And although the use of pesticides has become an urgent need to provide adequate agricultural production to meet the needs of the increasing population and the state's interest in having extra production for export, this use must be regulated as the excessive use of pesticides certainly has negative effects on crops and on man's health in turn.

Furthermore, regulating the use of pesticides both preserves the health of the farmers who spray their crops and reduces the residues of pesticides on crops and in soil, something that does not only help in producing good crops but also, and more importantly, helps in preserving the environment as a whole—through preventing these residues from reaching ground water, ditches and watercourses, contaminating water and harming important aquatic organisms like fish.

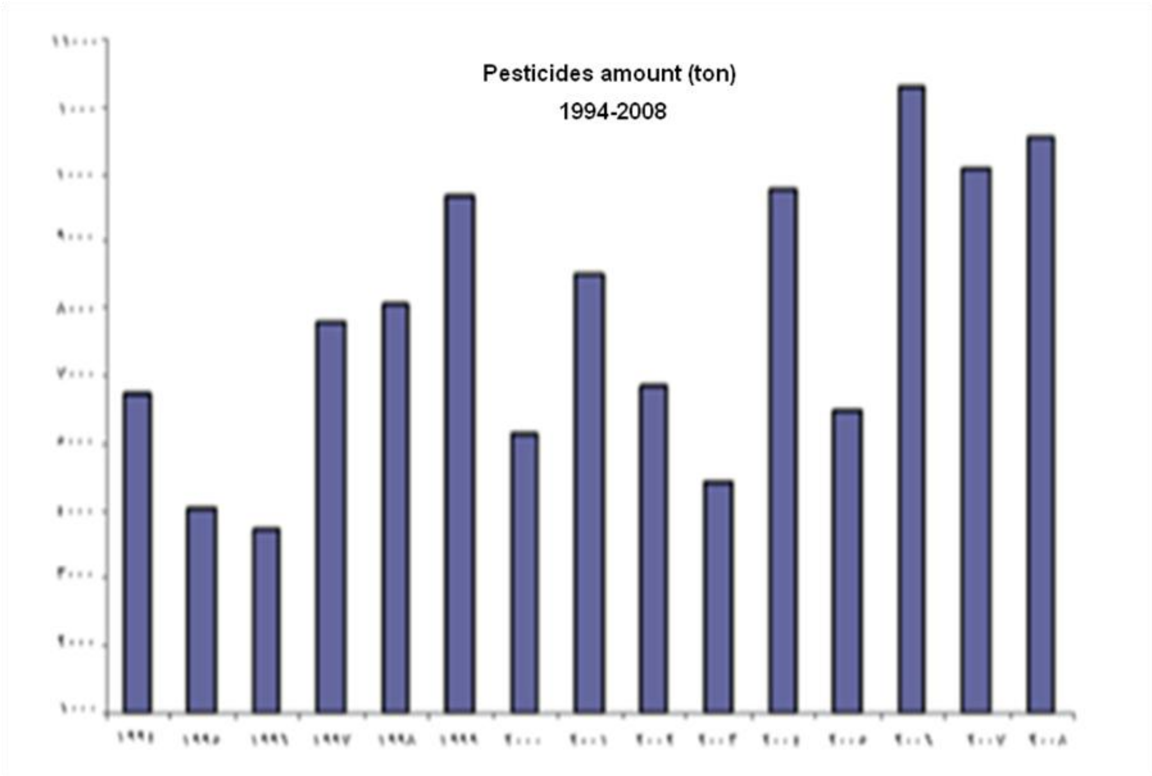


Figure (10-3) the amount of pesticides used in Egypt by tons in the years 1994-2008)

However, researchers, in the past twenty years, could deduce new methods for a more effective pest control system, depending less on pesticides and subsequently cutting off the high expenses of agricultural production. This does not only earn farmers more profits but also improves the efficiency of the pest control system by applying modern and effective agricultural methods, something that is positively reflected on the ecological system as a whole. Nevertheless, the full fruits of these measures are likely to appear after a relatively long time due to the Egyptian farmers' strong resistance to any changes or modern agricultural methods. These modern, effective, agricultural methods include:

1. Using species resistant to bacterial plant diseases and pests.
2. Following the agricultural rotation.
3. Sowing crops earlier or later than their due date to avoid contracting any plant diseases, especially during their activity periods.

4. Using good agricultural methods (plowing the soil to let the sun in its deeper layers—ridding the soil of the residues of any previous crops—considering adequate spaces between types of crops by pinching off the weak plants and planting good ones in the holes having none—pruning trees).
5. Regularly examining crop plantations for early diagnosis and treatment of any diseases or pests.
6. Using plant traps and attractive traps.
7. Manually pinching off harmful grass and removing white spots and eggs as with cotton worm.
8. Growing different crops to avoid having harmful grass in fields.
9. Using the proper irrigation systems and fertilizers.
10. Using small scale crop spraying to spray the defective plants instead of spraying the whole field.
11. Using good crop spraying machines and accurately calculating the needed amounts of pesticides to avoid the hazards of excessive use; e.g. the soil's absorbing and re-storing these chemicals.
12. Using natural enemies like some kinds of birds and plants as a means of pest control.
13. Using hormones (to impede the growth of larvae so as not to become a caterpillar or a nymph).

10-4 Fertilizers:

The excessive use of fertilizers leaves the soil full of their residues, the amounts not absorbed by the plants. These residues do not only represent an unjustified economic burden but also a major cause for pollution, namely water, soil and air pollution. As for water and soil pollution, irrigating the soil containing these residues of fertilizers helps these particles dissolve in the irrigation water, absorbed by the soil; and hence they finally reach underground water. Rain, ditches and underground water also play a key role in this water pollution as they carry these chemicals to bodies of water like rivers and lakes. Regarding air pollution, these residues of fertilizers represent a main cause for greenhouse gas emissions and subsequently global warming.

Accordingly, natural substitutes which are safe for both plants and humans can be used instead of chemical fertilizers. These natural substitutes, which are originally safe recycled agricultural waste, provide plants with the needed nutrition and preserve the soil's fertility through using organic fertilizers and composts. Using these organic fertilizers and composts has a direct positive effect on the environment, reducing soil and water pollution, especially for ditch and underground water, as well as air pollution by cutting off the poisonous fumes of chemical fertilizers' plants. This also has some economic fruits such as providing the needed amounts of fertilizers; and thus decreasing the demand for exported ones. The most commonly used chemical fertilizers include:

10-4-1 Phosphorus Compounds:

Phosphorous compounds—carried from cultivated lands by ditch, rain and underground water—are a key factor for contaminating bodies of running water. Chemically, phosphorous compounds are fixed ones whose effect on the soil remains for such a long time. They also have a poisonous effect on humans and animals alike. Therefore, the increase of phosphorus percentage in potable water, coming from underground water or running streams, is unhealthy. Such increase of phosphorous compounds also causes eutrophication, the increase of minerals in lakes, leading to an overwhelming growth of aquatic plants like seaweeds so that small aquatic animals become unable to feed on them; hence many of these plants die and decay under water, consuming much of the oxygen dissolvent in it. Such overwhelming oxygen consumption prompts aquatic animals to leave these lakes for lack of oxygen.

Nitrate Compounds:

Pollution due to nitrate compounds is a relatively new phenomenon that has been given due consideration only recently. Nitrate compounds exist in the soil, in bodies of running water and exist considerably in some plants' tissues; hence they reach man's body as he eats these plants. Having their roots in the soil, plants absorb nitrate ions which are among other water solutions absorbed by the soil. Sometimes plants' absorption rate of these nitrate ions is higher than that of plants' transforming these nitrates into organic compounds; thus a surplus of nitrates is stored in parts of these plants. Amongst the plants storing nitrates in their tissues are sorghum bicolor, maize, spinach, lettuce, radish, carrot, and legume.

Table (10-2) demonstrates some plants and the amounts they store of nitrite and nitrate compounds

Plant	Nitrates per kg	Nitrite per kg
Beetroot	2134	3,3
Carrot	183	1,5
Cabbage	330	2,3
Radish	2600	7,3
Celery	1321	0,7
Lettuce	1361	8,7
Spinach	442	3,2
Cucumber	156	8,0
Green beans	153	5,3

10-4 Climate Change and Agriculture:

The Arab Republic of Egypt has given due care to the process of surveying and monitoring records of greenhouse gas emissions in Egypt through coordination between local and international efforts in this respect. This is because of the universal nature of this particular phenomenon which poses a threat to the whole world, especially that the studies conducted by the Intergovernmental Panel for Climate Change (IPCC) have warned of grave consequences in case of constant rise in average global temperature. Some of these consequences are rising sea levels that can submerge some parts of the world, reduction in water resources and crop yields, and the spread of some epidemics like malaria.

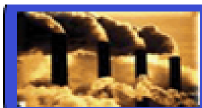
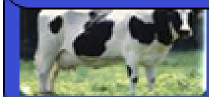
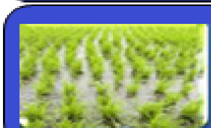
And although Egypt's total contribution to the global record of greenhouse gas emissions is merely 0.63%. Egypt is one of the worst hit countries by the impact of this phenomenon. The government's role in combating climate change can be demonstrated as follows:

1. Providing financial and technical support to develop institutional and research capabilities in terms of climate change.
2. Assessing the ecological and economic effects, resulting from climate change in Egypt, and carrying out acclimatization procedures to mitigate such effects.
3. Facilitating and supporting the implementation of joint research projects with the developed countries in the field of combating climate change and decreasing its devastating effects.

It is also worth mentioning that agriculture across the world causes 13,5% of the global records of greenhouse gas emissions. If these emission records are not considerably cut off, the average global temperature may rise by two or three Celsius degrees in the coming fifty years; thus causing further climate changes that will negatively affect food production, health and environment on a global scale. The frequency of storms, floods and droughts, resulting from climate change, is also expected to increase; thus threatening the collapse of agro-ecological systems. Moreover, the change in agricultural seasons, shortening the life cycle of all living organisms, will bring about new pests, diseases and various ecological disasters, something that will certainly affect both food security and economic profits. Therefore, agriculture is part of the solution for climate change problems as it helps absorb carbon dioxide, re-store it into the soil and transform it to biofuel. Besides, agriculture helps in establishing special agro-ecological systems that are particularly resistant to unusual or devastating environmental phenomena or emergency cases as these systems are particularly concerned with acclimatization procedures, especially that Egypt is one of the worst hit countries by the devastating effects of climate change. Knowing these acclimatization procedures is, therefore, particularly useful for farmers, animal breeders and meteorologists, informing them of agro-meteorological data and tools to prepare weather forecasts (for meteorologists),to monitor crops' growth and yields (for farmers) and to determine the agricultural climate zones so as to present studies on the effects of climate change and mitigation strategies as well as on the efficient management of biodiversity, to help the country adapt to the current and potential climate changes in a better way.

The impact of climate change on the agricultural sector has been apparently seen in the drop of wheat yield last year by 12% as a result of the change in the Egyptian climate map and the relative increase in maximum and minimum temperature records which have, in turn, affected the wheat crop during its various growth periods. Another major problem connected to climate change is rice cultivation which consumes a lot of water. But, the Agriculture Ministry has taken care of solving many such problems through considering the solutions studied and proposed by the Agricultural Research centre (ARC) to decide on the best of them. One of these solutions that are still under study is deducing new species of wheat resistant to high temperature and the change in agricultural rotation so as to survive in these new weather conditions. The ARC has also successfully deduced new rice species, consuming 50% less water in cultivation.

Table (10-3) agricultural sources of greenhouse gas emissions

	Chemical fertilizers' plants (greenhouse gas emissions
	Organic fertilizers and livestock production waste
	livestock production , methane emissions of ruminant animals
	Burning agricultural and livestock waste
	Agricultural lands and rice fields

- Chemical fertilizers' plants (greenhouse gas emissions: O, CH, CO2).
- Organic fertilizers and animal production waste (methane emissions of animal waste reach 2061 gigagram of carbon dioxide equivalent[CO 2-eq] per year, in addition to nitrous oxide)

  Source: Central Laboratory for Agricultural Climate, ARC.
- Animal production (methane emissions of ruminant animals reach 8967 gigagram of carbon dioxide equivalent [CO2-eq] per year).

  Source: Central Laboratory for Agricultural Climate, ARC.
- *Burning agricultural and animal waste (carbon dioxide emissions reach 70 million tonnes per year; thus exacerbating the problem of the black cloud).
- Agricultural lands and rice fields (methane emissions of burning rice straw reach 1491 gigagram of carbon dioxide equivalent [CO2-eq] per year, in addition nitrous oxide emissions of agricultural lands reach 32096 gigagram of carbon dioxide equivalent [CO2-eq] per year).

  Source: Central Laboratory for Agricultural Climate, ARC.
- Agricultural mechanism and irrigation pumps (carbon dioxide emissions due to use of fossil fuel).

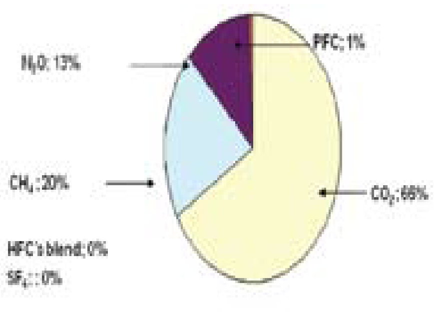
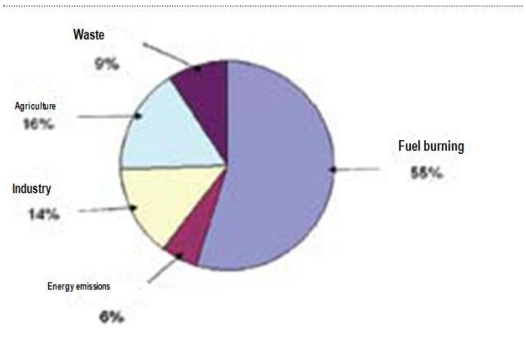


Figure (10-4) records of greenhouse gas emissions



(10-5) different sectors contributions to greenhouse gas emissions in Egypt

Source: Second National Egyptian communication report 2010

10-6 Agricultural Waste (Plant – Animal) and Organic Fertilizers:

Agricultural waste – whether plant or animal – is certainly considered one of the serious problems representing a great threat to the environment, agricultural activities, national economy and the process of development in Egypt as well. Thus, the Egyptian government has deemed combating pollution amongst its top priorities so as to protect the environment and stop wasting the national economy's renewable resources.

Table (10-4) Quantity and types of agricultural sector waste:

Quality	Quantity / year
Plant waste	33.10 million dry tons / year
Animal waste	18.88 million dry tons / year
Total	52.28 million dry tons / year

The wrong, traditional practices of getting rid of these types of waste, either by burning or by transferring them from the fields and disposing of them in ditches and from canal bridges, will certainly cause many short-term or long-term problems such as blocking these ditches and irrigation sources. Besides, the accumulation of these wastes may lead to the spread of insects and rodents, both of which are main causes of the spread of human and plant diseases and epidemics. Moreover, storing these wastes usually causes fires that may cause massive losses.

Furthermore, burning agricultural waste—such as rice straw, residues of pruning and grass from farm wastes, etc—is considered a major source of air pollution, which negatively affects the ecological system as a whole including human beings, plants and other living organisms due to greenhouse gas emissions which these burning processes definitely increase. Thus, the Egyptian government, through its various institutions, particularly the Ministry of Agriculture and the Ministry of State for Environmental Affairs, has made strenuous efforts to stop these harmful practices of burning plant and animal wastes and to train the farmers on the know-how process of recycling these wastes in order to produce organic fertilizers and composts that will restore both the soil's fertility and bio-balance. This will not only reduce greenhouse gas emissions and the use of chemical fertilizers, herbicides and fungicides but will also enhance the economic value of organic fertilizers. For, the agricultural waste used annually in organic fertilizers' manufacturing is less than 15% of the total volume of agricultural waste, something that is completely opposed to the needs of agricultural development in Egypt, which needs more than 200% of the amount of such waste to be transferred into organic fertilizers.

There will be great economic profits when recycling 50% of agricultural waste (animal-plant) to produce organic fertilizers and composts. Such profits include:

1. Obtaining sufficient amounts of biogas fuel, equivalent of 2.67 million tons of oil/ year, through out the year.
2. Cutting off heavy economic loses, resulting from the process of burning waste which subsequently causes the black cloud.
3. Producing better organic fertilizers up to 19.82 million tons / year.
4. Maintaining the organic matter which is about 8.7 million tons / year.
5. Maintaining the nitrogen element, equivalent of 189 thousand tons / year (about 541 thousand tons of ammonium nitrate 33%).
6. Maintaining the phosphorus element, equivalent of 160 thousand tons / year (about a million ton of calcium super phosphate 15%).
7. Maintaining the potassium element, equivalent of 145 thousand tons / year (about 319 thousand tons of potassium sulfate 48%).
8. Improving public health and restoring the soil's fertility as well as bio-balance as these organic fertilizers contain composts as well as major and minor fertilizing elements useful for both natural growth cycles and micro-organisms, being free of pathogens and weed seeds.

The Central Laboratory for Agricultural Climate has made a pioneering experiment in the field of farm waste recycling by organizing a number of courses and creating a production line for fertilizers. This unique experiment has also included recycling and utilizing organic wastes in the cities through the use of special species of earth worms to compost organic wastes, agricultural or not, to be transformed into highly rich organic fertilizers that can be used in agriculture, whether in a normal soil or even in green roofs planting on city buildings. The laboratory has established a specialized composting unit using earth worms to extend its activities to the cities and urban areas to contribute in improving and protecting the environment there as well, by reducing greenhouse gas emissions; as Cairo, for example, produces about 25 thousand tons of waste per day, 55% of which are organic wastes that are burned, buried or used to feed pigs.

Picture (10-1) recycling and utilizing organic wastes of cities and rural areas, using earth worms to produce organic fertilizers

Picture (10-2) recycling organic agricultural waste, using composting by earth worms to produce organic fertilizers

Picture (10-3) recycling various organic agricultural wastes, using air composting to produce organic fertilizers instead of burning wastes

In addition, rice straw bales have been used as a method for soil-less planting as shown in the attached figures, something that gives a hope for generalizing the experiment especially in non-reclaimed and hardly reclaimed lands, as well as in other lands that suffer from soil

Picture (10-5) using rice straw bales in agriculture

borne diseases like nematode, without using chemical fertilizers which are harmful for the environment, being a major source for water pollution.

10-7 Soil Deterioration:

Agricultural lands, especially the old ones, are considered natural resources that should be protected because there are no sources for renewing them, having no floods any more. There are many reasons for land deterioration as follows:

10-7-1 Soil salinity: the reasons for the increase of soil salinity are:

1. Flood irrigation as one of the surface irrigation systems.
2. Not abiding by the exactly needed amounts of water for each crop, but rather wasting irrigation water unconsciously.
3. Poor drainage systems: not establishing drainage systems in the new agricultural lands or maintaining such systems in the old lands.
4. Excessive use of fertilizers and pesticides that contain chemical compounds and salts that increase soil salinity on the long-term.

10-7-2 Desertification: this phenomenon is caused by lack of rain and land drought as well as sand proceeding to agricultural lands by wind.

10-7-3 Excessive use of pesticides: the excessive use of pesticides has serious effects, perverting the soil's properties and decreasing its soil's fertility; and thus affecting crop yields. Therefore, the soil should be protected against such cause for pollution. The excessive use of pesticides also contaminates running bodies of water, harming their living organism like fish, as well as underground water.

10-7-4 Urban sprawl: the urban sprawl must not come at the expense of old agricultural lands.

10-7-5 Pollution by heavy metals: it results from irrigating lands by drainage water, coming from agricultural or industrial sources or even from sewage. This use of contaminated water causes soil deterioration and subsequently affects crop production.

10-7-6 Plant and animal diseases: borne soil diseases, root problems and nematode greatly harm the soil, if not completely destroy it, and ultimately decrease crop production.

Therefore, the results of soil deterioration are:

1- Lack of food supplies necessary for food security on the long-term.
2- The extinction of certain plant and animal species or the farmers refrains from planting certain crops in certain places as a result of the deterioration of the soil.
3- Migration of some birds useful for agriculture or, worse, their extinction.

Accordingly, in order to protect the agricultural soil, reduce the pollutants, increase agricultural production, sustain agricultural development and protect the Egyptian environment that faces many ecological problems, there should be special programmes to improve the agricultural sector through good practices.

10-8 The State's Contribution to Agricultural and Urban Environmental Protection

Good agricultural practices (GAP) and good farming practices (GFP) reduce the sources of environmental pollution and help reducing emissions of greenhouse gases from agriculture as well as other sectors. The effect of those practices is directly reflected on the various elements of the environment, enhancing the management of natural resources through the following methods:

1. Land reclamation projects of desert and new lands.
2. Increasing the fine for constructing on agricultural lands.
3. Using modern techniques in agriculture.
4. Deducing highly productive seeds.
5. Depending on scientific research for enhancing all types of agricultural production.
6. Raising productivity per land unit.
7. Monitoring and applying safe food production criteria.

10-8-1 Managing the Agricultural Rotation

The agricultural rotation is the order of crop cultivation "cereals or vegetables" one after the other, in a certain land, with a specific system, for a number of years. This agricultural rotation aims at providing crops with their different nutritional needs from the soil, improving the properties of soil, reducing the spread of grass weeds, diseases and insects and regulating the use of agricultural fertilizers. This does not only ensure high quality agricultural production with minimum costs, but also it helps preserve natural resources and protect the environment by countering the effects of soil erosion factors and improving the soil's properties as well as by re-storing carbon dioxide into the soil. This agricultural rotation also preserves biodiversity to avoid the collapse of natural agricultural systems that can weaken the soil and bring about the spread of diseases and pests. To achieve all that, the Agricultural Research Center has developed an agenda for agricultural development programmes to help the farmers of each region to choose from amongst them the one that best suits their agricultural environment.

Picture (10-5) Agricultural Development Programme

- **Plant family, species, seeds' amount, proper temperature, agricultural season, crop yield.**

10-8-2 Managing Water Resources and Irrigation Water

Efficient management of water resources and irrigation water helps reducing pollution arising from agricultural activity, provides water, increases the efficiency of water use and raises the productivity of land unit areas and water. The use of modern irrigation systems (dripping and sprinkle) or the development of flood irrigation systems as well as the process of land leveling treatment by laser, especially for old lands, help to increase the efficiency of irrigation and provide enough irrigation water to be used in the horizontal agricultural expansion.

The Ministry of Agriculture, through the Agricultural Research Centre, has contributed in providing the required water amounts for different crops through the use of the internet nowadays and by issuing free periodicals in the past, such as issuing a specialized programme to observe the needs and water requirements of different crops in different parts of the state. This process is provided by the Agricultural Guidance Bureau of the Ministry of Agriculture to increase farmers' awareness of the importance of water rationalization and obtaining the data necessary to do so.

Picture (10-6) IRRI. CLAC programme, used in accounting water requirements for irrigating different crops, according to meteorological data, crop type, growth stage, and soil type

Over-irrigation further increases pollution in watercourses with residues of fertilizers and various pesticides. It also leads to the soil's loss of its nutrients as well as its physical and chemical characteristics. In addition, over-irrigation leads to wasting large amounts of irrigation water which Egypt direly needs for expanding and developing the agricultural sector. Furthermore, over-irrigation increases methane emissions from the flooded lands.

The irrigation development project which takes place in eleven different parts in different governorates (Sharqiya, Kafr El-Sheikh، Gharbia, Behera, Alexandria, Fayoum, Beni Suef, Minya, Assiut, Sohag, Aswan) is aiming at making these governorates pioneering examples in terms of developing irrigation in old lands. This national project for the development of irrigation is due to contribute in raising irrigation efficiency from 50% to 75% by using the modern irrigation methods; and thus saving about 10 billion cubic meters of water that can be used in reclaiming 1.5 million acres.

10-8-3 Integrated Farm Management

The Integrated Pest Management programme (IPM) is working on managing fertilization, irrigation, agricultural rotation and the use of natural and physical means to reduce the use of harmful, chemical pesticides; thus reducing soil, water and air pollution caused by pesticides' residues.

Picture (10-7) special programmes predicting fire blight in pears and mildew in grapes

Inputs	Outputs
Cultivated area (Alexandria)	Prediction
Average temperature (15)	Be cautious, the circumstances are adequate for catching diseases

Proportional humidity (80)	Disease (73.1)
Rain (2.3)	Predicting high infection
Inputs for trees	Recommendations
Flowering periods	
Ulcers (high percentage)	
Insects	

10-9 Environmental Benefits of Green Roofs in Cities, Industrial and Residential areas

The steady population growth has almost left cities choked with people, and this has certainly necessitated increasing the number of buildings and different facilities like schools, hospitals, factories, companies, etc to meet people's needs. In return, the green spaces within cities have severely shrunk, further adding to environmental problems, especially air pollution. Air pollution has gravely increased in cities due to car exhausts, factories' fumes, and the use of ecologically harmful manufactured materials, especially construction materials like asphalt and glass facades, particularly in the light of the severe reduction in green areas which are considered the only natural air filtering method. According to studies, we can overcome the negative impact of green areas' shrinkage in cities through "green roofs" i.e. using soil-less planting methods to grow plants on buildings' roofs instead of using these roofs for storing old and worthless stuff that both harm the environment and give buildings a negative outlook, especially from the top.

Green roofs planting systems depend on soil-less planting techniques (i.e. no mud or clay is used in such cultivation process) that do not leak water to roofs' floors, and on light weight planting tools(pots and other things) that do not represent a load on the buildings. There are also many positive effects for green roofs on the environment and the quality of life in cities that can be summarized as follows:

1. Studies have proved that green roofs plants considerably help reduce air pollution; for example, planting 1 square meter helps purify cities' air by ridding it of 100 g of air pollutants every year.
2. Green roofs plants also increase the proportion of oxygen and reduce carbon dioxide in cities' air; as it has been found that the cultivation of 1.5 square meters throughout the year produces enough oxygen to cover the respiratory needs of an adult for one year. The plants daily consume carbon dioxide, which is one of the main components of greenhouse gas emissions, through the process of photosynthesis which is made by the plants to produce glucose needed for growth and to release oxygen, which is necessary for human respiratory needs, as a waste product.
3. Green roofs plants help keep the roofs of buildings and various facilities clean by ridding them of wastes and worthless stuff being stored on these roofs which can abode many harmful organisms (mosquitoes - flies - mice - cockroaches - lizards... etc.) which negatively affect the health of these buildings inhabitants on the long run, in addition to being a main source of pollution within the city.

Picture (10-8) Green roofs in residential areas

4. Green roofs plants reduce the impact of the Urban Heat Island which is clearly manifested during summer in large cities, where there is a considerable change in weather clearly seen in the increase of temperature by 8 to 10 Celsius degrees more than the surrounding areas. This phenomenon is due to the fact that roads, various buildings and facilities absorb and store heat throughout the day and then re-emit it later, thus raising temperature. The

changes in weather lead to the imbalance of the ecological system by the preservation of smoke, dust, etc .

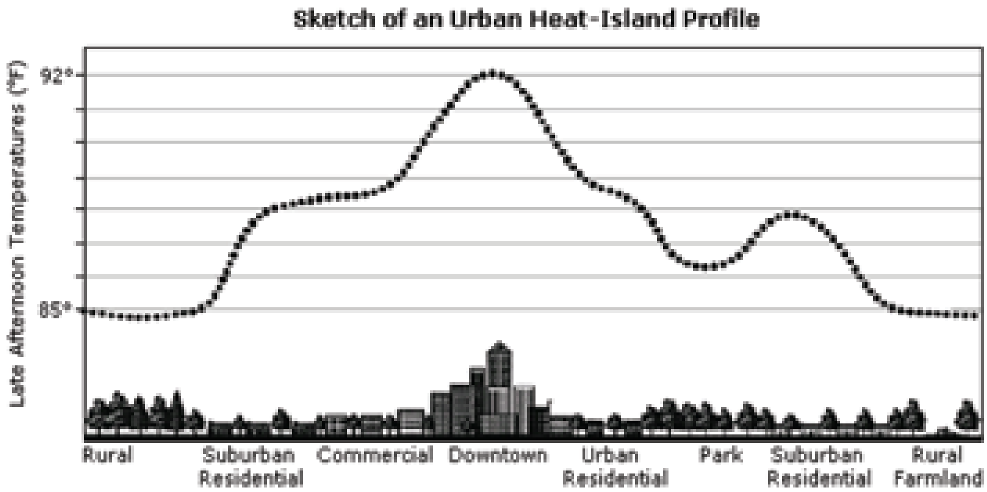
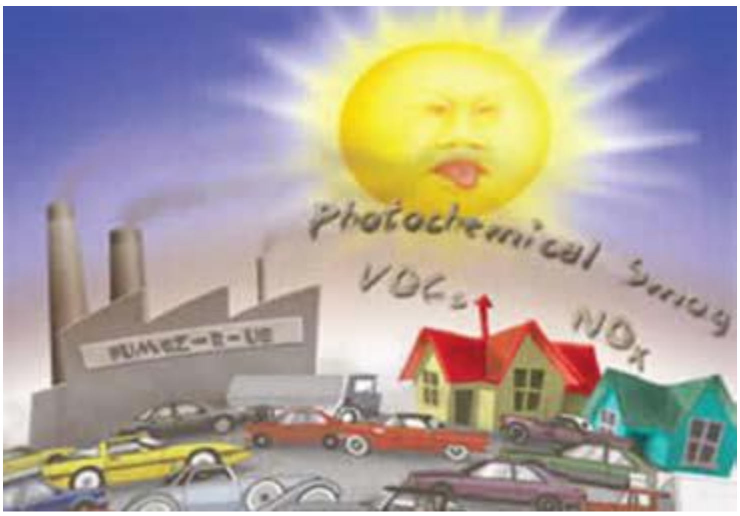


Figure (10-6) Urban Heat Island Phenomenon

Studies all over the world have shown that the Urban Heat Island phenomenon has different negative effects on the environment as follows:

a. As for Environment: The remarkable rise in temperature leads to various grave environmental problems: it increases air pollutants, stimulates the production of ground- level- ozone (in the air) and increases fumes whose accumulation in the sky, especially during the times of stillness of air, causes the phenomenon known as "the black cloud".



Picture (10-9) negative effects of Urban Heat Islands phenomenon on the environment

The shade of green roofs plants on the roofs of buildings and facilities in cities reduces the impact of the Urban Heat Islands phenomenon through protecting such roofs from the heat. These plants also help moderate temperature in their surroundings through the processes of transpiration and evaporation, i.e. dew going out of plants and then these water drops evaporate in the air.

Accordingly, these plants help reduce the temperature inside single-floor residential buildings or inside the last floor in multi-floor buildings by more than 8 Celsius degrees during the summer and preserve warmth inside these houses during the winter, something that reduces the use of air conditioners and subsequently reduces greenhouse gas emissions. In addition, it reduces the costs of cooling systems by up to 50% and heating systems by up to 25% per year.

10-10 Bio-energy:

Studies have stated that till the year of 2050 bio-energy, also known as clean energy, produced from biomass may provide about 25% of the total demand for energy. Due to the fact that all types of bio-energy are almost carbon-free, using most of these types, instead of fossil fuels, can contribute to combating climate change, especially by storing carbon in farms used to produce bio-energy.

Taking into consideration that the agricultural sector as well as forests are the main sources of biomass in the world, the growing market of bio-energy, its stocks and products, can contribute in increasing farms' income significantly, especially that more than 200 species of plants can be used in bio-energy production. Moreover, some plants can be used in reviving the soil of deteriorating and marginal lands.

Nevertheless, turning completely to using bio-energy raises concerns over food security in case lands and other productive resources are largely converted from food production to bio-energy production. Moreover, the intensification of the processes based on bio-energy could have grave impacts on water, soil, natural resources and biodiversity.

Picture (10-10) Benefiting from several plants in producing clean and cheap fuel, i.e. biofuel

Finally, we must evaluate the feasibility of clean energy systems in the light of the needs of countries, the resources they have, their current policies, and the various scenarios for the relevant economic, environmental and political changes. For, biofuel policies would not succeed unless in a comprehensive framework of policies and regulations for the agricultural sector. This will need coherent, long-term plans for the transformation and adaptation with these new changes, taking into account the complexities of managing the change in the global economy based on the market.

Part Four

Urban Environment

Chapter eleven

Urban Environment

11-1 introduction

The concept of new urban communities emerges to achieve several objectives including, for example: stop urban sprawl on agricultural land (unplanned urban growth), which is one of the urban development patterns, began to spread since the beginning of sixties and became more common during seventies as a result of the unbalanced growth between demand and supply in urban housing market and the increased migration to major cities, leading to the emergence of zones without authorized planning and slums on banks of canals ,railways and archeological sites which resulted in high rates of accidents, crimes and various forms of negative changes in social behavior due to the difficulty of controlling these slum communities.

One of the pillars of urban development in Egypt is to eliminate disadvantages of unplanned urban growth by constructing new cities in desert areas or around the existing cities to serve as new urban centers for development outside the crowded residential areas, away from the narrow strip of the Nile Valley and Delta in an attempt to reconstruct desert and limit urban sprawl on agricultural land.

11-2 Environmental problems in urban environment

Experiences and studies clarified that implementing urban planning in isolation from the basic requirements of environmental protection was fault directive .This has led to widening gap between urban growth, actual needs of population and resources that could be provided by the environment till depletion of resources, especially the non-renewable. This fault directive causes imbalances in many components of the natural ecosystems and negative impacts on both urban environment and public health; as a result of implementing urban and industrial development programs without taking basic requirements for environmental protection and adequate control on pollutants in consideration, which in turn cause many environmental problems within populated areas.

During late seventies, the Egyptian government developed a policy for urban movement to the vast Egyptian desert, this policy initiated by constructing large five cities, later on their number reached to 22 cities and urban communities and it is expected to reach 60 cities and urban communities by 2017, according to the recommendations of the urban and development map of Egypt. More than half of these cities, industrial development will form an essential part of its economic base.

11-3 Challenges of urban environment

The challenge facing new communities' development is not only the operational work, but the interaction of different development elements to create a society characterized by the quality of life, which is the goal of development, to be achieved through planning, implementation and management. If all of these factors do not achieve the quality of life, so the development is incapable of achieving its objectives. And the investments directed to this development are considered a waste of various resources in a country needs to deal with its resources efficiently and effectively, to achieve the maximum possible return of the national income. The main challenges of urban environment can be summarized as follows: -

1. 95% of Egypt's population live on 5% of Egypt's area
2. The Nile Valley is one of the largest population densities in the world
3. Urban sprawl on agricultural land is the dominant phenomenon in Egypt.

11-3-1Transport and roads in urban environment

Transport is a sensitive nerve in the social and economic entity on the level of the country as it is considered the effective mean to achieve ongoing contact between different economic and production process, represented in decreasing distances between producer and consumer, or transport of labors to the more influential areas in the production process to achieve the best investment of these human capacities.

The econometric studies conducted in India, Bangladesh and Vietnam, where large programs are implemented, by the World Bank, to improve roads showed the occurrence of large development impact as a result of improved rural roads in these countries. Their roads were suffering from institutional and technical problems represented challenge of achieving good development rates .It became clear that expenditure on roads in India has had largely positive impact on poverty alleviation in rural areas compared to other types of public expenditures, as the investment of each million rupees (equivalent to 22 thousand U.S. dollars) in rural roads resulted in pulling 163 person out of poverty.

Percentage of paved roads in Egypt is 78%, and based on the above mentioned; care of paving roads in rural areas will increase their rate of development.

11-3-2 Transport and traffic problems in urban environment

1. **Environmental problems**

Transport sector's emissions are rapidly growing compared to emissions of any other economic activity. This growth was due to the insignificant prices of transport, the increasing number of vehicles on roads, in addition to the improvement of fuel quality, which consequently reflected in increasing kilometers traveled on roads (Michaels, 1996).

Consumed energy by vehicles represents about 83% of the total energy consumed in transport sector (EEA, 1996b).

In fact, transport sector's emissions are perhaps the largest contributor to Global Warming from some industrial sectors. Licensed number of vehicles until 2008, were about 4.3 million vehicles, about half of them run in Greater Cairo (2.1 million vehicles), their fuel varied between gasoline and diesel, in addition to limited number powered by compressed natural gas .

According to a previous study carried out by Cairo Air Improvement Project (CAIP) to link pollutants to their sources, conducted by Desert Research Institute - the State of Nevada - Reno America. The study showed that vehicles' emissions are the major contributor to the high levels of standard pollutants (NOx, SOx, PM, Pb, HC), in addition to being the main contributor to emissions of carbon dioxide CO_2. Vehicles' exhaust contributes by up to 26% of the total pollution loads of suspended particulate matters in Greater Cairo and more than 90% of the total pollution loads of carbon monoxide, 90% of the total pollution loads of hydrocarbons and 50% of the total pollution loads of nitrogen oxides.

2. Institutional problems

Egyptian cities, particularly Cairo lack the existence of institutional entities in the field of engineering, transport and traffic planning. As a result of that traffic problem is escalating in cities and major urban centers in Egypt. In addition to the lack of finding appropriate and continuing scientific & engineering method to confront this problem, that in turn negatively impact inhabitants of these urban areas and their urban environment .

11-3-3 landscaping in urban environment

Despite, the healthy and aesthetic important role of green spaces and gardens in peoples' lives, and in light of the high levels of airborne dust, arising from vehicles’ exhausts and the occurrence of Cairo at the bottom of Mokattam hill, the impact on Cairo air quality exacerbated as a result of transport, traffic and the very limited green surfaces. For that reason, green surfaces must reach global standards estimated by some sources with eight to twenty-four meters square per capita, at least in cities. Work can be done to ease negative impact on environment from emissions of transport in many ways, the most important and least cost is the eco mitigation by expand cultivation of green spaces because of their high efficiency and resistance to gaseous pollutants ,particularly oxides of carbon, sulfur, nitrogen, ground ozone and suspended particulate. Civilization harmony's experts highlighted that cultivation of various types of trees available locally in areas of high potential for contamination with gaseous pollutants can possibly limit their effects, such as in the following areas:

1. Railways' warehouses and workshops.
2. Parking areas and their surroundings.
3. Traffic crossings.
4. Middle island between two-way roads.
5. Uphill and downhill of bridges.

Experts determined landscaping standards to meet pollution caused by traffic density as follows:

a. Distances standard: planting a tree at a distance ranged between 3-4 meters.
b. Pollution resistance standard: planting the area with appropriate density trees resistancing various types of pollution (175 deciduous trees +350 evergreen trees per 10000 m^2).

Table (11-1) types and amounts of pollutants that can be removed by afforestation

Type of pollutants	Amount of removed pollutants micro gram / hour
Dust and suspended particles	724826.8×10^3
Carbon monoxide	5.941326×10^3
Sulfur dioxide	9.8787668×10^4
Ground ozone	5.988674570×10^4
Nitrogen oxides	41.668814×10^3

Source: Guideline for environmental principles and criteria of civilization harmony - National Civilization Harmony Agency

11-4 Governmental policies addressing urban environment problems

Governmental urban policies focused on the following three objectives since seventies:

1. Stop encroachment of slums on agricultural land.
2. Orient urban growth toward new urban communities
3. Improve standard of living in poor urban areas, which do not enjoy the services.

11-4-1 Stop encroachment of slums on agricultural land:

1. Rates of population growth in Egypt reached 1.99% which is one of the highest global rates.
2. Egypt's population is expected to reach 96 million by 2020, which will escalate urban sprawl problem.
3. Percentage of slums in urban areas to their total population ranging between 25% in Assiut and 62% Giza governorates.
4. Cairo includes 81 slums inhabited by 8 million from the total 16 million people live in the capital. Slums occupy 62% of Greater Cairo area.
5. Estimated erosion of agricultural land since 1980 estimated by one million feddans as shown in Figure (11-1), which is considered one of the most fertile lands in the world and important economic resources.

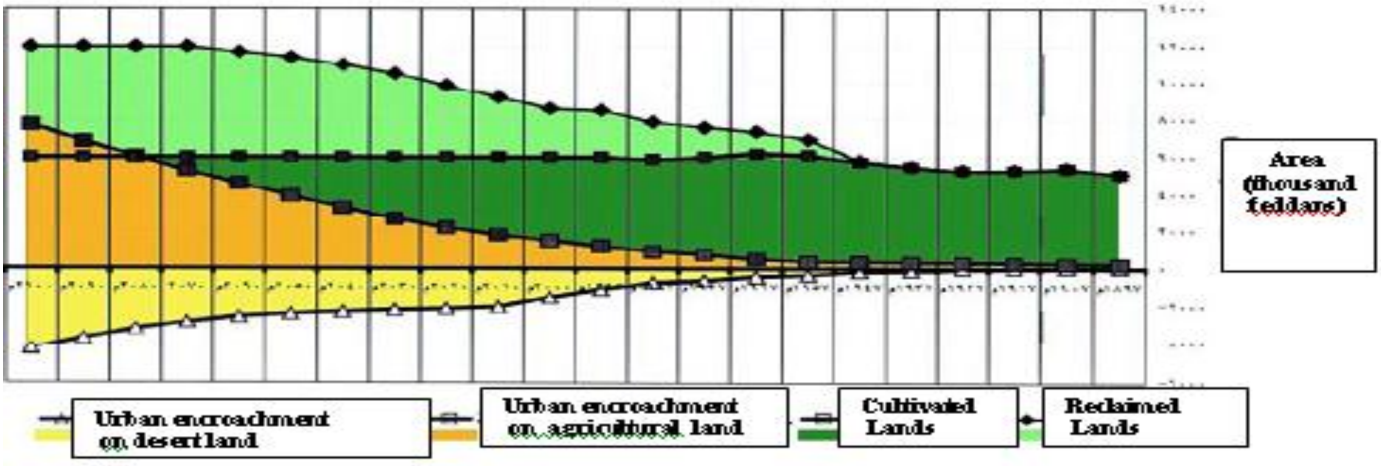


Figure (11-1) Rate of agricultural land erosion

11-4-2 Orienting urban growth to new urban communities:

1. Egypt constructed 22 new cities with target to increase their number to 60 cities by 2017.
2. Investments in building new cities in desert lands reached about 60 billion pounds from 1982 to 2002.
3. New cities offered about 683 thousand housing units with different levels.

11-5 Future vision of urban development.

1. Orient urban growth towards new communities constructed in deserts, away from the valley and Delta, to increase rates of development and quality of life.
2. Design buildings according to climatic conditions, available local building materials and energy resources ,which depends on the optimal use of sun rays and non consuming energy materials, such as stones, wood and clay; in addition to avoid use of concrete , aluminum and energy consuming materials.
3. Reconsider institutional structure of traffic engineering and transportation planning in urban areas.
4. Improve public transportation service , spread it geographically with accurate and close intervals operation schedules, to encourage individuals avoid using their own cars, where the car need 20 times the space of the street if it is used instead of bus.
5. Interest with increasing green surfaces and planting trees on both sides of roads and crowded areas by traffic.

Industrial Environment

11-6 Introduction

Industrialization remarkably developed in Egypt after the Revolution of 1952, priority was forward to chemical, textile and metal industries, especially iron and steel in Helwan city .These industries were concentrated along the strip of the Nile Valley in Upper Egypt (Mining industries) , Alexandria and Delta (textile industries) and Greater Cairo (paper ,metal products and machinery). Industrial planning has developed in the populated areas of Egypt which resulted in economic benefits and environmental damages, till the extent of declining environmental standards in areas of industrial activities. The probability of widening scope of these damages increased as a result of country's strong orientation towards constructing new urban communities based mostly on industry as an economic base. These communities will be established in desert which is characterized by fragile ecosystems. Thus, if the same principles and standards applied in the past remain while planning future urban communities, these fragile systems will be at risk of contamination and deterioration.

11-7 Problems of new industrial cities

Industrial oriented economic development need to be re-orientated to serve the environment and comply with it to satisfy needs of present generations without encroaching needs and rights of future generations; in addition to taking environmental standards and concepts in consideration while planning new industrial cities , such as green landscaping for their environmental and recreational roles.

11-7-1 Road networks and transport:

Pollutants load increased in industrial zone caused by traffic, lack of roads’ maintenance and landscaping which is crucial to alleviate pollution.

11-8 Future vision of industrial development

As a result of not considering environmental standards and concepts, Egypt's Strategy of Development and Reconstruction for 2017 recommend the following:

1. Highlight environmental goals and principles in planning industrial zones to prevent any negative impact on natural environment, residential areas and rationalize consumption of water, energy and natural resources.
2. Reduce pollution rates to the permissible international limits.
3. Highlight the importance of preserving pristine areas from pollution through taking environmental precautions such as in (Western and Eastern deserts, Sinai Peninsula); in light of country's increased orientation towards constructing new communities in pristine deserts of Egypt which is characterized by their fragile ecosystems.
4. Firm enforcement of Environmental laws.
5. Industrial zone configuration: it is recommended to avoid planning industrial areas as a strip extending longitudinally, especially in cross-sectional with wind direction to ensure the reduction of pollution.
6. Selection of industrial zone location: it is recommended that residential area should not be under wind (down stream) relative to industrial area(taking into account type and percentage of the prevailing winds in each season of the year) to prevent impact of the industrial zone on the residential area.
7. Classification and distribution of industries: it is recommended that industries classified into key levels or patterns based on their environmental impacts and spatial distribution of these levels for avoiding impact of them on the other due to the different activity within the same type.

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Chapter twelve

Energy

12-1 Introduction:

In light of the actual status of Egyptian energy sector, development needs and aspirations to upgrade national economy; continuous adoption and development of actions to improve energy efficiency and energy saving integrated with national strategies and plans of energy sector that cope with national development plans, are considered as one of the most important issues, that may contribute to provide energy security in Egypt, attract investment and achieve direct and indirect economic benefits leading to upgrade competitiveness of the Egyptian productive sectors, in addition to improve economic and social conditions, at all levels either for citizens, or sectors or the State as a whole.

12-2 Current situation:

12-2-1 Oil and gas projects:

During 2010, MSEA issued environmental approvals for 299 onshore and offshore projects for oil and gas concession areas. They include 18 seismic surveys projects to determine potential reserves , 199 exploratory drilling wells (182 onshore and 17 offshore) ; in addition to 72 oil and gas development wells with required facilities of platforms and gas processing (55 onshore wells and 17 offshore wells) , 2 projects for networks of gas pressure stations and 10 projects to extend networks of natural gas pipelines .

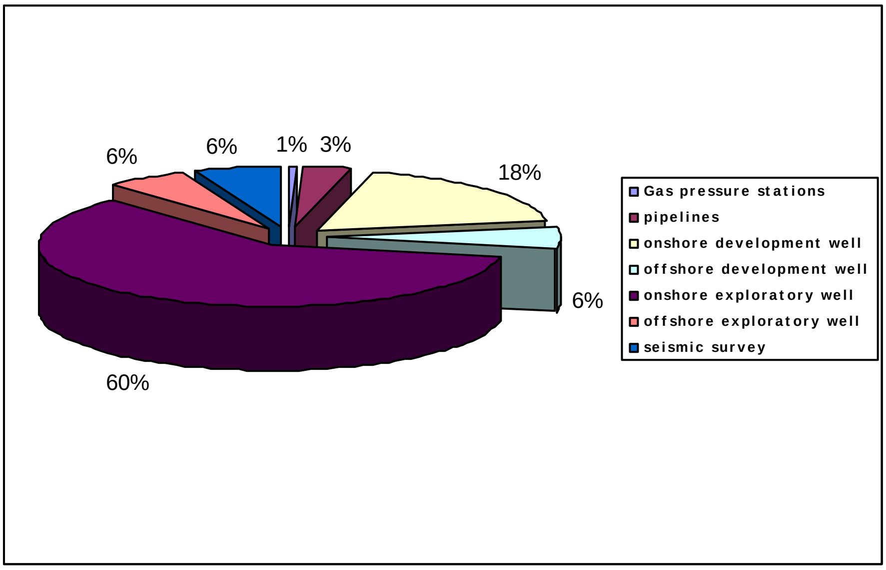


Figure (12-1) Percentages of environmentally approved oil and gas projects during 2010

12-2-2 Electrical Energy:

MSEA issued environmental approvals for three power generation plants operating with natural gas and diesel as an alternative fuel for emergency cases only, one wind farm, one thermal power plant and one small plant affiliated to private companies.

Table (12-1): Main indicators of electricity production in Egypt during2008/2009-2009/2010

Technical indicators of electricity production sources		2007/2008	2008/2009	2009/2010
Peak load (MW)		19738	21330	22750
Total generated & bought energy (GWhr)		1251229	131040	139000
	Thermal* (GWhr)	95782	101898	111576
	Hydro (GWhr)	15510	14682	12863
Generated energy from wind farms	(Alzafarana) **(GWhr)	831	931	1133
Generated energy from private sector (Boot)		12642	13241	13184
Generated energy from unconnected plants		350	271	218
Rate of fuel consumption in hydro power plants	Generated gm/ KWhr	217.6	218.9	215.6
Rate of saved fuel by using hydro power	(thousand ton heavy oil equivalent)	3395	3195	2773
Bought energy from industrial companies		14	17	26
Total fuel consumption (thousand ton heavy oil equivalent)		23562	24895	26773
Total sold energy from distribution companies (low and medium voltage)		106595	111714	124439
Rate of electric energy consumption per capita (KWhr)		1565		1790
Net energy exchange (export) (GWhr)				896

Source: Annual Report of the Ministry of Electricity and Energy, 2010

12-2-3 Industrial projects:

MSEA issued 2 environmental approvals for two cement production projects, their total consumption of natural gas are one million m^3 / day distributed as follows:

1. Amiriya Cimpor Cement Company, one production line having capacity of (1.5 million tons of cement / year) and total consumption of 0.5 million m^3 / day of natural gas.
2. Arab Company for Cement, one production line having capacity of (1.5 million tons of cement / year) and total consumption of 0.5 million m^3 / day of natural gas.

12-3 Future vision:

The effective contribution to realize energy-saving through balanced sustainable development programs requires action on several axes, in the forefront is building an active institutional building on multiple levels include competent entity contributing to accelerate activation of related programs at all levels and intensify their revenues, combining the decentralization of execution and integrated coordination in developing strategies, policies and plans.

In the framework of MSEA efforts to activate energy-saving activities in the industrial and domestic sectors to reduce pollutants associated with energy production from oil and natural gas sources, the ministry has established Energy-Saving Unit in August 2009 to implement programs of energy efficiency improvement in industrial and domestic sectors.

12-3-1 Energy efficiency and environmental protection program

This program aims to develop indicators for energy consumption in each sector depending on clear system of data collection and database sensitive to market changes, to serve as a tool to follow-up success of various activities related to the improvement of energy efficiency and energy saving ,in a manner linked to the contribution of each sector in enhancing industrial economy which will reduce energy consumption per unit product in industrial activities without any negative impact on the quality or quantity of the end product and reducing environmental pollutant emissions. Energy-Saving Unit provides governorates with technical and financial support for their industrial activities through conducting initial energy consumption audits to determine:

1. Opportunities of energy-saving and proposing technological applications.
2. Technical and financial feasibility studies for application, including:

- Expected energy-saving and value of financial savings
- Expected initial investment for implementing the application.
- Payback period and the return on investment.

- Expected emissions reduction of environmental pollutants (such as oxides of carbon, sulfur and nitrogen) associated with energy-saving.

Chapter Thirteen

Industry

13-1 Introduction

Industrial development in Egypt is considered the essence of growth and economic development. It reflects extent of economic progress to list its products on world markets map. Upgrade manufacturing & production sectors reflected on exportation sector, as it is vital and essential motive for realizing development in any country.

Industry occupies an advanced rank in its importance for the Egyptian National economy; as it stands on the top of the economical sectors in terms of its contribution to GDP, its strong interrelation with many productive and service sectors and its role in developing foreign trade and improving payments balance.

This necessitates application of initiatives in fields of industrial pollution reduction, industrial modernization, integration of cleaner technologies in new industries and adoption of environmental impact assessment. Legislation stipulates that establishment of any new project or expansion of any existed project must be preceded by a study to assess its environmental impact.

MSEA manages many funding programs to achieve environmental compliance, through providing soft packages to finance pollution abatement and cleaner production projects. The importance of cleaner production projects is reflected in being the most important method to achieve sustainable development and reduce pollutants in the industrial sector from the source; as well as coping with global industrial policies, spread of cleaner production trends, and emergence of new global concepts based on principles of total quality to achieve its product quality.

13-2 Current projects and programs

13-2-1 Egyptian Pollution Abatement Project (EPAP)-second phase (2007-2012)

The project provides soft financial package to support industrial pollution abatement projects in industrial facilities with financial package (80 % loan, 20% grant).
EPAP II concentrates on highly polluted areas in Greater Cairo & Alexandria governorates, combining huge industries emitting great amounts of air and water pollutants loads such as cement, iron, steel, chemical industries and tanneries. Funding package of phase II estimated with 185 million dollars (one billion Egyptian pounds). Provided support include the following:

1. **Financial Component:**

Provides soft loans for industrial facilities, re-loaned by National Bank of Egypt (80% loan, 20% non-refundable grant). The following illustrates budget of that component:

A-20 Million US$	World Bank for Construction and Development
B- Equivalent to 40 Million US$	Japan Bank for International Cooperation (JBIC)
C- 40 Million €	European Investment Bank (EIB)
D- 40 Million €	French Development Agency (AFD)

2. **Technical support Component:**

Provide technical support to industrial facilities which will be financed by the financial component (non-refundable grants).

3. **Current status (2010)**

51 projects are currently listed in the project, directed for 30 major companies and 200 brick factories (Arab Abu Saed area) with total cost estimated with 209,152 Million US$.

Table (13-1) Companies applying for financing their environmental projects

No.	Company name	Type of project	Cost (Million US$)
Cairo Governorate			
1	Kawmiah Distributing	Replacement of the old printing line with new one	**6**
Helwan Governorate (Helwan – Torah - El-Tebeen)			
2	National Cement	Installation of new technologies to control dust emission ،supply dust vacuum unit and cleaning unit.	**14.948**
3	Torah Cement	Installation of new technologies to control dust emission.	**16.5**
4	Helwan Cement	Fuel switching from mazot to natural gas	**2.5**
		Using alternative fuels (sludge, agricultural waste and RDF) instead of mazot and natural gas	**7**
		Installing small bag filers in cement mills area	**2.4**
5	Egyptian Starch & Glucose (Torah Plant)	Fuel switching from mazot to natural gas	**0.34**
6	El Nasr for Coke	Replacement of 180 Coke oven doors	**1.945**
7	Arab Abu Saed Brick Factories	Fuel switching for 200 brick factories from mazot to natural gas	**25**
Total			**70.633**
Qaluobia Governorate (Mostorod – Shubra El-Khima)			
8	Abou Zabaal Fertilizer	Production line modifications and installation of new technologies to control dust emissions (10 projects).	**14.991**
9	Egyptian Starch & Glucose	Replacement of glucose production line	**11.035**
10	Delta for Steel	Fuel switching from mazot to natural gas - installing de-dusting unit in furnaces area	**4.711**
11	Simo for Paper	Fuel switching to natural gas	**0.304**
12	Kiriazi	Waste water treatment plant	**4**
13	Pachien	Solvent recovery unit	**0.36**
Total			**35.401**
Fayome governorate			

14	Amisal	Establishment of Sodium Chloride production plant by using liquid waste	**7.8**
6th October governorate			
15	Alfa Ceramics	Install filters & WWTP	**2.3**
Total for Greater Cairo (Cairo, Helwan ,Qaluobia,Fayom,6th October)			**122.134**
Alexandria governorate			
(Baqoss, Borg El-Arab, El-Max , Abu-Qir , El-America, Kafr El-Dwar)			
16	Ameria for Cement	Installation of new filters to control dust emission.(4 projects)	**15.9**
17	Misr for Chemicals	Fuel switching from mazot to natural gas	**0.447**
18	The General Company for Paper industry (RAKTA)	Fuel switching from mazot to natural gas	**4.2**
		Installing waste water treatment plant	**2.4**
19	Ameria Petroleum Refining	Rehabilitation of production units to decrease discharged pollutant into Maruot Lake.	**15**
20	Harvest Food	Installing industrial waste water treatment plant	**0.21**
21	Alexandria Sodium Carbonate	Installing new equipment with new technology for dust control	**2.8**
22	National Paper	Installing industrial waste water treatment plant	**8**
23	Egyptian Petrochemical	Treatment of industrial waste water	**2**
24	Handy	Installing industrial waste water treatment plant	**0.3**
25	Great Foods	Installing industrial waste water treatment plant	**0.3**
26	El Nile Soft Drinks Company “Crush”	Installing industrial waste water treatment plant	**1.8**
27	Faragalla for Food Industries	Installing industrial waste water treatment plant	**1.5**
28	Ameria cimpor cement	Installation of new bag filter	**7.8**
29	Egyptian German Company for Porcelain	Installing industrial waste water treatment plant	**0.161**
Total			**62.818**
Mansoura governorate			
Talkha			
30	Delta Fertilizer	Install new nitric acid unit	**20**
Total			**20**
Suez governorate			
Qattamya			

31	Qattamya Cement	Using alternative fuel (agricultural waste, Refuse Derived Fuel (RDF) instead of mazot and natural gas	**4,2**
Total			**4,2**
Total for (Greater Cairo , Fayome ,Alexandria Mansoura and Suez)			**209,152**

Source: EEAA (Central Department for Industry – December 2010)

Examples for financed projects:

Egyptian Starch and Glucose (Tora plant)

Installation of three new natural gas burners and extending the external and internal natural gas network.

Picture (13-1) before implementation

Picture (13-2) After implementation

Delta Steel

Switch fuel of semi automatic rolling furnace to natural gas.

Picture (13-3) before implementation

Picture (13-4) after implementation

13-2-2 Private and Public Sector industry project (PPSI) 2008 - 2012

1. **Background:**
   The Private Public Sector Industry Project (PPSI) aims at supporting Egyptian industry (small – medium – large industries) to comply with environmental laws and regulation; as well as improve its environmental performance .It is a joint project between German government (represented by KFW) and Egyptian government (represented by Central Bank of Egypt) and Egyptian Environmental Affairs Agency as the implementing agency.

2. **PPSI's Objectives:**
   Support industrial pollution abatement projects in industrial enterprises in both private and public sectors

   Develop sustainable financial, technical and institutional mechanisms for pollution abatement and decrease pollution loads in the selected hot-spots areas particularly in Delta and Upper Egypt governorates in order to improve local environmental conditions.

   Activate legislative procedures, improve inspection efficiency; develop technical capacity of environmental institutions and competent banks; raise public awareness relating to industrial environment in Egypt, particularly within Delta and Upper Egypt Governorates.

3. **Current Status(Dec.2010)**

   35 companies are registered in the project (15 large companies and 20 small and medium), including 13 public sector companies and 22 private sector companies with total investment estimated by 31 million Euro.

Table (13-2) Companies applying for financing their environmental projects

No.	Company name	Type of project
Qena and Sohag governorates		
(Qena – Nagaa Hemady – Qous – Gerga - Armant)		
1	Qena for Paper	Prevent direct discharge of waste water on the Nile, turning it to sanitation network for treatment and use in irrigating timber forest. Contract with Drinking Water and Sanitation Authority for conducting engineering studies.
2	Misr Aluminum	Rehabilitation of old tar melting unit (Start up test)

3	Al-Ahram for Plastic Bags Production	Recycling line to reuse generated solid waste (installed and operated)
4	El-Romani for Plastic Bags Production	Recycling line to reuse generated solid waste (installed and operated)
5	Bebobird Factory for Leather Industries	Recycling line to reuse generated solid waste (installed and operated)
6	Al-Kawther Company for Food Production	Install new boiler with its connection utilities (installed and operated)
7	Al- Kawther Factory for Animal Fodder	Install air filters and 2 silos at the feeding area (under installation)

	Aswan **Edfo**	
8	Egyptian Ferrosilicon	Gases treatment (installed and operated)
9	El-Nasr for Mining	First project : Installation of filters for the raw mining material (installed and operated)
		Second project : Replacement of the three old crushers (under supplying)
10	Misr Edfu for Pulp and Paper	Pulp washing & recycling systems (Start up test)
	Minia Governorate	
	Abu Qurqas- New Minia Industrial City	
11	Sugar and Integrated Industries – Abu-Qurqas Factory	Switching fuel to natural gas (operated)
12	El-Redi Poultry	Industrial wastewater treatment plant (technical studies are under preparation)
		Rehabilitation of boiler (technical studies are under preparation)
13	El-Redi for extracting oils and Poultry Fodder	Rehabilitation of fodder line production (technical studies are under preparation)
		Rehabilitation of boiler (technical studies are under preparation)
14	El-Yasmin for Pasta Production	Installation of natural gas-boiler (technical studies are under preparation)
		Conveyor belts and ventilation

		system (technical studies are under preparation)
		Industrial wastewater treatment plant (WWTP) (technical studies are under preparation)
15	El-Mokhtar for Food Industries	Replacement of the existing manual packing unit by an automatic unit , (technical studies are under preparation)
16	El-Zaeem for fodder Production	Line filter ventilation, four silos in the storage area with mixing and automatic lift (technical studies are under preparation)
17	El-Saba for wood production	Replacement of old wood production line by new technology line (technical studies are under preparation)
		New painting line (technical studies are under preparation)
18	El-Forsan for Food production	Replacement of 10 sugar cookers, mills & de-dusting system (technical studies are under preparation)

Dakahlia Governorate		
19	Delta Fertilizer (environmental studies)	Installing of nitrogen emission reduction (Nox) unit
20	Mansoura Resins	Switching fuel to natural gas, (internal piping are under installation)
21	Dakhlia textile	Switching fuel to natural Gas, (installing internal piping ,burners, & external piping are under installation)
22	Misr oil and soap (Sandoub Factory)	Switching fuel to natural gas, (internal & external piping installed and burners are under installation).
23	Ashmawy Brick Factory	Switching fuel to natural gas, (operating)
24	Abd El-Hay Brick Factory	Switching to Natural Gas, (Operating)
25	Mansoura Bio-fibers	Solid waste treatment (technical studies are under preparation)

Sharkia governorate		
26	Misr oil and soap (Zaqaziq Factory)	Switching to Natural Gas,(operating)
27	CAN for gases filling	Installation of units to reduce industrial waste pollution ,(operating)
28	Sharkia Rice Mills.	Fuel switching to NG (under installation)
29	El-Shoubagy for Textile	Industrial wastewater treatment plant(technical studies are under preparation)
30	Gest for Metal	Install new sanding unit
31	El-Rowad for Poultry (ROFI)	Industrial wastewater treatment plant, (operating).
		Solid waste treatment unit, (operating).
El-Behaira governorate (Kafr El-Dawar)		
32	Misr for Spinning , Textile and Dyeing / Kafr El-Dawar	Switching fuel to natural gas(installed and operated)
33	Misr for spinning , textile and dyeing / Kafr El -Dawar - (Bida factory)	Switching fuel to Natural Gas(installed and operated)

Gharbia governorate		
Mahala		
34	Othman for dyeing	Installation of waste water treatment plant, (under installation)
35	SMC for electronics	Installation of waste water treatment plant (Start up test).

Source: EEAA (Central Department for industry – December 2010)

Examples for financed projects:

Misr Aluminum Company- Nag Hammadi

Melting unit of solid tar has been financed through PPSI project with 457030 Euro which represent 20% of the total amount of the project which is 2285150 Euro. It includes crushers, feeding to melting tanks, filters for tar dust and treatment unit for gases& fumes generated during melting process. These fumes treated within the unit and emitted to the air free from pollutants.

Picture (13-5) tar melting unit, before implementation **Picture (13-6) tar melting unit, after Implementation**

Al-Ahram Company for Plastic, (El-Kawsar city-Sohag)

Recycling waste resulting from plastic bags industry has been financed through safe disposal of generated waste.
Total amount for the project is 330 000 Euro provided by PPSI project (30% grant - 98000 Euro).

Picture (13-7) before Implementation

Picture (13-8) after Implementation

13-3 Future vision:

1. Raise environmental awareness among civil society through applying different systems such as assessment and classification of pollution resulting from industrial projects (Program for Pollution Evaluation Report, PROPER), through publishing results of such programs in Egyptian newspapers to evaluate performance of companies.

2. Apply Environmental Impact Assessment (EIA) for all new projects, which comply with the requirements of Co-financers (International Bank for Reconstruction and Development, Japan International Cooperation Agency, European Investment Bank, French Agency for Development), including the most important requirement which is holding public hearings and announce about these projects before their execution to guarantee transparency and improvement of the environmental status.

3. Reduce pollution loads of cement companies in Greater Cairo and Alexandria to the full compliance with permissible local standards and in some companies to the international standards during next five years.

4. Transfer all polluting industries from residential areas to authorized industrial zones such as Badr and El Akrasha.

5. Convert discharge of waste water from Nile River to public networks in some great industrial companies which is considered the main source of Nile water pollution, after conducting projects for treating or recycling waste water.

6. Reduce pollution loads in Greater Cairo hot spots areas (air quality) and Alexandria (discharge into sea), after executing proposed projects in industrial companies through MSEA's financial packages.

7. Study the effect of issuing Executive Regulations of Law No. 9/ 2009 on the environmental performance of industries.

Chapter fourteen

Solid Waste

14-1 Introduction:

Intensifying environmental concepts related to waste management and linking its economies with social and environmental aspects became an important issue; waste management process in most countries of the world became vital for public health and safety. Waste management system is an integrated and interrelated system; each step depends on its previous and at the same time the basis for the next step. The process starts with separation from source, collection, transport, recycling, recovery of substance that can be used then the final safe and sound disposal of rejects in landfills. In all cases, each step necessitates use of adequate methods appropriate with prevailing circumstances, available resources and specified list.

14-2 Percentages of solid waste generation:

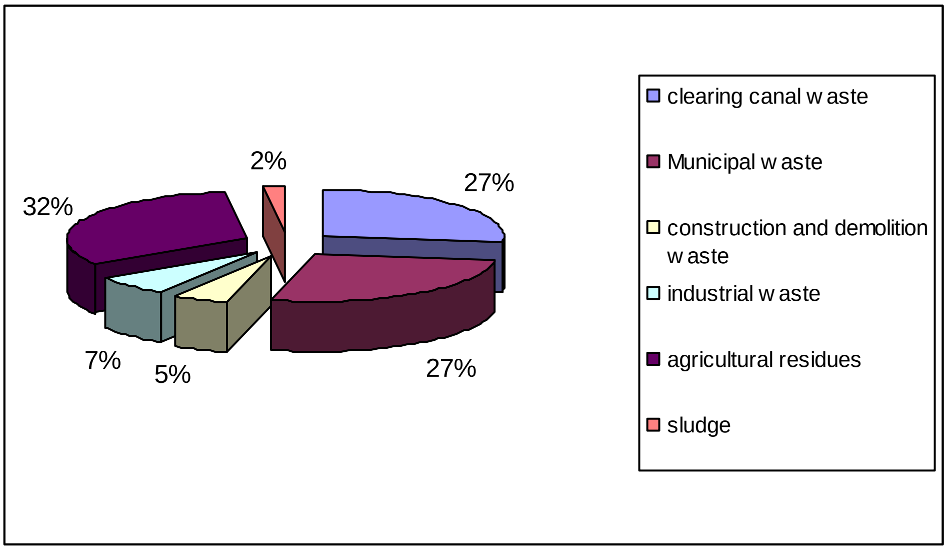


Figure (14-1) Percentages of solid waste generation.

Source: Central Department for waste, Hazardous waste & substance

14-3 Current status of municipal solid waste management in Egypt

Total quantity of generated municipal solid waste (household only) estimated with 21 million tons annually, which means daily generation of about 58000 tons. It is worth mention that recycling processes do not exceed 20 % and not professionally done, that expose citizens and workers to many healthy risks. Many dumpsites, where final disposal of such waste takes place are exposed to intentional ignition or self-ignition due to the unavailability of necessary equipments within these sites for waste coverage to prevent such burning.

14-3-1 Reasons for municipal solid waste problem mangment in Egypt

1. Deficient execution of integrated and sustainable system for solid waste management.

2. Lack of efficiency in capabilities, equipments and their poor operation and maintenance.
3. Shortage and inadequate financial resources to achieve required services.
4. Lack of expertise and human skills.
5. Lack of institutional and administrative systems in addition to lack of coordination among various stakeholders.
6. Indefinite roles and responsibilities; as well as weak monitoring and control processes.
7. Lack of environmental awareness and unsound behaviors in dealing with municipal solid waste.
8. Deficient enforcement of legislations concerned with solid waste management process.

14-4 Exerted efforts to reduce negative impacts during2010:

14-4-1 Controlling public landfills during severe air pollution episodes.

1. A plan was developed to control dumpsites within boundaries of Greater Cairo's sites (Al-Wafaa & Al-Amal, Shabramant, Al-Rubiky, El-Salam, 6th October).
2. Coordinate with Construction Authority to initiate work at Al-Wafaa & Alamal, Shubramant, Al-Rubiky and El-Salam and 6th October on September 2010.

Summary of achievements during this period:

1. Al-Wafaa & Al-Amal :

1. The site is permanently provided with two loaders and one truck for dust transfer.
2. Level & cover large parts of the dumpsite which are not covered and exposed to burn at any time.
3. Equipments used to level and cover intentionally burning pits (burning of electric wires and rubber) by some scavengers.
4. Provide assistance for coverage of daily received waste to reduce self-ignition.

2. Shubramant:

1. The site is permanently provided with one loader and one truck for dust transfer.
2. Equipments to cover and level burning pits.
3. Level & cover large parts of the dumpsite which are not covered and exposed to burn at any time.
4. Provide assistance for coverage of daily received waste to reduce self-ignition.

3. **Al-Rubiky:**
   1-The site is permanently provided with two loaders and one truck for dust transfer.
   2- Forty five burning pits have been covered and leveled with sand.

4. **El-Salam:**
   1. The site is permanently provided with one loader and one truck for dust transfer.
   2. Level & cover large parts of the dumpsite which are not covered and exposed to burn at any time.
   3. Equipments to cover & level burning pits that may occur in the site.
   4. Closing the old cell and covered with sand.
5. **6th October:**
   1. The site is permanently provided with one loader and one truck for dust transfer.
   2. Level & cover large parts of the dumpsite which are not covered and exposed to burn at any time.
   3. Equipments to cover & level burning pits that may occur in the site.
   4. Plan work cells and provide required technical support for daily coverage of received waste.
   5. Illustrative pictures for equipment during work at 6 October site.

Pictures :(14-1) (14-2), (14-3), (14-4) Shows 6th October dump site during work

14-4-2 Remove old accumulations from Greater Cairo

An integrated plan has been developed to remove old accumulations from Greater Cairo (Cairo - Giza - Qaluobiya - Helwan- 6th October), in collaboration with Construction Authority - Ministry of Housing; total amount of removed and transported accumulations to landfills were estimated with 68000 m^3. The following table shows removed accumulation from different governorates.

Table (14-1) Removed accumulation from different governorates

Governorate	Amount of accumulations (m^3)	Sites	Disposal
Giza and 6th October	500	El Omrania district, pasta factory tunnel	Shubramant landfill
	4500	El Omrania district, empty land	
	1000	El Omrania district, Abd El-Aty street	
	1000	El Haram district, Al-Tarabie street	
	1000	Bolake district, under El-Saft bridge	
	2000	Bolake district, Kafr Tohormos tunnel	
	1500	Bolake district, Saft El-Laban	
	2000	Bolake district, New Saft El-Laban	
	3000	Bolake district, El-Shabaka	
	2000	Bolake district, El-Tawhid mosque	
	7000	Bolake district, in front of the power plant	
	2500	Bolake district, Ard El-Lewa	
	2000	Al Agoza district, El Zabbalin	
	500	North district, next to Imbaba airport, Ring Road	
	4000	Warraq district, Bashtel, below the ring road, leba area	
	1500	Warraq district, Bashtel , end of El-Masabek Street, below the ring road	
	3000	Warraq district, Ezbat El Mufti, below the ring road	
	2500	Warraq district, Street 10 Al-Khlaifah bridge	
	10000	Warraq district, waste collection point below the ring road	
Cairo	500	El-Basatin district, antique wall	Al-Wafaa & Al-Amal landfill
	500	El Basatin district, Ezbat Abd El-Khaliq El-Tahawy , top of the Ring road	
Qalioubia	2000	El-Qanater El-Khairia center, ring road, Basosa	Abou Zable landfill
	500	Qaluoub , Meat Nama , Manty next to the ring road	
	10000	El-Khosos, Ezbat El-Nour, Bakosh , in front of the school complex	
	1000	Khanka , Sriaqos , Ismailia Canal Road	
Helwan	2000	Ezbat El-Zabbalin, El Gabal Valley	15th May dumpsite
	68000	**Total**	

Before lifting accumulations

After lifting accumulations

Pictures: (14-5), (14-6), (14-7), (14-8) Tunnels of ring road- Giza Governorate

Before lifting accumulations

After lifting accumulations

Before lifting accumulations

After lifting accumulations

Pictures: (14-9) (14-10) El-Khosos district – Cairo governorate

14-4-3 Development of waste management systems in Greater Cairo

Studying current situation and its problems in Greater Cairo region was the first priority since July 2009. This leads to developing the executive plans and amendment of contracts, evolving collection and transportation, increasing recycling rates, selection of new complexes for sorting, recycling and final disposal on adequate spaces and locations far from residential areas.

Since July 2009, MSEA in coordination with all stakeholders developed waste management systems by implementing the following steps:

1. Select new five sites as complexes for sorting, recycling and final disposal of waste in Greater Cairo's desert fringes, and the presidential decree No. 86 /2010 has been issued concerning these sites.
2. Prepare plans for developing waste systems in Giza and Cairo governorates and initiate their execution.
3. Identify needs for new delivery plants and development of existing stations.
4. Work is going on to construct two intermediate transfer stations for sorting waste for those interested in that process , to ban unplanned waste sorting.
5. Improve performance of contractors and garbage collectors through organizing contractual relationship with companies, and transfer current sorting activities to the new automatic sorting stations in Katamiya and El- Salam.
6. Develop controlling and monitoring system for performance of companies and all entities working in that field through establishing monitoring units in each district, constitute working teams and provide them with necessary training and equipments.
7. Work is going on to prepare feasibility studies and sign inception procedures for the two selected international projects, to benefit from waste in generating energy.
8. Prepare national campaign to raise public awareness with dangers of negative behaviors in handling waste, announce about development plans currently under execution and encourage citizens to participate in achieving their targets.

14-5 Future vision

Within the framework of developing integrated management systems for municipal solid waste management in Egypt and according to indicators comes from the current challenges facing applied systems in managing municipal solid waste, the following will be conducted:

1. Study and implement several development procedures, which include generation, transportation, recycling and final sound disposal in dumpsite.
2. Study application of some pilot projects in some governorates in the field of waste separation from source in cooperation with Beautification and Cleaning Authorities and private sector.

Chapter fifteen
Hazardous Waste & Substances

15-1 Introduction:

In Egypt, chemicals are used in different fields, for example to meet population growth needs, increasing rates of pesticides and fertilizers are consumed in agriculture to raise lands productivity; which resulted in contamination of surface and groundwater sources, various plants and crops and soil that negatively affected its productivity. Consequently human exposed to these pollutants whether directly through direct contact or inhalation of pesticides or indirectly through eating plants and animals that were breeding on these contaminated products.

Global awareness increased with dangers threatening human health and environment due to the increasing consumption of chemicals and their compounds. International environmental focus targeted group of chemicals called Persistent Organic Pollutants "POPs". Pesticides are the major of these substances and others are industrial chemicals produced and emitted unintentionally during some industrial processes as a result of burning waste of factories, hospitals and oils of electric transformers and condensers.

Dangers of these pollutants are due to the following:

1. Compounds or mixtures of chlorinated organic compounds.
2. Resist biological, photic and chemical degradation.
3. Half-life ranging between months to many years.
4. Volatile and spread in air, water and transferred across thousands of miles and deposited far from their origin place of release, where they accumulate in earth and water ecosystems.
5. Low concentrations are with high toxicity.
6. Hardly soluble in water and easy in fats, and consequently accumulate in fatty tissues of living organisms.
7. Easily absorbed in various foodstuff of vegetables, fruits and milk.
8. Many compounds including 12 which are called POPs and considered the most dangerous and harmful for their spread in the environment.

Table (15-1) Persistent Organic Pollutants

Chemical	pesticides	harmful chemicals	by-products
Aldrin	#		
Chlordane	#		
Dieldrin	#		
Endrin	#		
Heptachlor	#		
Merex	#		
Toxaphene	#		
D. D. T	#		
Hexachlorobenzene		#	
PCBs		#	

Dioxin			#
Furan			#

Source: Appendix3, Stockholm Convention, Persistent Organic Pollutants

Due to the importance and seriousness of POPs, Stockholm Convention on Persistent Organic Pollutants was concluded on 2nd May 2003 and entered into force on 17th May 2004 to ban circulation and handling of POPs. Number of signatory states is 152 including Egypt.

15-2 Environmental indicators:

15-2-1 Inventory of imported hazardous chemicals entered by customs releases:

MSEA received all applications from customs to give its technical opinion concerning allowing or disallowing entrance of hazardous chemicals substances to Egypt according to references lists stipulated in the international commitments ratified by Egypt, and prepared lists by competent authorities mentioned in Article 25 of Law 4 /1994 amended by Law 9 / 2009 and issued by ministerial decrees .

During 2010, five hundred thirty nine applications of customs release were reviewed; figure (15-1) shows comparison between quantities of imported chemicals during the period from 2006 till 2010. During 2006, quantities were (3513.826 tons) while during 2010 they were (2222) tons.

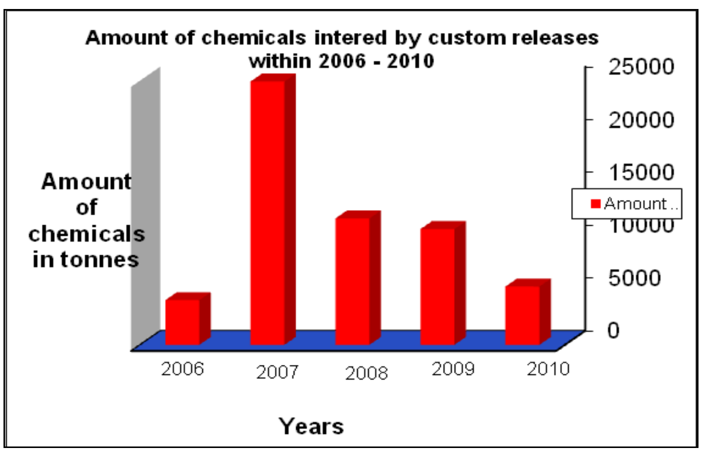


Figure (15-1) Amount of imported chemicals by customs releases from (2006 - 2010)

Source: Annual Report informed from Custom Authority

15-2-2 Inventory of imported pesticides and chemicals entered through agricultural sector (Central Laboratory of Pesticides):

Amounts of released and circulated pesticides in local market during2009 have been surveyed (Pesticides Committee - Ministry of Agriculture and Land Reclamation). Figure (15-2) shows that during 2009, amounts of insecticides, fungicides and herbicides were respectively 2019.738, 1905.88 and 1576.45 tons.

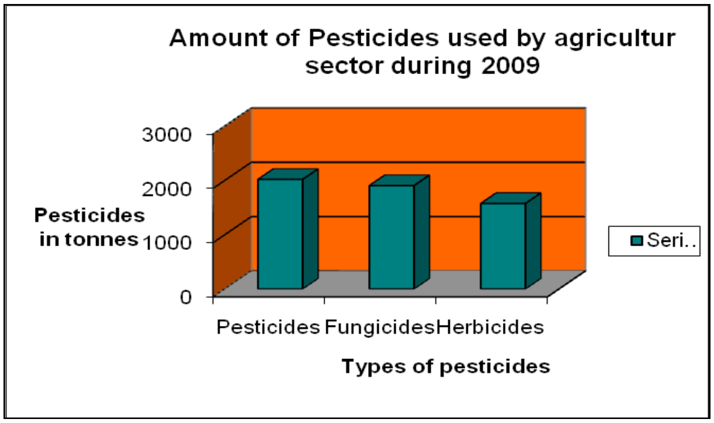


Figure (15-2) Amounts and types of pesticides used in agricultural sector during 2009

Source: Annual Report by Ministry of Agriculture

15-2-3 Inventory of imported chemicals entered through General Authority for Industrial Development:

Amounts of hazardous chemical substance imported for industrial sector have been surveyed from 2008 - 2010. Figure (15-3) shows that amount of chemicals were decreased during 2008 due to the impact of financial crisis, while increased during 2009 - 2010 because of its retreated impact.

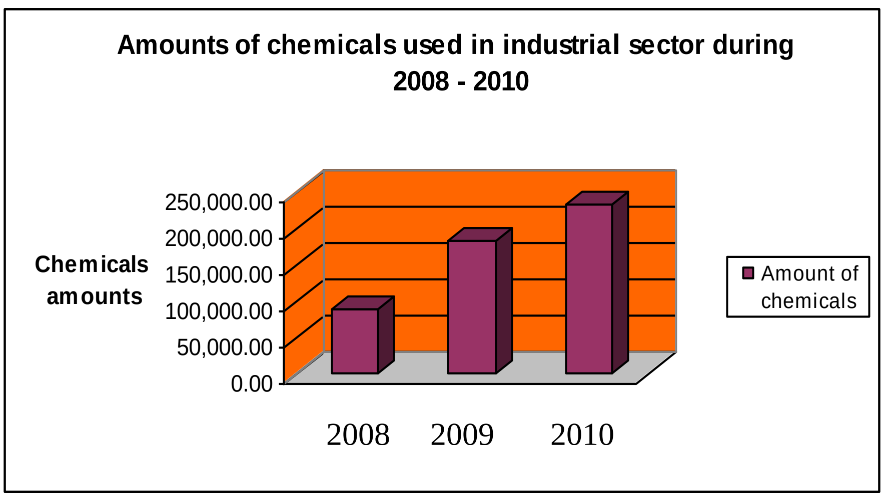


Figure (15-3) Amount of chemicals used in the industrial sector

Source: Annual Report from Ministry of Industry & foreign trade

Controlling hazardous chemicals , during their life cycle , imported for development purposes are the responsibility of competent administrative authorities which are ministries of Industry, Agriculture, Health, Interior, Electricity, Energy and Petroleum ; they are mandated by Law No. 4 /1994 amended by Law 9 / 2009 to grant licenses of their handling and circulation. Ministry of State for Environmental Affairs' role is restricted to formulate regulating technical principles and procedures.

15-3 Exerted efforts to reduce negative impacts

12-3-1Technical support for the integrated management of hazardous substances

1. Finalize preparation of the document entitled "Towards Sound and Safe Work Environment" in cooperation with Ministry of Manpower and relevant authorities, to maintain workers' health and environment.

2. Inventory quantities and qualities of phosphate in surface water in cooperation with Cleaner Production Center and Swiss project.

15-3-2 Training and environmental awareness

1. **Building capacities of qualified employees in various environmental fields**

a. Present paper about "Chemical and Biological Contaminants, and Occupational Safety " in a workshop titled "Chemical Applications of Radioisotopes and Methods of Disposing Radioactive Waste and Chemical, held in the " Regional Center for Radioisotopes"

b. Organize training programs to raise environmental awareness among relevant local community and NGOs about "Integrated Management of Hazardous Substances", Household Toxins ", "Mercury , its Environmental and Health Impacts "and "Cleaner Production in Cement Industry,".

c. Present working paper about "Environmental Pollutants" for different relevant authorities' such as industrial facilities, medical and toxicology centers.

d. Hold a workshop on "Integrated Management of Electric and Electronic Waste" in cooperation with Cairo University - Faculty of Agriculture.

e. Present working papers on "Integrated Management of Hazardous Substances" and "Occupational Safety," in the Livestock Research Center.

f. Hold a workshop in collaboration with Scientists' Syndicate in Menofia governorate, Menofia University, Ministry of Youth and Sports and environment offices to raise environmental awareness about sources, uses, health and environmental risks of unsound disposal of electronic and electric waste (E-Waste) for realizing their safe disposal.

2. **Scientific publications**

a. Translate the book published by "IPEN, into Arabic for its information on mercury, alternatives and ways to reduce its consumption.

b. Prepare awareness messages to raise environmental awareness about unsafe uses of (PCBs) and its health and environmental impacts.

c. Raise environmental awareness among children about "electronic and electric waste," by simplifying scientific information about their definition, sources and uses, for publishing in Bezra magazine.

d. Prepare flyer about electronic and electric waste, includes all important and simplified information to raise environmental awareness among all segments of society in cooperation with NGOs.
e. Prepare some questions and their answers about mercury and its impacts on health and environment, safe disposal of fluorescent lamps in case of their breakage, for publishing in Bezra magazine to raise environmental awareness among children .
f. Develop awareness messages about rational use of chemicals, unsound behaviors in dealing with them and safe handling of chemicals at home.

15-3-3Projects:

1. **Institutional Twinning project with Germany:**

Cooperation project between Germany and Egypt aims to provide experts in the field of hazardous substance integrated management, exchange experiences cope with international requirements, conventions and agreements, prepare specialized qualified employees in various departments and Regional Branches of EEAA and concerned ministries. Develop extensive and comprehensive training plan in cooperation with project's experts through the following programs:

a. Train different departments and Regional Branches of EEAA, concerned ministries, National Research Center, Universities and factories on the Global Harmonized System of classifying and coding chemicals GHS.
b. Provide different programs about "rationalize use of chemicals and reduce generating waste from industrial processes", "substance's life cycle" and "risk assessment" for various departments and Regional Branches of EEAA and relevant authorities.
c. Prepare training programs in collaboration with Cleaner Production Technology Center about "cleaner production in some industries such as textiles, leather and metal coating," and "integrated management of industrial liquid waste". Attended by different industrial sectors, relevant ministries and authorities.

Picture (15-1) Training programs of the Twining Project

Source: EEAA, General Dept. for Hazardous Waste & Substances

d. Prepare training program on environmental inspection, international legislation and laws
e. Prepare training program on ROHs, WEEE and REACH to qualify environmental inspectors.
f. Prepare training program on methods of improving inspection process and its evaluation through the inspection model for sound landfills which has been prepared in line with international legislations and has been applied to Nasriya landfill in Alexandria.
g. Identify some factories for piloting application of EU legislation on electric and electronic devices, with international expert. A report has been prepared to assist manufacturers in obtaining ROHs certificate.
h. Identify solid waste system in some foreign countries and try to apply some of them on controlled landfills in Egypt to improve their performance.
i. Evaluate databases of hazardous substances by international experts; a proposal was prepared for their updating and development.
j. Prepare questionnaire to evaluate and identify the most important recommendations after project end on April 2011.

2. **<u>Integrated management of mercury waste and recycling fluorescent lamps with (KOICA):</u>**
    a. Establish a recycling unit for fluorescent lamps in Nasriya landfill with capacity of 24.000 lamp/ day.
    b. Start work in the recycling unit for fluorescent lamps in Nasriya landfill in Borg El Arab, Alexandria governorate.
    c. Initiate collection of fluorescent lamps with its different kinds from relevant ministries, authorities, producers and consumers for recycling in Nasriya landfill.

3. **<u>Persistent Organic Pollutants “POPs” with (World Bank):</u>**
    a. Finalize second phase of the inventory surveying old transformers and condensers produced from (1950-1986).
    b. Coordinate with World Bank and Ministry of Electricity and agree on the co-finance. The project aims to highlight the importance of not mixing or selling these oils in public auction and providing (Kits) for testing prior their collection at the site.
    c. Identify important areas for future inventory of electric transformers and condensers all over Egypt through environmental inspection of EEAA‘s Regional Branches.

4. **Inventory and survey polychlorinated biphenyl (PCBs) with MEDPOL:**

Identify places, quantities of old electric transformers and condensers , contaminated oils with PCBs; in addition to the importance of safe disposal of POPs and 200 tons of contaminated oil (high concentration) outside Egypt, the following had been conducted:

a. Identify project's area (Alexandria) and coordinate with concerned ministries (Electricity - Health - Industry) and various relevant parties.
b. Present working paper on the current status of polychlorinated biphenyl PCBs in Egypt (JICA project - WB Project). Recommendations and important points that must be taken into account while finalizing next inventory and safe disposal were presented.
c. Prepare action plan, identify training needs, required equipments and tools for the safe disposal outside Egypt.
d. Make inventory and survey transformers, condensers and oils contaminated with (PCBs) starting from (1950-1986) in transformer stations of Mustafa Kamel, Smouha, downtown and collection tank of used oil.
e. Prepare environmental requirements for the intermediate storage where electric transformers and condensers are safely stored until their final disposal out of Egypt.

Picture (15-2) taking samples and analysis of oils

Source: EEAA, General Dept. for Hazardous Waste & Substances

5. **Enhance strategies to reduce unintentional emissions of POPs in the Red Sea and Gulf of Aden (PERSGA):**

Identify important sources of dioxins and furan emissions which are open burning and oil refines companies, and the following has been conducted:

a. Choose Suez Oil Refinery Company to implement the pilot project.
b. Choose Hurghada's controlled landfill for implementing the project.

Picture (15-3) controlled landfill in Hurghada
Source: EEAA, General Dept. for Hazardous Waste & Substances

15-3-4 Compliance with Basel Convention of controlling transboundary movements of hazardous waste and their disposal:

Department of Hazardous Waste and Substances follow prior notification system in coordination with Suez Canal authority, receive notifications as it is the focal point of Basel Convention, to permit vessels carrying hazardous waste passage from Far East to Europe through Suez Canal for purpose of recycling or final disposal; according to requirements of transit under the Basel Convention and conditions set by Egypt.

15-4 Future vision:

1. Safe disposal of 200 tons of contaminated oil with pure PCBs (highly concentrated oils), electric transformers and condensers outside Egypt. Finalize inventory of the highest pollution concentrations.
2. Conduct training courses for various EEAA's departments and Regional Branches on collection system, intermediate storage and safe disposal procedures of oils contaminated with PCBs.
3. Initiate inventory of quantities and types of new Persistent Organic Pollutants in new industrial facilities.
4. Prepare and print educational materials (brochures - book) to raise environmental awareness with mercury, electric and electronic waste.
5. Develop, improve and involve Regional Branches in customs releases' service to facilitate procedures for importers.
6. Finalize preparation of the integrated system to collect fluorescent lamps (consumed and imperfect) from producing industrial facilities, ministries and government buildings.
7. Conduct extensive training programs to raise environmental awareness with electronic and electric waste among various segments of the society.
8. Finalize inventory with mercury's different sources in Egypt, such as medical equipment, to identify size of the problem.

Chapter Sixteen

Environmental Performance Index

16-1: Introduction

Within the framework of MSEA's interest to improve environmental status and achieve environmental sustainability in Egypt; MSEA follows and studies international reports that reflect global environmental conditions in general and in Egypt in particular. In this respect, MSEA studies Environmental Performance Index (EPI), prepared and issued by Yale Center for Environmental Law and Policy - Yale University and Center for International Earth Science Information Network - Columbia University in cooperation with World Economic Forum (Davos) and Joint Research Center - European Commission. Total grades of EPI are (100) distributed as follows:

1. 50% for decreasing environmental pressures and impacts on human health.
2. 50% for increasing ecosystem vitality and proper management of natural resources.

These objectives reflect priorities of global environmental policies and international community adoption of the seventh goal of the Third Millennium Development Goals "Ensuring Environmental Sustainability". Calculation of index's grades relies on 25 performance indicators tracked across ten policy categories covering (environmental health- air quality- water quality- water resources- biodiversity- habitats- forests- fisheries- agriculture- climate change).

16-2 Egypt's rank in 2010 Global Environmental Performance Index (EPI):

1. Environmental Performance Index depends on the accurate data , information and results of their analysis provided by:
   a. Specialized experts in relevant fields.
   b. Statistics & decision makers from all over the world.
   c. International organizations such as (World Health Organization WHO - World Bank WB- Food & Agriculture Organization FAO - UN Children's Fund UNICEF-UN Environment Program UNEP - International Union for Conversation of Nature IUCN- International Energy Agency).
2. After reviewing Egypt's degrees and its rank in all EPIs since its issuance , It is clarified that Egypt's rank developed successively at all levels as follows:

a. **International Level:** Egypt's rank progresses from (2006-2010) as follows:

- Egypt ranked 85 out of 133 countries in 2006.
- Egypt ranked 71 out of 149 countries in 2008.
- Egypt ranked 68 out of 163 countries in 2010.

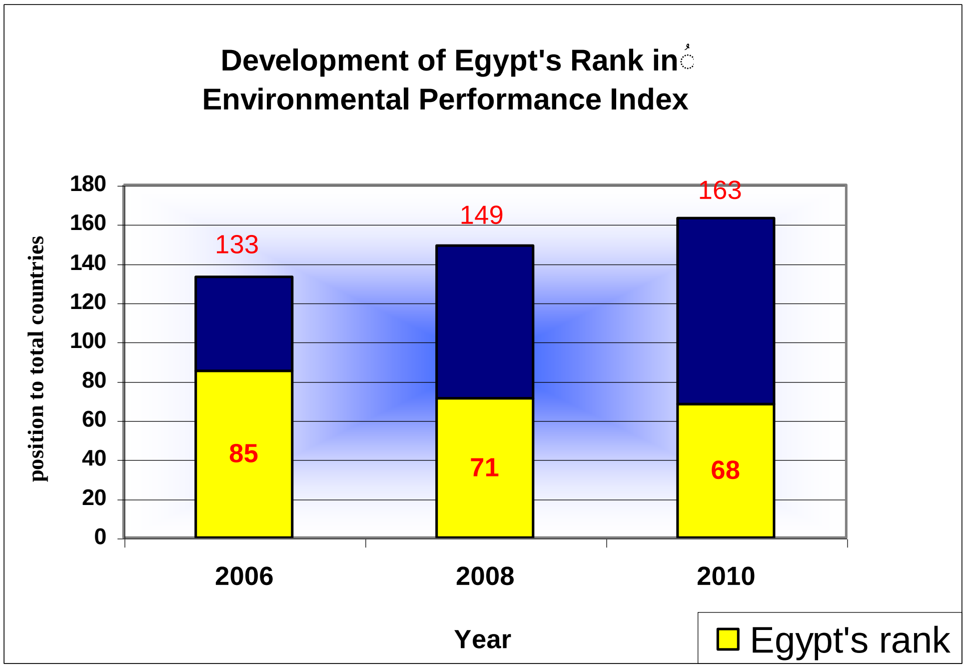
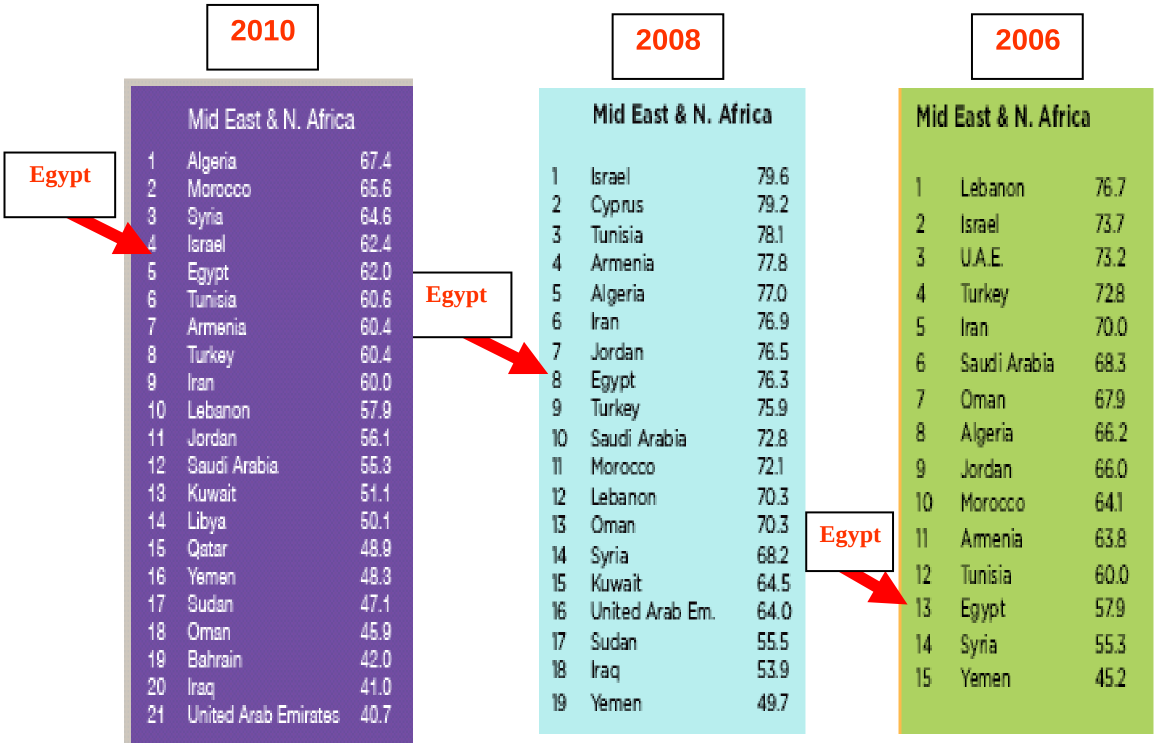


Figure (16-1) Development of Egypt's rank in the Environmental Performance Index at the international level

Source: Environmental Performance Index

b. **Regional Level:** (Middle East & North Africa group):

Egypt progressed to **the fifth rank** out of 21 countries in the Middle East & North Africa group in 2010, instead of the **"eighth"** in 2008 out of 19 countries and the "**thirteenth**" in 2006 out of 15 countries.



2010

Mid East & N. Africa		
1	Algeria	67.4
2	Morocco	65.6
3	Syria	64.6
4	Israel	62.4
5	Egypt	62.0
6	Tunisia	60.6
7	Armenia	60.4
8	Turkey	60.4
9	Iran	60.0
10	Lebanon	57.9
11	Jordan	56.1
12	Saudi Arabia	55.3
13	Kuwait	51.1
14	Libya	50.1
15	Qatar	48.9
16	Yemen	48.3
17	Sudan	47.1
18	Oman	45.9
19	Bahrain	42.0
20	Iraq	41.0
21	United Arab Emirates	40.7

2008

Mid East & N. Africa		
1	Israel	79.6
2	Cyprus	79.2
3	Tunisia	78.1
4	Armenia	77.8
5	Algeria	77.0
6	Iran	76.9
7	Jordan	76.5
8	Egypt	76.3
9	Turkey	75.9
10	Saudi Arabia	72.8
11	Morocco	72.1
12	Lebanon	70.3
13	Oman	70.3
14	Syria	68.2
15	Kuwait	64.5
16	United Arab Em.	64.0
17	Sudan	55.5
18	Iraq	53.9
19	Yemen	49.7

2006

Mid East & N. Africa		
1	Lebanon	76.7
2	Israel	73.7
3	U.A.E.	73.2
4	Turkey	72.8
5	Iran	70.0
6	Saudi Arabia	68.3
7	Oman	67.9
8	Algeria	66.2
9	Jordan	66.0
10	Morocco	64.1
11	Armenia	63.8
12	Tunisia	60.0
13	Egypt	57.9
14	Syria	55.3
15	Yemen	45.2

Picture (16-1) Ranks and degrees of Middle East & North Africa countries in the EPI

Source: Environmental Performance Index

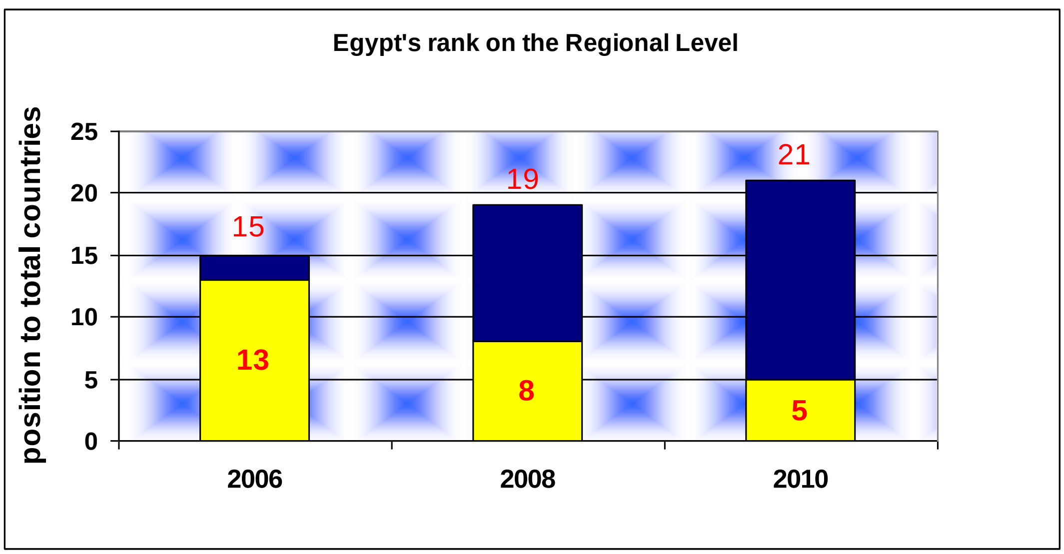


Figure (16-2) Development of Egypt's rank in the Environmental Performance Index at the regional level

Source: Environmental Performance Index

c. **Eastern Europe & Central Asia level :**

Egypt progressed to the **"sixth rank"** in 2010 out of 17 countries instead of the **"eighth"** in 2008 out of 18 countries and the **"ninth"** in 2006 out of 14 countries.

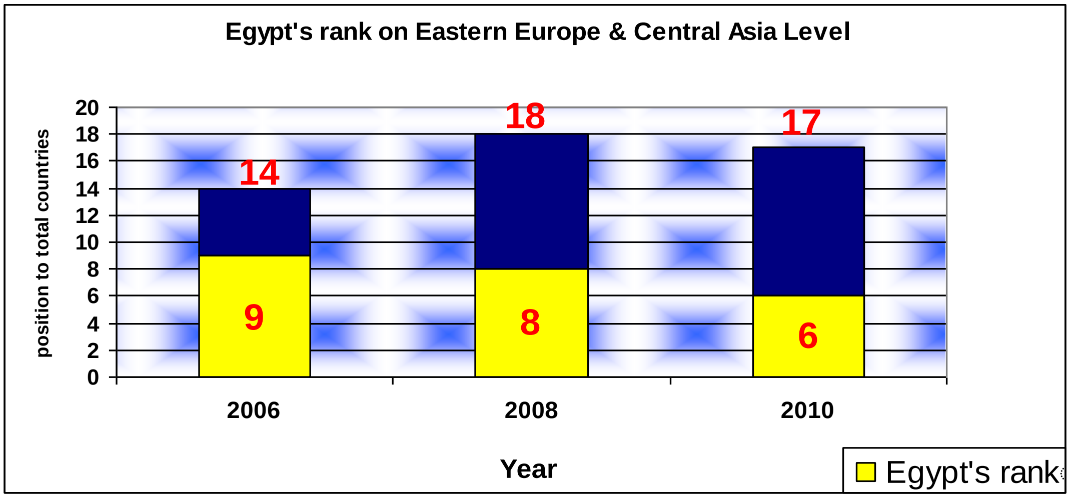


Figure (16-3) Development of Egypt's rank in the Environmental Performance Index at the Eastern Europe & Central Asia level

Source: Environmental Performance Index

a. Arab Countries

Egypt has got an advanced position at the Arab countries level as it had ranked the "**fourth"** in 2010 out of 17 countries and the **"fourth** " in 2008 out of 14 countries whereas the **"ninth"** in 2006 out of 13 countries.

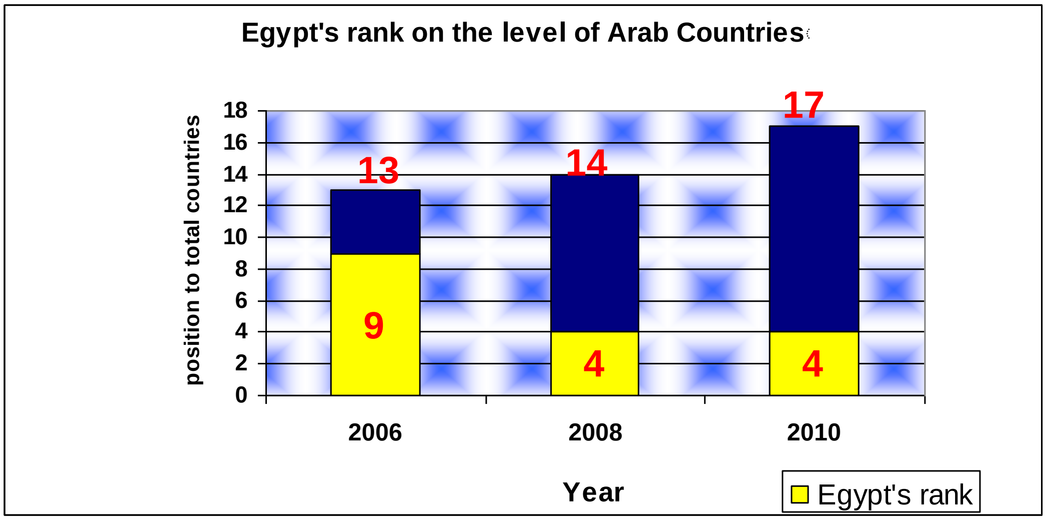


Figure (16-4) Development of Egypt's rank in the Environmental Performance Index at Arab Countries Level

Source: Environmental Performance Index

In this regard, MSEA formed a national committee from relevant ministries, to acquaint those in charge with the 25 indicators covered by the report, method of their calculation and coordination with international authorities responsible for providing the report with necessary data. A workshop has been held, from 14-16 December 2010, to examine method of improving Egypt's rank in the Environmental Performance Index, in cooperation with GEF/ UNDP. Two experts from Columbia University whom participated in EPI preparation and representatives from concerned ministries participated in the 2-days workshop during which discussions dealt with the 25 indicators covered by the report, method of their calculation, importance and weight of each indicator to Egypt. Discussions highlighted the importance of providing historic data about these indicators, method of their exchange with relevant authorities concerned with each indicator from which Columbia University derives data for the index.

Picture (16-2) events of the Environmental Performance Index workshop

The workshop directed attention to some other environmental indicators important for Egypt's geographical location & activities. One of the participants recommended that due to the availability of historic data about these indicators they must be included in the index.

Columbia University's experts pointed out the possibility of adding part about success stories of participating countries in the index، due to their perusal of Egyptian exerted efforts in the environmental field clarified to them through MSEA publications (Environmental Data & Indicators Index), (Egypt's State of Environment), (Annual Report of MSEA), (Brief Report of the most important and significant achievements of MSEA during the six years (2004-2010).

16-3 Conclusion

The successive progresses of Egypt's rank along issuance years of the EPI (2006, 2008, and 2010) reflect the positive exerted efforts for environmental protection and encourage taking effective measures to upgrade its rank in the index.

Chapter Seventeen

Environment Protection Fund

17-1 Introduction:

Environment Protection Fund established according to Law No. 4 /1994 amended by Law No. 9 / 2009. Amendments activate Article (15) which attributes legal personality to the Environment Protection Fund for more powers and capabilities necessary to activate its role in protecting environment and reducing all forms and kinds of pollution. Prime Minister decree No. 1706 /2009 formed the first EPF Board of Directors, chaired by Minister of State for Environmental Affairs and membership of representatives from Ministries of Finance, International Cooperation, Interior and Economic Development, head of the Competent Fatwa (legal Opinion) Department -State Council and NGOs ; two EPF Board of Directors meetings have been held during the first half of 2010 in activation of holding its meetings regularly and following EPF different activities. Preparations are going on to hold the third regular EPF meeting. EPF accounting unit established according to Ministry of finance decree No 59/2010.

17-2: Projects implemented by EPF during 2010

17-2-1: Projects totally financed by EPF

1- Hazardous substances and waste :

Table (17-1) Projects totally financed by EPF in the field of hazardous substances and waste

Project name	**governorate**	**Total finance**	**Fund's contribution**	**Beneficiary partner contribution**	**Total disbursed amount**	**Current situation**
Supply 10 incinerators for selected governorates according to priorities	Qena, Luxor , N.Sinai , Aswan, Alexandria	1.738.850	1.738.850		1.738.850	Install 10 incinerators in governorates of Qena, Luxor , N.Sinai , Aswan, Alexandria
Treatment unit for mercury waste	**Alexandria**	**2.000.000**	**500.000**	**1.500.000**	**500.000**	**Treatment unit is under construction**
Purchasing 4 incinerators	Assuit university – Sohag - Helwan university - Ismailia	1.222.000	1.222.000		561.000(40% of the contract's total amount which represent the	Helwan and Sohag incinerators had been installed ;while sites of Assuit and Ismailia universities

					down payment)	are still under inspection
Total					**2.799.850**	

Source: Environment Protection Fund

2 -Solid waste:

Table (17-2) Projects totally financed by EPF in solid waste field

Project name	Total finance (thousand pounds)	Fund's contribution	Total disbursed amount	Current situation
Recycling agricultural waste and rice straw; manufacturing organic fertilizer in Behera governorate.	1.100.000	1.100.000	1.100.000	The project has been finalized- September 2010
Second phase of extending sewage network to houses of Saflak village.	83.750	83.750	83.750	Finalized
Total			**1.183.750**	

Source: Environment Protection Fund

17-2-2 Projects under implementation and has been ratified

Table (17-3) Projects under implementation and has been ratified

Project name	**The side submitted the study**	**The side conducting the study**	**Fund's contribution**	**Beneficiary side contribution (in million)**	**Current situation**
Attributing all pollutants to their resources in 3 sites	Environmental Quality Sector	Environmental Quality sector	55 thousand dollars	**-**	Coordination to pay the allocated amount for a bill of the performed work
Replacement of two stroke motorcycles with	Environmental Quality Sector	Environmental Quality Sector	**2000**	**-**	Allocated from the remaining fund of taxi project

four stroke motorcycles					
Rice straw bales equipment center	Branches Affairs Sector	Branches Affairs Sector and EPF	**100**	**-**	Lotus company is the executive partner
Support development of Human Rights	NGOs	NGOs and EPF	**1000**	**-**	Fund is currently under transference to the project account
Total			**3250 +.55 thousand dollars**		

Source: Environment Protection Fund

17-2-3 Projects under implementation for Private and Public Sector Industry project (PPSI).

Table (17-4) Projects under implementation for Private and Public Sector Industry project (PPSI)

Company name	**Project name**	**Total funding (Egyptian Pound)**
El-Yasmin for Pasta Production	Industrial waste water treatment unit , installation of new filters and switching to natural gas	940.000
El-Zaeem for Fodder Production	Installation of a new line of filters , 4 silos in the storage area ; in addition to automatic mixing and lifting machine	1.315.000
El-Forsan for Food Industries	Installation of ventilation system, replacement of 10 sugar cooking machines with new machines working with natural gas and replace the two machines of chocolate paste.	830.000
El-Mokhtar for Food Industries	Replacement of the manual packing system with an automatic one	207.500
total		3.292.500

Source: Environment Protection Fund

17-3 Future Vision:

Amendment of Law No. 4 / 1994 by issuing Law No. 9 / 2009 attributed EPF the legal personality , effective from March 2009, thus to be more capable of performing its active role in executing environmental investments and realizing sustainable development through the following :

1. Independent regulatory structure has all the powers to perform EPF's role.
2. Independent accounting unit performing all its functions towards the optimum use of EPF's financial resources.
3. Board of Directors has all powers to motivate EPF's performance of its assigned tasks.

EPF considers capacity building of its staff an important issue, as it will qualify them to follow execution of Fund’s tasks and overcome obstacles facing implementation of projects according to the targeted plan.

List of some Abbreviations used in the Report

BOD	Biochemical Oxygen Demand
CAIP	Cairo Air Quality Project
CAST	Council for Agriculture Science & Technology
CCRMP	Climate Change Risk Management Programme
CDM	Clean Development Mechanism
Ch_4	Methane
COD	Chemical Oxygen Depletion
CO_2	Carbon Dioxide
DIN	Dissolved Inorganic Nitrogen
DIP	Dissolved Inorganic Phosphorus
DO	Dissolved Oxygen

EB	**Electron Beam**
EPA	**Environmental Protection Agency**
EPAP	**Environment Pollution Abatement Program**
ETO	**Ethylene Oxide**
GDP	**Global Domestic Product**
GEF	**Global Environmental Facility**
GFP	**Good Farming Practices**
GHS	**Globally Harmonized System of Classification & Labeling of Chemicals**
GWP	**Global Warming Potential**
FAO	**Food & Agriculture Organization**
HCFC	**Hydro Chlorofluorocarbon**

HPMP	**Hydro Chlorofluorocarbon Phase out Management Plan**
ICZM	**Integrated Coastal Zone Management**
IPCC	**Intergovernmental Panel on Climate Change**
IUCN	**International Union for Conservation of Nature**
IMO	**International Maritime Organization**
JICA	**Japanese International Cooperation Agency**
KOICA	**Korean International Cooperation Agency**
LEDs	**Low Emission Development strategies**
MRV	**Measurable, Reportable,**

	Verifiable
NAP	National Action Programme
NAMAs	National Appropriate Mitigation Actions
NH_3	Ammonia
NIS	National Inventory System
NO_2	Nitrogen Dioxide
ODP	Ozone Depletion Potential
PCB's	Polychlorinated Biphenyls
Pfcs	Per fluorocarbons
PH	Hydrogen Ion Concentration
PM_{10}	Particulate Matter
PPSI	Public & Private Sector Industrial Project
PRTR	Pollutant Release & Transfer Registers

REACH	**Registration, Evaluation & Authorization of Chemicals**
REMIP	**Regional Environmental Management Improvement Project**
SF_6	**Sulfur hexafluoride**
SO2	**Sulfur Dioxide**
TSP	**Total Suspended Particulates**
QIZ	**Qualified Industrial Zone**
UNDP	**United Nations Development Program**
UNFCC	**United Nations Framework for Climate Change**
VOCs	**Volatile Organic Compounds**
WHO	**World Health Organization**

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