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DANIDA

EIMP Phasing-out Phase, 2003-2004

End of Mission Report, Air Quality Monitoring, Mission 02, May-June 2003

Bjarne Sivertsen and Rolf Dreiem

Environmental Information and Monitoring Programme

Norwegian Institute for Air Research

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List of Abbreviations:

ASU	:	Ain Shams University
CAIP	:	Cairo Air Improvement Programme
CCC	:	Central Cairo Centre (EEAA)
CD	:	Central Department (EEAA)
CEHM	:	Centre for Environmental Hazard Mitigation
Danida	:	Danish International Development Assistance
DKK	:	Danish Currency Unit
EEIS	:	Egyptian Environmental Information System
EIA	:	Environmental Impact Assessment
EIMP	:	Environmental Information and Monitoring Programme
ESPS	:	Environmental Sector Programme Support
GD	:	General Directorate (EEAA)
GIS	:	Geographical Information System
GOE	:	Government of Egypt
IGSR	:	Institute for Graduate Studies and Research (Alexandria)
NILU	:	Norwegian Institute for Air Research
NIS	:	National Institute for Standardisation
NO_2	:	Nitrogen dioxide
PM_{10}	:	Particles with diameter less than 10 micrometer
RDE	:	Royal Danish Embassy
SO_2	:	Sulphur dioxide
QA / QC	:	Quality Assurance / Quality Control
TA	:	Technical Assistance
ToR	:	Terms of Reference

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1 Introduction

The EIMP project was launched in 1996 with the Egyptian Environmental Affairs Agency (EEAA) as the implementing agency for an environmental information and monitoring programme covering institutional support, coastal waters, air pollution, point sources emissions and the development of reference laboratories for improvement of the quality of monitoring data.

The EIMP project is funded by Danida and headed by COWI. NILU was as sub-consultant to COWI responsible for the design, installations, training and operations of the national air quality monitoring system for Egypt, to be operated by experts in EEAA. The design, installations and training of the monitoring network were completed covering 42 sites all over Egypt in July 2000.

The EIMP Phasing-out Phase has been formulated to consolidate EIMP achievements, while gradually integrating the EIMP activities and staff into the existing EEAA administrative and organisational structure.

The objective is to produce relevant data reports on ambient air quality as well as input to EEAA's State of the Environment reports in the form of reliable monitoring data in order to provide a sound basis for EEAA policy and decision-making. During the Phasing out Phase we will also prepare and maintain newsletters, internet web-site(s) and other relevant data dissemination media in order to ensure that EIMP data be made available to a larger segment of society and thus be used for developing a demand among the wider public for implementation of appropriate environmental policies and regulations

The second Mission during the EIMP Phasing out Phase Air Quality component was undertaken during 8 May to 6 June 2003. Responsible for the Mission was Bjarne Sivertsen. Rolf Dreiem spent 10 days in field to check the quality of measurements, maintenance and repair. (A shedule for the Mission is presented in Appendix A.2. People met during the mission are presented in Appendix A.1. References to previous presentations and summary reports was presented in Mission report 01 (Sivertsen, 2003).

2 The Monitoring programme, 2003

The following research institutions are contracted to undertake the air quality monitoring work:

- Institute for Graduate Studies and Research (IGSR), Alexandria,
- Cairo University, Centre for Environmental Hazard Mitigation (CEHM), Cairo,
- National Institute of Standardisation (NIS), Cairo.
- Ain Shams University (ASU), Cairo,

Meetings were held with the monitoring institutions at Cairo University, CEHM, and with Alexandria University, IGSR to update the status of the monitoring programme.

A maintenance and support programme was prepared for Rolf Dreiem. He checked the most critical components of the programme during his short visit to Egypt. The schedule and results of his work is presented in Appendix B.1.

2.1 CEHM monitoring status

The objective of the meeting was to go through the air quality monitoring programme with all operators present. A summary of the meeting included a status report and some action to be undertaken is presented in Appendix B.2.

Site status, instrument status and failures as well as the operations of the programme was discussed. A programme was initiated to find out the reasons why the impregnated filters show so low concentrations. The analyses carried out by the ion chromatographs seem to be under control. However, a proficiency test will be undertaken on filters prepared by NILU.

The many NO_x monitors that have been taken to the calibration laboratory at CEHM because of errors is now under repair and will be in field during the next few weeks.

2.2 IGSR monitoring status

A meeting with Dr Elsayed Shallaby and Hossam Said from IGSR was held in Cairo on 17 May 2003. The air quality monitoring programme in Alexandria and in the Delta was discussed, as presented in Appendix B.3.

There are still problems in several of the monitoring stations, but the programme seems to improve. Rolf Dreiem visited the IGSR site on 27 May. Errors was detected on the meteorological station:

- Calibration of the Wind Direction sensor is needed.
- The temperature sensor needs cleaning.
- Temperature sensor fan is not working, must be repaired.

The Eberline PM_{10} monitor at IGSR station was set to 0 degree on air inlet temperature. At this setting condensed water may come to the filter tape and give too high readings. Dreiem adjusted the temperature to 30 degree on air inlet tube. This operation should be performed on all air inlet tubes on the Eberline instruments.

The shelters that needed repair (identified in March) has still not been repaired. IGSR seem to wait for funds from EEAA.

Some of the proposals for changes to the monitoring programme in Alexandria were discussed again. Dr Shallaby will visit the possible sites and report on mail to B. Sivertsen. A site visit and final selection will be undertaken in October.

2.3 Sequential samplers

The SO_2 concentrations measured by the sequential samplers have been reported very low, especially in areas with high dust concentrations (e.g. cement factories in Helwan). A programme has been designed to investigate the reasons for these low concentrations. One part of these investigations was to compare SO_2 concentrations from sequential samplers with results from passive samplers.

The results of these first tests are presented in Appendix B.4. There were no systematic trends in the data. The ratio of passive to sequential samplers was on the average was 6.57. The ratios vary in general between 1 and 30. We thus have to wait until we receive the results from a number of more samples collected. The passive sampler samples for May 2003 will be analysed at NILU

Another task is to verify the quality of the analyses at CEHM. Five filters prepared at NILU for the proficiency test of the European Monitoring and Evaluation Programme (EMEP) were given to the laboratory at CEHM. The laboratory was requested to undertake the analyses according to normal procedures. See Chapter 3.2 for further details.

2.4 VOC sampling

The result of the first few VOC analyses have been presented and discussed in a memo dated 11 May 2003 (See Appendix B.5). Problems with the sample itself using the vacuumised steel canister seem to have been solved. In a mail from Thermo it has been specified that the canister can only be opened for sampling less than 5 minutes. The steel canister will in the future be used for short term (2 to 5 min) and for instantaneous. A systematic sampling programme may still give us the information we need concerning VOC concentrations at the selected sites.

Sampling started at Gomhoreya Street during the Mission, and the samples will be analysed even if the standard gases have been expired. New gases are being ordered.

2.5 Lead analyses

Lead analyses on filters from the PM_{10} samplers as well as from TSP samplers are part of the EIMP programme. These data have not been reported so far, and during Mission 2 results were retrieved from CEHM. The first results was available at EEAA, but had never been reported. The results of the lead analyses are presented in Appendix B.6.

A number of filters from the PM_{10} and TSP sampling were selected for analyses in October 1999 (Sivertsen, Memo 30 October 1999) and in October 2000 (Sivertsen, Memo 24 October 2000). The first set of filters, which are reported in Appendix B.6 shows that the lead concentration in the industrial areas of Shoubra ElKheima and Tabbin may exceed the Air Quality Limit values of 1 $\mu g/m^3$ as an annual average. Other sites in greater Cairo area had lead concentrations ranging between 0.2 and 0.8 $\mu g/m^3$.

A new set of filters based on PM_{10} and TSP samples was selected for lead analyses. The specification will be given to CEHM and is presented in Appendix B.7.

2.6 Meteorological data

Training on Met sensors maintenance, repair, and calibration was undertaken during the visit of Mr. Rolf Dreiem. Several parameters at many of the meteorological stations do not seem to work properly. Especially wind direction (WD) and wind speeds (WS) are important parameters for evaluation the importance of sources.

The wind speeds at many of the meteorological stations were too high. The calibrator readings at Abbaseya for instance was 11.18 m/s while the logger was reading 13.6 m/s. Similar discrepancies were found at Tabbin and IGSR. WS and WD sensors in the meteorological tower at Abbaseya were 15 degree out of vertical. The wind direction was corrected, while the error in wind speeds need further investigation to identify the reasons.

2.7 Upgraded calibration system

NILU proposed and the end of EIMP 1996-2001, phase 1, to use travelling standard gas cylinders for the field calibration instead of permeation tubes. The process has now started by the ordering of standard gases. Travelling standards were ordered in April, while the discussions of the primary standards were discussed during Mission 2. It was decided to order the gases from Scott.

2.8 New sites

A new location was selected for monitoring in Suez. A site visit and an evaluation of air quality in Suez were undertaken on 18 May 2003 (See Appendix B.8). A meeting was held with the local EEAA office (Suez R.B.O), represented by Mr Mohamed El Asmar, Senior Chemist at the Air Monitoring Laboratory. The meeting was very fruitful concerning a future co-operation in the collection of data for a complete air pollution survey of Suez. Mr El Asmar accompanied us on the site study. The sites selected have been approved and a letter has been sent to the local police authority for final approval.

Other sites will be evaluated as part of the new updated national monitoring programme for EEAA. This also applies for Alex and the Delta region, where we had several proposals for changes and additional measurements. A new site was found for the AlAsafra equipment. Dr Elsayed Shallaby inspected several possibilities that will finally be decided upon during our next Mission..

3 Reference Laboratory

3.1 QA/QC and Audit programme

The QA/QC programme developed by the EIMP programme seems to work satisfactory. We verified during the Mission that most of the procedures were followed.

Audits from NIS have been made available to the Monitoring Institutions. It is important that the site visits from the Reference Laboratories are communicated with the field operators to avoid visits to sites where instruments are down due to malfunctions or major errors at e.g. air conditioning units.

3.2 Proficiency test

To verify the quality of the analyses at CEHM five filters prepared at NILU for the proficiency test of the European Monitoring and Evaluation Programme (EMEP) were given to the laboratory at CEHM.

The last proficiency test performed by Ain Shams Laboratory has indicated that the SO_2 analyses performed by CEHM are systematically about 13 $\mu g/m^3$ higher that those specified by Ain Shams. The question about possible contamination of SO_2 as "background" on blank filters has been raised. The issue was also addressed by exchange of filters between CEHM and NILU.

Based on a comparison between CEHM analyses and "correct concentrations" the linear regression analyses show that for concentrations less than about 200 $\mu g/m^3$ the CEHM analyses are slightly higher than the standard filters. The "blank" filter was analysed by CEHM at 19 $\mu g/m^3$ giving an average "background concentration" of 15 $\mu g/m^3$ in the linear regression analyses. Without this single point the comparisons with the "correct data" were excellent (See Appendix C1).

The analyses of SO_2 performed at CEHM must be considered satisfactory

3.3 Gas cylinder leakages solved

A problem of leakage of gas from the primary and travelling standard gas cylinders was reported during Mission 01. The pressure at one of the SO_2 primary cylinders fell from 200 bars to 70 bars through 6 measurements only. A similar drop was recorded on a NO primary cylinder.

Rolf Dreiem investigated the problem during Mission 02 and found that the reason for this leakage has been caused by the use of equipment with the wrong type of threads on the outgoing fitting. The threads used out of the regulator are tapered, and it must be the same threads on the fitting. Even if the threads are sealed by Teflon tape a leakage will occur after some time (See Appendix C.2).

The solution has been given both to CEHM and to NIS. The gas leakage problem is thus considered solved.

4 Reports

4.1 Daily reports

Daily reports of the air quality in Cairo are available at the Minister office. The reports are presenting one-hour average daily maximum concentrations of SO_2, NO_2, PM_{10}, CO and Ozone. These concentrations are being compared to typical daily average concentrations measured during one specific air pollution episode in November 2000.

During the days between May and June 2003 we had very high concentrations of PM_{10} all over Cairo. There was a “mini Khamsin” over Cairo on Thursday 29 May.

4.2 Monthly reports

A data summary report issued every month in Arabic language presents the air pollution concentrations based on preliminary data. Short versions of the reports for March 2003 and April 2003 are presented in Appendix D.1 and D.2.

In addition to the normal exceeding of PM_{10} and TSP concentration limit values the SO_2 and CO concentration limits were exceeded in April 2003. The one-hour average CO concentration limit value was exceeded in Gomhoreya Street. The SO_2 concentration limits were exceeded at Gomhoreya, Tabbin and in Assyut.

4.3 Reporting episodes

Air pollution episodes occur over Cairo caused by meteorological conditions and by the presence of dust storms.

May-June is normally not the season for the typical air pollution episodes with very high concentration levels. However, in April and during the end of May we observed concentrations in Cairo much higher than normal. One such episode with very high PM_{10} concentrations are seen in Figure 1.

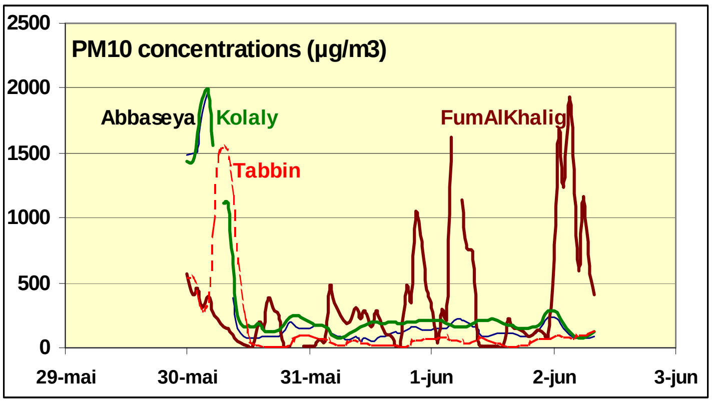

Figure 1: PM_{10} concentration episodes in Cairo May and June 2003.

Another episode is described in Appendix D.3. High SO_2 concentrations have been recorded during 23 and 24 April 2003 reaching a maximum of 411 µg/m^3 at Gomhoreya street canyon at 21:00 hours. The concentrations at Abbaseya and 6 other sites in Cairo are presented in Appendix D.3. An evaluation of the different concentrations in the street canyon at Gomhoreya indicate that traffic may not be the only source for SO_2

5 A national air quality network

The main purpose of the air quality measurements will be to identify the possible exposure to the public and to people in general. Information will be collected on ambient air pollution levels in areas where people live and work. To enable evaluation and assessments of air quality and to enable trend analyses a network of **fixed stations** is needed.

5.1 Assessment of the CAIP programme

The PM_{10} /$PM_{2,5}$ monitoring programme in the greater Cairo area has been reduced from 36 to 20 sites. A comparison of PM_{10} concentrations measured by the CAIP programme and by the EIMP programme has been undertaken as shown in Figure 2.

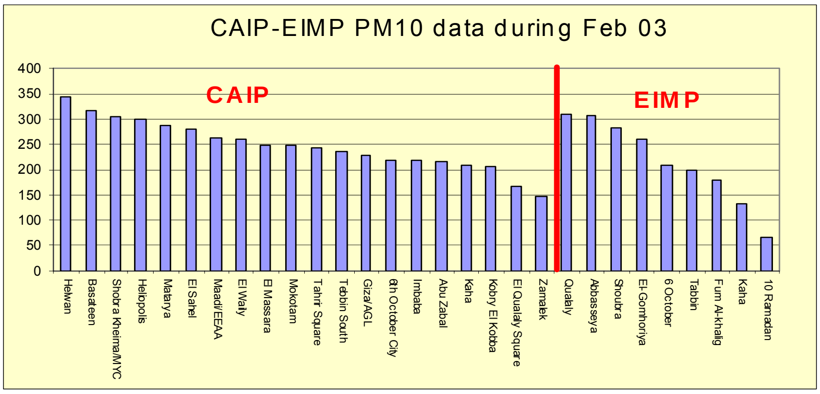

Figure 2: An example of comparisons between PM_{10} concentrations measured by CAIP and EIMP. Different types of samplers were used in EIMP. None of the sites are the same.

These types of comparisons have been run for several months. The general conclusion is that the levels of PM_{10} measured by CAIP are similar to those measured by the EIMP programme.

5.2 EEAA objectives for a national air quality network

An overall objective of the air quality measurement programme is to obtain a better understanding of the urban and residential air pollution as a prerequisite for finding effective solutions to air quality problems and for sustainable development in the urban environment. A preliminary draft indicating the typical objectives has been presented in Appendix E.1.

Further it will be important to identify areas where the Air Quality Limit values are exceeded and to identify possible actions to reduce the pollution load and to improve the general environmental conditions of the country.

The objectives of a national air quality network for Egypt will have to be formulated in co-operation with representatives from EEAA. The information collected so far from the EIMP programme and from the CAIP programme will be used to formulate this programme.

Several comments have already been given by the EIMP staff at EEAA as well as from the experts at the monitoring institutions at CEHM and IGSR. These comments and discussions are valuable input to the design of one national programme for EEAA.

Further evaluations and formulations will be developed during our next Missions to Egypt.

6 Air pollution management

6.1 An integrated system for air quality management

The application and use of the air quality data collected by the EIMP as well as for the CAIP programme has been discussed in several meetings at EEAA. It is desired to develop one common GIS based database, which integrate measurements, emission data and models for assessment and planning into one system.

A possible approach to meet these questions will be to start preparing the tools for performing an air quality management planning system to prepare an extensive assessment study and to prepare a master plan for air quality in Cairo. The tools for such planning including optimal abatement strategy planning are available.

One such system that meets the requirements of modern air quality assessment is the AirQUIS system, which was developed by the Norwegian Institute for Air Research (NILU) (www.NILU.no) to handle a number of air pollution tasks and challenges. It is based on a Geographical Information System (GIS). The main objective of a modern environmental surveillance platform like AirQUIS is to enable direct data and information transfer and obtain a remote quality control of the data collection.

A proposal for using the AirQUIS database for measurement data and for emission inventories has been presented in a memo to EEAA before. In a meeting on 10 May 2003 NILU was asked to present a proposal for developing a complete integrated database and planning system for EEAA including a cost estimate for the different modules including:

- The measurement database
- The emission inventory system
- The atmospheric dispersion models and
- The exposure and planning tools.

To meet these requests a project proposal for the development of such an integrated system was presented to EEAA on 13 May 2003. A cost estimate was based on AirQUIS reduced prices. NILU has agreed to reduce the prices compared to the normal list prices.

A complete price set up was presented in the propsal. The following summary has been prepared based on a specific request from EEAA.

The total cost for the Air Quality Measurement Module including the basic Kernel and the GIS system is given in the following:

The basic measurement module7800 US$
Hardware and computers 5750 US$
Installation and training6930 US$

Total cost for the AirQUIS measurement module installed and trained = 20 480 US $

If requested by EEAA the annual cost for maintenance and support will be 2500 US$

If the emission inventory module and the modelling modules are added to the basic GIS based kernel, the additional prices will be:

The emission inventory module including installation and training: 17 185 US$

The dispersion and exposure models with installation and trainng:24 645 US$

These prices have been based on the special offer given to EEAA by NILU.

The total AirQUIS system contains a number of modules, which may be selected individually or as a total package. The modules contains:

- Geographical Information System (GIS)
- Automatic Data Acquisition System (ADACS)
- Measurement
- Statistical and Graphical Presentation Tools
- Emission Inventory
- Emission Model
- Wind Model
- Dispersion Model
- Exposure Model

At the end of Mission 2 it was not decided what the action and next step from EEAA would be. For the purpose of integrating all air quality measurements into ONE system within EEAA it is of crucial importance that ONE database system, such as Module 1 (The basic measurement module) of AirQUIS will be developed at EEAA.

6.2 Air pollution strategy project

A meeting was called with Mr Mike Smith to discuss a new air quality strategy project undertaken within EEAA. The project is co-ordinated by Mike Smith, in relation to the use of air quality measurements and monitoring undertaken by EIMP and CAIP. Mike Smith has been assigned by the CAIP programme to help EEAA to develop an air pollution strategy. See Minute from the meeting Appendix F.1.

6.3 Ambient particle background level

To assess the total air pollution levels in Egypt it is necessary to evaluate what results from natural sources compared to the man made impact. Ambient particle levels are normally very high. A large fraction of this may originate from wind blown dust.

The recorded PM_{10} concentration levels as well as the Air Quality Limit values were discussed in a meeting at EEAA on 31 October 1999, reported in a memo dated 28 November 1999. It was agreed that it is necessary to further investigate the validity of the limit values as well as the need for verifying the normally/naturally occurring suspended dust concentrations in Egypt. A memo new was presented to EEAA on 31 May 2003 as seen in Appendix F.2.

7 Training needs assessment

Needs for further training by all personnel participating in the air quality monitoring programme for Egypt has been identified. To upgrade the personnel on the background and operations of the programme the training programmes will consist of:

- Seminars
- Workshops
- On-the-job training

Seminars and workshops will be prepared to give general presentations of the background and content of the data collected. On-the-job training will be given to the operators of instruments and equipment.

7.1 Seminar

One seminar has already been designed to update all participants in the air quality monitoring programme in understanding the measurements and the results obtained from the measurements. This seminar has been postponed till October 2003. No further preparations were thus performed during Mission 2.

7.2 Database application and air quality management, work shop

If EEAA will select to use the GIS based database system AirQUIS a workshop will be offered to give the local EEAA experts instruction in the use of the system. The training sessions will deal with both data system handling in addition to relevant theory and practical use of the system.

For other international projects a two-week training seminar has been offered at NILU. Several users in Europe and Asia have been attending these seminars. For EEAA we will propose that this training will be undertaken as workshops to be held at EEAA to reduce the costs and give more local experts the chance to participate. A maximum of 5 people should attend these workshops.

7.3 On-the-job training

On the job training was performed during Mission 2 related to the operations and maintenance of instruments. Part of this training included the use of travelling standard gases for improving the Quality assurance procedures.

Instrument repair and maintenance was checked and verified and several instruments were prepared fro return to the field during these training sessions. Training in air quality data reporting continued as an on-the-job effort. Monthly, quarterly and annual reports as well as analyses of specific air pollution situations were part of this training.

8 Administrative work

Several meetings were held during Mission 2. The outcome of these meetings is all referred to in this report. Some specific meetings are also referred to below.

8.1 Meeting with Egyptian Meteorological Authority

A meeting was arranged with the Egyptian Meteorological Authority (EMA) to discuss the air quality measurements and monitoring capabilities at EMA. We received some general information about weather predictions, the different departments of the Authority as well as input to air quality measurements undertaken by the EMA.

Our impressions of the air pollution work performed as well as staff and their background and capability to undertake local air quality monitoring is summarised in Appendix G.1.

8.2 Future database EEAA

A meeting was arranged to discuss the future air quality database to be used by EEAA. Representatives from The CAIP as well as from the EIMP programme participated in the discussions. See Appendix G.2. It was pointed out that the database installed at EEAA should be able to receive all kinds of air quality data both on-line from monitors and manually imported from samples and analyses. EEAA wants to receive an offer for such database.

In the introduction it was mentioned that the Measurement module of the AirQUIS GIS based database would handle all the needs and requirements stated by EEAA. One outcome of the meeting was a proposal included cost estimates for a complete AirQUIS system to be established at EEAA. See also Ch 6.1.

8.3 State of the Air Quality in Egypt

A memo was prepared as a beginning of a "State of the Environment Report" for EEAA and Egypt. The memo represents a summary of the air quality during the last three years of measurements, 2000-2003, based on the EIMP monitoring programme. The analyses were based on data from a total of 42 measurement sites located in all parts of Egypt.

The first part of this memo is presented in Appendix H and includes the most important air pollution components. The most adverse component is presented first and the lesser important indicators are following. The sequence of priority is; suspended dust (PM_{10}, black smoke), SO_2, Ozone, CO and NO_2.

8.4 Other meetings

Staff meetings were held every Saturday at 10:00 hrs. Minutes from these meeting were made available and updated.

Before the end of the Mission NILU together with the EEAA was requested by the Ministry of Civil Aviation to undertake an Environmental Impact Assessment (EIA) related to air pollution emitted from the different sources at a new air terminal at the Cairo Airport. In a meeting with the Minister of Civil Aviation on 4 June 2003 representatives from EEAA and NILU were briefly informed about the plans for the new Terminal. We were also presented to the Terms of Reference (TOR) for the "Local Air Quality" studies to be undertaken. This specific assessment, which will have to rely on EIMP data as baseline and background information, has to be finalised and presented before 1 September 2003.

The Mission ended 10 June 2003. A final meeting summerised the Mission and it was agreed that the next Mission will be in October 2003 and include a seminar on air pollution measurements and results. A layout for this seminar was presented in Mission 01 report. (Sivertsen, 2003)

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Appendix A

People and schedules

A.1People we met and colleagues (May-June 2003)

EIMP office,3 EEAA Building, 30 Helwan Str. Maadi, Cairo (behind Sofitel hotel) , Tel. 202 525 6474 ext. 7223, Fax: 202 525 6467, e-mail: eimp@intouch.com

Staff: Ahmed AlSeoud (EEAA. *tel: 0123102068, 5721289), aahmed_hm@yahoo.com*

Air: B Sivertsen (Task Manager), tel. 351 1615, Dreiem, Haytham Ahmed (p: 320 2078)

CEHM / Cairo Univ, tel 571 9688, Fax; 571 9687: Dr Sharkawi, Dr. Mortallah, (Dr. Yehia Abd El Hady) Dr Tarek El Arabi (Project Manager) mob: *0123484050*,

Staff:Ashraf Saleh (data retrieval), Dr. Essam Abdel Hallin (data retrieval), Mahir Sayed Hafez (Tabbin), Ahmed Sayd (Qualaly, Gemhoroya), Yassin Fathi (Giza CU, Fumm al Kahlig), Kamela (Mon.lab., Shoubra), Ahmed Sulamen (Chem lab head), Ameni Taher (Chem. Anal.).

IGSR Alex Univ, tel:03422 7688, lab: 03 422 5007, Proj. tel: 424 1485, Fax 203 421 5792

Dr M El-Raey tel: 0*123109051 (elraey@cns.sisnet.net)*, Dr. El Sayed Shallaby,

Shawkat K. Guirguis (QA) (*aplab@igsrnet.net*), Dr Zekry Ghatass, Ashraf A Zahran, Mohamed Rashad Hossam A Said, Heba Said,

Data Management: Jacob Andersen, Hossam ElShakhs, Ayman El-Maazawy, Mohamed Shendy

Coastal Water: Arne Jensen, Erling, Ole, Al Shabrawi Mahmoud

Reference Lab: Ulla Lund, (Street 13 Maadi) tel: 012 312 0951, Mai EzzEldin Ahmed (counterpart), Fleming Boysen,

EEAA,Dr. Mohamed Said Khalid (Chairman), Dr Mawaheb, Mrs Hoda Hanaffi (head of GIS),
Dr Mahmoud Nasrallah

EEAA, Suez: Mr Mohamed El Asmar, Senior Chemist at the Air Monitoring Laboratory.

Sofitel Hotel: Maadi, Tel: 526 06011, Fax: 202 526 1133

Ambassader: Norge: Al Gazira al Wusta str. Amassadør Bjørn Frode Østern. Vivi Heck 735 3340

Maadi: Oystein Rismyr 44 Road 20. Apt 4, 753 0007

Danmark: 12 Hassan Sabri, Zamalek, John Carstensen 378 2040

COWI: 00 45 45 97 22 11

Danida: Jørgen Simonsen, 21 Road 86/Mustafa Kamel, P: 358 6167, Mob: 012 214 1759

USAID - CAIP: Jim Howes, Monir Labib, Jennifer Baker (Training) , Kirk Stopenhagen

Mrs Ekhlas Gamal ElDin, Hani, Said, Mike Smith

Meterological Authority (EMA): Dr. Ahmed Adel Faris (Deputy Chairman), Dr. Mohamed M. Eissa (Dir. Gen. Information), Dr. Rabiee El Fouly (Dir Gen. Research), Dr. M.A. Abbas (Dir Gen for Instruments and Laboratories),

CTS: Amr ElSoueini, tel: 378 2908, Fax: 350 4977, *Mobile: 012 216 6670*, Ali Hamed

EMC Bill Hayes, Steve Gersh (Vice President), Fax:805 544 1824, (sgersh@emcslo.com)

Mohammed Nasar (AQ) , tel 351 5174, Canal Street 3, Maadi

Giza Pyramids: Dr. Hawas, Ahmed El Hagar

Sakkara: Mohammed Hagras, Hamdi Amin

Leif Marsteen /Rolf Dreiem: 10 street 86, apt. 10, Maadi, Cairo, tel 351 3226, Magde 351 1359, Maadi contact: Espen Alstad

Saddam driver: 012297 189, **Ahmed driver**: 010 113 7410

BS: Flat: no.4 103 Street, Mahmoud Taha, mob: 012 341 3899, priv. 5255743, leil. 3.etg. 5255743

A.2 Time schedule

Air Quality Monitoring - Work Plan -May 2003

Day	Hr.	Task	Assignment	Comment	Person
Saturd. 10 May	0830 1000 1300		Arrival EEAA, Staff meeting CAIP/EIMP meeting databases	Asked to prepare plan for AQ improvement	AAE
Sund. 11 May	am.		Discuss time schedules – get data Status reports Reporting at EEAA		HA, BS HA HA
Mond. 12 May	1030 pm		Meeting CEHM, monitoring programme Passive samplers, QA tests Summary meeting		HA, BS staff
Tuesd. 13 May			Day off		
Wednesd. 14 May	1000 pm		Status sites, evaluate PM_{10} CAIP/EIMP	Annual report IGSR	HA, BS
Thursd. 15 May					
Friday 16 May			Day off		
Sat. 17 May	1000 1200 pm		Staff meeting EIMP Meeting IGSR- Sayed Shallaby, Hossam National Day Norway !		HA, BS
Sun. 18 May	0700 1100 eve		Site visits to Suez Rolf arrives	Status instruments etc.	HA, BS IGSR staff
Mon. 19 May	1000 pm		Prepare schedule for Rolf		HA, BS staff
Tuesd. 20 May	am		Data interpretation		HA, BS
Wednesd 21 May			Annual report – State of the art AQ		BS AAS, BS
Thursd. 22 May			Day off		
Friday 23 May			Day off		
Saturd. 24 May	1000 pm		Staff meeting Prepare national monitoring programme Rolf at CEHM with Yassin	Repair NOx okay	BS RD
Sund. 25 May			BS Vacation day RD to Tabbin	Met sensors	RD, Maher
Mond. 26 May	0500		BS Vacation day RD Kaha and Shoubra	Ceck met sensors	BS RD
Tuesd. 27 May	am		CEHM filters and VOC programme State of env. report RD to Alex IGSR Haytham dinner at Friday	IGSR and regional check met sensors	BS BS RD
Wednesd. 28 May			Meeting Meteorological Authority BS to CEHM? Summary RD visit	Filters and control	BS, AAS BS, AS BS, RD

Day	Hr.	Task	Assignment	Comment	Person
Thursd. 29 May			Rolf leaves Day off – golf, shop, Kallekanin		
Friday 30 May			Day off EinSokna		
Saturd. 31 May	1000 pm		Staff meeting State of Environment report finish		
Sund. 1 June			Meeting Dr Nasrallah		
Mon. 2 June					
Tuesd. 3 June	am		Final discussion EEAA air quality monitoring programme		
Wednesd 4 June			Summary and discussions		BS,HA A, AAE
Thursd. 5 June					
Friday 6 June	0510		BS Leave Cairo		BS

EIMP staff

Ahmed Abu ElSeoud (AAE)
Mai Ahmed (MEA
Shabrawi Mahmoud (SMI),
Ayman El-Maazawy (AEM),
Ashraf Saleh (ASI)
Mohamed Kasim (MK)
Mohamed Shindy (MS)
Khalid Hamdi (KH)
Haytham Ahmed (HAA)
Hossam ElShakhs (HMS)

Expat:
Bjarne Sivertsen (BS),
Ulla Lund (UOL),
Jacob Andersen (JA)

Appendix B

Status CEHM measurements

Appendix B.1: Memo from R. Dreiem

Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467

Memo

Date: 29 May 2003
To: Bjarne Sivertsen
Copy:
From: Rolf Dreiem

Day	Action	Comments
18 May 2003	Travelling from Norway to Cairo. Arrived in Maadi at 0145 on 19 May 2003	
19 May 2003	Went to CEHM to discuss with Yassin. 7 NOx analysers did not work due to cooler failure. An engineer at a local laboratory had repaired 3 coolers. 3 others are beyond repair. New coolers have arrived from CTS and the repaired coolers will be kept as spare parts. VOC samplers are going to be operated manually. Yassin is going to take the canister out of the sampler and add a restrictor to the air intake. The sampling time will be 3-5 minutes constant. PM10 High Volume samplers was repaired and returned to Alexandria. **Gas leak on cylinders.** We tested the whole system from cylinder to outlet of regulator. A leak was found between the shut off valve and the outlet fitting. The cause of the leak was wrong threads (See Memo dated 21 May 2003)	
20 May 2003	Office work. Went to storage to collect potentiometer for wind direction. **The storage is not in good order**. It is difficult to find spare part. We had to look in several big boxes to find the parts we needed. Prepared work notes in the afternoon	HAA will have to organise the storage!

Day	Action	Comments
21 May 2003	Went to **NIS** to meet Dr Samir. Looking at the same problem concerning gas leaks as at CEHM 2 days earlier. Some gas regulators had leaks due to incorrect fittings. Dr Samir will request correct fittings from Yassin, CEHM. At **Abbassyia station** Maher and I tested WS. WS readings are too high. Calibrator was 11.18 m/s and we read 13.6 m/s. WS and WD sensors in the met tower was 15 degree out of vertical. Corrected. WD is Okay. Further investigation has to be made to find out the reason why there is a difference in WS	Correct fittings from CEHM!
24 May 2003	**Staff meeting**. Comparing 3 offers on reference gas cylinders. Advised Mai to by cylinders from Scott. Stability on Scott is 2 years vs. 1 year on other offers. Went to **CEHM** after lunch to meet Yassin. Yassin is going to make 2 steel canisters ready for VOC sampling and Kamela is going to take 1 sample at 9 AM and 1 sample at 2 PM this week. **SO_2 filters from NILU** has been analysed. Dr Tarek will give BS the results tomorrow. Findings at CEHM: CO, SO_2 and NOx analysers from Gomhoroyia station are waiting for repair. Done in 2 weeks. NOx analysers from Maadi and Mansoura need new coolers. 1-2 weeks. Instruments from Kafr El Zayat: SO_2 from CEHM 1 week ago. NOx from CEHM this morning. PM_{10} Beta Gauge at CEHM. Need cleaning, Maher. Monitoring Lab is working good and a logbook concerning analysers repair is in good order. The laboratory is improving every day, learning by doing.	

Day	Action	Comments
25 May 2003	Organised my trip to Alexandria. Went to Tabbin with Maher. WD has not worked the last 6 months. Repaired today, and working good. Calibrator is not working on this sensor. Wind speeds, using calibrator. Figures are in m/s. Calibrator - Readings LO11.1813.5 MED21.9026.3 HIGH43.3652.1 Similar results here as at Abbassya. **Temp sensor**: Calibrator is not working on this temp sensor. TSP Hi Vol: Pump burnt 2 days ago. Fuse burn. No electricity after pump burning. Fuse replaced today, the station working Okay.	Maher will replace pump this week.
26 May 2003	Went to Shoubra and Kaha with Kamela and Maher. **Shoubra station:** The WD sensor did not work. Replaced. Calibrator - Data logger 0 25 36.5 60 68.9 90 180 205 Subtract 25 on WD readings! **WS** Same as Tebbin and Abbassya. **Kaha station**: WD sensor was 20 degree out of NORTH, corrected from NE to N. CalibratorData logger 0 340 180 160 WS: Same as Tebbin and Abbassaya.	

Day	Action	Comments
27 May 2003	Went to Alexandria by Train. Findings on met tower in Alex: Calibrator Readings LO11.1812.9 MED21.9026.0 HIGH43.3652.2 WD is corrected by turning the WD unit until correct WD is obtained. Calibration of WD is needed. Temp sensor needs cleaning. Temp sensor fan is not working, must be repaired. Eberline at IGSR station was set to 0 degree on air inlet temp. At this setting condensed water may come to the filter tape and give too high readings. I adjusted temp to 30 degree on air inlet tube. This must be done on all air inlet tubes on Eberline instruments. Train back to Cairo at 7 PM	
28 May 2003	Making work notes. Had a meeting with Yassin, taking about my findings in Alexandria and at Met One instruments	
29 May 2003	Return to Norway	

Appendix B.2: Meeting with CEHM 12 May 2003

EIMP

Environmental Information
and Monitoring Programme
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467

Meeting

Date: 12 May 2003
Present: Dr.Tarek and the crew from CEHM, Haytham, Ashraf EIMP and Bjarne S
Reporting:Bjarne Sivertsen

EIMP Air Quality Measurement Programme Status,

	Site	Area type	Parameter	Status	Responsible	When?
1	El-Kolaly	Urban centre	NO_x SO_2 PM_{10} TSP	okay okay okay okay	Ahmed Yassin	
2	El-Gom horiya.	Street canyon	NO_x SO_2 CO PM_{10} (A) VOC	all monitors have been disconnected to be brought to lab today some samples collected	Kamla Yassin	?
3	Abbasseyi a	Residential.	SO_2 O_3 Met PM_{10} PS (NO_2)	okay O3 for annual calibration soon WD checked today PM has to be checked today	Kamla	12May 12 May
4	Nasr City	Roadside/ Res	SO_2 BS NO_2 PM_{10} (s)	SO_2 low, 10% of passive okay okay	Mahmoud	
5	El-Maadi (EEAA)	Residential	Tel. NO_x SO_2 PM_{10} (S)	there was a problem? at CEHM for Repair (okay okay	Maher Yassin	
6	Tabbin	Industrial	NO_x SO_2 Met PM_{10} TSP	okay okay WD wrong, WS strange, check! okay	Maher	

	Site	Area type	Parameter	Status	Responsible	When?
7	Tabbin south	Industrial	SO_2 BS TSP DF PS (NO_2) VOC	SO_2 rubbish, use Passive! okay okay okay will be taken 5 min aver.	Maher	
8	Fum Al-Khalig	Road /urban	NO_x SO_2 CO PM_{10}	okay okay okay, calibration? okay	Kamla Yassin	
9	Abu Zabel	Industry/Res	PM_{10} DF PS (S+N)	okay okay okay	Adel	
10	Shoubra El-Kheima	Industrial	SO_2 Met NO_2 TSP PM_{10} (A) DF VOC	okay WD out of order, no data okay okay okay okay will continue	Kamla	
11	Giza, Cairo University	Residential	NO_x SO_2 O_3 Met	No data available Site presently out of operation	Ahmed Yassin Maher	Start before July03?
12	Kaha	Regional Background	NO_x O_3 PM_{10} Met	okay okay okay ? WD strange, Temp. records loss Met sensors have to be checked	Kamla Maher	
13	6 October	Res/ industrial	SO_2 BS NO_2 PM_{10} (S) DF	was wrong, low conc !! PS! okay okay okay	Adel	
14	10 Ramadan	Residential	SO_2 BS PM_{10} (S) DF PS (NO_2)	okay error on controller? okay okay	Adel Maher	May ?
	Canal area					
15	Suez	Res/urban	NO_x SO_2 TSP DF PS (S+N)	The sites in Suez will be relocated and restarted	Ahmed Yassin	site decided 17 May
16	Port Said	Residential	PM_{10} (A) PS (S+N)	okay okay	Adel	
17	Ismailia	Residential	PM_{10} (A) PS (S+N)	okay okay	Adel	
	Upper Egypt					
18	El Fayum	Urban	PM_{10} (A) DF PS (S+N)	okay okay okay	Mahmoud	
19	El Minya	Urban/Res	PM_{10} (A) DF PS (S+N)	okay okay okay	Maher	
20	Assyut I	Res/Urban.	NO_x SO_2 Met PM_{10}	repaired, okay since 1 April okay okay okay since 8 May	Maher Yassin	

	Site	Area type	Parameter	Status	Responsible	When?
21	Assyut II	Residential	DF PS (S+N)	okay okay	Maher	
22	Naga Hammadi	Industrial/res	PM_{10} (A) DF PS (S+N)	okay okay okay	Mahmoud	
23	Luxor	Urban/res	SO_2 BS DF PS (S+N)	low, but not as Cairo SS okay okay	Mahmoud	
24	Edfu	Urban.	PM_{10} (A) DF PS (S+N)	okay okay okay	Mahmoud	
25	Kom Ombo	Industrial	SO_2 BS PM_{10} (A) PS (S+N)	okay okay okay	Mahmoud	
26	Aswan	Urban/res.	SO_2 O_3 Met DF PS (NO_2)	okay okay okay (WD data will be checked with Met Authority data) okay okay	Mahmoud	
	Sinai Area					
27	Ras Mohamed	Background	O_3 PM_{10} (A) DF PS (S+N)	okay okay not operated any more	A. Ibrahim Maher	

Other matters

SO_2 sequential samplers

The SO_2 concentrations reported by the sequential samplers are very low, especially in areas with high dust concentrations (cement factories in Helwan) and in areas with high ammonia and dust concentrations (Delta and Alex). We are working to find out the reasons why the impregnated filters show so low concentrations. The analyses carried out by the ion chromatographs seem to be under control. If the problem will not be found, we may have to use passive samplers at all Sequential sampler sites.

Passive sampling

SO_2 Passive Sampling has been performed at stations using SO_2 sequential samplers (Nasr City, Tabbin South, 6 October, 10 Ramadan, Luxor, and Kom Ombo) to compare the analysis results.

To further investigate the levels of SO_2 and NO_2 a new series of measurements will be undertaken at the following sites:

Site	SO_2	NO_2	Site	SO_2	NO_2
Tabbin South	X		KomOmbo	X	
Nasr City	X	X	IGSR	X	X
6 October	X	X	ElMax	X	X
10 Ramadan	X		Gheat ElEnab	X	X
Shoubra		X	Tanta	X	
Kolaly		X	Damietta	X	
Luxor	X				

The samplers will be located at the sites during 14 to 20 May, exposed during 2 weeks and collected before 4 July to be brought back to NILU for analyses. (BS leaves on 6 July).

Gas leakages

The problem of leakage of gas from the primary and travelling standard gas cylinders delivered by Linde was reported during Mission 01. The pressure at one of the SO_2 primary cylinders fell from 200 bars to 70 bars through 6 measurements only. A similar drop was recorded on a NO primary cylinder. The concentrations stayed constant at the certified level.
It was statsed that all investigations have been undertaken and no leakages have been detected. A memo on the proc edures and results was requested.
Rolf will have to look into the problem during his mission.

New and modified sites

A new location must be selected for Suez Station. This task will be undertaken on 18 May. Other sites will be evaluated as par of the new updated national monitoring programme for EEAA. This also apply for Alex and the Delta region.

NO_x monitors

Several NO_x monitors have been the CEHM for repair. The necessary spare parts have finally arrived, and repair starts on 12 May 2003. Three NO_x Monitors belonging to the IGSR programme have been off-line for several months: IGSR from 13 Dec 2002; Kafr El-Zayat, from 8 Feb 2003; Mansoura, from 22 Feb 2003). Rolf will check and verify the repair.

VOC sampling and analyses

A few samples of VOC have been collected and analysed. The result of the analyses have been presented and discussed in a memo dated 11 May 2003. Problems with the sample itself using the vacuumised steel canister seem to have been solved. In a mail from Thermo it has been specified that the canister can only be opened for sampling less than 5 minutes.

We will consider using the steel canister for instantaneous sampling or for short term sampling, as this may give us the information we need concerning VOC concentrations at the selected sites.
Training on sampling procedures and VOC data interpretation will be undertaken by expatriate experts.

Meteorological sensors

Training on Met sensors maintenance, repair, and calibration will be taken into consideration during the visit of Mr. Rolf to Egypt. Several parameters at many of the meteorological stations do not seem to work properly. Especially wind direction (WD) and wind speeds (WS) are important parameters for evaluation the importance of sources.

Analytical test, proficiency test

Five filters prepared for the proficiency test of the European Monitoring and Evaluation Programme (EMEP) were given to the laboratory at CEHM. The laboratory was requested to undertake the analyses according to normal procedures and give the result as well as the gas chromatogrammes to B Sivertsen as soon as the analyses have been finalised.

EIMP Passive sampling programme

Updated Oct 1999

			Quarterly samples									
	Site name	**Area type**	**Jan**	**April**	**July**	Oct	monthly	Passive		**Other**		
	Cairo											
3	Meteorological Inst	Residential.	x	x	x	x		NO2		SO2	M	
7	Tabbin south	Industrial					X	NO2		SO2		df
9	Abu Zabel	Industry/res					X	NO2	SO2			
12	Gizapyramid	Monument					X	NO2	SO2			
	Sakkara	Monument	x	x	x	x		NO2	SO2			
	Tahrir Sq.Am.Un.	Urban					X	NO2	SO2		A	
	Shoubra (Kamela)	Residential	x	x	x	x		NO2	SO2			
	Helwan (Maher)	Residential	x	x	x	x		NO2	SO2			
	Nasr City (Tarek)	Residential	x	x	x	x		NO2	SO2			
	Heliopolis (Tarek)	Residential	x	x	x	x		NO2	SO2			
	AinShams (Ahmed)	Residential	x	x	x	x		NO2	SO2			
	Canal area											
	Suez industrial	industrial/res.					X	NO2	SO2			df
16	Port Said	Residential					X	NO2	SO2		A	
17	Ismailia	urban/resid					X	NO2	SO2		A	
	Upper Egypt											
18	El Fayum	urban					X	NO2	SO2		A	df
19	El Minya	Res./ Industrial					X	NO2	SO2		A	df
21	Assyut 2	residential/urban					X	NO2	SO2		A	df
22	Naga Hammadi	industrial/res					X	NO2	SO2		A	df
	Luxor, Karnak	monument	x	x	x	x		NO2	SO2			
	Luxor, Temple	monument	x	x	x	x		NO2	SO2			
24	Edfu	Industry/urban.					X	NO2	SO2		A	df
25	Kom Ombo	industrial					X	NO2		SO2	A	p
26	Aswan	urban/residential.					X	NO2		SO2	A	df
	Sinai Area											
	Sharm ElSheik	city, tourist	x	x	x	x		NO2	SO2			
27	Ras Mohamed	background					X	NO2	SO2		O3	df
	Alexandria											
33	IGSR, Background	Urban regional					X	NO2	SO2		O3	M
	AlAzafra (Shallaby)	Residential	x	x	x	x		NO2	SO2			
	Roman theatre	Monument	x	x	x	x		NO2	SO2			
	Delta Area											
40	Kafr Dawar	industrial					X	NO2		SO2	A	df
34	Damanhur	industrial/res					X	NO2	SO2		A	df
	Kafr el Zayet south	industrial					X	NO2	SO2		A	df
36	Tanta	urban					X	NO2		SO2	A	
39	Domyat	resid					X	NO2		SO2	A	df

A = AIRmetrics PM10 sampler
df = dust fall collector

In addition Passive sampling will be undertaken every quarter around the AbuQuir factories.

Appendix B.3:IGSR-meeting 17 May 2003

**Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467**

Meeting

Date: 17 May 2003
Present: Dr. Elsayed Shallaby, Mr Hossam A Said, Mr Bjarne Sivertsen, Haytham Ahmed.

Meeting with IGSR – monitoring programme
EIMP Air Quality Project
Summary of status of the measurements by IGSR

Introduction

The objective of the meeting was to go through the air quality monitoring programme with IGSR project manager. Site status, instrument status and failures as well as the operations of the programme was discussed.

The IGSR team responsible for the measurements in Alexandria and in the Delta are:
DrElsayed A.Shalaby
DrShawkat Guirguis
DrZekry Ghatass
DrMohamed Rashad
DrAshraf Zahran
EngHossam Said Ahmed
Eng Heba Said

A summary concerning the status of the IGSR air quality monitoring programme is prepared and presented in the following Table.

EIMP Monitoring and Sampling Program Status, IGSR

I.D	Alexandria Sites	Area type	Param	Stat	Responsible	Comments
28	Abu Qir	Industrial	SO_2(PS) NO_2 (PS) NO_2 (SS) NH_3	Ok Ok Ok Ok	M.Rashad	NH3 does not give correct readings. Dr. Sayed will try to get it from the air defence academy. Dr. Raey will try to get approval to move the site.
29	El-Max Petrogas	Industrial	SO_2 (SS) NO_2 (SS) PM_{10} (HV) DF	Ok Ok OK Ok	M. Rashad	
30	IGSR, Alex	Urban	NOx (M) SO_2 (M) PM_{10} (M) CO (M) SO_2 (PS) NO_2 (PS)	--- - Ok ? - --- Ok	Heba Said.	Sent to CEHM for repair SO2 & CO have been repaired and will be installed in the station. PM_{10} taken from ElMahalla
.	El-Asafra-	Residential	SO_2 SS PM_{10} (AM) SO_2 (PS	Ok Ok Ok	M.Rashad	All parameters give low concentrations. Should move instruments to a new location. PM_{10} sent to Damanhour
32	Gheat El-Inab	Residential	SO_2 (SS) NO_2 (SS) PM_{10} (HVS)	Ok Ok Ok	M. Rashad	PM_{10} HV low concentrations, have to be checked
33	Alexandria regional	Regional	Met Ozone (M)	------ Ok	Heba Said	Maher will go to check the met tower. O_3 monitor has been repaired and will be taken from CEHM Telephone line will be checked by Hossam.
41	El Nahda	Industrial Semi urban	PM_{10} (HV) DF	--- Ok	M. Rashad	PM10 has been taken from the station due to power supply problems.
42	El-Shohada Square Station	Traffic	SO_2 (M) NO_2 (M) PM_{10} (AM) SO_2 (PS) NO_2 (PS)	Ok Ok Ok Ok Ok	M.Rashad	Concider moving CO monitor from IGSR to this site?
34	Damanhour	Urban	PM_{10} (AM) SO_2 (PS) NO_2 (PS)	--- Ok Ok	H. Ahmed	The station has been closed due to problem in accessing the location. New location will be selected by the task manager.
35	Kafr El Zayat Kafr Elnasrya	Industrial/res.	SO_2 (M) NO_x (M) PM_{10} (M) DF SO_2 (PS) NO_2 (PS	 ---- no Ok no no	H. S.A	All equipment at CEHM for repair. SO2 monitor will be moved from IGSR station. Maher will go to the station to check PM10 monitor Passive sampling in Elnasrya has stopped due to loss of samplers
36	Tanta	Urban	SO_2 (SS) PS (N) PM_{10} (AM)	Ok -- Ok	H. S.A	Repair of shelter will be started as soon as the requirement sent from IGSR.
37	El-Mahalla	Industr/res.	SO_2 (M) PM_{10} (M) DF	Ok - Ok	H. S.A	PM10 repaired and will be installed in the station.

	Area type	Param	Stat	Responsible	Comments
-Mansura	Industr/res.	Met NOx (M) SO_2 (M) DF	Ok --- Ok Ok	Ashraf Zahran	No met data in quarterly report NOx sent to CEHM for repair.

I.D	Alexandria Sites	Area type	Param	Stat	Responsible	Comments
39	Damietta	Urban/resid	SO_2 (SS) PM_{10} (HV) NO_2 (PS) DF	Ok Ok Ok Ok	Ashraf Zahran	Electricity is ok now.
40	Kafr Dawar	Urban/industry	SO_2 (SS) PM_{10} (AM) SO_2 (PS) NO_2 (PS) DF	OK Ok Ok Ok Ok	H. Ahmed	Shelter need repair

General comments

1. We suggest to move Elasafra shelter to another site such as Hagar Elnawatia or Elras Elsouda which are believed to be exposed to high levels of air pollution.
2. A fax has been sent to remind for winter season

IGSR Project Manager
Elsayed Shalaby

Appendix B.4: Test of sequential samplers versus passive samplers

Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467

Memo

Date: 3 June 2003
To: EIMP, Ahmed Abou Elseoud (AAE),
Copy: Haytham Ahmed (HAA)**,**
From: Bjarne Sivertsen (BS)

Test of sequential samplers versus passive samplers

Introduction

The low SO_2 concentrations reported by the sequential samplers have been investigated by comparing simultaneous measured concentrations performed by passive samplers.

Passive sampling programme

SO_2 Passive Sampling had been performed from January till April 2003 at stations using SO_2 sequential samplers (Nasr City, Tabbin South, 6 October, 10 Ramadan, Luxor, and Kom Ombo). The results from these measurements are presented in the next chapter.

To further investigate the levels of SO_2 and NO_2 a new series of measurements was designed during Mission 2. Parallell measurements will be undertaken at the following sites:

Site	SO_2	NO_2	Site	SO_2	NO_2
Tabbin South	X		KomOmbo	X	
Nasr City	X	X	IGSR	X	X
6 October	X	X	ElMax	X	X
10 Ramadan	X		Gheat ElEnab	X	X
Shoubra		X	Tanta	X	
Kolaly		X	Damietta	X	
Luxor	X				

The samplers will be located at the sites during 14 to 20 May, exposed during 2 weeks and collected before 4 July to be brought back to NILU for analyses.

Results

The results of the sampling undertaken in January to April are presented in the following Figure.

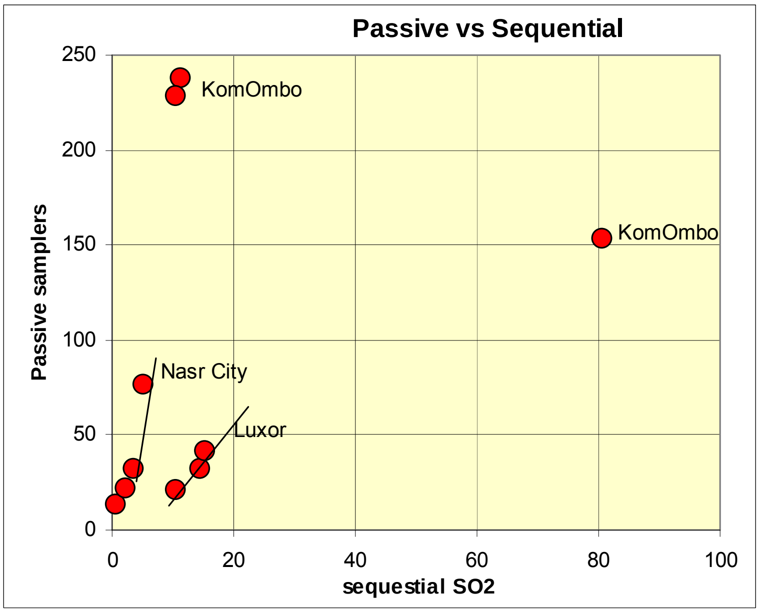
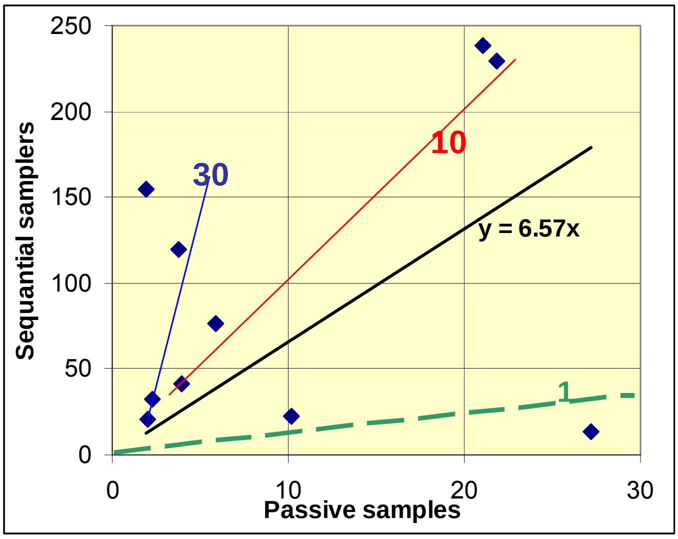


Figure 1: SO_2 concentrations measured by sequential samplers and by passive samplers during the same time periods.

During one month in Kom Ombo (January 2003) when the passive sampler concentration was 150 µg/m^3, the sequential samplers showed 81 µg/m^3.

At other sites the ratio of Passive to sequential samplers was between 2 (Luxor) and 10 (Nasr City). The ratio seems in general to be higher in Cairo and the Delta than in Upper Egypt.

Figure 2 indicates that the ratio of passive to sequential samplers on the average was 6.57.



The ratios vary in general between 1 and 30. There were no systematic trends in the data. We thus have to wait until we receive the results from a number of more samples collected. The passive sampler samples for May 2003 will be analysed at NILU.

Appendix B.5: VOC sampling programme

Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467

Memo

VOC sampling programme

Introduction

Five VOC samplers are available in the air quality network. In October 2000 the measurement programme at the start of measurements was designed to include the following sites:

Site	Bi-weekly (1)	Comment
El-Gomhoryia	X	Inside the room
Tabbin South	X	In shelter, intake through wall
Shoubra	X	On the top of the roof
El Max	X	In shelter, intake through wall
Damietta	X	In shelter, intake through wall

(1) Sampling days as PM_{10} or TSP samplers.

After installing the canisters in the above-mentioned sites, samples will be analysed in the chemical laboratory at CEHM.

Preparations performed in October 2000

1 - Calibration Gases

2 cylinders with regulators have been delivered by EIMP to the lab.

I) Propane = 9.83 ppm

II) Hydrocarbon mix of

N-Butane	= 0.102	% moles
Ethane	= 0.0957	% moles
Iso-Butane	= 0.102	% moles
Methane	= 0.189	% moles
N-Pentane	= 0.205	% moles
Propane	= 0.959	% moles

III) 2 Regulators of P/N = 5127BC10
- Inlet installed successfully on the head of cylinders
- Outlet without screw to be installed on the device (Outlet will be Silicon tube of diameter = 1/4 inch.)

2 - External CO_2 Coolant

Available with regulator in the laboratory and connected to the Purge and Trap unit
-.CO_2 regulator outlet is 3/4 inch
-.Purge and Trap unit Inlet is 1/8 inch.

3 - Manuals for Purge & Trap unit

Manuals for Purge & Trap unit are available in the lab.
Purge & Trap unit software = G1909-90300
Purge & Trap unit Hardware = G1900-90310

4 - Manuals for GC Software

These kinds of manuals are not available. CEHM has tried to look for it in the local market but they did not find it.
They suggest printing the on-line help from the software itself.

5 - Extension cables

Extension cables for power supply of canisters are available in the lab. Defected batteries have not been changed upon request from Bjarne after meeting with Amr El Seouni (Manger of CTS).

He found these kinds of batteries are too expensive and their role is only backup for electricity.

6 - The responsible persons in the lab.

Two persons that are working part time for CEHM will be responsible for the operation of GC unit. They have been trained by Ove Hermannsen to undertake the analyses. These two persons are thus well trained on operating GC, one of them has 6 years experience in operating such units, the other has 2 years experience in the same field.

7 - Column of GC

The column is available in the lab and has been connected.

8 - Helium Cylinders

The connection of helium cylinders gave some problems due to fitting the regulator of cylinders to the tube. CEHM had been manufacturing connection locally.

9 - Capillary Tube between Purge & Trap unit and GC

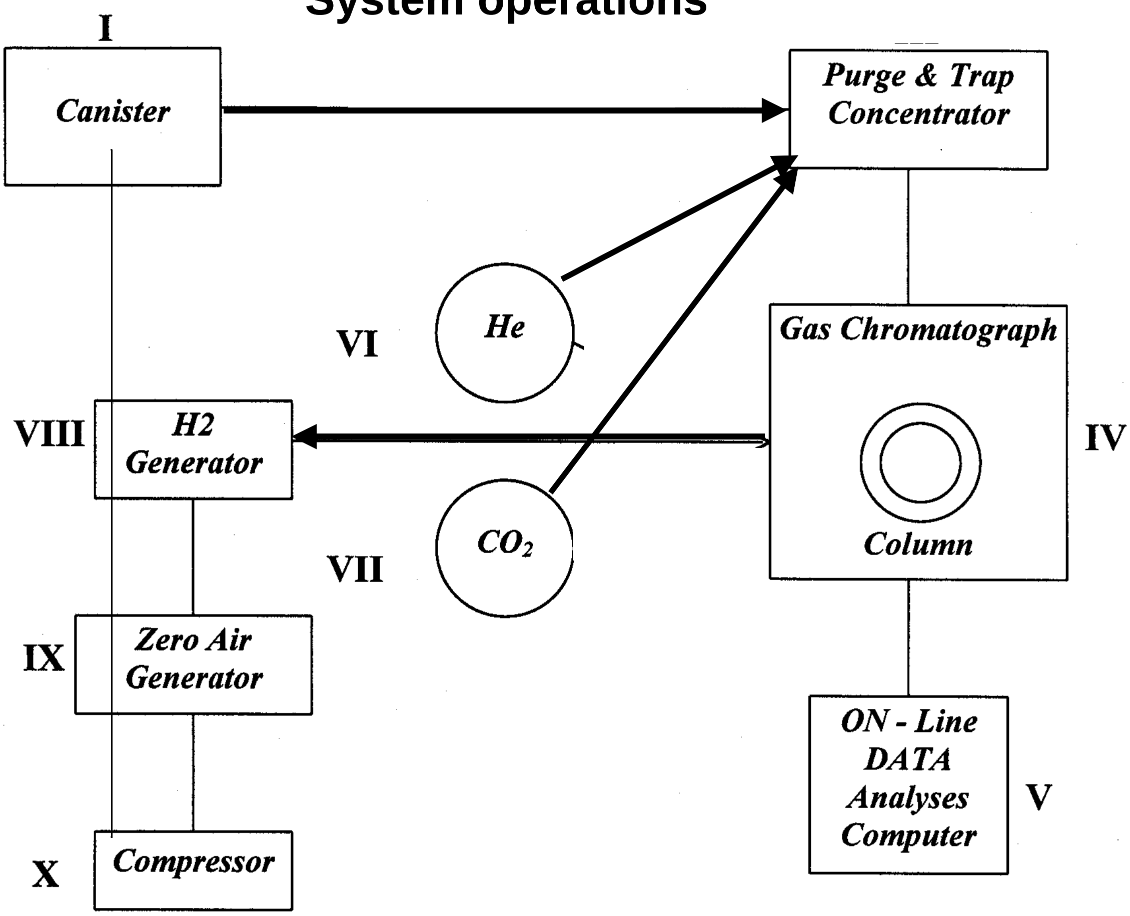
The old tube has been damaged due to intensive work on the unit. A new one was ordered.

10 - Pressure Gauge

The pressure gauge and its valve controller are available in the lab.

System Chart:

System operations



Appendix B.6: Lead analyses in Egypt 1999

Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467

Memo

Date: 1 June 2003
To:EIMP, Ahmed Abou Elseoud (AAE),
Copy:Haytham Ahmed (HAA),
From:Bjarne Sivertsen (BS)

Lead analyses in Egypt 1999

Introduction
Analyses of lead in the air based on selected ambient filters are part of the EIMP programme. A number of filters from the PM_{10} and TSP sampling were selected for analyses in October 1999 (Sivertsen, Memo 30 October 1999) and in October 2000 (Sivertsen, Memo 24 Oct 2000). The first set of filters have been analysed at CEHM and is reported below. The results from the 2000 selection have not been transferred to EEAA.

Methods
Suspended particulates in air are collected by the use of a high volume sampler with an airflow rate of 1 m^3 min^{-1}. A large rectangular filter (size 203x254 mm) is used and a sampling period of 24 h is a typical value. The high volume sampler may collect different fractions depending on what air intake (hood) is used. The two most common fractions are:

- TSP - the total suspended particulate fraction includes particulates with a size up to 25 - 50 µm.
- PM10 - the suspended particulate matter fraction with particulates smaller than 10 µm. A hood with a cut-off at 10 µm in used for this fraction.

The collected particulates are determined gravimetrically by the difference between the weight of unexposed and exposed filters. The weighing procedure is the same for both fractions above.

Particulate lead may also be determined in the dust collected on the filter down to a concentration of at least 0.1 µg Pb m^{-3}.

The lead in the particulates collected on the filter may be determined after digestion of the filter material with nitric acid. The lead in the nitric acid extract of the filter can then be determined by atomic absorption spectrometry.

At a concentration of 0.1 µg Pb m^{-3} in air and 24 h samples, the concentration of the extract produced by the digestion, is about 0.35 µg Pb ml^{-1}. At a concentration level in air between 0.1 - 1 µg Pb ml^{-1}, the concentration in the extracts from the filters will thus be between 0.3 - 3 µg Pb ml^{-1}. At this concentration level flame atomic absorption spectrometry (FAAS) is of sufficient sensitivity for the determination of lead.

For the determination of lead it is important to clean all equipment very carefully. All equipment, which is used for the treatment of samples and standards, should be rinsed by soaking in 1 % nitric acid and rinsed with deionized water before use.

Filter selections
The EIMP programme was designed to select a total of about 60 filters every year for lead analyses. The first series of filters were selected in October 1999.
The following **PM_{10} filters** should be analysed:

	Site	**Filter from day**		**Conc.**		**Aver conc**
		first priority	**second priority**	**µg/m³**		**µg/m³ tot**
4	Nasr City	26 oct 99	17 dec 98			95
5	Maadi	29 sep 99	15 sep 99			129
13	6 October	29 mar 99	22 may 99			78
14	10 Ramadan	24 dec 98	26 sep 99			69
28	AbuQuir	7 april 99	22 july 99			
29	ElMax	18 feb 99	14 july 99			
32	Gheat ElEnab	14 jan 99	15 april 99			
39	Domyat	22 july 99	10 june 99			

The following **TSP filters** should be analysed

	Site	**Filter from day**		**Conc.**		**Aver conc**
		first priority	**second priority**	**µg/m³**		**µg/m³ tot**
1	Kolaly	18 aug 99	9 sep 99			772
6	Tabbin	24 may 99	14 aug 99			617
7	Tabbin south	9 june 99	8 aug 99			800
10	Shoubra	17 feb 99	24 may 99			569
15	Suez					

A second selection of filters was prepared in October 2000.

The following **PM_{10} filters** should be analysed

	Site	Filter from day		Conc.		Aver conc
		first priority	second priority	µg/m³		µg/m³ tot
4	Nasr City	10.June 2000	29 june 2000	307	307	
			17 May 2000		165	
5	Maadi	11 May 2000	30 june 2000	166	105	
			29 june 2000		156	
13	6 October	16 June 2000	17 May 2000	230	156	

The following **TSP filters** should be analysed

	Site	Filter from day		Conc.		Aver conc
		first priority	second priority	µg/m³		µg/m³ tot
1	Kolaly	11 May 2000	5 April 2000	960	862	
6	Tabbin	29 April 2000	30 June 2000	900	893	
7	Tabbin south	18 May 2000	23 April 2000	2180	1194	
10	Shoubra	11 April 2000	5 April 2000	1468	608	
15	Suez	23 April 2000	29 June 2000	2480	1503	

Results

The first set of data has been analysed at CEHM and is presented in Figure 1 below.

It can be seen that the lead concentration in the industrial areas of Shoubra ElKheima and Tabbin may exceed the Air Quality Limit values of 1 $\mu g/m^3$ as an annual average.

However, it has to be stated that the filters selected are based on days with relatively high total concentrations of PM_{10} and TSP. The Figure also shows a mix of PM_{10} concentration filters and TSP filters. The three highest concentration ranges are all from TSP filters.

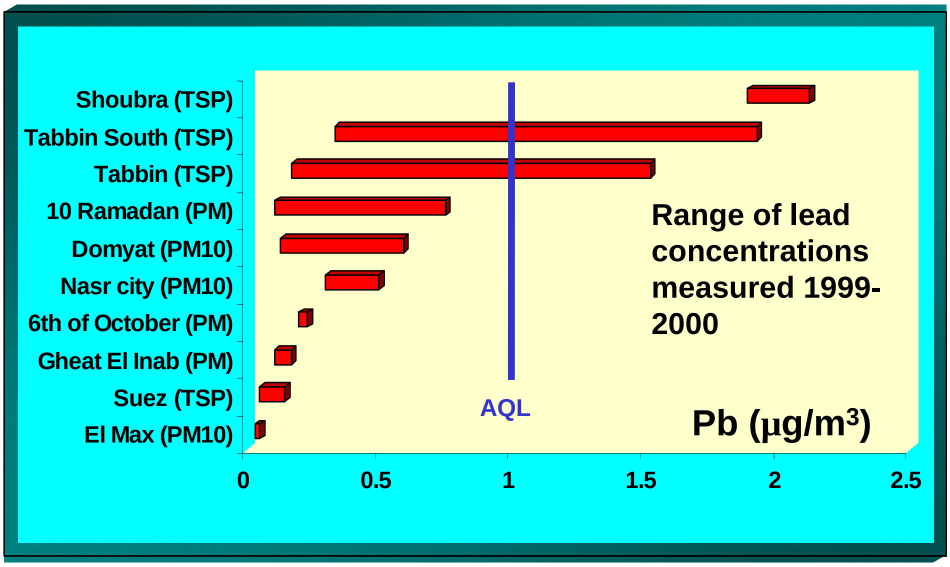


Figure 1: Ranges of lead concentrations analysed on PM_{10} and TSP filters selected during the period December 1998 to October 1999. The concentrations represent typical daily average concentrations on days with high total dust levels.

The data available so far from the EIMP programme is very limited to draw any final conclusions.

However, concentrations from lead analyses presented by the CAIP programme seems to be in the same order of magnitude as the results presented from EIMP analyses above. A summary of lead analyses on PM_{10} and PM2.5 filters undertaken by the CAIP programme during the month of October 2002 is shown in Figure 2. Lead concentration representing the sum of $PM_{2,5}$ and PM_{10} ranged from 0.6 to 2.1 $\mu g/m^3$ in the greater Cairo area.

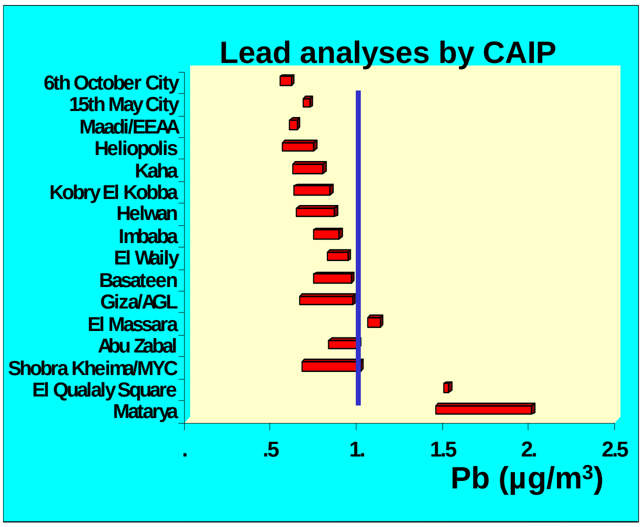


Figure 2: Lead analysed by CAIP on $PM_{2,5}$ and PM_{10} filters during October 2002.

Further analyses on filters from 2000 and 2002 will be analysed in the EIMP programme.

Appendix B.7: Filters selected for lead analyses

EIMP

Environmental Information
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EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467

Memo

To: CEHM att: Tarek ElAraby
From Bjarne Sivertsen, Haytham Ahmed
Date: 3 June 2003

Sampling Programme
Filters selected for lead analyses

The following **PM_{10} filters** should be analysed for lead (Pb):

Site	Filter from day		Conc.	
	First priority	Second priority	μg/m^3	
Nasr City	12 Mar 2002		111.2	
Maadi	28 Mar 2002	24 Jul. 2002	130.4	144
Shoubra	13 Jan 2002	24 Feb 2002	311	318
6 October	15 Jan 2002		110.3	
Gomhorya	2 Mar 2002	26 Mar 2002	286.1	261.1
ElMax	10 Nov. 2002	13 Apr. 2002	149	191.5
Gheat ElEnab	13 May 2002	12 Mar. 2002	138.6	342
Domyat	1 Apr. 2002	3 Dec. 2002	188.1	106

The following **TSP filters** should be analysed

Site	Filter from day		Conc.	
	First priority	Second priority	μg/m^3	
Tabbin	23 Aug 2002	4 Sep. 2002	786	1503
Tabbin south	18 Jul. 2002	30 Jul. 2002	707	448
Shoubra	10 Sep 2002	13 Apr. 2002	674	676
Kolaly	30 Jul. 2002	12 Jun. 2002	606	1056

Appendix B.8: Air quality measurement sites in Suez

EIMP
Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467

Memo

Date: 18 May 2003
To: Ahmed Abou Elseoud (AAE)
Copy: Haytham Ahmed (HAA)
From: Bjarne Sivertsen (BS)

Air Quality Measurement Sites in Suez

Introduction

The air quality monitoring site that has been operated in Suez will have to be moved due to changes in the infrastructure as well as indications for changes in the building mass surrounding the measurement station.

A site study was conducted to Suez on 18 May 2003. Mr Haytham Ahmed and Mr. Bjarne Sivertsen participated from the EEAA/EIMP programme.

A meeting was held with the local EEAA office (Suez R.B.O), represented by Mr Mohamed El Asmar, Senior Chemist at the Air Monitoring Laboratory. The meeting was very fruitful concerning a future co-operation in the collection of data for a complete air pollution survey of Suez. Mr ElAsmar accompanied us on the site study.

Measurements with the mobile station at RBO

A mobile laboratory has been provided by JICA to the local EEAA laboratory. This station is being used to measure at various positions around the Suez area. Measurements of So2 , NOx, CO, Ozone and PM_{10} is conducted one month at each site. The measurements have been conducted at:

- Hod El-dars Hospital (near the EEAA office)
- Public Transportation Office down town
- Fisal Primary School
- Petroleum Workers Hospital
- Etakka Power Station

During the visit the mobile laboratory was placed near the Al Arbeein Police station in El Geish Street. The power was preliminary shut down when we visited the site, so we could not see the data.

Mobile station at Al Arbeein Police station

Data are collected every week on diskettes and reported on a monthly basis. We agreed that the data collected from these stations would in the future be transferred to EEAA at the end of each month. In return the monthly reports by EEAA will be provided to the local office in Suez.

Experts from the Arabic British Dynamics (ABD) are calibrating the monitors every three-month. The NMHC monitors are not working, and seem to be exposed to the same problem of power instabilities as the EIMP programme has experienced. Ambient particles seem to be measured with Anderson samplers in 9 size fractions of particles.

For the future co-operative programme it was decided that to achieve a complete picture of the air pollution situation on the Suez area the mobile station would measure one month at the time at the following sites (See map):

- The Petroleum Training Centre north of the petrochemical factories and between the factory areas and the residential areas. (Site type: Industrial/Residential)
- The NIOF buildings south of the Etakka Power station, steel and fertiliser industries (Industrial site)
- Hod Eldars hospital, at EEAA building for especially regional ozone (residential background site)

Typical concentration measured by the mobile units

We looked at some recent data from printout files containing hourly data. Most of the data seem to be adequately quality assured, even if no QA/QC programme had been developed as part of the measurements. The calibrations undertaken every 3 month by ABD were the only quality assurance routine in the programme. The NMHC monitors were out of operations, CO monitors did not seem to work and the SO_2 concentrations varied in quality. The wind sensors did not seem to work adequately.

We received some typical average concentration measured during the summer and autumn 2001 by the mobile network. A summary of these data is given in the Table below.

Typical monthly average concentrations (ppb, µg/m[3] for PM_{10} and TSP) measured by the EEAA R.B.O. in Suez, during 2001

	Houd El-dars hosp	**ElArbein Police**	**Faisal P school**	**Petrolum hospital**	**Etakka Power st.**	**Amigo village**
	22.9-1.10	**1.-10.10**	**10-20.10**	**20-29.10**	**29.-7.11**	**7-17.11**
SO_2	5	11	11	17	-	1
NO_2	8	55	31	45	16	37
Ozone	41	8	25	20	-	-
PM_{10} (mon)	384	14	63	55	328	311
TSP (HV)	524		403		104	126
PM_{10} (HV)	209		206		72	88

	Houd El-dars hosp	**ElArbein Police**	**Faisal P school**	**Petrolum hospital**	**Etakka Power st.**	**Amigo village**
	23.6-2.7	2.-11.7	11-21.7	21-30.7	30.7-8.8	8-18.8
SO_2	5	3	6	1	1	5
NO_2	62	76	18	43	53	146
Ozone	-	-	-	-	-	-
PM_{10} (mon)	254	615	352	258	322	208
TSP (HV)	170	436	403	141	125	378
PM_{10} (HV)	19	369	206	109	97	108

Updated EIMP/EEAA programme in Suez

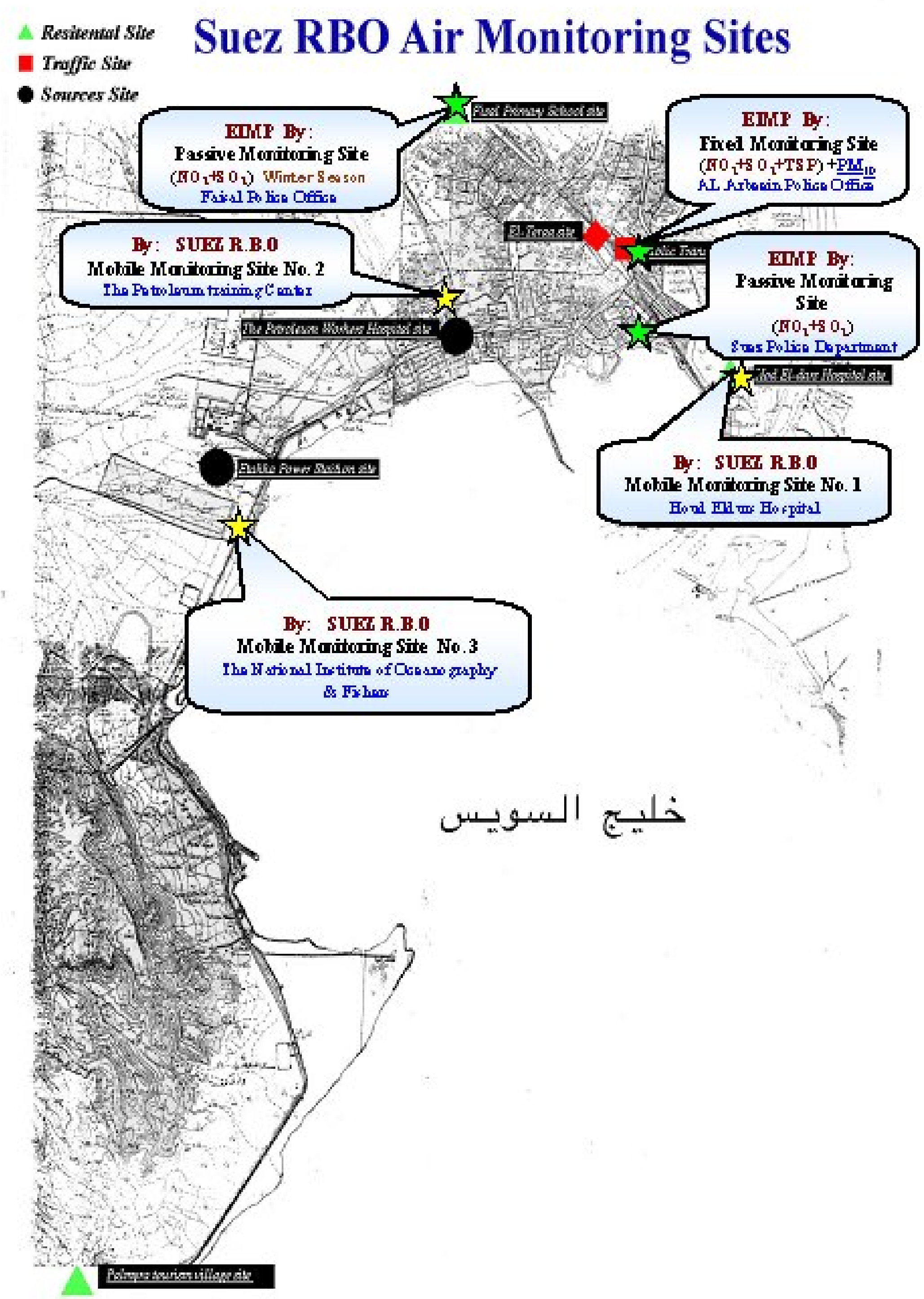
Several sites were visited for monitoring and sampling using the EIMP programmes equipment. Based on the objectives of the EIMP programme a permanent site will have to be selected for continuous monitoring. In addition passive samplers may be used to improve and increase the general information about the air quality in Suez.

The site for a permanent air quality monitoring station in Suez, inside the fence of the Al Arbeein Police station.

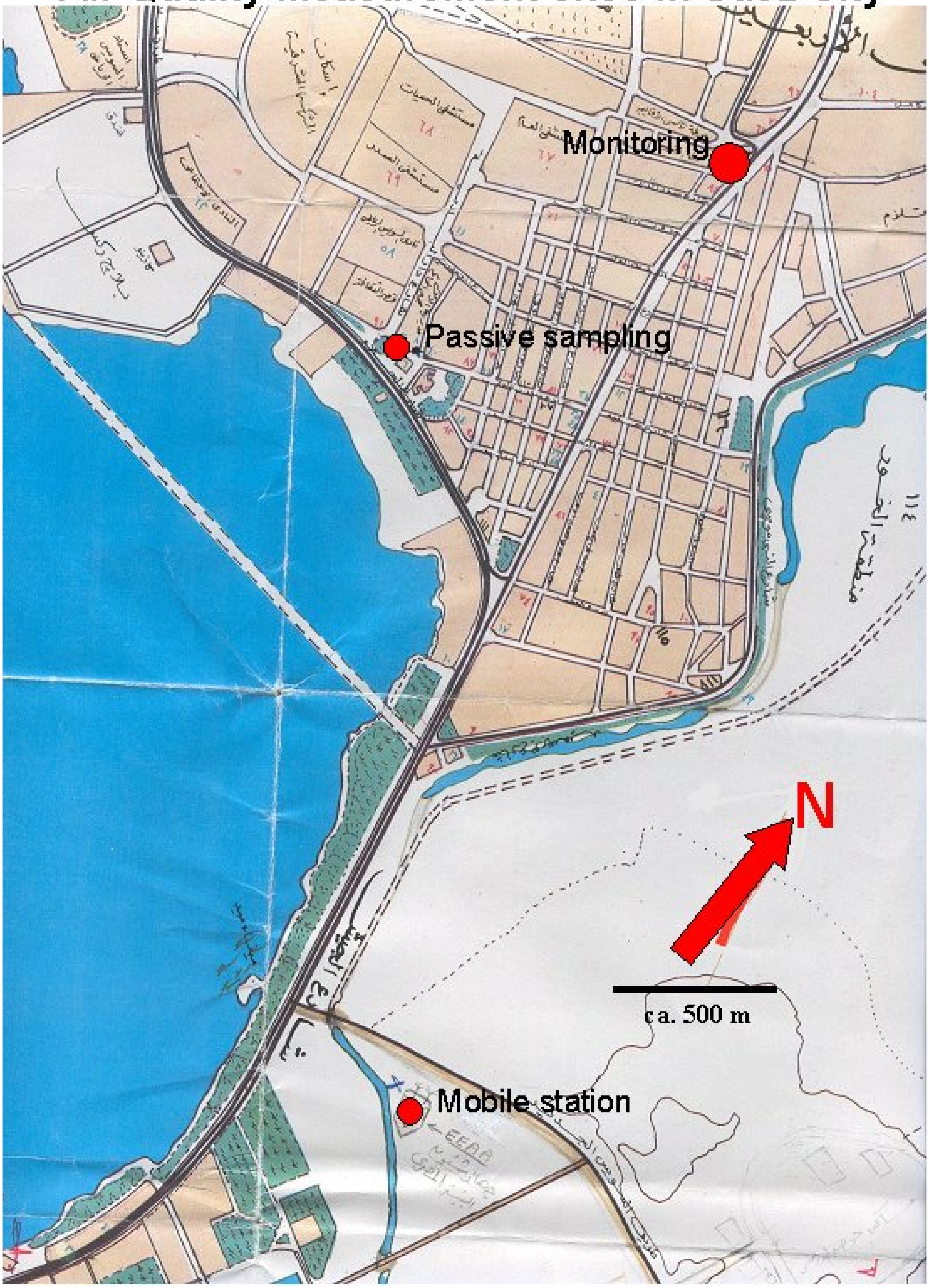
The main monitoring site will be located at Al Arbeein Police station in El Geish Street, which is the main street of Giza. The air intakes will be about 5 metres from the street at about 3 m above the surface. The site is considered a roadside station inside the urban area. (Urban/roadside). The parameters to be measured here are: SO_2, NOx, TSP and dust fall. We will try to find an AirMetric sampler for PM_{10} measurements.

In addition the permanent site, two sites were selected for passive sampling of SO_2 and NO_2 :

- At the Suez Police centre south of the city centre samples will be collected on a monthly basis.
- At Al Faisal police station passive samplers will be collected during winter months (Dec-Feb)



Air Quality Measurement sites in Suez City



Appendix C

Quality assurance

Appendix C.1: Filter analyses at CEHM

EIMP
Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
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Tel: 202 525 6442, Fax: 202 525 6467

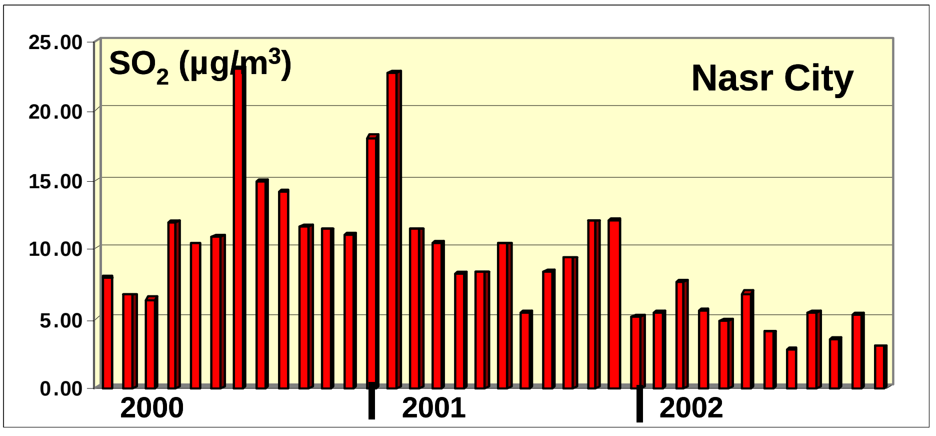
Memo

Date: 3 June 2003
To: EIMP, Ahmed Abou Elseoud (AAE),
Copy: Haytham Ahmed (HAA)
From: Bjarne Sivertsen (BS)

Filter analyses at CEHM

Introduction

The SO_2 concentrations reported by the sequential samplers have been very low, and seem to have been reduced during the last months as seen from the monthly average concentrations measured at Nasr City below.



Monthly average SO_2 concentrations measured with sequential samplers at Nasr City.

The concentrations were reported lowest in areas with high dust concentrations (cement factories in Helwan) and in areas with high ammonia and dust concentrations (Delta and Alex). The analyses carried out by the ion chromatographs seem to be under control. However a series of tests have been designed to identify the problem.

Analytical test, proficiency test

Five filters prepared by NILU for the proficiency test of the European Monitoring and Evaluation Programme (EMEP) were given to the laboratory at CEHM. The laboratory was requested to undertake the analyses according to normal procedures. Analyses were performed in May 2003 and the results as well as the gas chromatogrammes were provided to B Sivertsen at the end of May.

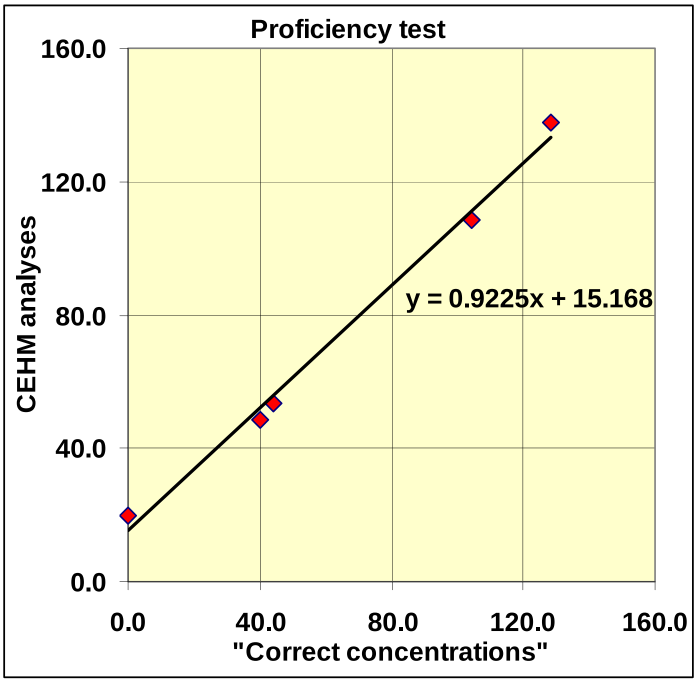
Results of filters provided by NILU

The results of the analyses of the five filters were given in µg/filter as sulphate and as SO_2. The following results are presented in µg/filter as SO_2.

- B1: 108.4 µg/filter som SO_2
- B2: 53.4
- B3: 19.9
- B4: 48.4
- B5: 137.8

The results were sent to NILU for comments.
The correct answers for these filters should have been (presented in µg/filter as SO_2):

- B1: 104.2 µg/filter som SO_2
- B2: 44.1
- B3: blank
- B4: 40.1
- B5: 128.2



The linear regression line shown in Figure 2 show that the CEHM analyses have a “background concentration” of 15 µg/m^3.

Except for the single point analysed for the “blank” the comparison with t he “correct data” is excellent. For concentrations less than about 200 µg/m^3 the CEHM analyses are slightly higher than the standard filters.

The analyses of SO_2 performed at CEHM must be considered satisfactory.

Appendix C.2: Gas leakage

EIMP

Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467

Memo

Date: 21 May 2003
To: Ahmed Abou Elseoud (AAE)
Copy: Haytham Ahmed, Tarek ElAraby, Mai Ezz El din Ahmed
From: Bjarne Sivertsen and Rolf Dreiem

Gas leakage on calibration gas cylinders solved

Introduction

The problem of leakage of gas from the primary and travelling standard gas cylinders has been discussed in several meetings. The pressure at one of the SO_2 primary cylinders fell from 200 bars to 70 bars through 6 measurements only. A similar drop was recorded on a NO primary cylinder. The concentrations stayed constant at the certified level.

Several proposals for investigations of the problem were indicated by NILU. It was stated in a meeting as late as 12 May 2003 that all investigations have been undertaken at the laboratory at CEHM and no leakages have been detected. A memo on the procedures and results was requested. After arrival of Rolf Dreiem on 20 May 2003 to CEHM he was requested to look into the problem.

Gas leakage detected
The whole calibration gas cylinder system was investigated and searched for leakages; from the first cylinder regulator to the outlet from the regulators.

A leakage of gas was detected between the shut off valve and the last outlet fitting. The calibration system had to be pressurised all the way to the calibrator to find this leakage.

The reason for this leakage has been caused by the use of equipment with the wrong type of threads on the outgoing fitting. The threads used out of the regulator are tapered, and it must be the same threads on the fitting. Even if the threads are sealed by Teflon tape a leakage will occur after some time.
This problem is related to the AGA regulators. All regulators **must be inspected.**
New correct fitting with new Teflon tape have to be used.
NIS has also been informed about the problem.

Appendix D

Reports

Appendix D.1: Monthly report March 2003

Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467

Memo

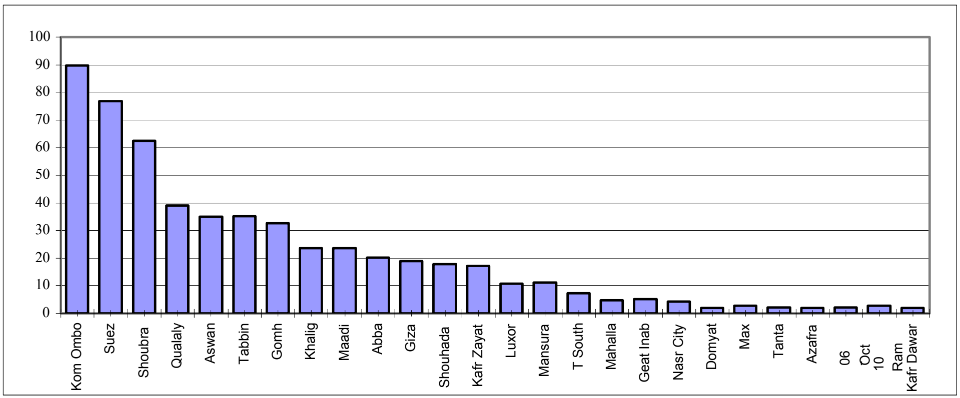
Date: 21 May 2003
To: EIMP Phase out
From: Bjarne Sivertsen and Haytham Ahmed

Monthly report March 2003 - Summary

Introduction

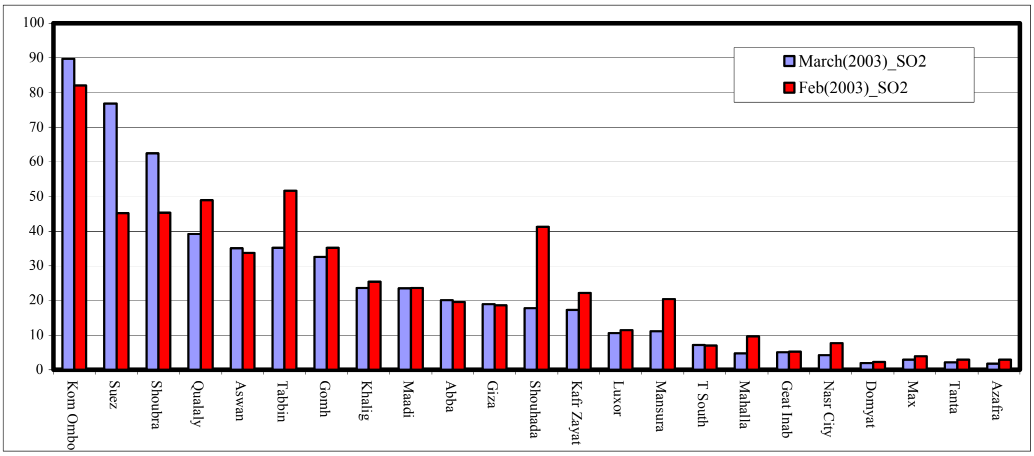
The following short summary and comments have been based on the monthly report for March prepared by Ashraf Saleh and Haytham Ahmed. The report was originally prepared in Arabic language.

SO_2 concentrations



Monthly average SO_2 concentrations at all sites in Egypt, March 2003

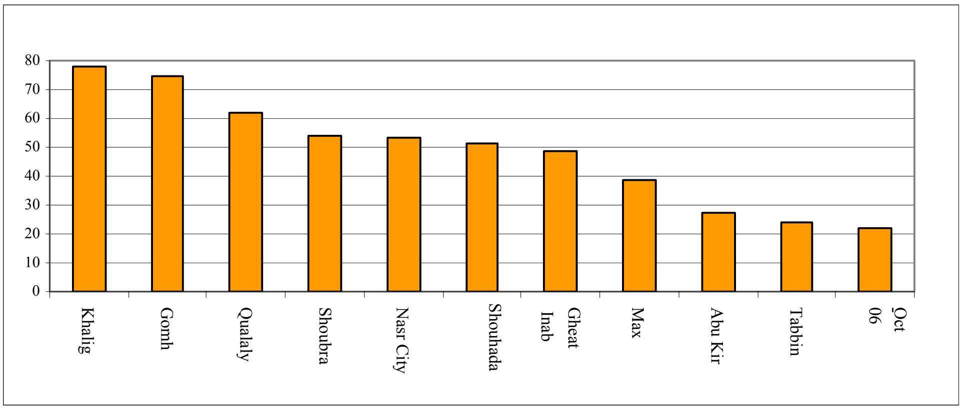
Exceedance of 60 µg/m³ (annual average AQL) was found in Kom Ombo, Suez and Shoubra ElKheima. Except for Kom Ombo the SO_2 levels measured by sequential samplers (ElAzafra, Tanta, Domyat, ElMax, Nasr City, Gheat elInab and Luxor are much lower than the concentrations measured by monitors.



Monthly average SO_2 concentrations measured in March 2003 compared to concentrations of February 2003.

Similar patterns were seen in December 2002 and in January 2003. Concentrations at the three most impacted sites were higher in March than in February.

NO_2 concentrations

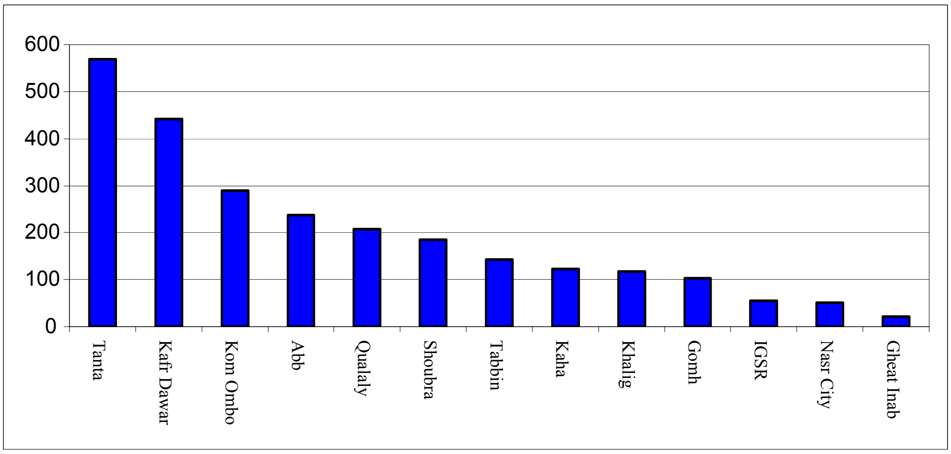


Monthly average NO_2 concentrations from 11 sites in Egypt, March 2003

The NO_2 concentrations were on the average highest in the city centre of Cairo with monthly average concentrations ranging between 60 and 80 µg/m^3. The general monthly average concentration level for most of the sites in the greater Cairo area was between 50 and 80 µg/m^3..

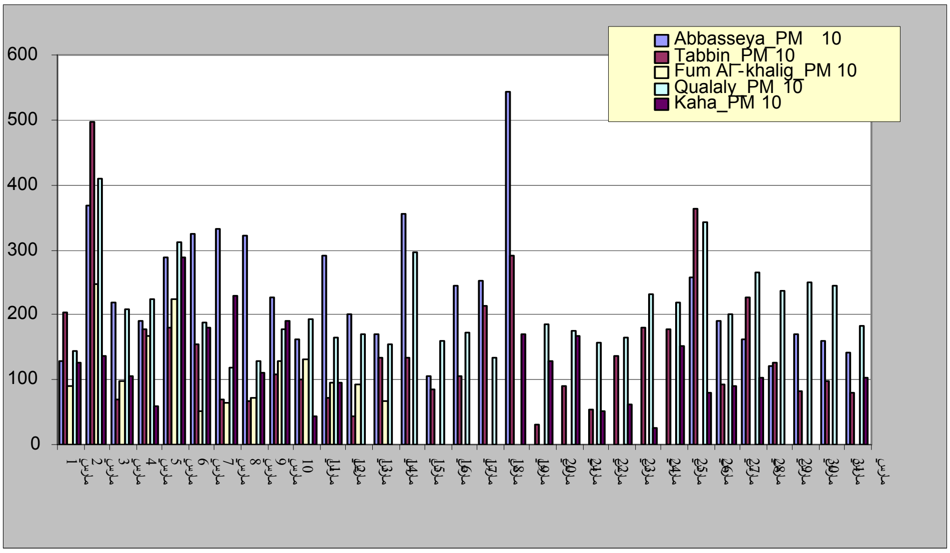
PM_{10} concentrations

PM_{10} concentrations are exceeding national and international air quality limit values at all sites in Egypt. Monthly average concentrations between 150 and 250 µg/m^3 were measured in the urban area of Cairo in March 2003. At two sites in the Delta (Tanta and Kafr Dawar) the PM_{10} concentrations in March reached 450 to 550 µg/m^3.



Monthly average PM_{10} concentrations

The daily average concentrations of PM_{10} are presented for March 2003 in the following Figure.

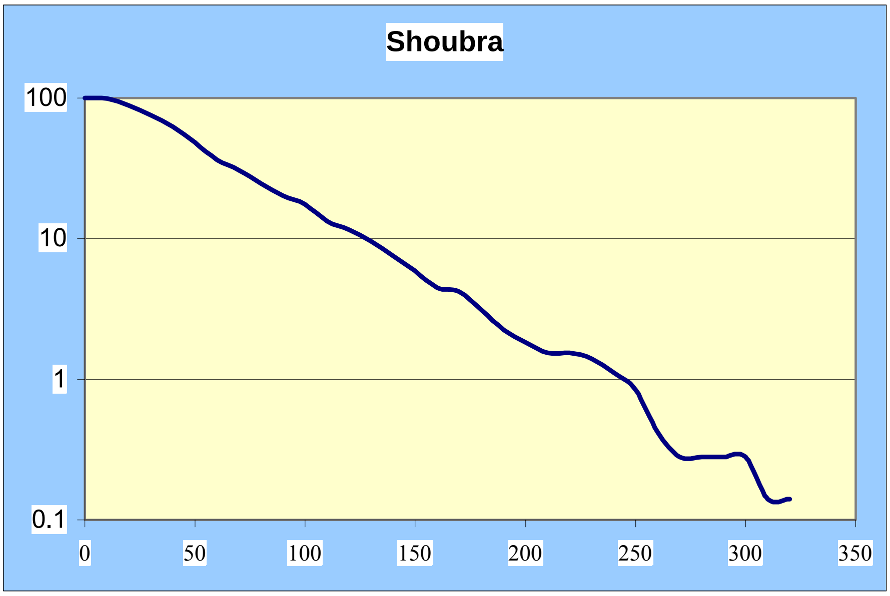


Daily average PM_{10} concentrations at 5 sites in the greater Cairo area.

On a few days the 24-hour average PM_{10} concentrations exceeded 400 µg/m^3 at the sites in Cairo city centre. PM_{10} concentrations exceeded more than 5 times to AQ limit value of 70 µg/m^3 during 6 occasions in March 2003.

SO_2 concentrations

The cumulative frequency distribution of hourly SO_2 concentrations measured at Shoubra ElKheima show that the 99-percetile concentrations were 240 µg/m^3 in March 2003. The hourly limit value of 350 µg/m^3 was never exceeded.



Cumulative frequency distribution of SO_2 at Shoubra el Kheima

Summary of March 2003 data

The following table summarise the maximum one-hour average concentration measured at 17 sites during March 2003.

Station	CO**	Ozone	PM10	NO2	SO2
Kolaly			1458	91	188
Gomhorya	15			144	94
Abbassya		112	1007		163
Maadi					76
Tabbin			1691	82	167
Fum Khalig	7		421	162	157
Shoubra El Kheima					311
Giza		94			143
Kaha		109	716	95	
Suez					153
Aswan		109			94
Shohada				145	68
IGSR	8		265		
Alex. Reg.		92			
Kafr Zayat					185
Mahalla					11
Mansura					40
AQL	**30**	**200**	**-**	**400**	**350**

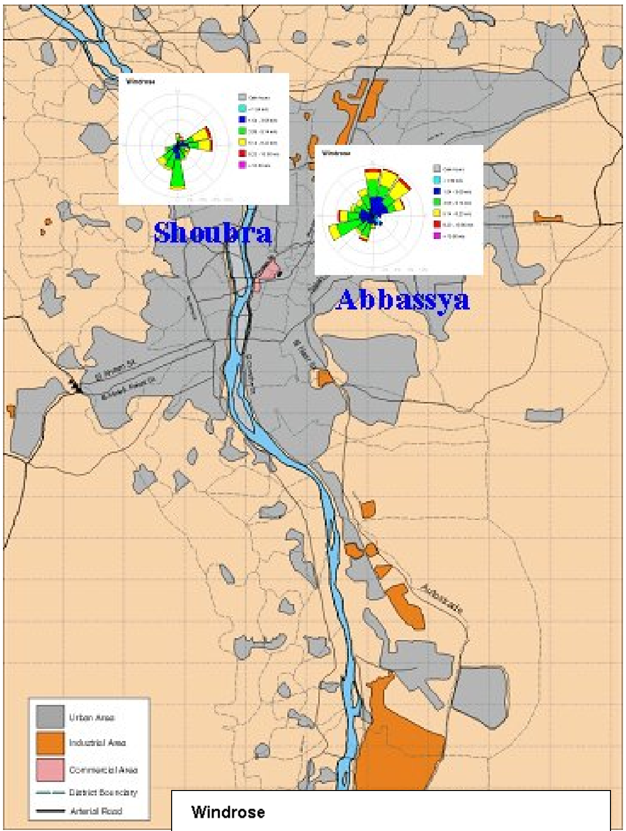
Exceedances of the one-hour averages are not identified from this table. PM_{10} concentration limits are only available for 24-hour average values.

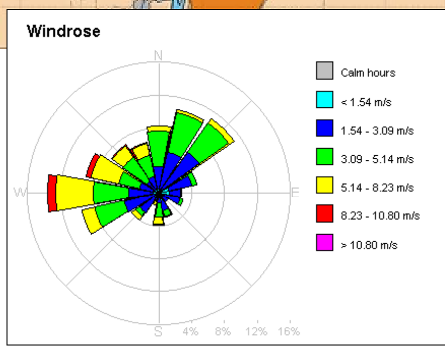
Meteorological data

The wind direction frequency distributions (wind roses) for Abbaseya and Shoubra are presented in the Figure below.

The frequency distributions are very different, and more than should be expected. The wind direction sensor at Abbaseya seems to be closest to what is expected. There may be a malfunction of the sensor at Shoubra. This will be checked in May.

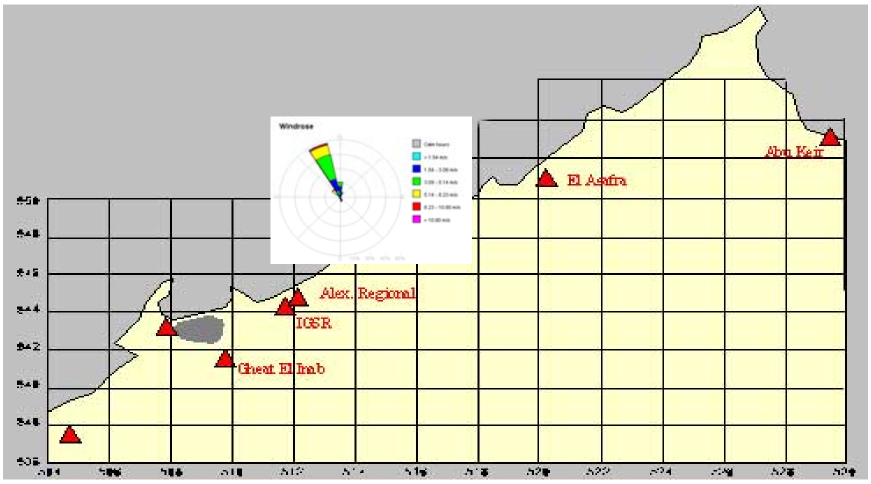
The wind rose for ElMansoura is presented below. The pattern here is not very different from the wind recorded at Abbaseya in Cairo. However, most of the time it is blowing from west, down the Nile river western branch. The second most frequent wind directions are from around north east.



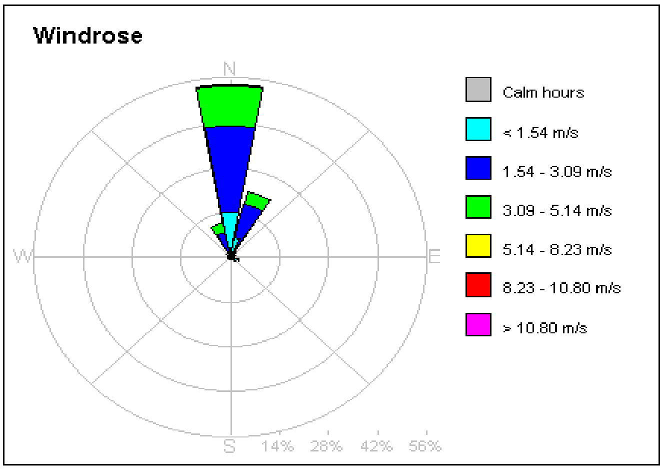


Wind rose for Mansoura

The wind frequency distribution for Alexandria is also presented below.



Wind frequency at Alexandria Regional Site.



Wind rose for Aswan, March 2003

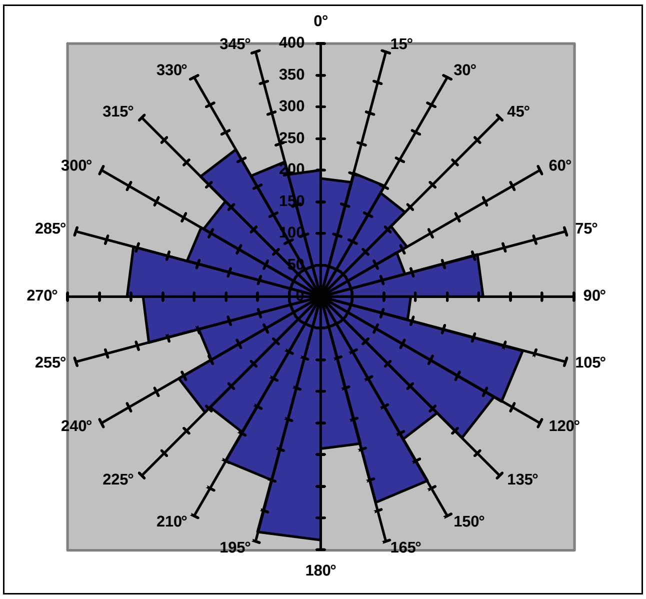
The wind in Alexandria seems to always blow from North-north west in March. The wind direction sensor at this site has not been working properly, so these data has to be questioned. The site will be checked in May 2003.

The wind directions measured at Aswan also looks suspect. The most frequent wind direction is from the north. This seems to be in accordance with the climatological data available from the Egyptian Meteorological Authority. However, it may be adequate to check the wind direction sensor at Aswan again.

The average concentrations of PM_{10} as function of wind directions at Tabbin is presented in the next Figure.

The highest PM_{10} concentrations occurred at the site in March when it was blowing from around south and south east.

These are the directions towards the smelters and industrial complexes in southers Tabbin.



Breuer diagramme PM_{10} at Tabbin

Appendix D.2: Monthly report April 2003 - Summary

Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467

Memo

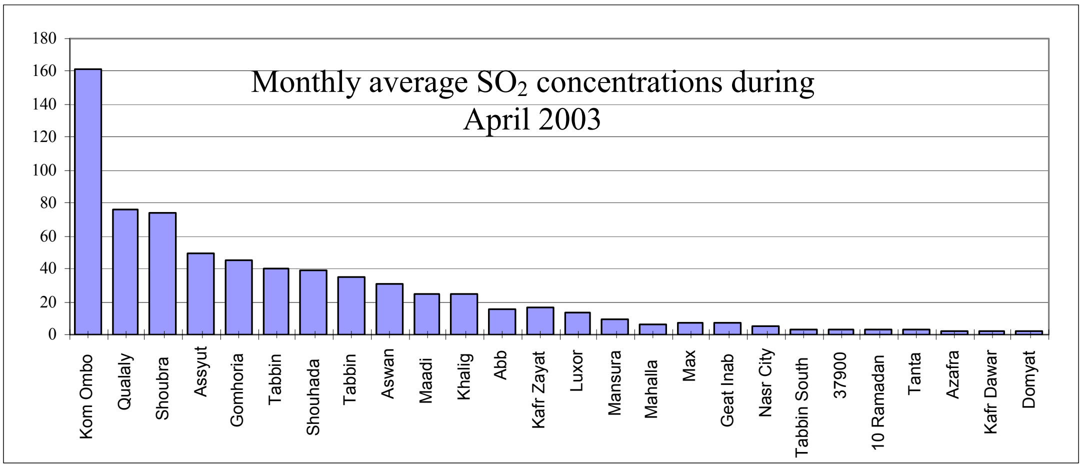
Date: 2 June 2003
To: EIMP Phase out
From: Bjarne Sivertsen, Ashraf Saleh and Haytham Ahmed

Monthly report April 2003 - Summary

Introduction

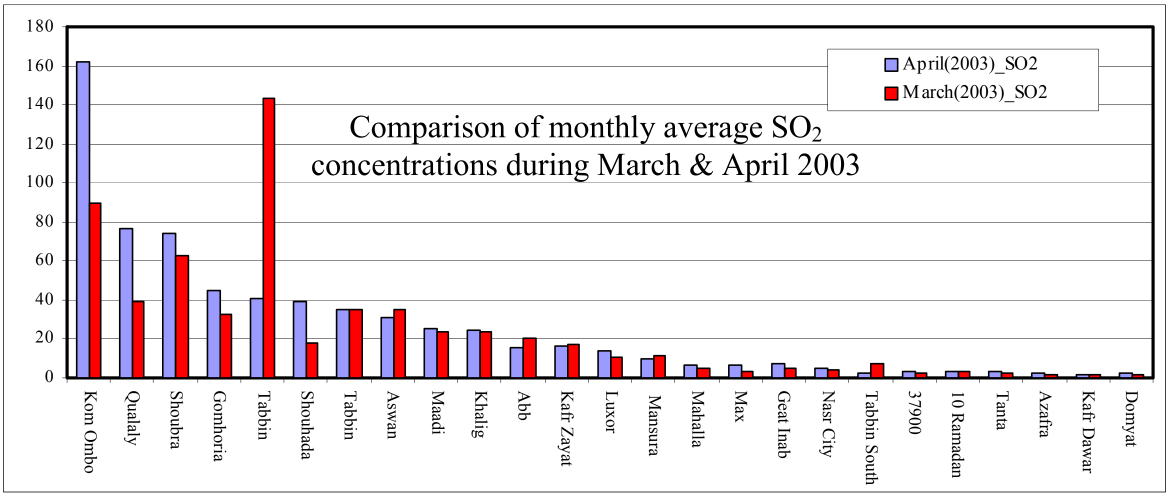
The following short summary and comments have been based on the monthly report for March prepared by Ashraf Saleh and Haytham Ahmed. The report was originally prepared in Arabic language.

SO_2 concentrations



Monthly average SO_2 concentrations at all sites in Egypt, April 2003

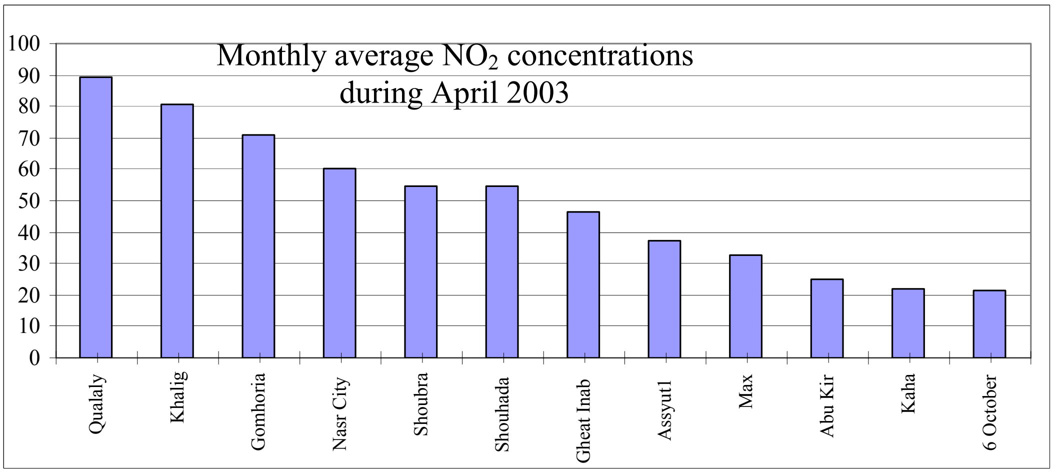
Exceedance of 60 µg/m^3 (annual average AQL) was found in Kom Ombo, at Kolaly and Shoubra ElKheima. The typical monthly average concentrations of SO_2 ranged between 18 and 42 µg/m^3 in the greater Cairo area.



Monthly average SO_2 concentrations measured in April 2003 compared to concentrations of March 2003.

Concentrations at the three most impacted sites were all higher in April than in March. SO_2 concentrations at Tabbin were considerably lower.

NO_2 concentrations

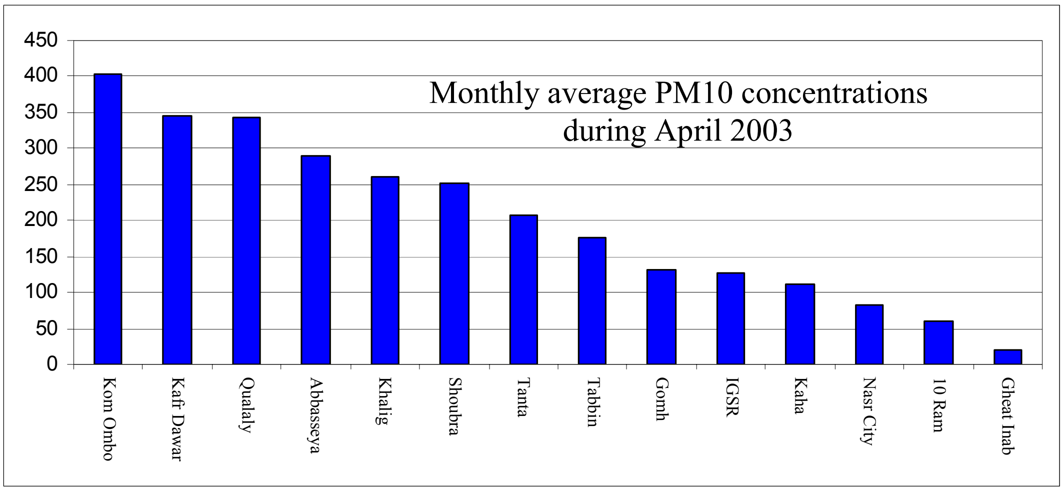


Monthly average NO_2 concentrations from 2 sites in Egypt, April 2003

The NO_2 concentrations were on the average highest in the city centre of Cairo with monthly average concentrations ranging between 60 and 90 µg/m^3. Also the city centre site in Alexandria had NO_2 concentrations giving a monthly average of 54 µg/m^3.

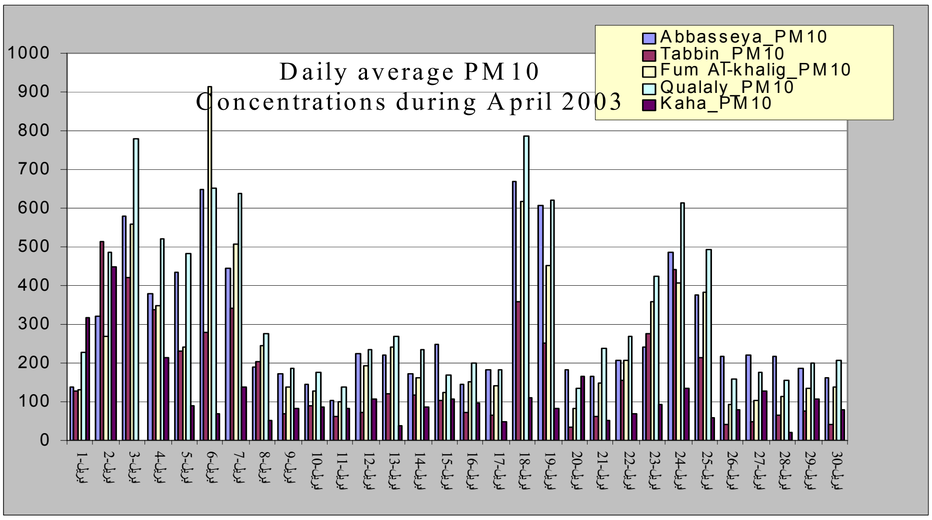
PM_{10} concentrations

PM_{10} concentrations are exceeding national and international air quality limit values at all sites in Egypt. Monthly average concentrations between 250 and 350 µg/m^3 were measured in the urban area of Cairo in April 2003. This was considerable higher than the month before. At the two sites influenced by industrial activities the monthly average PM_{10} concentrations were 350 to 400 µg/m^3.



Monthly average PM_{10} concentrations

The daily average concentrations of PM_{10} are presented for April 2003 in the following Figure.

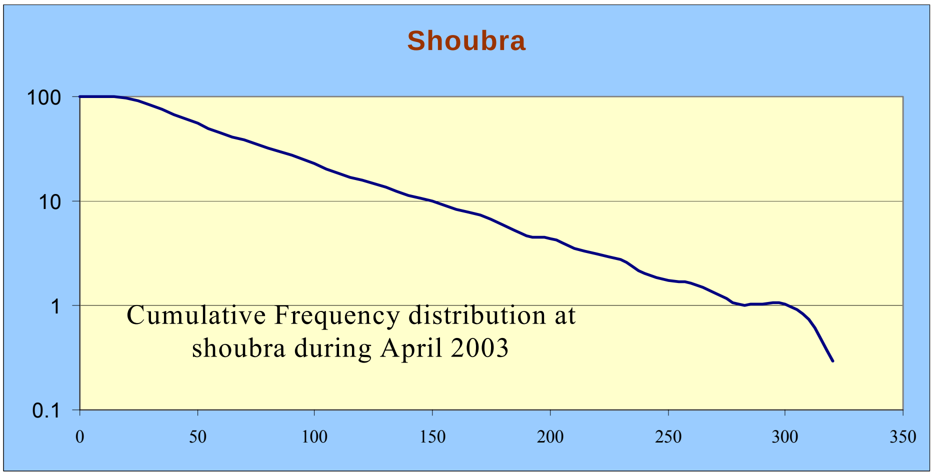


Daily average PM_{10} concentrations at 5 sites in the greater Cairo area.

On a few days the 24-hour average PM_{10} concentrations exceeded 600 µg/m^3 at the sites in Cairo city centre. PM_{10} concentrations exceeded more than 10 times to AQ limit value of 70 µg/m^3 during 3 occasions in April 2003. The daily average concentrations were significantly higher than during the month of March.

SO_2 concentrations

The cumulative frequency distribution of hourly SO_2 concentrations measured at Shoubra ElKheima show that the 99-percentile concentrations were around 300 µg/m^3 in April 2003. This is higher than measured during previous months. The hourly limit value of 350 µg/m^3 was never exceeded.



Cumulative frequency distribution of SO_2 at Shoubra el Kheima

Summary of April 2003 data

Maximum one-hour average concentrations for April 2003 are presented in the following table.

Station	CO**	Ozone	PM_{10}	NO_2	SO_2
Kolaly			1740	139	282
Gomhorya	34			171	411
Abbassya		130	1879		138
Maadi					84
Tabbin			1335	128	462
Fum Khalig	10		1664	182	120
Shoubra El Kheima					344
Kaha		113	750	76	
Suez		132			
Assuyt1				134	476
Aswan					101
Shouhada				135	94
IGSR	10		518		
Alex. Reg.		82			
Kafr Zayat					185
Mahalla					40
Mansura					66
AQL	**30**	**200**	**-**	**400**	**350**

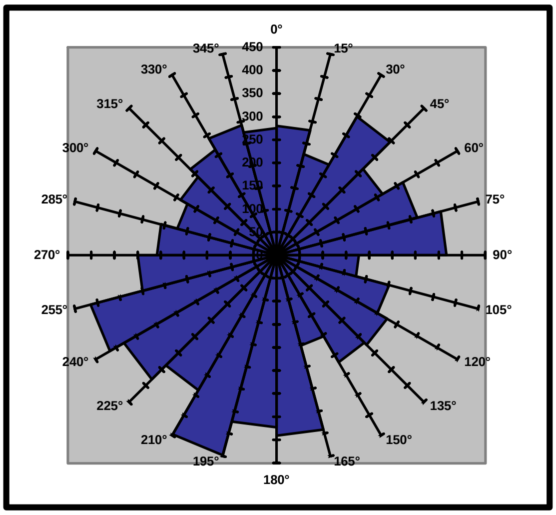
Exceedances of the one-hour average CO concentration limit value were recorded in the Gomhorya street. Also SO_2 concentrations at Tabbin and in Assyut exceeded the air quality limit values in April.

The following table summarise the daily maximum concentrations measured at 29 sites in Egypt during April 2003.

Station	Soot	CO*	Ozone*	PM_{10}	NO_2	SO_2
Kolaly				787	107	158
Gomhorya		17		191	111	158
Abbassya			117	670		40
Nast City	47			150	117	16
Maadi						52
Tabbin				513	46	142
Tabbin South	63					11
Fum Khalig		6		915	120	68
Shoubra El Kheima				476	123	172
Kaha			102	449	35	
6^{th} Oct.	51				37	6
10 Ram	121			70		14
Assuyt1					66	130
Luxot	196					34
Kom Ombo	1033			536		509
Aswan			123			55
Abu Keir					53	
El Max	68				72	21
IGSR		4		248		
Alex. Reg			76			
Azafra	51					9
Gheat Inab	45			24	64	22
Shouhada					87	56
Tanta	141			322		14
Kafr Zayat						50
Mahalla						13
Mansura						22
Domyat	145					8
Kafr Dawar	97			463		11
AQL	**150**	**10****	**120**	**70**	**150**	**150**

As always there was a number of exceeding of the PM_{10} air quality limit value. Also SO_2 , soot and CO have been exceeded at some sites during April 2003.

PM_{10} as function of wind directions



Breuer diagram for PM_{10} concentrations at Abbasseya station during 2003

Appendix D.3: High air pollution episode Cairo

EIMP

Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467

Memo

Date: 3 June 2003
To: EIMP, Ahmed Abou Elseoud
From: Bjarne Sivertsen (BS), Haytham Ahmed (HAA)

High air pollution in the Cairo streets on 24 April 2003

Introduction

High concentrations of air pollutants have been observed frequently in the last few years in Greater Cairo area. The reasons for these high concentrations, which in some cases have been identified as air pollution episodes, are a contribution of air pollutant emissions and specific meteorological conditions. The most frequent episodes are generated by calm meteorological conditions combined with accumulation of pollutants emitted from a variety of sources.

High air pollution

High SO_2 concentrations have been recorded during 23 and 24 April 2003 reaching a maximum of 411µg/m3 at Gomhorya street canyon at 21:00 hours. The concentrations at Abbaseya and 6 other sites in Cairo are shown in Figure 1.

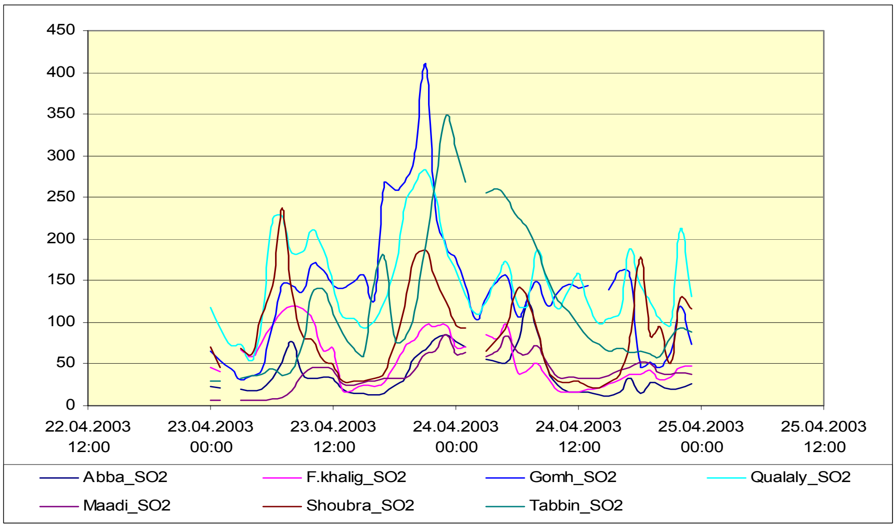


Figure 1: SO_2 concentrations (µg/m^3) measured at 7 sites in Cairo 23 and 24 April 2003.

High concentrations have also been observed two hours later at Kolaly station reaching a maximum of 282 µg/m^3 . The situation can be explained by the meteorological parameters at Abbassya where the wind was blowing from east, south-east with low wind speed at the beginning of the day of 23 April. The concentration level was not specificly high.

Later in the day the wind direction changed to blow from around south with moderate wind speed giving rise to higher SO_2 concentrations. In the evening the wind speed over Cairo centre decreased again leading to the very high SO_2 concentration of more than 400 µg/m^3.

At the beginning of the day of 24 April the wind starts to blow from south with increasing wind speeds leading to improved air dispersion and pushing the concentrations back to its normal levels.

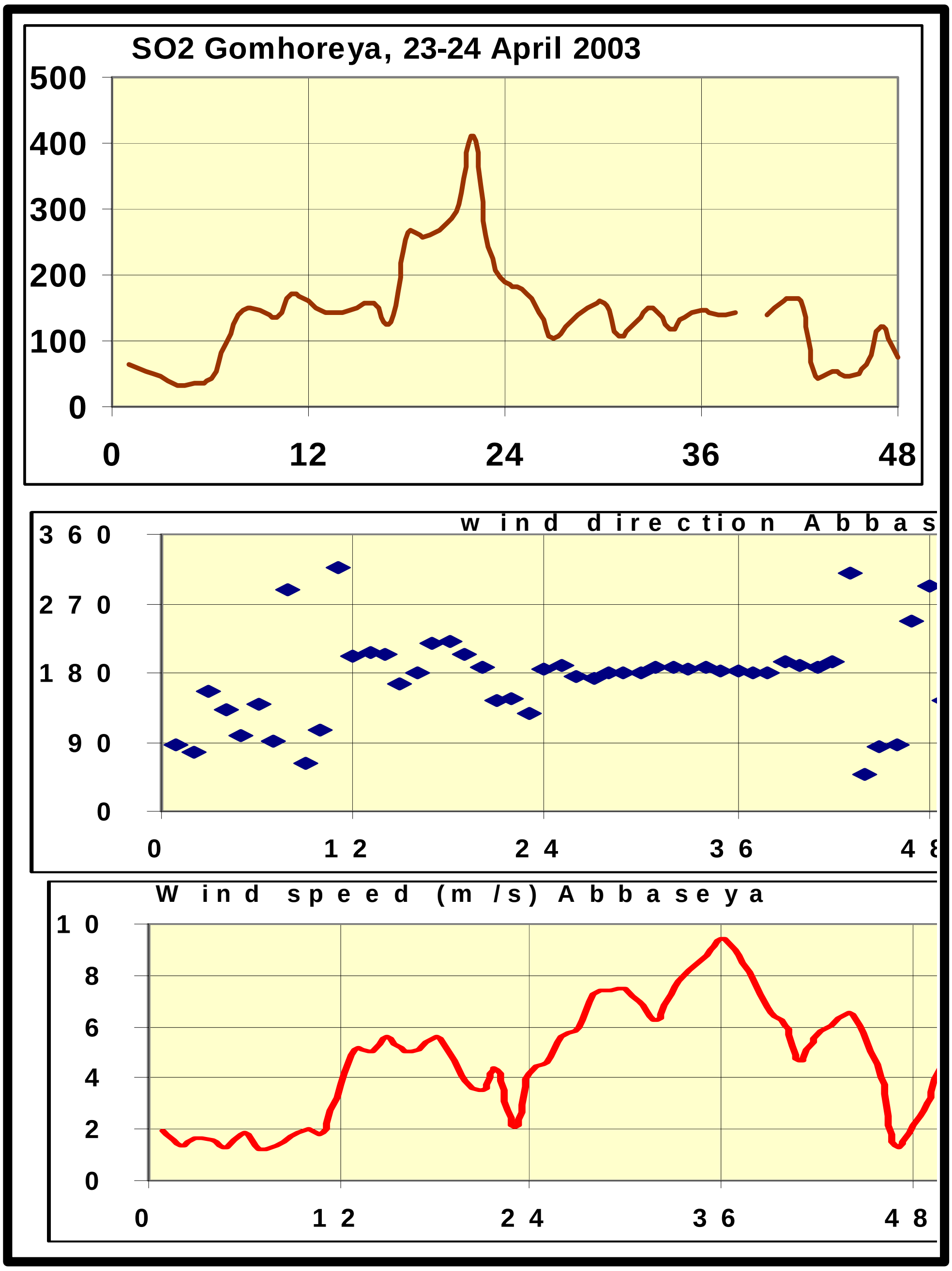


Figure 2: SO_2 concentrations at Gomhorya station combined with wind direction and wind speed of Abbassya station.

This meteorological situation give us indication that the concentrations were locally produced in the streets of Cairo Center.

Sources of Air Pollution

To identify the sources of these high concentrations we have investigated the co-variation of some parameters. The plot of SO_2 as a function of CO shows that there is a relationship between the two parameters. CO is normally formed when cars are stuck in traffic jam (idling). If diesel buses are part of this traffic conjection they will emit SO_2. SO_2 and CO is also produced from waste burning.

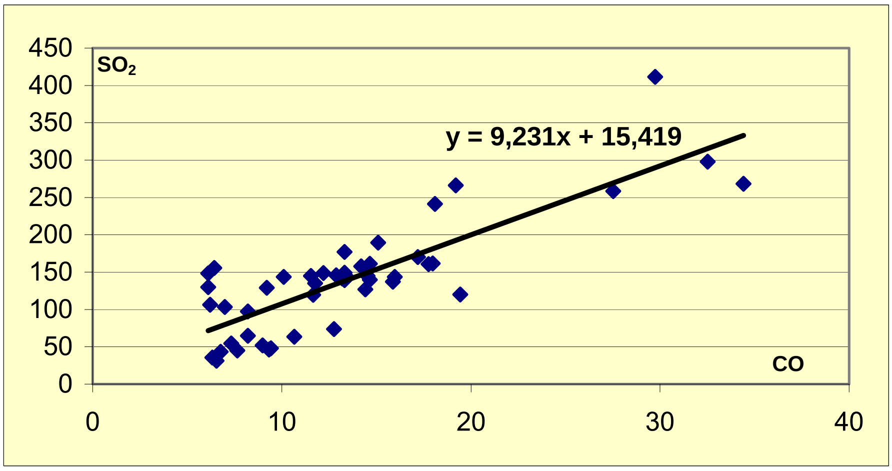


Figure 3: SO_2 concentrations as a function of CO during the days of 23-24 April.

The high concentrations of SO_2 recorded during late evening of 23 April could be a combination of traffic congestion and open-air waste burning subjected to poor atmospheric dispersion conditions.

The plot of SO_2 as a function of NO_2 indicate that the high SO_2 concentrations are not occurring simultaneously with high NO_2 concentrations, indicating that traffic may not be the only source for SO_2.

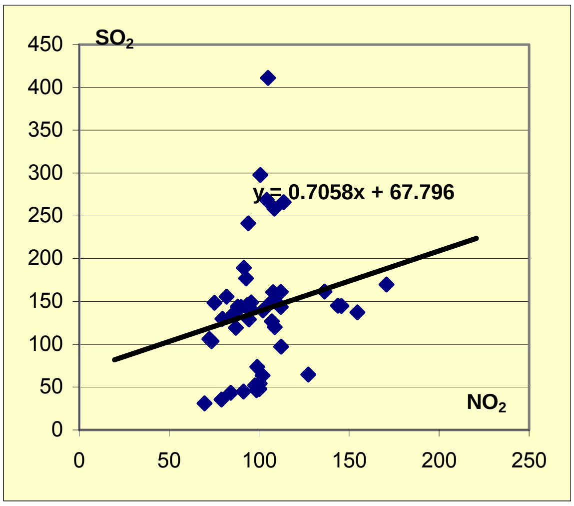


Figure 4 shows that there was a large range of SO_2 concentrations occurring during NO_2 levels of about 100 $\mu g/m^3$. The highest SO_2 concentrations occurring just before midnight on 23 April did not give rise to high NO_2 concentrations. What were the sources then?

Figure 4: SO_2 concentrations as a function of NO_2 during the days of 23-24 April.

Appendix E

National Air Quality Network

Appendix E.1 Leakage of gas from standard gas cylinders

Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467

Memo (Preliminary Draft)

Date: 1 June 2003
To: EIMP, Ahmed Abou Elseoud (AAE)
Copy: Haytham Ahmed (HAA)
From: Bjarne Sivertsen (BS)

Objectives and background for a national air quality monitoring programme for Egypt

Introduction

EEAA has expressed a need for a comprehensive assessment of the overall requirements for establishing a complete national air quality-monitoring network for Egypt. This request has been addressed and included as part of the Phasing Out Phase of the EIMP programme.

The air quality monitoring networks developed by the EIMP programme and by CAIP will be assessed to prepare a comprehensive plan for a future National Air Quality Monitoring Network. The plan is to combine the two existing networks and other adequate measurements of air quality in Egypt. Part of the task will also be to identify future needs.

Several comments have already been given by the EIMP and the CAIP staff at EEAA as well as from the experts at the monitoring institutions at CEHM and IGSR. These comments and discussions represent valuable input to the design of one national programme for EEAA. The final objectives of a national air quality network for Egypt will have to be formulated in co-operation with representatives from EEAA.

Objectives

An overall objective of the air quality measurement programme is to obtain a better understanding of the urban and residential air pollution as a prerequisite for finding effective solutions to air quality problems and for sustainable development in the urban environment.

Further it will be important to identify areas where the Air Quality Limit values are exceeded and to identify possible actions to reduce the pollution load and to improve the general environmental conditions of the country.

The main purpose of the air quality measurements will be to identify the possible exposure to the public and to people in general. Information will be collected on ambient air pollution levels in areas where people live and work. The measurements will cover areas of impact from various sources of pollution.

To enable evaluation and assessments of air quality and to enable trend analyses a network of **fixed stations** is needed. There are international rules for estimating the minimum number of sampling points for fixed measurements to assess the compliance with limit values for the protection of human health.

Measurement siting criteria

The first priority for location of monitoring stations in an urban or residential area will be to identify an area where you would expect the highest concentrations. In many urban areas of Europe as well as in Egypt this may be in a busy street canyon. In some regions it may be downwind from a major industrial source or in areas of extensive waste and agricultural burning.

The following considerations are sited from the European Air Quality Daughter Directives and relates to fixed measurement points directed at the **protection of human health** (Macro scale siting):
Sampling should be sited to

1. Provide data on the areas within polluted areas or urban agglomerations where the highest concentrations occur to which the population is likely to be directly or indirectly exposed for a period which is significant in relation to the averaging period of the limit value(s);
2. Provide data on levels in other areas within the agglomerations, which are representative of the exposure of the general population.
3. Avoid measuring very small microenvironments in their immediate vicinity. As a guideline, a sampling point should be sited to be representative of air quality in a surrounding area of no less than 200 m^2 at traffic-orientated sites and of several square kilometres at urban-background sites.

The information shall be available in such a form that it is suitable to:

- Facilitate a general description of air quality, and its development over time (trend);
- Enable comparison of air quality from different areas and countries;
- Produce estimates of exposure of the population, and of materials and ecosystems;
- Estimate health impacts;
- Quantify damage to materials and vegetation;
- Support development of cost-effective abatement strategies;
- Support legislation (in relation to air quality directives);
- Influence/inform/assess effectiveness of future/previous policy.

The assessments should be based upon concentration fields (space-time fields) produced by the monitoring and information network or by a combination of monitoring and modelling, and should cover local as well as regional scale. The modelling efforts are essential in forming the link between emissions on the one hand and exposure and effects on the other hand.

Air pollutants to be measured

It is normally not possible to measure all the air pollutants present in the urban atmosphere. We therefore have to choose some indicators that should represent a set of parameters selected to reflect the status of the environment. They should enable the estimation of trends and development, and should represent the basis for evaluating human and environmental impact. Further, they should be relevant for decision-making and they should be sensitive for environmental warning systems.

Local and regional authorities are using the selected set of environmental indicators as a basis for the design of monitoring and surveillance programmes and for reporting the state of the environment.

Air quality indicators should:

- Provide a general picture,
- Be easy to interpret,
- Respond to changes,
- Provide international comparisons,
- Be able to show trends over time.

Measurement techniques should be reasonably accurate and within an acceptable cost. The effect of indicators on health impact, building deterioration, vegetation damage, etc., should be adequately documented and linked to public awareness. Selected indicators should respond to mitigation actions to prevent manmade negative impacts on the environment.

The most commonly selected air quality indicators for urban air pollution are:

- Nitrogen dioxide (NO_2),
- Sulphur dioxide (SO_2),
- Carbon monoxide (CO),
- Particles with aerodynamic diameter less than 10 μm (or 2,5 μm), PM_{10} ($PM_{2,5}$),
- Ozone.

Most of these indicators have been identified in the air quality limit values as presented in the Law no. 4 for Egypt. Based on impact to public health some selected air quality guideline (AQG) values for most of these indicators have also been presented by the World Health Organisation (WHO, 1987 and 1995)

In the European EUROAIRNET programme priority indicators have been selected for different types of impact to the environment. A summary of the first priority pollutants as given by the European Environmental Agency (EEA) is presented in the Table below.

Priority pollutants included in the urban air quality monitoring programmes.

No.	ISO-Code[9]	Formula	Name of pollutant	Units of measurement	Average over
1.	01	SO_2	Sulphur dioxide	µg/m³	1 h
2.	03	NO_2	Nitrogen dioxide	µg/m³	1 h
3.	24	PM10	Suspended particulates (< 10 µm)	µg/m³	24 h
4.	39	PM2.5 [14]	Suspended particulates (< 2.5 µm)	µg/m³	24 h
5.	n.a.[15]	PM1	Suspended particulates (< 1 µm)	µg/m³	24 h
6.	22	SPM	Suspended particulates (total)	µg/m³	24 h
7.	19	Pb	Lead	µg/m³	24 h
8.	08	O_3	Ozone	µg/m³	1 h
9.	V4	C_6H_6	Benzene	µg/m³	24 h
10.	04	CO	Carbon monoxide	mg/m³	1 h

Data representativity

It is important to bear in mind, when measuring air quality or analysing results from measurements that the data you are looking at is a sum of impacts or contributions originating from different sources on different scales.

Data should represent measurements collected at different stations representing different microenvironments, characterised by:

SC:Street canyon, RS:Roadside
I: Industrial UB:Urban Background
R: Residential B:Regional Background

Descriptions should be prepared to specify parameters, samplers and monitors. Meteorological data available in the area should also be provided, and some simple statistics on prevailing wind directions has to be prepared and presented.

The classification of measurement stations is divided into 3 types of areas; urban, suburban and rural. In each of the areas there may be 3 types of stations; traffic, industrial and background. The background stations are divided into; near-city background, regional and remote background stations.

Descriptions of the areas are given in the Table below:

Type of area	Description	Type of station
Urban	Continuously built-up area	Traffic
Suburban	Largely built-up area: continuous settlement of detached buildings mixed with non-urbanized areas	Industrial
Rural	Areas that not fulfill the criteria for urban/suburban areas	Background: - Near city - Regional - Remote

Quality Assurance and Quality Controls (QA/QC)

It is important for the operations of a monitoring network to include a comprehensive QA/QC programme to assure that the monitors are actually providing concentrations within the required level of uncertainty, and that malfunctions and errors are detected and corrected.

It will be necessary to develop and implement a complete QA/QC system for the operational level of the air quality monitoring programme. Complete documentation will have to be established, which explains in detail how to perform and record all operations necessary to run, maintain and calibrate the instrumentation both in the laboratory and in the field. The procedures are supposed to be used by the operators in their daily work.

Air Quality assessment

The air quality data collected by the national monitoring programme should enable air quality assessments. The database applied for performing a preliminary assessment of air quality should include the last 5-year of data. For the preliminary assessment air quality in some of the areas the database could include less than 5 years.

Adequate training of experts to undertake future air quality monitoring, data presentations and reporting is an important part of the establishment of such programmes. For reporting to the international bodies and for complete assessments it will also be necessary to add capacity for air quality modelling and forecasts.

Measurement Reference methods

The International Standardisation Organisation (ISO) and other international bodies have prepared and presented air quality measurement reference methods. The following list of reference methods have been quoted from the European Daughter Directives:

I. Reference method for the analysis of sulphur dioxide:
Ambient air - determination of sulphur dioxide - ultraviolet fluorescence method. ISO/FDIS 10498
A Member State may use any other method, which it can demonstrate, gives results equivalent to the above method.

II. Reference method for the analysis of nitrogen dioxide and oxides of nitrogen:
Ambient air - determination of the mass concentrations of nitrogen oxides - chemiluminescence method. ISO 7996: 1985
A Member State may use any other method, which it can demonstrate, gives results equivalent to the above method.

IV. Reference method for the sampling and measurement of PM_{10}
The reference method for the sampling and measurement of PM_{10} will be that described in EN 12341 "Air Quality - Field Test Procedure to Demonstrate Reference Equivalence of Sampling Methods for the PM10 fraction of particulate matter". The measurement principle is based on the collection on a filter of the

PM10 fraction of ambient particulate matter and the gravimetric mass determination. One accepted method for PM10 sampling is using the German "Kleinfilter gerat" If monitors are to be used for PERSONAL measurements the new Eberline beta gauge monitor could be applied, even if this is still not a completely accepted method.

III. Reference method for the sampling and analyses of lead:
For sampling of lead use the reference method specified for sampling of PM_{10} .A Member State may use any other method, which it can demonstrate, gives results equivalent to the above method.
For the analysis of lead use ISO 9855: 1993 "Ambient air - Determination of the particulate lead content of aerosols collected in filters". Analyses to be performed with atomic absorption spectroscopy method.

Additional sampling equipment

For preliminary assessment and supplementary measurements it may be necessary to add simpler and less expensive sampling equipment. To establish the capability of performing screening studies using passive samplers or to verify potential highly polluted areas it is recommended that the central laboratory will be equipped with adequate instruments for the analyses of filter samples and samples of SO_2 and NO_2 .

This laboratory should at least have:
- Ion Chromatograph(s)
- Atomic Absorption Spectrometer
- Micro balances
- Climatised room

The field equipment should include a number of passive samplers (included training procedures for impregnation and preparation of filters). This will establish the capability for indicative measurements and screening studies. Also a few sequential samplers for continuous 24-hour sampling of SO_2 and NO_2 will increase the possibility for evaluating the concentration distributions and verify dispersion models. These samplers are not considered reference instruments but will add to the value and quality of monitoring programmes.

Appendix F

Air Pollution Management

Appendix F.1: Meeting with Mike Smith, CAIP

**Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467**

Meeting

Date: 2 June 2003
Present: Mike Smith, Ahmed Abu ElSeoud (AAE), Bjarne Sivertsen
Recorded: B. Sivertsen (BS)

Meeting with Mike Smith, CAIP

Introduction

The purpose of the meeting was to discuss the air quality strategy project co-ordinated by Mike Smith, in relation to the use of air quality measurements and monitoring undertaken by EIMP and CAIP. Mike Smith has been assigned by the CAIP programme to help EEAA to develop an air pollution strategy. In the process it will be important to engage stakeholders and the EEAA itself in the process.

A planning tool?

The work that M Smith has just started will include a risk assessment. The risk assessment will use quantitative techniques. It will be preceded by a comprehensive review of all-available data and information pertaining to air quality in Egypt. However the risk assessment will also include a qualitative approach to those air parameters and issues where there is insufficient data to support a quantitative approach.

The NILU developed AirQUIS system for planning and optimal abatement strategy development was discussed. It was stated from M Smith that all the components, such as data, databases, GIS system etc is already available within EEAA. However, it is scattered and spread out on different projects and in different departments.

An important task in the near future should be to integrate all this into ONE integrated system for air quality assessment and planning. AirQUIS, which has been proven to fulfil these entire needs world wide, would be a perfect basis and tool for this work. A quantitative system for developing a list of priorities in a cost-effective sequence will improve the incentives for policy and decision-making within EEAA and in Egypt.

Future support from USAID

The strategic objective of the work performed by Mike Smith is to assure incentives and motivation for policy and decision-making in the field of air quality improvements. The target user is EEAA and various stakeholders. If the project reaches deliverables through the process of participation it will release money from the Egyptian Environmental Policy Programme (EEPP).

EEPP is a fund transfer programme whereby various amounts of funds are transferred to the Government of Egypt on completion of different policy initiatives. EEAA receives a proportion of those funds. The decision of how to utilize the funds rests entirely within EEAA.

EEAA will have a fair amount of flexibility in the application of some of these funds. If the Agency sees it as a proper action they may use from these funds to purchase the necessary software tools for future assessment and planning.

A one-year programme

The programme that Mike Smith has started will last for one year. It will engage a number of stakeholders in a number of meetings and workshops and it will also include the revision of air quality standards for Egypt.

The programme will "look at the problems in an integrated and qualitatively way". At the end it will be up to EEAA to develop a strategy based on an overall assessment of the present situation.

Input from the EIMP measurement programme as well as from CAIP will be needed in this assessment. All memos and monthly reports will be forwarded to M Smith in the future. The memos prepared by BS during the EIMP Phasing out Phase, Mission 2, have been provided to M Smith through Haytham Ahmed.

Appendix F.2: Background PM_{10} concentrations in Egypt

Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467

Memo

Date: 31 May 2003
To: EIMP, Ahmed Abu ElSeoud (AAE)
Copy: Haytham Ahmed (HAA)
From: Bjarne Sivertsen (BS)

Background PM_{10} concentrations in Egypt

Introduction

In the discussions of high PM_{10} concentrations frequently measured in Egypt, the natural background levels originating from wind generated dusts in the desert areas have been discussed.

An early study of suspended dust in Cairo revealed that the typical background PM_{10} concentrations averaged 45 to 65 µg/m^3 during average wind speed conditions. (Rodes et.al. 1996). At the city centre during prevailing wind from north more than 50 % of the fine particle mass was produced by oil combustion (mazoot and diesel).

It has also been stated (Sivertsen et.al. 2001) that the background level seems to be around the daily background level of 70 µg/m^3, which is equivalent to the Air Quality Limit values given by the Law no. 4 of Egypt. These levels can be found also in areas where local anthropogenic sources do not impact the measurements.

The recorded PM_{10} concentration levels as well as the Air Quality Limit values were discussed in a meeting at EEAA on 31 October 1999, reported in a memo dated 28 November 1999. It was agreed that it is necessary to further investigate the validity of the limit values as well as the need for verifying the normally/naturally occurring suspended dust concentrations in Egypt.

Two approaches were indicated and a project proposal was developed to identify and verify the natural background level of suspended dust in Egypt. The proposal below was intended to establish a background for and to justify a more realistic evaluation of the suspended dust concentration levels in Egypt.

Measured concentrations by the EIMP programme

Typical concentration levels of PM_{10} have been analysed to evaluate the average background level of PM_{10} in Egypt.

PM_{10} measurements performed by High Volume samplers during the period July to September 2000 are shown in the following tables.

Site	Conc. range	Aver µg/m^3
Nasr City	70-400	120
ElMaadi	60-125	86
6October	40-213	87
10Ramadan	44-98	65

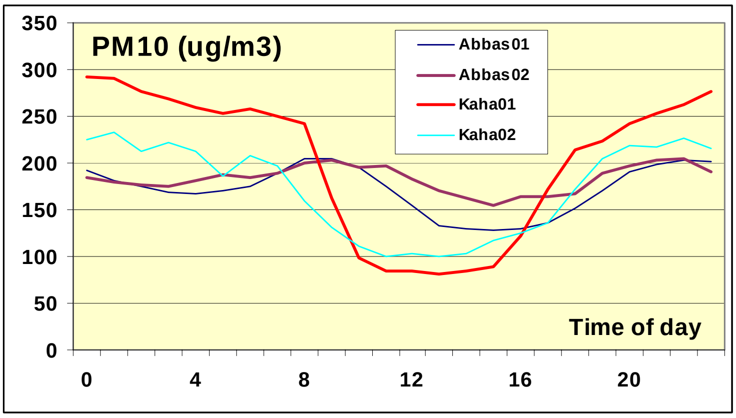
The average PM_{10} concentrations at the four sites ranged from 65 to 120 µg/m^3.

PM_{10} measurement with monitors collected at two sites in the greater Cairo area are presented in the next table based on two years of data; 2001 – 2002.

Site	Median (µg/m^3)	Aver conc. (µg/m^3)	St.dev.
Kaha	139	180	184
Abbaseya	139	178	161

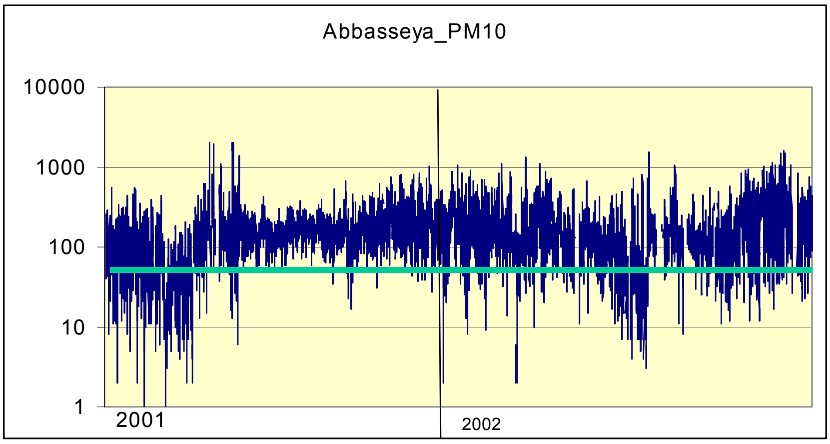
The most frequent occurring concentration at Kaha and Abbaseya was 139 µg/m^3. The standard deviation in the variation is in the same order of magnitude as the average concentration.

PM_{10} concentrations vary during the day. In the afternoon the atmospheric dispersion conditions are at its best. Around Kaha the local burning will also be limited. To further study the possible background concentration we have estimated the afternoon average concentrations. The annual average diurnal variation is presented in the figure below.



The afternoon annual average concentration in the city centre of Cairo is normally about 125 to 160 µg/m^3 as seen from Abbasseya in 2001-2002. At Kaha the afternoon average concentration was about 80 to 100 µg/m^3. The nighttime very high concentrations are caused by the combination of burning and low level inversions. Pollutants are kept at the surface and the spread in the atmosphere is limited.

The measurement data at Abbaseya from 1 Jan 2001 to 31 Dec 2002 is presented in Figure 1 below.

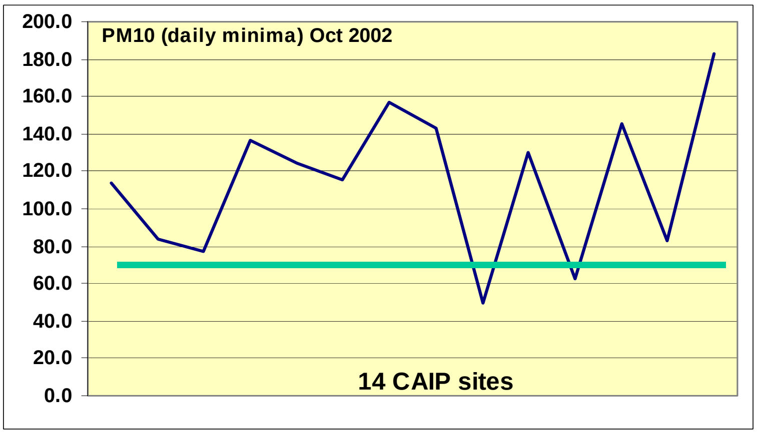


About 20 % of the 24-hour average concentrations measured at Abbaseya during 2000 and 2002 were below 80 µg/m^3. From the above analyses we conclude that the average background may be in the neighbourhood of 60 to 80 µg/m^3.

PM_{10} measured by the CAIP programme

PM_{10} is measured as 24 hour average concentrations every 6 day by the Cairo Air Improvement Programme (CAIP). Several months of data from these measurements have been evaluated.

The figure below illustrates the variation of the lowest PM_{10} concentrations measured at 14 sites during October 2002.



The daily minimum concentration seldom is less than 70 µg/m^3. There are again reasons to believe that the background level may be in this range.

Source apportionment study in Cairo

Prior to the EIMP programme measurements a source apportionment study had been undertaken in Cairo for a short period of time. We were invited to a presentation of results from this study named An Assessment and Source Apportionment of Airborne Particulate Matter in Cairo undertaken for the U.S. Agency for International Development by Charles E Rodes, Philip A Lawless at Research Triangle Institute NC. USA and Dr. Mahmoud M Nasralla at NRC in Cairo.

A copy of the transparencies is shown in Appendix T of the EIMP Mission report 2. In the city centre of Cairo the PM_{10} concentration averaged over 150 µg/m^3 with approximately 50 % being in the fine particle fraction (< 2,5, micrometer).

The typical background PM_{10} concentrations averaged 45 to 65 µg/m^3 during average wind speed conditions. At the city centre during prevailing wind from north more than 50 % of the fine particle mass was produced by oil combustion (mazoot and diesel). At Maadi about 35% of the fine particles were sulphate, about 33 were burning of vegetation and trash and only about 15% was caused by traffic.

Conclusions

PM_{10} concentrations measured with different type of instruments, in different measurement programmes at a variety of sites and at different seasons indicate that the typical average background concentration of PM_{10}

seems to be around 70 to 80 μg/m^3. A level of 70 μg/m^3 is equivalent to the Air Quality Limit value for 24-hour average PM_{10} concentrations as given by the Law no. 4 of Egypt.

These levels can be found also in areas where local anthropogenic sources do not impact the measurements. The “natural background” levels are thus assumed to be originating from wind generated dusts in the desert areas surrounding the large urban areas such as Cairo.

Appendix G

Administrative work

Appendix G.1: Air Quality Measurements at Meteorological Authority

Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467

Meeting

Date:	31 May 2003
Present:	Dr. Ahmed Adel Faris (Deputy Chairman), Dr. Mohamed M. Eissa (Dir. Gen. Information), Dr. Rabiee El Fouly (Dir Gen. Research), Dr. M.A. Abbas (Dir Gen for Instruments and Laboratories), Ahmed Abu ElSeoud (AAE), B.Sivertsen
Recorded:	Bjarne Sivertsen (BS)

Air Quality Measurements at Meteorological Authority

Introduction

The purpose of the meeting was to discuss the air quality measurements and monitoring capabilities by the Egyptian Meteorological Authority (EMA). We received some general information about weather predictions, the different departments of the Authority as well as input to air quality measurements undertaken by the EMA.

Our impressions of the air pollution work performed as well as staff and their background and capability to undertake local air quality monitoring is summarised below.

In the discussions with the General Director of Scientific Research Department it was pointed out that EMA also had a special department for Environmental Meteorology. Most of the work seemed to be linked to agricultural climatology, and a limited part of the work was related to air pollution.

Weather Forecast Used in Air Pollution

Weather forecasts are performed with a resolution of 50x50 km. The “ETA” model is being used for this purpose. Some of the output may be used for air pollution forecast, but this part of the work is taken care of by the team located in the EEAA building.

Background Air Quality Data

Most of the air quality measurements that are undertaken by EMA are aimed at mapping the background air pollution levels. Simple samplers are usually used to collect the data, which produces time-integrated concentrations. In Cairo continuous monitors had been used.

One article in the Meteorological Research Bulletin (Volume 17, 2003) presents SO_2 observations and trend over Egypt (Sharobiem and Hussayni) based on measurements at three sites in Egypt: Branni, Hurghada and Cairo. The measurements were collected in 1999-2000. In addition "the column of SO_2 and UV-B was taken with by a Brewer spectrometer at Matrouh."

Air Quality Monitoring Station at EMA

An air quality monitoring station had been installed at the roof of one of the EMA buildings at Abbaseya. It is located only 10 m away from the EIMP air quality monitoring programme automatic monitoring station.

The EMA station was supposed to measure SO_2, NO_2, CO2, and ozone. An Andersen High volume sampler with PM_{10} cut off was also placed at the site.

After inspecting the measurements, the conclusions were that none of the instruments were working properly:

- The PM_{10} sampler had not been cleaned for years, and was also stated not in operation,
- Two SO_2 monitors (Thermo Instruments) had been taken to the laboratory for repair and had not been in operation for at least few years,
- The NO_2 monitor was in the same condition as the SO_2 monitor; not in operation,
- The CO2 monitor was in operation and showed about 960 ppm. (The expected level of CO2 should read about 350 ppm),
- The ozone monitor was also measuring, but the level of about 15 ppb is far less than what should be expected at this site in the middle of the day.

We asked to see the quality assurance (QA/QC) programme. The people attending the site visit did not know of any QA/QC procedures except for calibrations.

Calibration?

The calibration of monitors was undertaken at a calibration and repair laboratory. The laboratory itself did not keep up to a standard sufficient to meet the requirements of air pollution measurement. Background air quality measurements cannot be performed based on equipment repaired and calibrated in a non-cleaned laboratory.

By request we were shown the calibration equipment. We specifically asked to see the ozone calibrator. We were only shown one calibrator, stated to be the one used for ozone. The Thermo 145 calibrator, that was available in the laboratory, is normally only designed for SO_2 calibration, i.e. for an instrument that had been out of operation for years.

Air quality background and skills

It seemed from the discussions that the scientific training and skills were not appropriate for operating a local health based air quality monitoring programme in Egypt.

QA/QC, maintenance, repair and operations require sound knowledge of instruments, quality assurance, calibrations and air quality in general. The EIMP programme has spent 5 years on this training and the operators at CEHM, IGSR and the Reference Laboratory at NIS is presently performing according to international standards.

Meteorological data for air pollution studies

The General Director of Information stated that EMA has started to prepare a closer co-operation with EEAA. One topic that has been in operation for some time is the test version of air pollution forecast procedure undertaken in the EEAA building. These forecasts are, however, still not distributed to the public.

EMA is also looking into other possible services that can be provided to EEAA, without specifying what these services could be.

Wind frequency distributions

One possible support to the EEAA air quality monitoring programme would be to verify wind conditions as well as vertical temperature profiles and inversion heights and strengths.

During the meeting we requested wind frequency distributions (wind roses) from three sites in Egypt:

- Cairo Airport,
- Aswan and
- Alexandria.

These data were not readily available. No annual report had been issued concerning climatological data of this kind for years. However, we were promised that these wind data would be forwarded to EEAA the next day.

Dust storms

An important part of the air pollution impact in Egypt is the suspended dust generated by wind in the desert areas surrounding the large urban and residential areas. Dust storms and Khamsin forecasts have been available on the Internet some years ago, and we have used it for explaining some high episodes of suspended dust in Cairo.

When requesting these data and information about dust storm forecasts it was stated that this work is still undertaken by EM. However, the information is not any more available for the public, and the service will probably have to be purchased from EMA. This service would, however, be a natural service provided to EEAA in return for Monthly reports on air quality provided by EEAA.

Conclusions

The general impression of EMA from an air pollution point of view was rather negative. It does not seem to be adequate to perform air quality monitoring on a large scale based on the performance that we were demonstrated.

The training and background needed for operating an air quality network as well as the basic scientific knowledge of air pollution did not seem to be available. However, local meteorological skills and scientific background in boundary layer meteorology is more elaborate at EMA and could be a support to EEAA, especially when dispersion models are to be applied in the future.

Appendix G.2: EEAA database for Air Quality

**Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467**

Meeting

Date: 10 May 2003
Present: Mrs. Ekhlas Gamel ElDin, Ahmed Abou Elseoud, Ashraf Saleh Ibrahim, Khalid Hamdi, Haytham Ahmed, Mr. Said, Mr. Hani, B. Sivertsen
Recorded: Bjarne Sivertsen (BS)

EEAA database for Air Quality

Introduction

A meeting was arranged to discuss the future air quality database to be used by EEAA. It was pointed out that the database installed at EEAA should be able to receive all kinds of air quality data both on-line from monitors and manually imported from samples and analyses. EEAA wants to receive an offer for such database.

In the introduction it was mentioned that the Measurement module of the AirQUIS GIS based database would handle all the needs and requirements stated by EEAA. An investigation has revealed that most of the air quality databases available internationally have been specially designed to meet the well defined questions asked by specific users; institutions, authorities or organisations. This is also the case with the simple database developed and used by the EIMP programme. AirQUIS is one of the few generally developed commercially available air quality management systems that integrate air quality monitoring, modelling, management and planning.

A complete integrated system

Ahmed Abou Elseoud pointed out that EEAA is presently moving into more assessment work. It would thus be more interesting to integrate the monitoring database directly with an emission inventory and modelling system, where the results could be used directly for strategy planning.

One British expert Mr Michael Smith, who is presently working with Chemonix USA, has been assigned to EEAA to work with Air Quality Strategy for Egypt. A meeting with Mr Smith will be arranged to discuss the objectives and tools used.

The AirQUIS system

The NILU developed AirQUIS system is one of the most complete platforms for combining air quality monitoring, assessment and planning. AirQUIS operates in several modules, including ambient air quality data, air emission data, dispersion and exposure modelling and a user-friendly presentation system. It has the ability of adaptation to specific user needs.

Proposal and offer (cost estimate)

The EEAA representatives requested in the meeting a project proposal to represent the basis for evaluation the purchase, installation and operation of an AirQUIS system at EEAA.

The proposal must include:

The Modules estimated individually:

- Measurement module
- Emission inventory module
- Modelling module
- Exposure and Assessment

Integration with existing databases (Interface developments)

Installation costs (include 1 Server and 3 clients)

Training costs

Costs for Maintenance, service and upgrading (given for each individual Module)

Appendix H

State of the Air Quality in Egypt

Appendix H.1: The air quality situation in Egypt

EIMP

Environmental Information
and Monitoring Programme
Phasing out Phase
EEAA - Danida - COWI
30 Misr-Helwan Str. Maadi, Cairo, Egypt
Tel: 202 525 6442, Fax: 202 525 6467

Memo

Date: 21 May 2003
To: EEAA, Ahmed Abou Elseoud (AAE),
Copy: Haytham Ahmed (HAA),
From: Bjarne Sivertsen (BS)

The Air Quality Situation in Egypt

1. Introduction

This memo represents a summary of the air quality during the last three years of measurements, 2000-2003, based on the EIMP monitoring programme. The Environmental Information and Monitoring Programme, EIMP, was established for Egyptian Environmental Affairs Agency (EEAA) in co-operation with Danida in order to have a view of the present environment. As part of the EIMP programme a national air pollution-monitoring programme consisting of a total 42 measurement sites has been developed and established.

The design of the EIMP Air Quality Monitoring network includes:

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

The Centre of Environmental Hazard Mitigation (CEHM) at Cairo University and the Institute of Graduate Studies and Research (IGSR) at Alexandria University are operating on behalf of EEAA, a total of:

- 14 sites located in Greater Cairo area,
- 8 sites in Alexandria area,
- 7 sites in Delta,
- 3 sites in Canal area and
- 10 sites in Upper Egypt and Sinai

The presentation below has been organised with the most important air pollution components presented first and down in priority, i.e.: suspended dust (PM_{10} , black smoke), SO_2 ,Ozone, CO and NO_2 .

2. Suspended dust

Particles can be suspended in the air for long periods of time. Some particles are large or dark enough to be seen as soot or black smoke. Others are so small that individually they can only be detected with an electron microscope. Some particles are directly emitted into the air. They come from a variety of sources such as cars, trucks, buses, factories, construction sites, tilled fields, unpaved roads, stone crushing, and burning of waste and wood.

The smallest particles; sub-micron and particles less than 2,5 micrometers, ($PM_{2,5}$) is not measured by the EIMP programme. PM2,5 is measured by Cairo Air Improvement (CAIP). Thoracic particles that may be transported to the lung after breathing is from a health point of view the most interesting indicator for ambient dust. These particles are less than 10 micrometer in diameter and are called PM_{10}. A part of the PM_{10} is black smoke or soot most often originating from combustion. The total mass of suspended particles varies in size from the smallest sub micron particle to the larger particles up to about 50-100 micrometer in size. This total mass can only be measured by high volume samplers and is referred to as Total Suspended Particles (TSP).

In the following we will present the concentrations of these particle fractions measured in Egypt from 2000 to 2003.

2.1 Thoracic particles, PM_{10}

Concentrations of suspended dust measured as PM_{10} are exceeding national and international air quality limit values at all sites in Egypt. Monthly average concentrations are commonly recorded at between 200 and 300 µg/m^3. Typical annual average concentrations are presented for 25 sites in Figure 1.

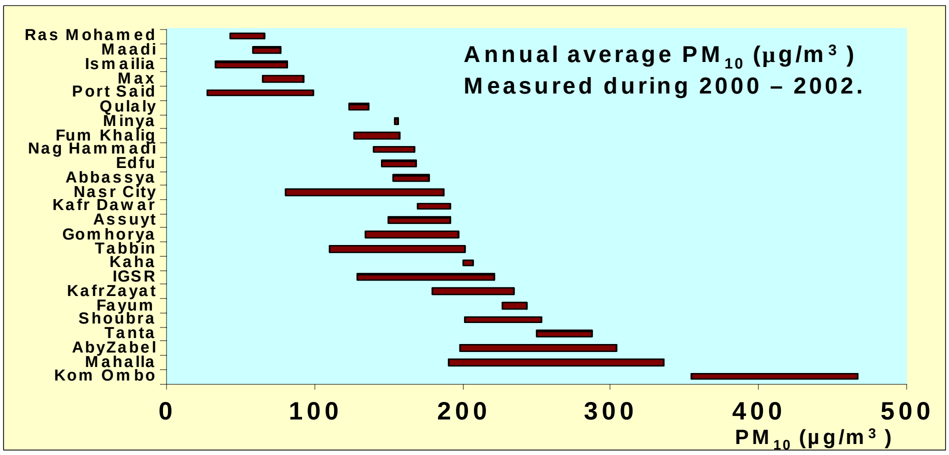


Figure 1: The range of annual average PM_{10} concentrations measured at 25 sites in Egypt (2000 - 2002)

In the greater Cairo area the air quality limit value (AQL) of 70 µg/m^3 as a 24-hour average concentration was exceeded between 45 and 98 % of the time in 2002. Similar periods of exceeding were found in 2000 and 2001.

2.2 Black smoke (soot)

Also the black smoke concentrations are frequently found to exceed the Air Quality Limit value of 150 µg/m^3 as a 24-hour average concentration. Figure 2 presents the frequency of exceedance of the AQL value at five selected sites in Egypt.

At industrial sites such as in ComOmbo (downwind from a sugar factory) and in the southern Tabbin area (brick factories) the black smoke concentrations were above the AQL value during 8 to 43 % of the time annually from 2000 to 2002.

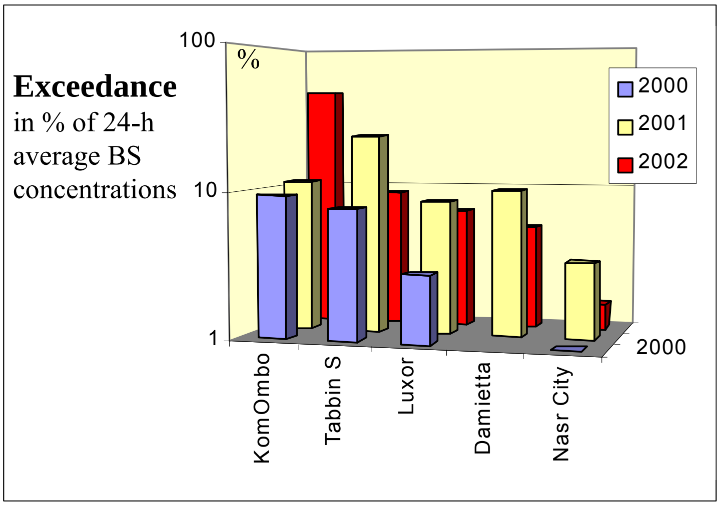


Figure 2: The frequency (in %) of exceeding the Air Quality Limit value of 150 µg/m^3 as daily average concentration at 5 selected sites in Egypt during 2000, 2001 and 2002.

Measurements of black smoke in Luxor, Damietta and in a street in NasrCity show that exceeding of the daily limit values occurred also at these sites (1 to 8 % of the time).

2.3 Total suspended particles (TSP)

The annual average TSP concentrations measured at 5 sites in Egypt from 2000 to 2002 is presented in Figure 3.

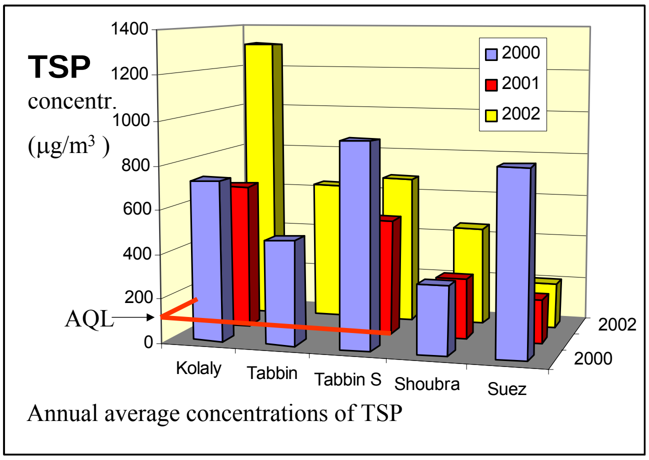


Figure 3: Annual average TSP concentrations measured in 2000, 2001 and 2002.

The Air Quality Limit (AQL) value for Egypt, 90 $\mu g/m^3$ as annual average, was exceeded at all sites. Sites surrounded by traffic, industries and high activity, such as Kolaly in Cairo city, Tabbin with cement factories and other industrial activities had very high TSP concentrations. At Suez there was a significant improvement in TSP concentrations when the bus station that surrounded the site moved out of the city.

High TSP concentrations may in many cases also be generated by wind blown dust, e.g. during the Khamsin period.

3. Sulphur dioxide, SO2

Sulphur dioxide, or SO_2, belongs to the family of sulphur oxide gases (SOx). These gases dissolve easily in water. Sulphur is prevalent in all raw materials, including crude oil, coal, and ore that contains common metals like aluminium, copper, zinc, lead, and iron. SOx gases are formed when fuel-containing sulphur, such as coal and oil, is burned, and when gasoline is extracted from oil, or metals is extracted from ore. SO_2 dissolves in water vapour to form acid, and interacts with other gases and particles in the air to form sulphates and other products that can be harmful to people and their environment.

The SO_2 concentrations measure at a variety of sites in Egypt occasionally exceed the AQL values as given by Law no. 4. SO_2 is, however, not an air pollution problem of the same magnitude in Egypt as suspended particles. The limit values are most often exceeded in or near industrial areas and in some few cases inside urban areas as in the Cairo city centre. As an example the exceedances of the 24-hour average concentrations are presented for 5 sites in Figure 4.

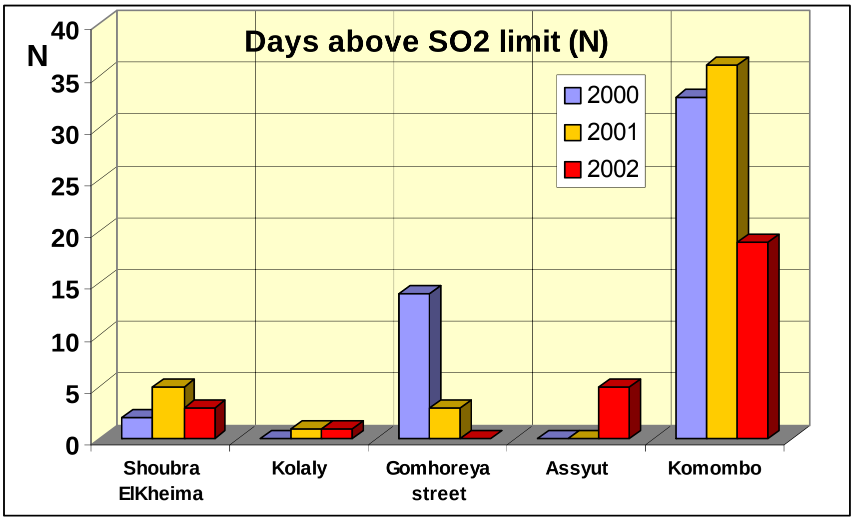


Figure 4: The number of days when the AQL values for SO_2 (24-h average) have been exceeded in 2000, 2001 and 2002 at 5 selected sites in Egypt.

Industrial areas like Shoubra ElKheima (several industries) and Kom Ombo (where the measurements are taken only 1 km downwind from a sugar factory) have revealed frequent excedance of the limit values, while the urban stations inside Cairo only occasionally have exceeded the limit values. Also in Kafr Zayat and in the southern Tabbin area we have recorded the SO_2 concentrations to exceed the limit values.

The short-term concentrations given by the one-hour average concentrations are normally exceeded during less than 1 % of the time inside Cairo.

Annual average concentrations have been estimated from different type of measurements, and concentrations above AQL have been found in many areas and at several measurement sites.

Long-term average concentrations estimated from passive sampling of SO_2 are presented in Figure 5.

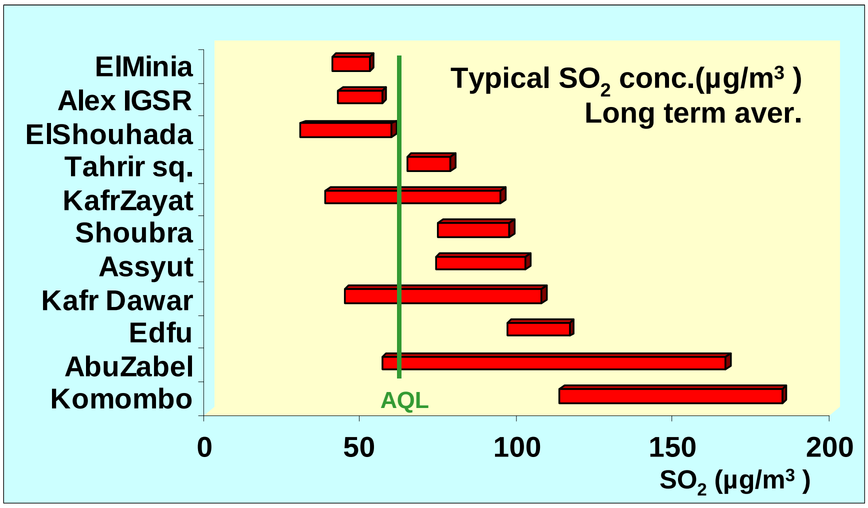


Figure 5: Typical ranges of long-term average (annual) concentrations of SO_2 measured by passive samplers at 11 selected sites in Egypt.

Again we see that sites impacted by industrial emissions are exposed to the highest concentrations of SO_2. Even at Tahrir Square, in the city centre of Cairo, the SO_2 level was slightly higher than the limit values.

4. Carbon Monoxide, CO

CO is a component of motor vehicle exhaust. High levels of CO generally occur in areas with heavy traffic congestion. In cities, 85 to 95 percent of all CO emissions may come from motor vehicle exhaust. Other sources of CO emissions include industrial processes (such as metals processing and chemical manufacturing), residential waste and wood burning, and some natural sources such as forest fires.

Inside the city centre of Cairo traffic jam often occur and the typical daily average concentrations of CO thus will exceed the Air Quality Limit values.
Figure 6 indicates the frequency of exceedance of the 8-hour average concentration of 10 mg/m3

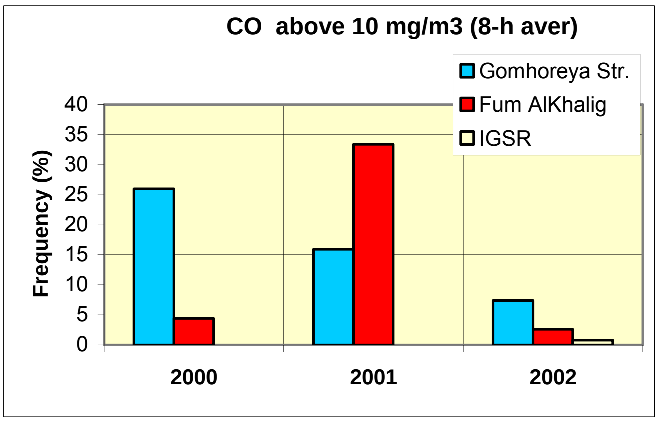


Figure 6: The occurrence of 8-hour average CO concentrations above the AQ limit value of 10 mg/m3 measured at one street canyon and two roadside stations.

In the streets of Cairo, such as around the old opera square (Gomhoreya street) and at the highly traficated FumAlKhalig area the daily 8-hour average CO concentration was exceeded in 5 to 33 % of the time.

The one-hour average limit value of 30 mg/m3 was rarely exceeded. This happened only during a few hours each year in the Gomhoreya street canyon.

5. Nitrogen dioxide (NO_2)

Nitrogen oxides, or NO_x, are the generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. Many of the nitrogen oxides are colourless and odourless. However, one common pollutant, nitrogen dioxide (NO_2) along with particles in the air can often be seen as a reddish-brown layer over the urban area.

Nitrogen oxides form when fuel is burned at high temperatures, as in a combustion process. The primary sources of NO_x are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels.

NO_2 is being measured by the EIMP programme at 22 sites in Egypt. Annual average concentrations ranged in 2002 between 25 and 83 $\mu g/m^3$ .In the streets of Cairo the average concentrations were between 75 and 83 $\mu g/m^3$.

The one-hour average limit value of 400 $\mu g/m^3$ was not exceeded in 2002. However, the 24-hour average limit value of 150 $\mu g/m^3$ was exceeded during one to five days in the streets of Cairo. Passive sampling data indicate that there may be other areas with high traffic density where the limit values occasionally were exceeded.

6. Ozone, O_3

Measurement data indicate that ground level ozone together with small particles is one of the major air pollution problems of Egypt. We therefore have to understand the formation and occurrence of ozone.

Ozone (O_3) at the surface is most often created by a chemical reaction between oxides of nitrogen and volatile organic compounds (VOC) in the presence of heat and sunlight.

VOC + NOx + Heat + Sunlight → Ozone

Ozone has the same chemical structure whether it occurs miles above the earth or at ground level and can be "good" or "bad," depending on its location in the atmosphere. In the earth's lower atmosphere, ground-level ozone is considered "bad." Motor vehicle exhaust and industrial emissions, gasoline vapours, and chemical solvents are some of the major sources of NO_x and VOC, which help to form ozone. Sunlight and hot weather cause ground-level ozone to form in harmful concentrations in the air.

In the greater Cairo area the transport time during hot summer days is long enough so that large amounts of harmful ozone is being created in the area. Afternoon maximum concentrations as recorded at Giza (Cairo University) and at a roof station at Abbaseya are typical examples of this kind of regional formation of ozone. Both these sites represent the kilometre scale urban areas away from local sources.

Figure 7 illustrates the annual average diurnal variation of ozone at 4 selected sites in Egypt.

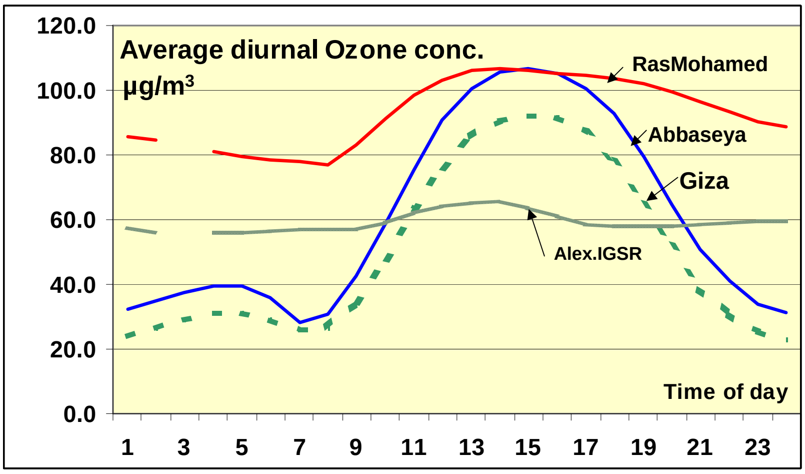


Figure 7: Annual average diurnal variation of ozone measured at 4 sites in Egypt 2000-2002.

The regional background measurements undertaken at Ras Mohamed at the southern tip of Sinai indicate that the background ozone level is on the average higher than the levels measured in Cairo and Alexandria. However at daytime during summer conditions the concentration levels that are reached in the greater Cairo area are higher than the maximum background concentrations. In the morning rush hours we see that the NOx emissions from cars are reducing the ozone by using ozone to form NO_2. The ozone concentrations therefore reach a minimum at about 08:30 in the morning.

Ozone may also be formed at far distances (tens to hundreds of kilometres) downwind from large cities like Cairo and Alexandria. From Cairo high concentrations may be found in the Nile valley south of the city. From Alexandria the maximum concentration may be found in the Delta.

At the measurement site itself in Alexandria we see from Figure 7 that the ozone levels are influenced by NOx emissions from traffic in the city. The “fresh” NOx emissions are “using” ozone. The concentrations are therefore relatively low as the site clearly is located inside the urban boundary layer.

The one-hour average concentrations rarely exceeded the Air Quality Limit value of 200 µg/m^3. These concentrations were exceeded during less than 1 % of the time.

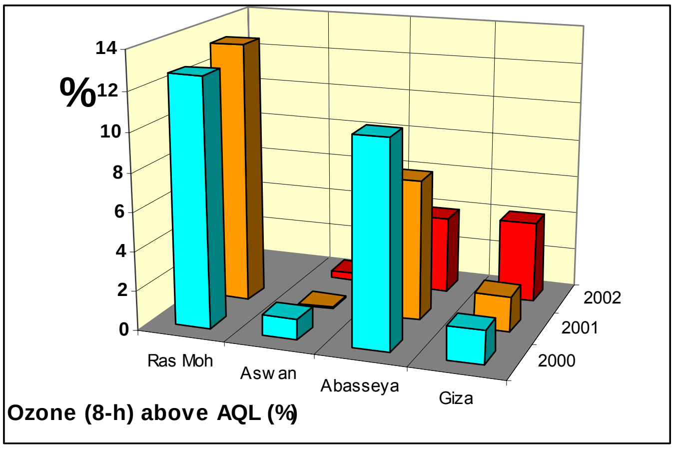


Figure 8: The frequency (%) of 8-hour average ozone concentrations exceeding the AQL of 120 µg/m^3 .

The 8-hour average limit value (120 µg/m^3) however, was exceeded more frequently, as the relatively high ozone concentrations during the summer season seem to last for several hours.

At Ras Mohamed the 8-hour average concentration was exceeded during 13,4 % of the time in 2001, at Abbaseya 10,5 % of the time in 2000 and at Giza and Aswan up to about 4 % of the time. During the summer season exceedances are found more frequently.

7. Summary and conclusions

Suspended dust (measured as PM_{10} and TSP) is the major air pollution problem in Egypt. Annual average concentrations of PM_{10} range between 100 and 200 µg/m^3 in urban and residential areas and between 200 and 500 µg/m^3 near industrial areas. Daily average concentrations of more than 6 times the Air Quality Limit value for Egypt are being recorded occasionally in the urban areas of Cairo. The natural background concentration of PM_{10} in Egypt has been evaluated to represent levels close to or around the Air Quality Limit value of 70 µg/m^3 as a daily average.

The concentration levels of SO_2 and NO_2 have also been observed to exceed the Air Quality Limit values in industrial areas and during some occasions in the big cities. Both the long term (annual averages) and the short-term (1-hour average) Air Quality Limit levels have been exceeded. Eight-hour average CO concentrations in streets and along roads in Cairo frequently exceeded the Air Quality Limit value.

High concentrations of surface ozone have been observed as a result of regionally produced secondary pollutants in the Cairo region. Also the background measurements of tropospheric ozone at Ras Mohamed, at the southern tip of Sinai, show high concentrations of ozone, especially in the summer season.

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ABSTRACT
The EIMP Phasing-out Phase has been formulated to consolidate EIMP achievements, while gradually integrating the EIMP activities and staff into the existing EEAA administrative and organisational structure.

The second mission during the EIMP Phasing out Phase Air Quality component was undertaken during 8 May to 6 June 2003. Responsible for the mission was Bjarne Sivertsen. Rolf Dreiem spent 10 days in field to check the quality of measurements, maintenance and repair. The quality assurance programme was intensified with special measurements and analyses, and some of the instrument problems were discussed and solved. Several meetings were held during the Mission, and a new database for EEAA was discussed and presented. A first presentation of the content of a state of the Environment report was prepared and presented.

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