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DANIDA; Air Quality Monitoring Programme

Mission 2 Report

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1. Introduction

As part of the development of an Environmental Information and Monitoring Programme (EIMP) for the Arab Republic of Egypt, in which NILU is responsible for air pollution, B Sivertsen visited Egypt in May and June 1996.

The project is funded by Danida. The project leader is Jan Hassing from COWI in Copenhagen. VKI (the Danish Water Quality Institute) and COWI is responsible for coastal water monitoring, NILU is responsible for air pollution monitoring, VKI is responsible for the reference lab. and COWI is responsible for pollution sources and emissions.

The visit to Egypt in May-June was part of the Phase 1 of the project.. The main objectives of this visit was to undertake part A, B and C of the work programme activities:

B.1.2. Analyse existing data

B.2.1. Select representative monitoring sites for A.Q measurements

B.2.2. Define site characteristics.

B.2.4. Select air pollution indicators

B.2.5. Select sites for meteorological measurements

B.2.6. Specify meteorological data

B.2.7. Specify use of existing equipment

C.1.1. Evaluate existing equipment

C.1.2. Prepare list of equipment

Some of the persons we met are presented in Appendix A.

2. Introductory meeting

A first introductory meeting was held at the new EIMP project office in 3 Abdel Aziz Selim street in Mohandessin. Jan Hassing presented the status of the project (see Briefing note Appendix B). The need for assistance from EEAA and from the Environmental Monitoring and Occupational Health Centre (EMOHC) in Embaba was stressed. We requested a meeting with Jan Hassings counterpart dr. Elzarka at EEAA as soon as possible.

Douglas Clark was busy establishing a PC network and an internet line to our office. He participated in the meeting and would also be in the meeting with Dr. Elzarka at the EEAA meeting.

Input from NILU to the instrumentation of the reference lab. (at NRC) was requested.

3. Meetings

3.1 9 May 1996, Chemonics

AT EEAA we met 3 representatives from a US company "Chemonics"; (David Fratt, Washington DC, Hesham Sabra, Dokki str. Giza, Mark Hodges, CH2M HILL, Gainesvill Fl.), who were preparing a proposal and bidding for the USAID Cairo Air project . This mainly concerns lead air pollution from industries and from car traffic. They wanted to perform a baseline study using HIVOL samplers analysing lead on PM10 samples.

They wanted to co-ordinate with the EIMP project. They further proposed a quarterly meeting to update the progress on both sides.

The proposal deadline was 10 June. The measurements will at best start October 1996.

3.2 9 May 1996, EEAA

The following persons participated in the meeting with Dr. Elzarka; Dr Abdil Latif Hafez, responsible for the Air Quality Department in EEAA and Heba Mohammed Adly who will participate in the data analysing and site inspection work with EMOHC.

Agreements were made with the EMOHC laboratory for visits there from Sunday 12 May at 10:00 hrs. The plan is to study all the data they have, evaluate instruments and analyses and prepare a complete site investigation.

The UNITAR Pollutant Release and Transfer Register (PRTR) for developing countries was discussed. Egypt has been selected the first pilot country by UN. There will be a PRTR workshop in Alexandria from 19 May, where the EIMP project will be presented in depth. About 60 participants will be attending the workshop.

I prepared a paper (see Appendix C) for presentation at the workshop.

3.3 12 May 1996, EMOHC lab. in Embaba

Together with Heba Mohammed Adly from EEAA I paid the first of many visits to the EMOHC laboratory. Dr. Seham Hendy introduced us to Mr. Mohammed (Ibrahim Refaye) El Amawi, who is responsible for the air pollution measurements at the laboratory. He had been with the lab since 1982, and was planning a study of PAH from traffic in Cairo (see Appendix D).

The laboratory has 5 employees with university degrees in physics, one chemist trained in computers and 12 technicians. Dr. Seham wanted to see the job descriptions produced by us for the EIMP project. (see Appendix E)

We visited the sampling station at the roof (UTM: 328,73,3329,25). The Andersen sampler looked dusty and unclean. This was taken care of before it was set into operation again. At a visit to the laboratories we were shown one of the ten semi automatic BS/ SO_2 samplers. Three of these samplers are located in the Cairo area, the rest distributed to other areas in Egypt. The samplers operate on a flow rate of 1 l/min and is based upon absorption of SO_2 in a H2O2 solution.

The laboratory also has a Anderson Hivol sampler with a 10 micrometer cut off hood, that is being used for special designed studies. It was recently used for a study of the air quality around the Helwan University in Helwan. Preliminary results from this study is indicated in the following table.

Concentrations ($\mu g/m^3$)

Date	TSP	PM10	SO_2
30.3.1996	449	224	30
31.3.1996	456	245	15
1.4.1996	421	245	15
2.4.1996	447	256	8
3.4.1996	403	182	-

The filters are dried and weighed before and after exposure. They also can use low flow rate samplers, which consists of simple pumps with a flow rate of 25 ft3/min (ca.700 l/min). These samples have been used to collect one hour average samples at about 4 m above the ground around the Helwan University (on the East, West and South side of the University).

TSP Concentrations ($\mu g/m^3$)

Date	East side	West side	South side
31.3.1996	211	356	432
1.4.1996.	545	1653	361
2.4.1996	1399	901	161
3.4.1996	400	1375	544
4.4.1996	916	418	510

The laboratory has started some training analysing heavy metals on filters using atomic absorption (Perkin Elmer 460 AAS). They are also using a HP GC 5890 to analyse chlorinated HCs in water samples. They have tried to analyse PAH in air, but have no standards available.

I also started to go through the air quality data that were available on the local computer in the Embaba lab. Some of these data are presented in Appendix F.

To compare the concentrations found from some of the data collected, air quality guidelines and standards were requested. A summary of these air quality standards for Egypt is presented in Appendix G.

3.4 16 May, project meeting

Mogens Heering, head of the quality assurance group, participated together with Hassing, Clark and Sivertsen in a status report meeting at the EIMP offices.

It was stressed that purchase of equipment can not be undertaken unless approved by the working groups. It is therefore of utmost importance that these groups will be established and will be in operation as soon as possible. We have to reduce the number of members in these groups to a minimum.

NILU will make specifications for all the air pollution equipment during the summer of 1996, even if some of this will not be purchased during the first year. We should also look into possible changes in the working plan, relative to the start up of monitoring in different areas of Egypt.

NILU-produced equipment that is needed to undertake the work has to be specified clearly. This can either be given as an offer in line with others or it can be taken out of the general procurement procedures and be delivered as part of the consultant support from NILU. This will probably represent a very small part of the total procurement.

D Clark requested support from NILU concerning equipment for emission measurements. We further discussed the monitoring responsibilities in Egypt. Will EMOHC lab in Embaba be able to handle this? They will at least need more qualified people, and EEAA will need to find means to offer adequate salaries.

3.5 16 May 1996, USAID CAIP

We had another meeting with consultants bidding for the USAID Cairo Air Improvement project. Kevin T Donovan and Mohammed Latif from Ecology and Environment told that the scope of the project had been totally changed the last few weeks. They now seem to go through an exercise to see how and what the different consultants will prepare themselves. The project still has high priority, but no one knows what the project will contain..? Lead pollution is, however, still a main issue.

Measurements of emissions and ambient air lead will probably still be important parts of the project. The project has a deadline at 17 June 1996. For traffic modelling Mr Latif wanted to contact NILU.

3.6 17 May 1996, Norwegian Embassy

During the celebrations in the Embassy I met interesting representatives(married to Norwegian wives), that could support on air quality measurements in Egypt. Dr. Hisham Fouad Aly at the Atomic Energy Authority is undertaking ozone and NOx measurements at sites where they measure radioactivity. I was invited to visit the authority.

3.7 20 -22 May 1996, PRTR Workshop Alexandria

The EIMP group participated in a PRTR (Pollutant Release and Transfer Register) workshop in Alexandria. We were invited by EEAA to present the EIMP programme.

As a follow up of the UNCED, Rio de Janeiro Conference, Agenda 21 ch. 19, OECD has held 5 workshops to develop a Guidance for PRTRs to be established in developing countries. Mexico and Egypt has been selected pilot countries for establishment of PRTR systems. (see Appendix H), and it is mentioned in the guidebook that Norway will have such a system.?

Some valuable information concerning the environmental status in Egypt was presented during the 3 days. However, I believe it will take many years for Egypt to be able to undertake the comprehensive task of a PRTR. It also became unclear who would pay for it, even if the main responsibility would be at the shoulders of EEAA.

For the EIMP sub project on emission inventories, some valuable information could be gathered through the working group established for surveying data collection.

3.8 22 May 1996, Visit to NIOF

Hassing and Sivertsen visited the National Institute for Oceanography and Fisheries (NIOF) in Alexandria. Dr. Ali Ibrahim Beltagy gave us an introduction to the work and the laboratories. NIOF will be our counterpart in the coastal monitoring programme of EIMP. The laboratories were well equipped. They had operated an Aanderaa automatic weather station, and they even had a High volume sampler for TSP.

The roof of the laboratories had an air condition room, and the site would be a perfect location for meteorological measurements and for background ozone monitoring. All the infrastructure; power, telephone lines etc. was available.

3.9 27 May and 1 June 1996, Visit to Atomic Energy Authority

After meeting Dr Hisham Fouad Aly at the Norwegian Embassy, I was invited to visit the Atomic Energy Authority in Cairo. I met with

- Dr. Hisham Fouad Aly
- Dr.Ahmed Ahmed El- Kady
- Dr. Mokhtar S.A. Hamza.
- Dr. Aly Islam M Aly

In the 1 June meeting at the laboratories in Nasr City I was shown the multi gas monitoring station, which they were about to start testing. This little container on wheels contained mainly Thermo Environmental equipment:

- One ozone monitor based on UV photometer,
- gas filter correlation CO analyser , model 48,
- pulsed fluorescent SO_2 analyser, model 43A,
- chemiluminiscent NO-NO2-NOx analyser, model 42,
- total hydrocarbon, THC analyser model 51,
- ESC 8800 data logger,
- gas calibrator model 146,
- zero air supplier,
- hydrogen generator.

A technical note was prepared after the visits to the Atomic Energy Authorities. (see Appendix I).

3.10 27 May 1996, USAID CAIP, K&M Engineering

K&M Engineering and Consulting Corporation represented by Joseph Shanley and Habiba Ahmed wanted to discuss the possible connections between the CAIP (Cairo Air Improvement Project) and the EIMP projects. K&M Engineering is part of a consortium with Radian Corp. , Parson and others.

One of the tasks described in the USAID project (task 4) is air pollution monitoring. This may have some links to the Danida programme. The following items were discussed:

- The development of a system for air improvement and links with the EIMP air pollution measurement programme,
- Can the US data be incorporated in the EIMP network?
- Are there any links with the training programmes and possible chemical analyses?

The USAID monitoring programme will be very specific for the issues included in CAIP. The programme will include measurements of car emissions, studies at lead smelters and the development of lead analyses capabilities in Cairo.

3.11 29 May and 4 June 1996, Cairo University, CEHM

Three representatives from the Cairo University Centre for Environmental Hazard Mitigation (CEHM) wanted to discuss the EIMP programme's possible needs and use of data from an air quality monitoring station which is going to be established at the Cairo University. Dr Mohamed I Sultan is the principal investigator. He is most of the time at the Argonne Natl. Laboratory in USA. The contact person in Cairo is Zeinhom El Alfy (geologist). The third person was visiting dr. Neil Sturchio , group leader of the Geochemical Processes Environmental Research Division at Argonne Natl Lab.

Funds (3 mill USD) has been given from the US Dept. of Agriculture to the Cairo University to establish the air quality station included laboratory equipment and training. Three laboratories are being established in the new chemistry building (third floor):

a) A remote sensing laboratory.

b) Geographical information systems laboratory (based upon ArcInfo).

c) Computing facilities.

At the chemical laboratory they will install ICP, ICHPLC, GCs and air quality monitors which are to be purchased before the end of June. They are building a new floor at the Chemistry building where the air quality sampling station is planned to be located.

On 4 June I met with Professor M.A.El Sharkawi, Dean of the Faculty of science and director of the CEHM programme. He was positive to a cooperation with the EEAA air quality monitoring programme, and would support an exchange of data between their air quality station at the Cairo University and EEAA. The site for the AQ station at the third floor of the new Chemistry Building was visited. This site will be well suited as a kilometre scale reference station on the western side of Cairo. The room available for the equipment will have power, telephone lines and computer facilities. The station is at the moment planned for NOx-NO2 , Ozone , CO and particle monitoring.

It will be possible to add SO_2 and VOC. Argonne also has a PAN expert that could use the Argonne PANalyzer for a limited time period here.

Argonne Natl Laboratory is also bidding for the USAID CAIP project. The group will be interested in sharing the data with the EIMP air quality programme. How can this be arranged? In return the group at the University will be interested in meteorological data from the EIMP programme. They are building up a modelling group, and they will educate and train experts that could be used in the EEAA air quality monitoring programme in the future.

3.12 4 June 1996, CCC at EEAA

Dr. Mawaheb Abov El Azm who is responsible for the Central Cairo Centre (CCC) at EEAA wanted a meeting to discuss the possibilities for co-ordination between the JICA project; which will deliver equipment also for air quality monitoring, and the EIMP programme.

EEAA will establish a Central Monitoring Laboratory in the new EEAA building in Maadi within one month or so. This is part of the first phase of the JICA project, which also will include training. Staff from the CCC will go to Tokyo to receive training in the use of equipment, which will be delivered to EEAA. This also will include air quality measurements. A list of the present equipment available in this laboratory is presented in Appendix U.

The contract for air quality equipment has not been signed yet, and the type of equipment to be delivered has not been discussed.

An expert committee has been established to develop Egyptian standard methods for air quality monitoring. A method document will be available in a few months. The next meeting in the group will take place in EEAA on 9 June. I was invited to participate in the meeting.

3.13 6 June 1996, Meeting with EEAA staff

A meeting was arranged with 8 members of the EEAA staff to present the project and to receive information on the EEAA staff members background and interests.(see Appendix L).

After presentation of the EIMP project, the sub programmes, the data management system and the various phases of the project, the EEAA members presented their background and present tasks.

They represented the EEAA GIS and computer centre, waste management projects, air pollution group and the new CCC analytical laboratory.

Working groups will be established for the different sub programmes of EIMP. Some of the EEAA staff has already been assigned to some of these programmes. For air pollution monitoring the following two persons indicated that they wanted to participate and be part of the working group:

- Ms Heba Mohammed Adly, Environmental Researcher, Air Pollution Dept.

- Mr. Omar Hussein Sayed, Computer specialist, GIS section.

After the meeting they both have received tasks to work on. Heba for developing plots of air quality data from the Embaba lab. network for 1996, and Omar for preparing a UTM reference system and a presentation of the measuring network in the GIS system available at EEAA.

3.14 9 and 13 June 1996, Sampling standards committee

I was appointed member in the expert committee established by EEAA for standardisation of air pollution measurement methods in Egypt. The first meeting in the group took place on 11 May 1996 (see minutes from the meeting, Appendix M).

The standard methods for air pollution monitoring in Egypt has been requested by EEAA and will be linked to the Egyptian Environmental Law and air quality standards.

Discussions on TSP and PM_{10} sampling were the main topic of the second meeting in the group on 27 May 1996. IT had been concluded that high volume samplers similar to that proposed by the USA EPA should be used. Also some low volume samplers could be applied.

The discussions on SO_2 sampling stated that two wet chemical methods had been used in Egypt. Most of the routine programmes have been based on absorption in H2O2 solution following analyses by titration (total acidity). There have been extensive problems reported in Egypt due to absorption of NH3 and other alkaline compound which neutralise the acid formed from SO_2. One main reason for bad data quality has been caused by "negative SO_2 concentrations" in these analyses. A better method would probably be to analyse the total amount of SO_4^- by the so-called Thorin method described as one of the ISO standards. Preferably one should use ion chromatography to obtain the best analytical results for SO_2 absorbed in wet solutions or on impregnated filters.

When using monitors for continuous measurements of SO_2 these should be based upon pulsed UV fluorescence analysers like the ones approved by US EPA.

Dr. Abdel Aziz El Dakhakhni mentioned in the second meeting that considerable amount of absorption liquid is lost at ambient temperatures above 25 deg. In many of the Governerates they will need a simple method for SO_2 sampling and analysis.

It was therefore proposed that three laboratories in Egypt were selected to try, test and report on different methods for SO_2 sampling. The use of H2O2 absorption following ion-chromatograhy for analysis should be one of the methods. A second method as described in the EMEP manual from the Chemical Co-ordinating Centre for the European EMEP programme (see Appendix M) should also be tested. Analyses by the old Thorin method (still one of the ISO standards) was also mentioned.

The three laboratories for the test should be

- The High Institute of Public Health at Alexandria University
- The National Research Centre
- The Environmental Monitoring and Occupational Health Centre

Ein Shams University was also mentioned as a possible test laboratory. Minutes from the meeting are included in Appendix M.

The question of financing a study of this kind was discussed. Dr ElZarka requested whether the Danida EIMP programme could include this work in their support. It was clearly stated that this originally was not part of the programme proposal. However, it could be of interest for the future air pollution sampling in Egypt. Another possible source for finance to this work could be the JICA minilab programme. Dr. El Zarka would discuss these matters with the Danida project manager Jan Hassing.

For the support of impregnated sampler units used in Europe NILU has been contacted. A possible introduction to these methods in Egypt will include training.

3.15 16 June 1996, IGSR, Alexandria

Dr. M. El-Raey hosted a visit to the Institute of Graduates Studies and Research (IGSR) in Alexandria. The institute is divided into four departments:

- Environmental studies
- Materials research
- Information technology
- Bio science and technology.

Environmental studies represent the largest department. This department addresses issues of natural resources, energy and pollution. The facilities include laboratories for remote sensing, air pollution monitoring, GIS, meteorological measurements and modelling. (see Appendix P).

Most of the air pollution studies that are carried out by the institute are short term and intermittent. There are no continuous long term measurement programmes undertaken at the moment.

Mr Saleh Mespah was responsible for remote sensing techniques and has used GIS to present satellite images of air pollution. Ms Marvet Amin is working on dispersion models, and has used the USA EPA Industrial Source short term model to estimate impact from various industries in the Alexandria area.

The application was very simplified using one selected meteorological condition; wind from NW at 3-5 m/s and near neutral stability. TSP concentrations from emissions at cement factories were estimated without taking into account particle size distributions and diffusive emissions around the building complexes.

At the laboratories several monitors for gaseous air pollutants were stored. The monitors were delivered by Rotork Analysis Automation Limited in England through a grant. Some of the equipment has been out of order since the delivery. Spare parts are missing and there is no funds for repair. Among the monitors there was a NDIR modell 41 CO /CO2 analyser, a NOx -NO-NO_2 analyser (the lamp was not operating), a SO_2 -H2S analyser based upon IR spectroscopy and a sumX datalogger that never worked.

The need for new modern updated instruments was evident. Some simple individual SO_2 sampling have also been undertaken by wet chemical methods and absorption in single glass bottles. The analyses have been using the WestGaeke method. Similar samples of NO_2 have been analysed using the arsenite method (Harrison and Perry; Handbook on air pollution analyses).

The meteorological measurements measured from a 2 m pole on the roof of the building were not recorded at the moment as the computer was out of operation. The equipment was based on sensors from Campbell instruments.

Three medium volume particulate samplers were available in the laboratory. These had been used as part of assignments from industries, and for various research work. The flow rates of these TSP samplers (from Rotheroe and Mitchell, Negretti Automation, England) were between 40 and 100 l/min. Studies have been undertaken for analyses of lead in several industrial areas across Egypt. A report on the results from these studies was available.

Filter samples had also been analysed for radioactive isotopes. The Atomic Energy Authority radiation monitor in Alexandria was placed on the roof of the building.

The ISGR instititute is interested in and is willing to be part of a local expert team for Alexandria and surrounding areas under the national air pollution monitoring network for Egypt. I believe the institute also have the capability of taking a local responsibility for monitor station calibration, service and the field part of the quality assurance. They will also have access to all the data, which on a daily basis will be transferred to the central computer unit for final quality control and quality assurance before transferred into the EEAA database.

One of three monitoring stations in Alexandria could be at the institute, which is located in the central part of the city. Typical parameters to be measured at this site would be SO_2 , NO_2, PM_{10} and meteorology. At least two more sites have to be selected in industrial/ residential type areas of Alexandria. The health authority measurement sites will be inspected at our next visit to Alexandria.

It was also mentioned that the Meteorological Service is operating measurement stations west of Alexandria that could be used for background ozone measurements. Burg elArab was one site mentioned. A visit should be paid to these sites through a contact to the meteorological service . The person to contact will be Dr.Hassin Zohdi.

3.16 17 June 1996, High Institute of Public Health , Alex.

Invited by Dr. Ebdel Aziz El Dakhakhni I visited the High Institute of Public Health at the University of Alexandria. Dr Dakhakhni was not present during my visit but his colleges presented me for the institute and the work on air pollution that is undertaken.

Dr. Abdel Aziz Kemel introduced me to the different departments and the colleges working mainly on air pollution matters. As in the ISGR institute the air pollution studies are usually of short duration and undertaken as part of contracts from industries or as part of data collection for PhD theses.

The institute has about 20 Anderson type high volume samplers. Many of these are in operation presently around different type of industries. Filters are normally exposed for 24 hours or two days every week, and collected weekly.

Gravimetric analyses are always performed and some filters are being analysed for specific heavy metals or other air pollutants. Heavy metals are analysed by atomic absorption (A Perkin Elmer instrument).

For SO_2 sampling simple single glass bottles with H2O2 solutions were used manually. These were analysed by titration. The air volume flow is usually between 1 and 10 l/min. A similar method is used for NO_2 sampling. These samples are analysed with the Salzman method.

The laboratory was also equipped with old fashioned Bendix type gas monitors for NOx- NO_2 , SO_2 /H2S and THC. The system included a calibration unit. These instruments had not been used for a while and was only on display.

An interesting PhD theses by Mahmoud Fathy Mohammed on The Assessment of Traffic Air Pollution in the City of Alexandria, gave some valuable input to the type of and the size of the air pollution problem inside the city of Alexandria.

Measurements were carried out at 35 sampling points in different streets in the urban and residential areas of Alexandria. Typical annual average TSP concentrations ranged from 96 to 400 $\mu g/m^3$ on weekends, from 120 to 450 $\mu g/m^3$ on week days. The average TSP for all stations all measurement days was 214 $\mu g/m^3$.

The annual average NO_2 concentrations varied from 10 to 60 $\mu g/m^3$ .A frequency distribution indicate that during 38% of the cases the NO_2 concentrations are less than 20 ppb, 43% range from 20 to 40 ppb, 12% between 40 and 49 ppb and 6% are above 50 ppb.

Lead concentrations ranged from 0,5 to 2,6 $\mu g/m^3$ and sulphate concentrations between 10 and 20 $\mu g/m^3$. A summary of annual average concentrations in three type of areas of Alexandria is presented in Table 3.2.

Table 3.2: Annual average concentrations of selected air pollutants in the city of Alexandria (Mahmoud D Mohammed, 1993).

Area type	Sites	Concentrations (ug/m3) (hivol filters)				Gases (ppb)	
	N	TSP	Pb	SO4--	NO3-	NO2	CO
Industrial	6	727	0,94	17	1,7	33	4700
Commercial	14	509	0,73	11	2,1	28	3600
Residential	15	400	0,63	12	2,3	23	5300

Typical levels of TSP, lead (Pb), organic particles (BSOM), combustible particles, SO_4^{--} , NO_3^-, NO_2 and CO is also presented for different areas of traffic and residential areas in Appendix Q.

Wind data from the National Weather service (airport) for July 1994 - May 1995 is also presented in Appendix Q.

The High Institute for Public Health is interested in participating in the national air pollution monitoring programme. One of their permanent sampling stations in the EL Max area at Wadi Al Quamma is well suited as one of the industrial impacted residential sites to be selected in Alexandria.

The institute will probably participate in a test on different wet chemical methods for SO_2 sampling and analyses in Egypt, and could also in the future be responsible for reporting such data to the national air pollution monitoring network. Concerning TSP sampling and analyses in particular the institute seems to have adequate experience. There is however no PM_{10} samplers available in Alexandria. New samplers of this kind will have to be procured.

A detailed site visit to possible monitoring sites in Alexandria, including those operated be the Ministry of Health Centre, will have to undertaken in October.

3.17 Source apportionment study in Cairo

We were invited to a presentation of a 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 Mahmoud M Nasralla at NRC in Cairo.

A copy of the tansparencies are shown in Appendix T. In the city centre of Cairo the PM_{10} concentration averaged over 150 $\mu g/m^3$ with approximately 50 % being in the fine particle fraction (< 2,5, micrormeter).

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

4. Site visits to sampling stations in Cairo

4.1 Site visits

The sites operated by the EMOHC laboratory in Embaba were visited together with Mr. Mohammed Refaye El-Amawi and the responsible technicians for each site. Mr. Refaye is the main responsible for air quality measurements and analyses at the laboratory.

The stations used the British produced sequential 24 h average sampler from Glass Development Limited. Most of the stations had the old version of the sampler. These were more than 10 years old, built into a wooden box and seemed to have done its best and should more or less have been taken out of the programme. At three sites they used the new version ;"Sampler 8 Monitor" from Glass Development Limited, delivered by Scientific Instrument Makers in London. A manual for this instrument is found in Appendix J.

Table 4.1: Air quality monitoring sites in Cairo with locations given in UTM reference co-ordinate locations.

Site name	Old UTM (from map)		Measured UTM (GPS)	
	x	y	X	Y
Azbakkeya	638,50	816,62	330,50	3326,62
Nozha	646,15	821,55	338,15	3331,55
ElSaheil	638,20	819,50	**330,29**	**3329,44**
Nasr City	645,80	817,45	337,80	3327,45
Abo el Ssaoud	637,20	811,85	329,20	3321,85
Maasarah	643,75	799,35	**335,79**	**3309,58**
Helwan	646,20	792,60	**337,43**	**3302,61**
Tebin	645,00	785,20		
F.of Med. Ain Sh.	642,00	818,50	**334,24**	**3328,56**
Embaba	636,55	819,24	**328,73**	**3329,25**
Ttalbia, Giza	633,21	810,51	325,21	3320,51
Hawamdia	640,40	798,20	**332,37**	**3308,56**
Attaba	638,72	815,56	**330,99**	**3325,65**
Shoubra el Kheima	638,60	823,30	**330,58**	**3333,40**
Salem City			**348,02**	**3338,08**

The sites visited are presented in Table 4.1. together with their positions given in two sets of UTM reference co-ordinates.

The old UTM co-ordinate set were found on maps (1:25000) provided by the Survey of Egypt. The new UTM reference system is read directly from the Global Positioning System , GPS navigator. This is a satellite based navigation system developed by U.S. Department of Defence and produced by Garmin International. This GPS navigator was used during the site visits. The map datums used for Egypt is named " Old Egyptian - Egypt" . The Cairo positions refer to UTM grid zone 36.

From the site visits we produced site visit reports presented in Appendix K.

Most of the stations were well selected and representative for urban, residential and industrial areas where people live. The background for the existing network was to serve as input to the World Health Organization (WHO) world wide reporting on air quality. Data have also been supported to the UNEP/GEMS programme (Global Environmental Monitoring System, Earthwatch).

SO_2 and black smoke(BS) are being measured with two types of sequential 24h average low volume samplers based upon particle collection on a filter and absorption of SO_2 in a H2O2 solution. Most of the sites had the old fashioned wooden box delivered by Glass Development Limited in England more than 10 years ago. Only two stations; Embaba and Nasr City, had a new type sequential sampler from Glass Development Limited.

The intake of air for sampling of SO_2 and black smoke varied from 2 to 10 m above the ground. Some of the air intakes were located too close to the wall and some influenced by near by vegetation. Most of the intake positions can be improved if the sites are to be used for future monitoring.

The TSP monitors, which were all based on old Andersen type high volume samplers delivered by General Metal Works Inc., were located on the roof of the buildings. Most of these sites were representative for the kilometre scale pollution, but in some cases they were placed too high above the ground where people normally are exposed.

Very few of the intake locations are influenced by very local or micro scale emissions, except a few intakes above streets inside street canyons. However, some locations of this kind are also needed for the future air pollution monitoring programme.

4.2 Quality assurance and controls

In summary it should be stated, based upon the site visits, that the quality control and the quality assurance of the present monitoring programme is not adequately undertaken. Calibrations, inter calibrations and controls are missing.

The flow rates at some of the high volume samplers are sometimes checked but many of these are poorly maintained and cleaned.

At some of the stations the sequential samplers were out of operation due to lack of spare parts such as pumps. At some stations the glass bottles were completely dry (no H2O2 solutions left) either due to evaporation or because of mal functions in the timer operation. The air had been pulled through the same bottle for several days. No check lists or instrument log was available at the site. However a check list exists in the laboratory.

4.3 Responsibilities

Responsible for the air pollution work in EMOHC included analyses and reporting is Mr. Mohammed J Refaye ElAmawi, head of the air pollution laboratory.

Responsible for the collecting of data from the various measurement stations is Miss Kamela Mostafa (BSc. in physics). She is also responsible for the analytical instruments in the laboratory and for quality assurance.

Mr. Moshil Erian (BSc. physics) is responsible for supervising all measurement stations and for follow up of the check lists from the technicians. He shall also visit all sites to see that the instruments are working properly.

From our experience during the site visits malfunctions at the stations are not reported adequately in the system. The person responsible for the reporting of data is not fully aware of the data quality. The direct flow of information and the co-operation between the different responsible persons concerning quality assurance is presently poor. It seems like the responsibilities have not been clearly stated.

In the present system one technician has the responsibility for one or several sites selected for him exclusively. In case of illness,holidays or other reasons for absence no other technician take over the responsibility for this person's sites, and the result is poor data availability (missing data). This system has to be changed so that the responsibility for the different monitoring sites can circulate among the technicians. In this way another person can take over one site in case of illness or absence of any kind.

5. Future air quality monitoring programme

5.1 Strategy

The monitoring sites for the future national air quality monitoring programme is being be selected based upon available information on:

- monitoring objectives,
- meteorological conditions, prevailing winds,
- existing data,
- major air pollution sources

The measurement sites will cover different scales of air pollution, as stated in the international requirements for air quality monitoring (UNEP/GEMS programme);

- central urban roads and street canyons (kerbside),
- urban scale regions and residential areas,
- industrial areas,
- background areas.

Different air pollution indicators will be measured at the different sites dependent of the specific sources and problem at that site.

The first priority air pollutants as presented by UNEP/GEMS, WHO, OECD and others are:

- Sulphur dioxide (SO_2),
- Total suspended particulate matter (TSP) , or better PM10 (suspended particles with diameter less than 10 micrometer),
- Nitrogen dioxide (NO_2) and/or NOx (nitrogen oxides),
- Ozone (O3)
- Carbon monoxide (CO).

Not all parameters will be measured at all sites. This will be dependent upon site specifications and typical dominating sources. In some sites also dust fall be measured on a monthly basis with simple dust fall gages.

Meteorological data on an hourly bases will be needed to explain the air quality data collected. Wind speeds, wind directions and atmospheric turbulence (stability) are the most important parameters.

As part of the monitoring programme a few automatic weather stations (AWS) will be established at representative air quality monitoring sites

5.2 Site selection background

5.2.1 Measurements with passive samplers

To evaluate the representativeness of some of the monitoring sites, simple field studies using inexpensive passive samplers have been applied to measure SO_2 and NO_2 concentrations. This was performed in Cairo from 7 to 14 June 1996. A report with the results from this study will be presented.

5.2.2 Site visits

The site visits reported in chapter 4.1. and in Appendix K, represents the main basis for the proposed monitoring programme in the Greater Cairo area. These sites represent the measurement programme operated by the Environmental Monitoring and Occupational Health Centre in Embaba. The sites have been selected for evaluation of health impact and most of the sites are located in urban or residential areas in local health centres or hospitals. Approvement and agreements with the Ministry of Health probably have to be established for future use of these sites.

Some of the sites represent different area types, and where locations, representativeness and infrastructures have been found adequate, the site has been selected also for the future modernised monitoring programme.

5.2.3 Co-operation with other institutions

During visits and discussions with different institutions and experts it has been demonstrated that modern monitoring of air pollution is about to start as part of different research programmes in other organisations than EEAA. Data from these programmes could represent important input to the proposed future air quality monitoring programme for EEAA.

It remains to establish formal agreements between EEAA and other laboratories such as Atomic Energy Agency and The Cairo University CEHM project (see ch. 3.11). These are interested in a co-operation with EEAA to support the national air pollution network with data and information from air pollution networks outside EEAA. The programmes in question will perfectly fit into the proposed EIMP programme and will thus support and improve the national air pollution monitoring system for Egypt.

If the co-operation with these institutions fails, the total information on air quality will be reduced, and in some areas there will probably be a need for parallel measurements and double work.

For measurements in other areas co-operation within the field of local inspections, calibrations and maintenance may have to be established. For Alexandria the Institute of Graduate Studies and Research may be one candidate.

5.2.4 Air quality and important emission sources

Available air quality data reported in Appendix F and subjective information about major air pollution sources have also been used to select sites for the future monitoring programme in Cairo. One major source for air pollution in Cairo is definitely traffic. As stated in a study submitted to the Energy, Development and Environment Conference in Cairo 1994 (see Appendix P) 80 million kg of pollutants are emitted from vehicles in Cairo. Vehicle exhaust fumes represent 60% of the air pollution emitted into the Cairo atmosphere, which means that a considerably higher percentage of the population exposure stems from car traffic.

Other major source areas are the highly industrialised area Shoubra el Kheima north of Cairo. This represents a large area with various types of industries. Some of these are old type smelters with very high emission rates. Many of these emissions are at ground level or from low stacks.

The Helwan Tebbin area south of Cairo is another highly polluted area with 4 large cement factories, iron and steel , metal industries, power stations, coke , chemicals and fertiliser industries. The annual average dust emissions from the cement industries were in 1992 during normal operating conditions estimated to about 250 000 tons/y.

5.3 Proposed monitoring programme

The total continuously operated air pollution monitoring programme developed for EEAA by Danida should contain between 30 and 40 monitoring sites, dependent upon the availability of existing or planned monitoring sites by other institutions. A summary of a typical total monitoring system for Egypt has been presented and is shown in Table 5.1.

Table 5.1. : A typical monitoring programme for Egypt

		automatic monitors							sampler	
Sites/areas	**no**	**SO_2**	**NO_2**	**PM**	**O3**	**CO**	**HC**	**Met**	**SBS**	**PM**
Greater Cairo	11	6	5	5	2	3	2	3	8	5
Alexandria	4	2	1	2	1	1	1	1	2	3
Urban areas	9	6	5	1	1			2	3	5
Residential area	6				1				5	2
Industrial areas	8	2	1						7	4
Background.	1				1					1
Total number	**39**	**16**	**12**	**8**	**6**	**4**	**3**	**6**	**25**	**20**

This programme represents a comprehensive continuous programme for a country like Egypt. It will probably not be possible to operate the total programme only from one institution. However the responsibility for the daily follow-up, data collection and quality control should be placed in one laboratory.

In addition there will be a need for local inspections, calibrations and technical support, which will require a close co-operation with other laboratories and institutions and if requested a possibility for data exchange and data availability also at other laboratories than the responsible one and in EEAA.

One of these institutes could be the Institute of Graduate Studies and Research in Alexandria (IGSR) as referred to in chapter 3.15. For local measurements, calibration and controls of the monitoring programme in Alexandria and surrounding areas, this institute will take the responsibility and report to the central laboratory in Cairo. The same type of training as at the central laboratory will have to be undertaken for personnel at IGSR.

5.4 The Greater Cairo air pollution monitoring programme

5.4.1 The automatic monitoring programme

A total of 11 sites is being proposed for continuous monitors with data transfer daily via modems and telephone connections.

In our first proposal some of these sites will have to be operated by equipment belonging to other institutions such as Atomic Energy Agency and The Cairo University. The programme also require some co-operation with the Cairo University and Tebbin Institute for Metallurgical Studies (TIMS). The following sites is proposed for Cairo:

Site Name: **Azbakhaya**

Type of area: Street canyon

Objectives: To measure air pollution continuously in a street canyon of central Cairo.

Parameters: NOx-NO_2 , CO, NMHC (VOC), PM_{10} .

Air intake: About 4 m above the street inside the street canyon.

Comments: The site is operated by EMOHC

Site Name: **Attaba**

Type of area: Urban centre

Objectives: To measure air pollution continuously in a central location of Cairo. The site should be representative for the kilometre scale pollution over the city centre.

Parameters: NO_x-NO_2, SO_2, PM_{10}, dustfall.

Air intake: At the roof level of a 3 storey building.

Comments: The site is operated by EMOHC with a TSP Anderson type sampler at the roof.

Site Name: **Tahrir square / Egyptian Museum**

Type of area: Urban centre

Objectives: To measure air pollution continuously away from the street canyon in a ground based station in central Cairo.

Parameters: NO_x-NO_2, SO_2, O_3, CO, NMHC (VOC), PM_{10}.

Air intake: About 2 m above the ground in a shelter located inside the Egyptian Museum park area.

Comments: This site is planned by the Atomic Energy Agency, and will have to be operated by the Agency, supervised and in co-operation with the EEAA programme to obtain the same type of data quality assurance.

Site Name: **Embaba (residential)**

Type of area: Residential

Objectives: To measure air pollution continuously in a residential area in north western Cairo. In addition to being impacted by the general traffic emissions, this area might during some meteorological conditions, see impact from the northern industrialised areas of Shoubra el Kheima.

Parameters: NO_x-NO_2, SO_2, O_3, PM_{10}, dustfall and meteorological parameters; wind, temperatures, humidity, stability/ turbulence, radiation.

Air intake: For gases from the laboratory with intake about 3 m above the ground, PM_{10} and meteorology at the flat open roof.

Comments: The site is and will be operated by EMOHC

Site Name: **Embaba (road side)**

Type of area: Curb side station near a major road.

Objectives: To measure air pollution continuously at the curb side of a highly trafficated main road in Cairo to measure concentration due to moving traffic.

Parameters: NO_x-NO_2, CO, NMHC (VOC), PM_{10}.

Air intake: About 2 m above the ground near the pavement of the road.

Comments: The site will be operated by EMOHC

Site Name: **Faculty of Medicine, Ain Shams University**

Type of area: Urban/ Residential

Objectives: To measure air pollution continuously in a urban/residential area north east in central Cairo. The site should be representative for the kilometre scale

Parameters: NO_x-NO_2, SO_2(PM_{10} or TSP) and meteorology; wind, temperature, stability/turbulence, radiation..

Air intake: About 8 m above the ground. The present intake is only about 6 m from the curb side of a major road.

Comments: The site is operated by EMOHC. If any stations have to be changed or moved to other sites, this will have to go first. However, the site will be kept for meteorological measurements.

Site Name: **Nasr City**

Type of area: Residential area

Objectives: To measure air pollution continuously in the residential area of Nasr City in Cairo north east.

Parameters: NO_x-NO_2, SO_2.

Air intake: About 3 m above the surface away from major streets.

Comments: The site is operated by EMOHC

Site Name: **Maadi**

Type of area: Residential

Objectives: To measure air pollution continuously in the residential area of Maadi south of Cairo

Parameters: NOx-NO_2 , SO_2 , PM_{10} .

Air intake: About 3 m above the ground, away from streets.

Comments: The site will be established at the new EEAA offices or in the close surroundings of this.

Site Name: **Shoubra (elKheima south)**

Type of area: Industrial/residential

Objectives: To measure air pollution continuously downwind from the Shoubra elKheima area in some of the most polluted regions of Cairo.

Parameters: SO_2, NO_x-NO_2, VOC, PM_{10}, dustfall.

Air intake: About 3 m above the ground.

Comments: The site has to be established. One possibility is at a water treatment plant. The station may be operated by a complete instrumented container established by the Atomic Energy Agency. If this is not possible, the instruments from Faculty of Medicine will be placed here.

Site Name: **Tebbin**

Type of area: Industrial

Objectives: To measure air pollution and meteorology in the industrial area of Helwan/ Tebbin in the very southern part of greater Cairo area.

Parameters: SO_2, PM_{10},TSP, dustfall, meteorology, wind, temperatures, stability/turbulence, radiation.

Air intake: The station will be located at the roof of the Tebbin Institute of Metallurgical Studies (TIMS).

Comments: The site will be part of the studies undertaken in the highly polluted industrial area of Helwan/Tebbin. TIMS has operated measurements here before and the personnel at TIMS will be able to undertake local calibrations, maintenance and service.

Site Name: **Giza (Cairo University)**

Type of area: Residential open area.

Objectives: To measure air pollution continuously in en open area (kilometre scale) in the western parts of Cairo.

Parameters: NO_x-NO_2, SO_2, Ozone.

Air intake: From the third floor on the new chemistry building inside the Cairo University. The site is far away from streets and local sources.

Comments: The site will be operated by the University of Cairo; CEHM programme.

Site Name: **Giza (Pyramids)**

Type of area: Background

Objectives: To measure ozone on a background station outside the city area of Cairo, and also introduce air pollution measurements close the cultural heritage of the Pyramid site.

Parameters: Ozone.

Air intake: At 2 m above ground from a shelter located at the meteorological station near the Kufu pyramid.

Comments: The site has to be established, and the meteorological service who operates the meteorological station has to be contacted.

5.4.2 An upgraded sampling programme

In addition to the new automatic monitoring programme supported and installed by the Danida EIMP programme , some of the semi automatic and manually operated sampling stations should be upgraded and operated in the future.

These stations will give additional information and yield a more complete picture of the state of the environment. However, these data can only be reported months after the collection of samples, as they will have to be analysed manually in the laboratory, and quality controlled by experts. They will typically be part of an annual report and will be important input to the evaluation of long term trends and developments together with the more important data from the monitoring programme.

One new station of this type should be established in Salem City about 20 km north east of Cairo. This city have a population of about 1 million, and could represent a kind of reference station to the ones located inside Cairo. The parameters to measure here would be SO_2, NO_2 and PM_{10} (or TSP) and dustfall.

Another site that should be upgraded is the measurement station at Hawamdia. This site is located south west of Cairo, and could frequently be impacted by pollution from the big city. At this site also dustfall should be included.

At Abo el Ssaoud in old Cairo and at the site in western Shoubra el Kheima sampling of SO_2 and TSP could be continued with improved equipment.

5.5 Monitoring programme for Alexandria

The site visits to all possible monitoring sites in Alexandria has not been fulfilled yet. Another study has to be undertaken in October-November 1996.

However, it is clear that there will have to be 3 or 4 automatic monitoring stations in Alexandria.

The city centre site could well be covered by one station at the Institute of Graduate Studies and Research on Abdel Nasser street in central Alexandria. At this site we should monitor SO_2 (even if there seems to be rather low concentrations of SO_2 in this area) NO_2 , PM_{10} and possibly meteorology at the roof of the building.

Another site could be in the ElMax area at Wadi Al Quamar, where the High Institute of Public Health today is running a manually operated sampling station for TSP, and occasionally SO_2 and NO_2 .

The automatic monitoring stations in Alexandria could also be supported by semi-automatic samplers for chemical analyses in the laboratory. There are experienced laboratories for this kind of analyses in Alexandria. However, none of these are operating ion chromatographs, which would be needed for SO_2 analyses.

6. Field equipment

6.1 Type of equipment needed

Various type of equipment must be purchased for the air pollution monitoring programme. The main elements are:

- Air quality monitors for gases
- Air pollution samplers for suspended particles
- Air pollution samplers for selected gases and dustfall gages
- Meteorological equipment (Automatic weather stations)
- Data loggers and data transfer systems
- Telephone lines and modems
- Computers in field and at the central data collection unit
- Calibration equipment and spare parts
- Some additional analytical laboratory equipment
- Monitoring station facilities; benches, shelves, air-condition, power, air intake facilities etc..

Some of the equipment already in use in Egypt can be used in the future air pollution monitoring programme. A discussion of quality of the sampling equipment inspected at the present EMOHC laboratory monitoring programme can be found in the site study reports.

A complete report in equipment needs with lists including procurement specifications as shown in Appendix N for SO_2 will be developed.

6.2 Monitoring station facilities

At some of the monitoring sites selected for the future monitoring programme some of the facilities needed are already available. However, the sites have to be re-visited before installation of expensive equipment.

Each monitoring site should be secured and have (preferably) an air conditioned room, or a place where the room temperature do not exceed 30-35 degrees C.

Power (220 V) and telephone lines have to be available. Power is normally a small problem. However, new telephone lines have to be ordered and installed at all sites. These also have to be secured and made unavailable for private use.

In some cases a small shelter may have to be built or purchased if available in Egypt. A typical layout for Nordic conditions is shown in Appendix S for indication of size and dimensions. The availability for shelters or containers included delivery conditions and prices will have to be investigated later.

All air intakes have to be standardised and facilities for this will be specified and prepared before the first installation.

6.3 Local sales representatives

For most of the equipment needed for the air pollution monitoring programme in Egypt local sales representatives exists in Egypt.

These representatives will be contacted concerning delivery conditions, training, future services and guarantees.

A list of local representatives for air quality monitoring equipment in Egypt is shown in Appendix O together with one typical set of monitors and data acquisition system available on the marked.

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USAID PROJECT NO 263 - 0140 / 3

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Environmental Pollution Prevention Project (EP3)

Ahmed Gamal Abdel Rehiem, Ph.D.
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Appendix B

Briefing note

BRIEFING NOTE FOR EIMP ACTIVITIES IN THE PERIOD 22 JAN TO 17 APRIL. 1996
17-04-96

1 COASTAL WATER MONITORING

- working relations established with National Institute of Oceanograpy and Fisheries
- survey of potential monitoring sites (41 covering the full coastline of Egypt)
- survey of NIOF facilities. equipment and capabilities (i.a. Quality Assurance) in Alexandria. Suez and Hurghada
- preparation of strategic water sampling programme (major pollution sources - baselines. sampling frequencies and parameters for analysis
- review of equipment lists and preparation of budgets
- preliminary assessment of areas for training QA
- identifiaction of database requirements
- preparation of work plan for year 1

Spesifikasjoner

Main documentation: "End of Mission Report"

2 AIR POLLUTION MONITORING

- assessment of the capabilities and facilities of the Environmental Monitoring and Occupational Health Centre. Imbaba
- visits to air pollution knowledge centres (i.a. NRC)
- preparation of preliminary air sampling programme
- preparation of preliminary equipment lists and budgets
- identification of database requirements
- preparation of work plan for year 1

Main Documentation: Work Plan

3 POINT SOURCE DATABASE MONITORING

- assessment of capabilities and facilities of Tabbin Institute for Metallurgical Studies (TIMS)
- assessment of General Organization for Industrialization (GOFI)
- assessment of Federation of Egyptian Industries (FEI)
- planning of database structure. hardware and software needs
- identification of database requirements
- preparation of work plan for year 1

Main documentation: Work Plan

Licence documentation bare industrien / ikke vassverk og petroleum
Energy Institute har laget national energy balance
Greenhouse gas

4 REFERENCE LABORATORY

- establishing working relations with National Research Centre (NRC)
- ~~preparation of equipment lists and budgets~~
- identification of space at NRC for reference laboratory
- preliminary identification of areas for training

Main documentation: "End of Mission Report"

Equipment list lages v/ VKI..

5 INSTITUTIONAL SUPPORT

- preparation for establishment of Committees and Working Groups
- initial work on contracts with monitoring institutions
- planning of database structures
- assessment of hardware and software needs
- specification of hardware and software
- purchases of immediately needed hardware and software
- development of office databases and filing systems
- development of programme document systems

Main documentation: "Data Management Requirements" and implemented office systems

6 PROCUREMENT

- preparation of guidelines for procurement including Preparation of Documents. Queries. Evaluation and Award. Expediting and Final Control
- considerations regarding "Green Procurement"

Main Documentation: "End of Mission Report".

7 PROJECT MANAGEMENT AND ADMINISTRATION

- cooperation with EEAA
- coordination activities and liaison with CIDA. USAID and other donors initiated
- coordination with OSP and EETP
- overall control of programme activities
- planning and supervision of staff activities
- financial control and budgetting
- employment of financial officer and executive secretary
- running-in of computer accounting procedures and office routines
- setting up communication (E-mail. phone and fax) and logistic support
- preparing office facilities

8 FACTORS ENHANCING PROGRAMME DEVELOPMENT

- EEAA has been given approval of substantial staff increases (27 at management level and several more at sub-management level)
- EEAA is implementing the planned organization
- EEAA is legally supported by the 1994 Law and the Executive Regulations
- the Environmental Fund can be used to cut red tape in certain situations
- ~~EEAA has substantial donor support~~
- data aquisition will take place through the monitoring institutions' contract work
- Danida and CIDA programmes complement each other and the high activity level will create more momentum

jmh/17-4-1996

Appendix C

Paper presented in Alexandria

Air Quality Monitoring and Information System for Egypt

Bjarne Sivertsen
EIMP
Task Manager Air Quality

Presented at the PRTR Workshop
Alexandria Egypt
20 - 23 May 1996

EIMP Programme, 3 Abdel Aziz Selim street, Mohandessin, Cairo
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Air Quality Monitoring and Information System for Egypt

Bjarne Sivertsen

1. A modern Air Quality monitoring system

The Guidelines for the UNITAR Pollutant Release and Transfer Register (PRTR) specifies that programmes should be conducted by industries and by research institutions to provide adequate information on emissions and the status of the ambient environment. The modern air quality monitoring system to be developed together with EEAA represent such a programme. The main goal which is to detailed map the air quality in Egypt, will also provide valuable basic information to authorities and to the public.

The key features of the modern environmental information system is the integrated approach that enables the user in a user friendly way to not only access data quickly, but also use the data directly in the assessment and in the planning of actions. The demand of the integrated system to enable monitoring, forecasting and warning of pollution situations has been and will be increasing in the future. The data will also be used for generating new indicators that directly relates to health impacts. This will require that numerical dispersion models for air pollutants are available with on-line data input as a part of the system in urban areas.

1.1. Main objectives

A main objective of the modern environmental surveillance platform is to enable direct data and information transfer and obtain a more or less direct and remote quality control of the data collection. This will require that a new sensor technology or that the classical way of monitoring the quality of the environment is being modified. Several monitors and sensors are already available on the market that makes on-line data transfer and control possible. For several other compounds and indicators this is not the case.
A modern monitoring system will meet the requirements and objectives of the main users, which are to:

- Provide information on how much air pollution the population is exposed to,
- Establish a basis for strategies to reduce air pollution,
- Estimate environmental impacts from present and future developments.

---

2. Technical features of the system

Several Air Quality Surveillance systems are presently being developed and have been demonstrated in selected areas in Europe. One such system ," ENSIS '94; an ENvironmental Surveillance and Information System ", was developed under the Eureka umbrella for the Winter Olympic Games in Lillehammer.

The ENSIS concept has later been further developed into an AirQUIS module for air pollution surveillance, a WaterQUIS module for water pollution, and similarly modules for noise, for materials and building deterioration etc. The different modules are all operated in the same main framework and can be integrated to a flexible total system.

For the EIMP project parts of the AirQUIS modules will be used to establish the Air Quality monitoring and information system for Egypt.

The modern system will include:
- Data collectors; sensors and monitors,
- data transfer systems and data quality assurance/control procedures,
- data bases included emission and discharge modules,
- user friendly graphical presentation systems included Geographical Information Systems (GIS),
- a decision support system
- data distribution systems and communication networks for dissemination of results to "outside" users.

All these elements will be part of the monitoring system for Egypt. One important part will be missing in the EIMP project. In this phase we will not include statistical and numerical models (included air pollution dispersion models and meteorological forecast procedures). Numerical dispersion models can be added later, dependent upon which areas are defined for modelling purposes.

3. Meteorological data

Meteorological data represent an important part of the input data to a system that is going to be used for information, forecasting and planning purposes. Meteorological data are also important for explanatory reasons together with climatological data. Meteorological data are needed from the surface, normally collected along 10 m towers, and up to the top of the atmospheric boundary layer. Automatic weather stations (AWS) are currently being used in most larger field studies and in remote areas and in complex terrain. Meteorological "surface data" such as winds, temperatures, stability, radiation, turbulence and precipitation are being transferred to a central computer via radio communication, telephones or satellites.

For the EIMP project meteorological stations will be included and selected so that they will represent wind and dispersion conditions for larger areas surrounding the sites. Meteorological data from the Weather service will also be used to study representativity. However, standard climatological data are normally not adequate to describe dispersion, turbulence and thus explain the air pollution situations.

4. Environmental indicators

The selection of parameters to include in the monitoring programme should enable an automatic access to data relevant for assessing the environment included air pollution and atmospheric conditions, pollution of rivers and seas, ground water, waste, noise and radiation. For all these environmental compartments there should be a set of environmental indicators.

An indicator can be a single variable of sufficient sensitivity to reflect changes in the status of the environment. An indicator can also in some cases be a value derived from a set of independent variables in the system. From the selection of indicators it should be possible to estimate trends and developments. They should also represent the basis for evaluating impacts on human and the environment. They should be relevant for decision making and they should be sensitive for information and warning issues.

The selected set of environmental indicators will be used by local and regional Authorities as a basis for the design of measurement programmes and for reporting the state of the environment.

The establishment of environmental indicators will help to:

identify the quality of the environment,
quantify the impact ,
harmonise data collection,
assess the status and the rate of improvement/deterioration,
identify needs for and support the design of control strategies ,
support input to management and policy changes.

The indicator should represent the "pressure" on the environment and include both background indicators and stress indicators. So-called response indicators are selected to reflect the societies awareness or response to its surroundings.

The indicator should;

provide a general picture,
be easy to interpret,
response to changes,
provide international comparisons,
have a target or threshold value to provide a basis for assessment,
be able to show trends over time.

It should also be possible to measure within a reasonable accuracy and price. It should be adequately documented and linked to public awareness; health impact, building deterioration, vegetation damage etc.. Selected indicators should response to mitigation actions to prevent human made negative impacts on the environment.

5. Data transfer and quality assurance

Specially designed data loggers for environmental data are available. Dataloggers designed and built by NILU are suitable in the Air Quality monitoring system for Egypt. The logger is directly linked to a modem.

Data transfer can be via local radio communication for limited distances. Data will further be transmitted on public telephone lines or via satellite to the main computer facility. The central unit might be a major field station or a central laboratory.

Data quality assurance programmes included direct quality control is performed at different levels in the data collection process;

- in field during automatic and manual calibrations and controls,
- at the central data collection base following quality assurance routines as described i.e. in ISO 45001 from the International Standardisation Organisation,
- in approvals to the final data base,
- through simple statistical and graphical evaluations to check validity and representativeness of data.

The quality control procedures give the data respectability which means that for most purposes they can be believed. The data become reliable, which is the key for using the data for reporting, controls and planning. To be used properly for scientific and environmental management purposes the data must also be comparable and compatible.

Integrated data from local sites and from various environmental compartments require comparable data quality. The various local networks have to operate to high standard including proper implementation of good practice by network managers and site responsible personnel.

6. The data bases

The development of an associated database or metadata is important to all modern environmental monitoring and information systems. The database system may consist of several databases which have to serve as a main storage platform for:

- on-line collected environmental data,
- emission and discharge data included emission modelling procedures,
- historical data and background information like area use, population distributions and trends,
- regulations, guideline values and information on the support and decision making process.

The data bases contain information to enable an evaluation of the actual state of the environment and it include data for establishing trend analyses, warnings and to undertake countermeasures in case of episodic high pollution.

6.1. The on-line data base
All data collected on-line will after quality assurance and controls be part of the information data base. From this base it will be possible to obtain quick graphical presentations, or to subtract data for public information purposes etc...

6.2. The Emission data base
The emission data base is an interactive platform for collecting input data for emission estimates. It contains information about the sources, emission factors, consumption data, information on locations (gridded co-ordinates), stack heights, stack parameters, fuels etc. The emission data base can be operated directly by the user, who can use the emission models directly to present emission data directly. Any changes and additions to the emission data base will result in updated emission estimates with links to the dispersion models and resulting database for graphical presentation.

6.3. Historical and background data base
The historical and background data base module includes relevant objects and information such as monitoring stations and sensors, sensor developers, responsible institutions, locations and measurement schedules, methods, data owners, maintenance routines etc..
It also contain information about earlier and additional environmental data collected in the area. Background information such as area use, population distributions and inventories of vegetation and materials/buildings in the area may be important part of this database. Such information can be used for impact assessment estimates and for some of the emission estimates.

6.4. Supporting data base
The supporting data base, which may be part of the background data base contains information on regulations, requirements, air quality guideline values or water quality standards for various applications.
Information about regulations and plans given by local authorities or by governmental bodies should be included in this database, as well as support actions and emergency procedures.

The total associated database system will also serve as a link to a meta information system which include information on external environmental data. These functions might also include:

- navigation facilities to access the needed information,
- support for standardisation activities,
- world wide web/ internet functions and bridges.

7. Data presentation; graphics and GIS

Environmental data collected through the automatic monitoring and telematic network will be quality controlled and transferred for storage in the integrated relational databases. Statistical programmes for control of quality and representativeness will be used, and the first results can within one hour after field collection be presented using user-friendly graphical tools.

The information may be multimedia: texts, tables, graphs, images, sound or video dependent on the end user. The presentations have to be designed to meet the user needs. These users may be:

- authorities at different levels (municipal, regional, national, international),
- industrial users,
- schools, universities and the scientific community,
- various organisations,
- the public and media.

The environmental data are usually linked to geographical sites. In particular when monitoring data are supported and supplied by model estimates of spatial concentration distributions and impacts, it is suggested that the presentation of the results would involve the use of maps or digitalized Geographical Information Systems (GIS).

8. Environmental information to the public

A wider distribution of environmental data to the public has become a part of the development of modern environmental surveillance and information systems. New approaches have been developed for dissemination of environmental information which can be adapted to different information distribution systems. These systems could be teletext, public telephone network, special designed health advice information lines, telefax distributions, INTERNET networks etc..

Information of air quality in urban areas have been issued to the public on a daily basis described in terms of "very good", "good", " poor" etc. Some European cities already are providing this type of information. The modern information system will focus more on variable messages and more updated access to the data through teletext or Internet applications.

UNITAR
PRTR Pilot Studies

- Background information
- Regulatory infrastructure
- Administrative infrastructure
- Programmes included emission and ambient monitoring

EIMP project

EIMP - The Arab Republic of Egypt

- **Objective**
  - to establish national air pollution network
  - co-operation with EEAA
  - approved by EEAA
- **First Phase**
  - screening of existing air pollution network
  - air pollution sources and major problems
  - prepare list of procurements
  - design monitoring programme

EIMP project

EIMP -

Air quality monitoring in Egypt

- **Select sites based upon**
  - sources and known impacts
  - meteorological / climatological data
  - objectives and strategies
- **Select pollutants**
  - typical sources
  - air quality standards and regulations (max limits)
- **Select equipment**
  - continous monitors
  - automatic samplers
  - hand held passive samplers
  - etc..

EIMP project

First phase programme

- **Job descriptions**
- **Analyze existing data**
- **Select representative sites**
- **Define site characteristics**
- **Select air pollution indicators**
- **Select sites for meteorological measurements**
- **Specify meteorological data**
- **Specify and prepare list of equipment**

EIMP project

Environmental indicators

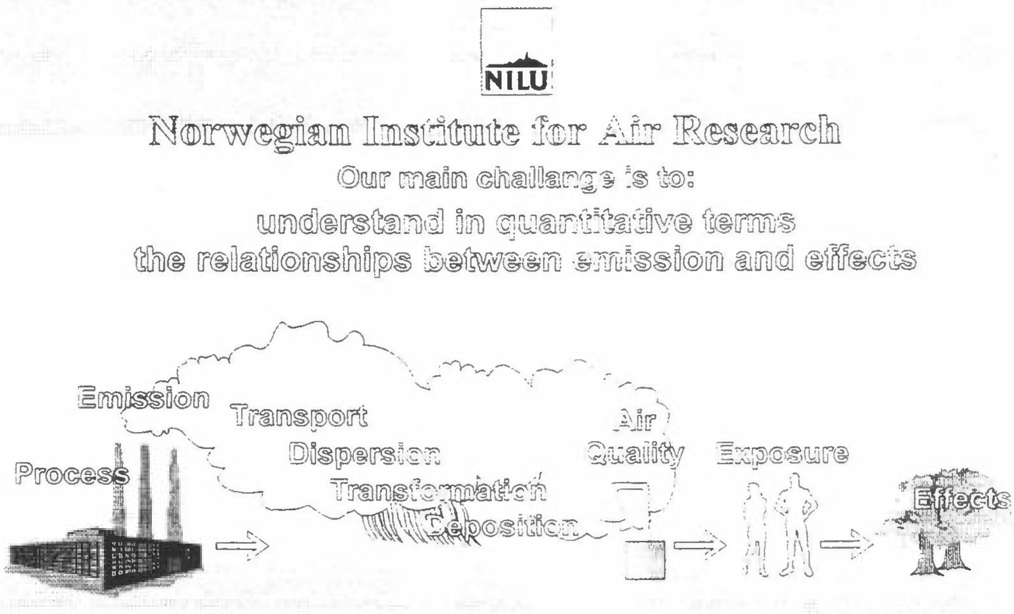
Will help to:

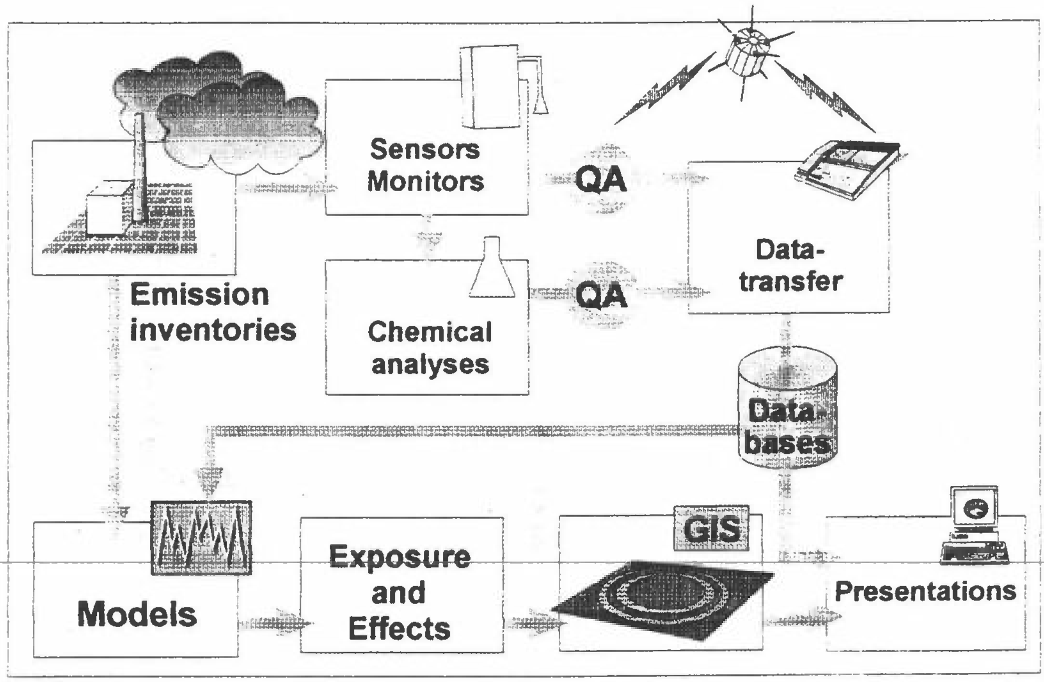
- ➔identify the quality of environment
- ➔quantify the impact
- ➔harmonise data collection
- ➔assess state and improvement
- ➔identify needs for control strategies
- ➔input to management and policy changes

Environmental indicators

The indicator shall:

- ➔provide a general picture
- ➔be easy to interpret
- ➔response to changes
- ➔provide international comparisons
- ➔have a target or threshold value
- ➔be able to show trends over time


NILU
Norwegian Institute for Air Research
Our main challange is to:
understand in quantitative terms
the relationships between emission and effects
Emission
Transport
Process
Dispersion
Transformation
Deposition
Air
Quality
Exposure
Effects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QA
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Data-
transfer
Emission
inventories
Chemical
analyses
Data-
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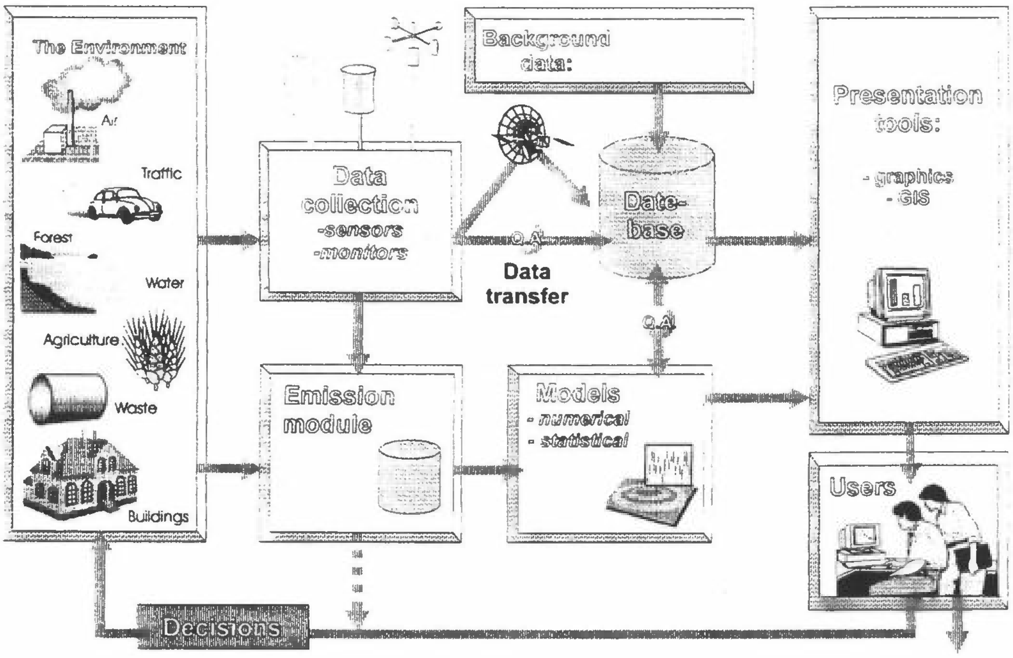
Models
Exposure
and
Effects
Presentations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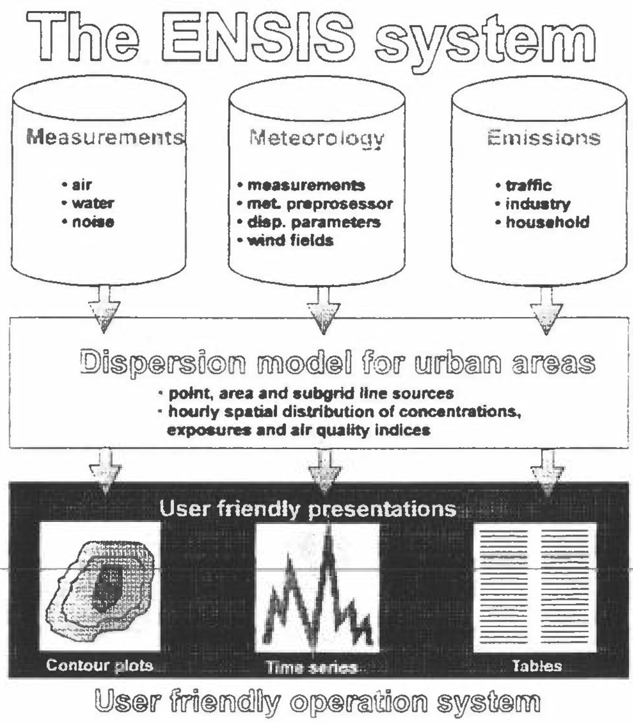
Air
Traffic
Forest
Water
Agriculture
Waste
Buildings
Data collection
-sensors
-monitors
Background data:
Q.A.
Data transfer
Data-base
Q.A.
Presentation tools:
- graphics
- GIS
Emission module
Models
- numerical
- statistical
Users
Decisions


The ENSIS system
Measurements
• air
• water
• noise
Meteorology
• measurements
• met. preprosessor
• disp. parameters
• wind fields
Emissions
• traffic
• industry
• household
Dispersion model for urban areas
• point, area and subgrid line sources
• hourly spatial distribution of concentrations, exposures and air quality indices
User friendly presentations
Contour plots
Time series
Tables
User friendly operation system

AirQUIS

AirQUIS-Emissions	• Consumption • Emission factors • Inventories (industry - energy - traffic)	
AirQUIS-Monitoring	• Air Quality Database • Graphical presentations (GIS)	
AirQUIS-Wind	• Meteorological preprosessor • Wind field models	
AirQUIS-Models	• Subgrid models • Street and road models • Urban scale models	
AirQUIS-Statistics	• Maxima, minima, average concentration • Procentiles • Cumulative frequency distributions	hourly estimates
AirQUIS-GIS	• Maps • Topography • Urban sub areas	dynamic use of maps
AirQUIS-Effects	• Population exposure • Impact on materials and buildings	

A typical air quality monitoring programme for Egypt

		automatic monitors							sampler	
Sites/areas	no	SO_2	NO_2	PM1	O3	CO	thc	Met	SBS	PM
Greater Cairo	11	6	5	5	2	3	2	3	8	5
Alexandria	4	2	1	2	1	1	1	1	2	3
Urban areas	9	6	5	1	1			2	3	5
Residential area	6				1				5	2
Industrial areas	8	2	1						7	4
Background ar.	1				1					1
Total number	39	16	12	8	6	4	3	6	25	20

EIMP project

Appendix D

Mohammed Ebrahim Refaye El Amawi CV and project proposal

C .V .

Name : Mohamed Ibrahim Refaye El Amawi

Date if Birth :16/ 08 / 1954 .

Place Of Birth: Kalyoibia .

Home Address :Cairo,El Salam City,Cairo waw (9) Zone Blk :12 Entrance : 3, Flat No. 12,

Post :Chemist in Air Pollution Lab. (1982-1990)

Senior of Air Pollution Lab.

Director of Air Pollution Lab.&National Network For Air Pollution Monitoring (1994 - Now).

Office Address :Centre of Environmental & Occupational Health. Ministry of Health . Giza ,Imbaba,1 AlTair Fekry St., Tel:3119691 .

Qualifications & Training Courses :

* B.Sc. Fac. of Sc. Ain Shams Uni. Very Good (1979).
* Master of Public Health Scs.,Majoring Occupation Hygiene and Air Pollution. High Institute of Public Health, Alexandria Uni., Very Good (1994).
*Air Pollution Control Course, Osaka,Japan.June-Oct. (1990).
* Workshop about Environmental Impact Assessment, by CIMARP held in Ismalia ,

R ponsibility :

*Choose the site of sampling of air pollutants& collecting of samples
*Investigate any complain abiut air pollution in Egypt .
* Chemical & Statistics analysis of samples,data &results Presentatic
* Focal Point for GEMS, WHO, in Egypt.
* Supervisore of National Air Pollution Monitoring Network in Egypt.

Title :

" Study of some polynuclear Aromatic hydrocarbons Emitted from autoexhaust to Greater Cairo atmosphere "

A protocol submitted to the Faculty of Science, University of Cairo, For the degree of Ph.D. in Environmental Chemistry (Air Pollution)

Name : Mohamed Ibrahim Refaye El Amawie.

Qualification :

(1) B.Sc., Biology Dept., Ain Shams University, 1979

(2) Master Degree of Occupational Hygiene and Air Pollution.

Title of Master :

" Evaluation of the Environment Inside the Buses of the General Organization for Public Transportation of Alexandria Province " Dept. of occupational Hygienc, High Institute of Public Health.

Alexandria University, 1994.

Introduction :

Motor vehicles play an important role as one of the major Air pollution sources in urban areas especially in large cities.

Motor vehicles emission contain a large amount of suspended particulates. This particulates contain varieties of Hydro-carbons. Among these compounds are polycyclic aromatic hydrocarbons (PAH). PAH are a group of chemicals that are present in the environment in very small quantities, due to traffic and industrial activities.

PAHs contain a large number of carcinogenic compounds such as benzo (a) Pyrene (BaP), and didenzo pyrene derivatives.

Also, polychlorodibenzo- P. dioxins M(PCDD) and polychloro dibenzo-furans (PCDF) have been detected in motor vehicles exhaust. Sometimes PAHs are detected in air, which comprise for example, 2- nitrofluorene, 9- nitroanthracene, 7- nitrobenz(a) anthracene and 6- nitrobenzo(a)pyrene.

The exposure to these poltutants for long periods of time could cause a bad health effects.

Aim of the Work :

Investigations in this work are destined to the study including detection, estimation and carcinogenic related to PAHs which are emitted from motor vehicle in ambient air in Greater Cairo.

Research Plans :

(1) Site of Sample

Four site will be chosen to represent the following :

(a) A city center which represent a heavy traffic density with congested traffic especially those area containing high buildings, which lead to accumulation of some pollutants in the atmosphere.

(b) Road traffic in high ways (desert roads) site represents an open area characterized with high ways traffic (Desert Road).

(c) A small village near Cairo which has a small number of traffic.

(d) Control site will be considered either in a farm or desert.

(2) Sampling Periods :

The time factor will be studied on monthly and season bases.

(3) Measurement of total suspended particulates in different sites, days and seasons.

(4) Meterological parameters will be under taken from general organization of Meteorological Monitoring.

Supervisors :

(1) **Dr. Abdel Razek Abdoh El Sirafy** A.A. Elsirafy 9/10/95

(Assoc. Prof., Analytical Chemistry, Chem. Dept., Fac. Sc., Cairo University).

(2) **Dr. Alia Abdel Shakour.** Dr. Alia A-Shakour 11/9/95

(Prof. Air Pollution, National Center Research (NCR).

(3) **Dr. Seham Hindy.** Dr. Seham M. H. Hendy

(General Director center of Environment Monitoring, Ministry of Health, M.D. in Community Environmental and Occupational Medicine.

References ;

(1) Kersten. W; Reich. T; " Air Pollution by polycyclic aromatic Hydrocarbons (PAH) in the city of Hambury " Govt Reports Announcements and Index (GRA & I), lusse 21 (1993)

(2) Ege. Joergensen. C; Jeppesen. S; "Traffic and Health an Account of Health efpects connected with Air Pollution from Traffic " Govt Reports Announcement and Index (GRA & I) Issue 05, (1993).

(3) Peterson. MR; Naugle. DF; Berry-MA, " Indoor Air-Assessment: Methods of Analysis for Environmental Carcinogens " ~~Govt Reports Announcements and Index (GRA & I) Issue 08 (1991).~~

(4) Gundel. LA; Daisey. JM; Mahanama-KRR; Lee-VC; Stevens-RK " Polycyclic Aromatic Hydrocarbons in Indoor Air and

Environmental tobacco smoke measured with a new integrated organic vaporparticle sampler, Revision " (GRA & I), Issue 01, (1994).

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(6) El Amawi, M.I.R. " Evaluation of the Environment Inside the Buses of the General Organization for Public Transportation of Alexandria Province " Master thesis of Public Health Sciences, H.I.P.H Alexandria University (1994).

(7) " Encyclopaedia of Occupational Health and Safety " Vol.I.P. 102 - 104, Vol.II. P. 1755 - 1758, 3rd edition ILo, Geneva (1983).

Norsk institutt for luftforskning
Norwegian Institute for Air Research

PROJECT PROPOSAL

Date : 9 June 1996
Ref. : P 811
Author : B Sivertsen

Training visit to NILU Chemical laboratory for Mohammed J Refaye

1. Background

Mr Mohammed J Refaye is part of the team at the Environmental Monitoring and Occupational Health Centre in Imbaba. This centre has been appointed monitoring institution for the Environmental Information and Monitoring Programme (EIMP) supported by Danida for the Egyptian Environmental Affairs Agency (EEAA).

As part of the training Mr Refaye has requested a 6 weeks training visit to the Norwegian Institute for Air Research (NILU) at Kjeller Norway. NILU is one of the leading air pollution laboratories in Europe with responsibility for the European Monitoring and Evaluation Programme (EMEP) and part of the Topic Centre for Air Pollution in the European Environmental Agency (EEA).

2. Objectives

The main objectives for the visit to NILU is to receive training in modern laboratory systems and to perform analyses of various air pollution samples.

Filter samples will be brought from the Cairo air sampling network to be analysed for PAH compounds and for selected heavy metals.

Training in the analyses of passive samplers for SO_2 and NO_2 will be given as well as the use of impregnated filters for SO_2 and NO_2 sampling, included preparations and analytical procedures.

3. Time schedule

The visit will be undertaken as soon as funds are made available. The training at NILU will last for 6 weeks.

4. Cost estimate

The cost estimate is based on 6 weeks tight follow up at NILU, training by experienced international air pollution experts and the use of the modern NILU laboratory equipment.

Travels	6.000,- NOK
Accommodation	50.000,- NOK
NILU support, training by experts	114,000,-NOK
Various analyses and equipment	16.000,- NOK
Total budget	185.000,- NOK

The total amount is equivalent to about 28.000 US dollars.
The cost estimate is based on NILU's prices for 1996.

Appendix E

Job descriptions for the Air Pollution Monitoring Laboratory and EEA Counterparts

Job descriptions
Air Pollution Monitoring laboratory

The Air Pollution Monitoring laboratory will consist of two types of experts:

a) Experts to take care of the automatic monitoring programme consisting of on-line data transfer to a central computer at the monitoring laboratory.

b) Experts to take care of sampling units for gases and particles, from which samples are carried to the lab. for wet chemical analysis or gravimetric measurements.

Experts to the on-line monitoring system

Position: **Head of Air Pollution Monitoring Laboratory**

Responsibilities and duties

Manage, plan and be responsible for the air quality monitoring programme included reporting.
Participate in the planning and establishment of the air quality monitoring system for Egypt.
Update and maintain the quality of the monitoring system and be responsible for adequate operation and good quality of the collected data.
Be responsible for contacts to EEAA, and report the results to EEAA and to other organizations,
Assign duties to appropriate members of the staff and ensure that necessary equipment, spare parts and facilities are available.

Qualifications:

University degree (PhD) with at least 5 years of experience in scientific oriented work or a Sivil Engineer/ MSc with at least ten years experience. Preferably the person should also have experience in management and some background related to environmental issues.

Position: **Senior engineer (MSc:), data responsible**

Responsibilities and duties

Responsible for the daily data retrievel, data quality control and data transfer to the final data base. The person will be responsible for following up daily routines in the laboratory, reporting all errors and mistakes, check data, prepare print outs, introduce calibration factors and correct data

Qualifications:

Engineer or MSc with computer experience, mathematical/ statistical background . He/she should also have some technical knowledge or background in environmental sciences.

Position:	**Technicians/ engineers (at least 6 persons)**
Responsibilities	Each expert will be responsible for a number of specified sites/stations. Daily check and control of field monitors, field calibrations, repair of equipment, contact with local station keepers. They should be available for quick repairs in case of problems.
Qualifications:	Engineers, electronic/technical and/or chemical background with technical and some mechanical insight and interest. They have to have experience from measurement techniques, field work or other instrument oriented practical work. All these persons will undergo onthejob training during the establishment of the programme.
Position:	**Calibration lab responsible engineer or MSc**
Responsibilities:	Have the overall responsibility in the Monitoring lab. calibration room for repair, calibration, updating of equipment, support, reference gases and contact to the international expert organizations for intercalibrations and reference controls.
Qualifications:	Electronic or chemical engineer/ MSc with at least 5 year experience in instrumentation, monitoring or instrument controls.

Experts for the chemical lab

Position:	**Analytical chemists (3 persons)**
Responsibilities	To prepare samples, undertake analyses and calibrate instruments, correct data, preparae and impregnate filters, evaluate results.
Qualifications:	At least MSc degree in analytical chemistry. At least one person with more than 10 years experience in a laboratory, preferably used to handle low concentration environmental samples.

Position: Laboratory assistants (2 persons)

Responsibilities: Clean , wash and prepare equipment for field use and for laboratory analyses. Prepare filter holders and various work in the lab.

Qualifications: Some experience from laborarory work.

Air Pollution Monitoring Laboratory Staff

Available experts indicated by the EMOHC laboratory in Embaba, May 1996.

Positions are in reference to the EIMP specifications presented in the job descriptions dated 14 March 1996.

1. Head of laboratory: Dr. Seham M.H. Hendy (PhD)

2. Senior Engineer: Mr Mohammed J Refaye El Amawi (MSc.)

3. Technicians: Mr Moshil (Michael) (BSc. Physics)
Mr Saper
Mr. Mahdi
Mr Torec

4. Calibration lab. responsible: Mr M. J. Refaye El Amawi (MSc)

5. Analytical chemists: Mrs Kamala (BSc)
Mrs. Samia
Mrs Amira

6. Laboratory assistants: Mr Ahmed Fausi
Mr Ismahil
Mr Bahid
Mr. Aloe?

Position 2 will have as main responsibility data retrieval and quality control. This person should be a data expert. Mr. Refaye will probably not have relevant background.

Air Quality Laboratory staff 11.06.96

For **position 3** we have requested at least 6 experts. They will be trained in monitor checks, calibrations, repair etc.. and have to be well qualified technicians. They should have electronics and technical background.

Position 5 personnel should have at least MSc degree, and one person should have at least 10 years experience in chemical laboratory, preferably low concentration environmental samples.

The key personnel in the future monitoring laboratory will be

a) The head of the Monitoring section of the Lab., who will be responsible for data quality control and assurance, contacts to EEAA, update and maintain the quality of the monitoring system and assure good quality of the data transmitted to the outside world.
b) The data responsible senior engineer, who will be responsible for the daily data retrieval and quality controls, prepare print outs, check data, introduce calibration factors etc..

I believe that both these two positions will have to be found outside the present Embaba laboratory.

Note

Subject	Job Descriptions for EIMP Counterparts in EEAA Air Pollution Monitoring Programme
Date	18 Jun 1996
To	Dr. M. El Zarka
Copy	
From	Jan Hassing

Environmental Information and Monitoring Programme

EEAA - Danida - COWI

3, Abdel Aziz Street
Mohandessin, Cairo, Egypt

Tel.: +202 361 5085
Fax: +202 361 5085

E-mail: eimp@intouch.com

1 Air Pollution Monitoring Counterpart

Position title: Air Pollution Monitoring Specialist

Rank of position: Senior specialist reporting to head of Department of Environmental Quality

Responsibilities:

You will be responsible for managing the day-to-day operation of EEAA's responsibilities for establishing and operating an air polltion monitoring system for Egypt. You will bridge periods when the Air pollution monitoring programme task manager is not in Egypt. The EEAA use and distribution of air quality information, analyses of data and description of cause relationships will represent an important part of the future tasks.

The analysis of air quality data from the network collected and quality controlled by other laboratories under contract to EEAA will be your responsibility. The received data is to be compiled in an integrated database system within EEAA, and summarised in periodic reports on the state of the Egyptian environment.

Duties

Planning and coordination of EEAA's air pollution monitoring programme. The duties include coordination with other institutions, ministries and internationally-sponsored projects.

Preparation of technical Terms of Reference for contracts with the air quality monitoring laboratory and co-operating institutes. These Terms will describe in detail the work to be done, methods to be used, and quality control procedures to be followed by the contractors.

Supervision of the performance of contractors, including review of progress reports, acceptance of data and other results. Participate in the procurement prosess.

Preparation of written reports, in Arabic and English, which summarise the results of EEAA's air pollution monitoring programme including statistical and graphical summaries of collected data, and descriptive interpretations of the results.

.

Assist the air pollution monitoring institutions to identify the details of the programme, to select monitoring sites and to establish contracts with site owners. Supervision and training of staff on data collection, analysis methods and quality control procedures.

Work with database technicians to design, implement and maintain EEAA's air quality database.

Professional development associated with the position

This position is closely associated with an internationally-sponsored programme for development of EEAA's air quality monitoring and data collection capabilities. The person in this position will work closely with one or more international experts on air pollution monitoring and data management, who will provide advice and training in the development of methods and reporting procedures for the use of the air pollution data .

Qualifications

Education and experience: Masters or PhD degree in the geophysics (meteorology) or environmental sciences , with at least five years professional experience.

Expertise: Background should include familiarity with the air pollution emission sources, causes and impacts of air pollution. Some training in geophysics or meteorology, experience from dispersion modelling and/or some basic knowledge in basic inorganic and organic chemistry. Experience with air pollution measurement and analytical techniques will be an advantage. Some background in environmental data management and the background for the establishment of air pollution guidelines or criterias will be required.

Computer experience: Experienced user of PC word processing and spreadsheet software, and familiar with database management concepts. Experience with database software will be an advantage.

Appendix F

Selected air quality data from EMOHC laboratory in Embaba

Air quality data (SO_2)
Greater Cairo area 1995

	Measurement site	U T M coord.		SO2 concentrations (ug/m3) mean	max.	st.d.	valid obs.	(%)
1	Azbakkia			30,8	116	29	59	16,2
2	ElSaheil			6,5	19	6	28	7,7
3	Nozha			18,9	111	21	217	59,5
4	Nasr City			10,7	105	15	176	48,2
5	Abo el Ssaoud	637,385	811,622	11,3	100	20	82	22,5
6	Maasarah			18,4	56	20	14	3,8
7	Helwan			4,8	20	7	38	10,4
8	Tebin			12,2	57	14	63	17,3
9	F.of Med. Ain Shams			50,8	3543	272	168	46,0
10	Embaba	636,405	819,001	21,7	113	19	204	55,9
11	Ttalbia, Giza	633,207	810,509	12,0	57	14	87	23,8
12	Hawamdia			18,4	247	47	100	27,4
13	Attaba							

Air quality data (Black smoke ,BS)
Greater Cairo area 1995

	Measurement site	U T M coord.		Black smoke (BS) concentrations (ug/m3) mean	max.	st.d.	valid obs.	(%)
1	Azbakkia			121	525	124	66	18,1
2	ElSaheil			60	206	45	60	16,4
3	Nozha			39	1387	90	260	71,2
4	Nasr City			28	135	19	239	65,5
5	Abo el Ssaoud	637,385	811,622	70	289	52	284	77,8
6	Maasarah			54	300	49	191	52,3
7	Helwan			35	138	24	175	47,9
8	Tebin			58	258	47	106	29,0
9	F.of Med. Ain Shams			76	234	55	215	58,9
10	Embaba	636,405	819,001	47	179	33	264	72,3
11	Ttalbia, Giza	633,207	810,509	33	434	33	256	70,1
12	Hawamdia			41	316	40	243	66,6
13	Attaba							

SO2 and BS
average conc. 1995 Greater Cairo

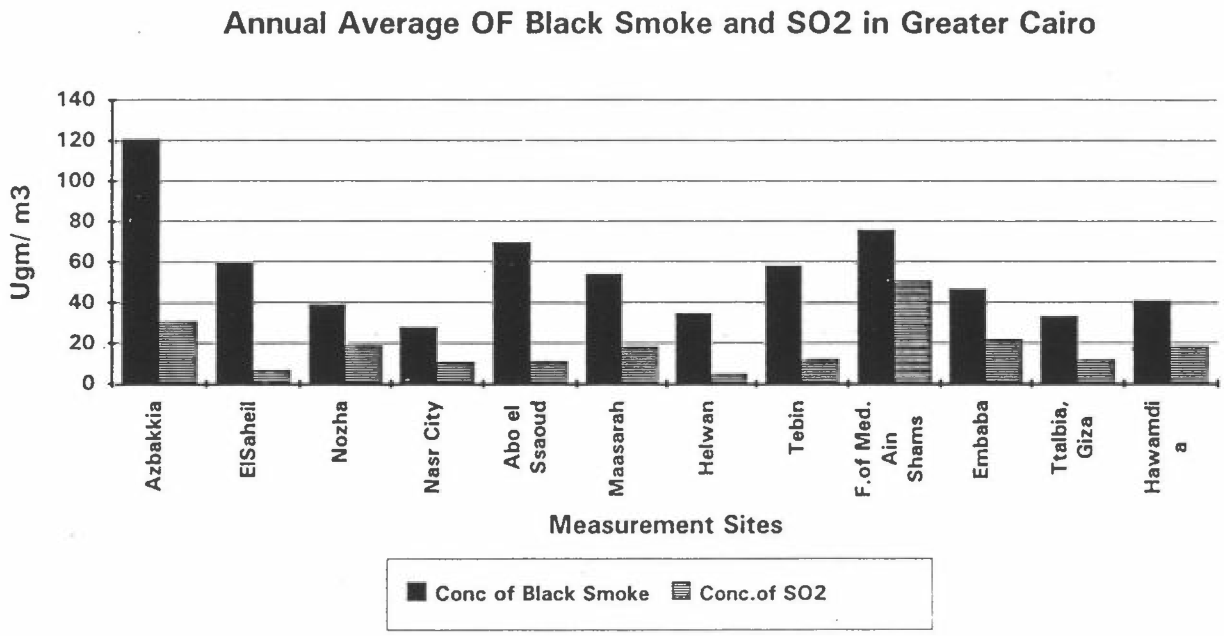
	Annual average conc			Maximum concentr.	
	BS	SO2		BS	SO2
Azbakkia	121	30,8		525	116
ElSaheil	60	6,5		206	19
Nozha	39	18,9		1387	111
Nasr City	28	10,7		135	105
Abo el Ssaoud	70	11,3		289	100
Maasarah	54	18,4		300	56
Helwan	35	4,8		138	20
Tebin	58	12,2		258	57
F.of Med. Ain Shams	76	50,8		234	3543
Embaba	47	21,7		179	113
Ttalbia, Giza	33	12,0		434	57
Hawamdia	41	18,4		316	247
	81	25		421	182

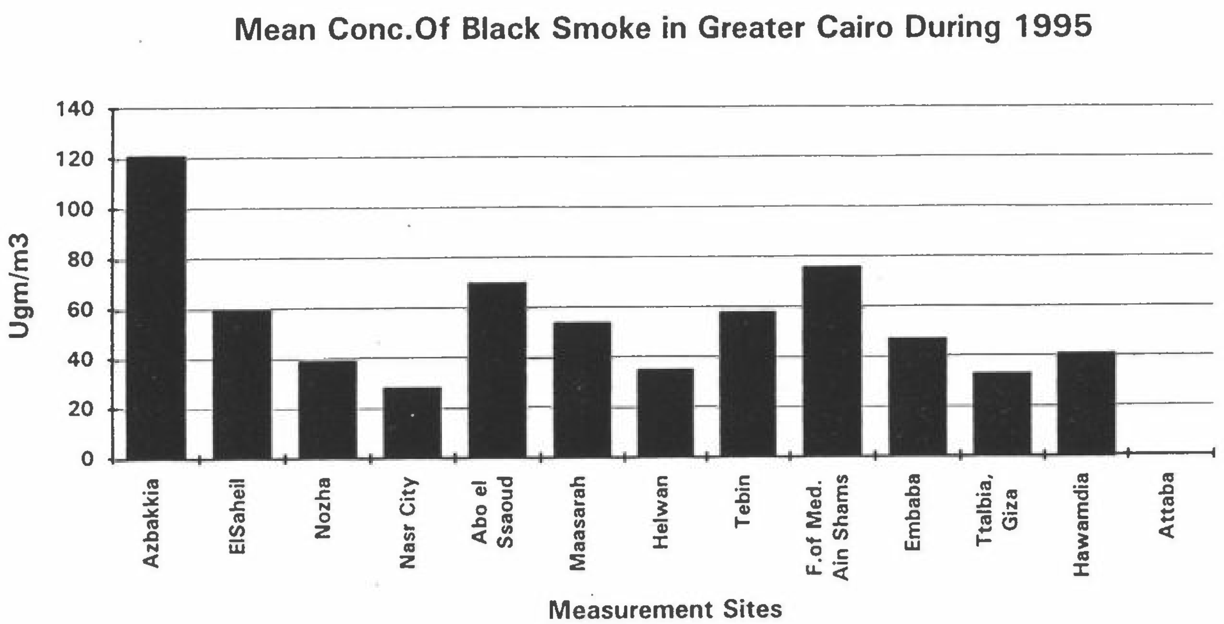
Correction coeff. 0,53942 -0,11166

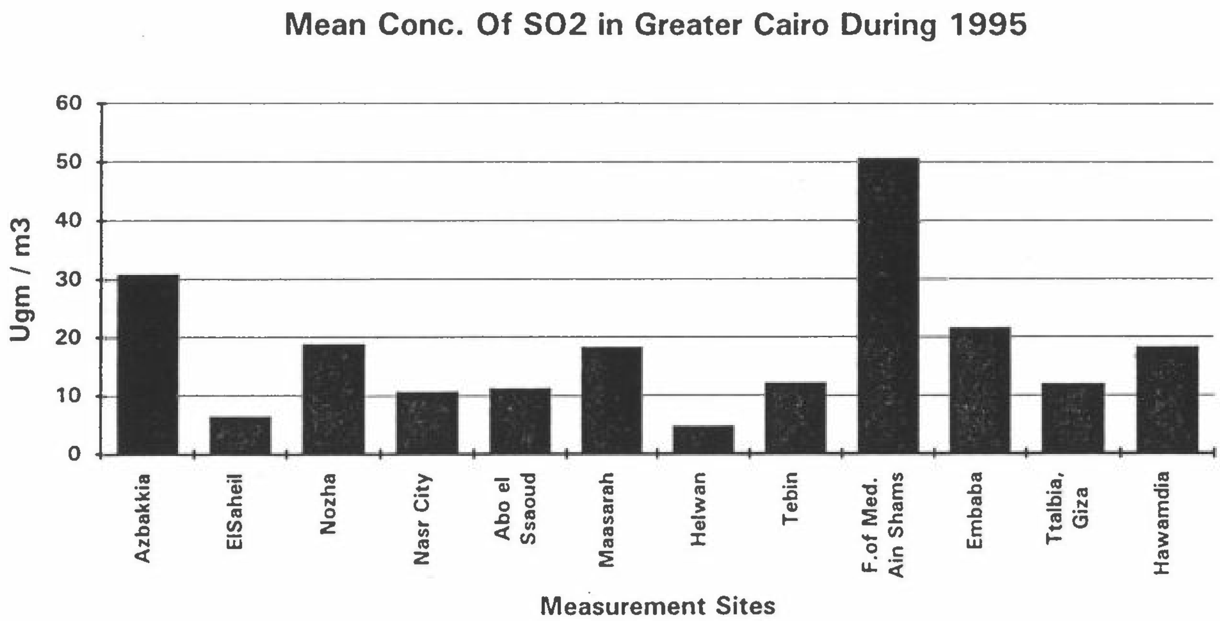
Average concentrations (ug/m3)

Measured during 1 January to 31 March 1996

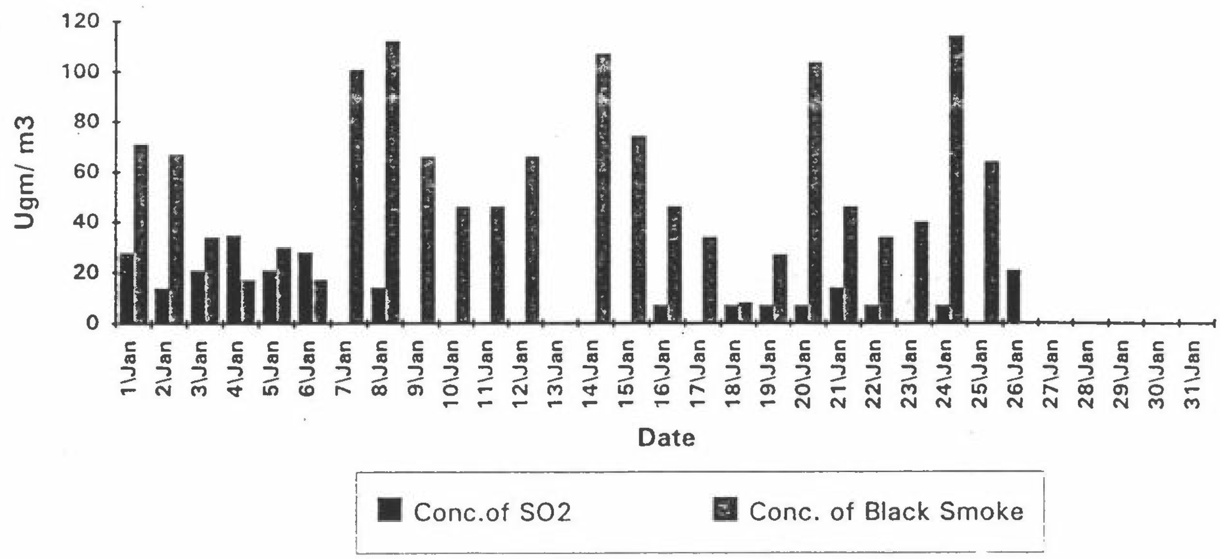
Site	U T M		Concentrations (ug/m3)		
	x	y	SO2	BS	TSP
Azbakkia	638,70	815,80			
ElSaheil	638,95	817,75			
Nozha	646,10	821,40	47		
Nasr City	647,40	817,70	8	39	
Abo el Ssaoud	637,20	811,85			
Maasarah	643,75	799,35	13	131	
Helwan	647,00	793,00			
Tebin	645,00	785,20			
F.of Med. Ain Shams	642,00	818,50	14	78	
Embaba	636,20	819,05	11	49	450
Ttalbia, Giza	632,00	809,00			
Hawamdia	639,90	798,80	4	66	898
Attaba	639,00	815,60			


Annual Average OF Black Smoke and SO2 in Greater Cairo
140
120
100
80
60
40
20
0
Ugm/ m3
Azbakkia
ElSaheil
Nozha
Nasr City
Abo el Ssaoud
Maasarah
Helwan
Tebin
F.of Med. Ain Shams
Embaba
Ttalbia, Giza
Hawamdi a
Measurement Sites
Conc of Black Smoke
Conc.of SO2

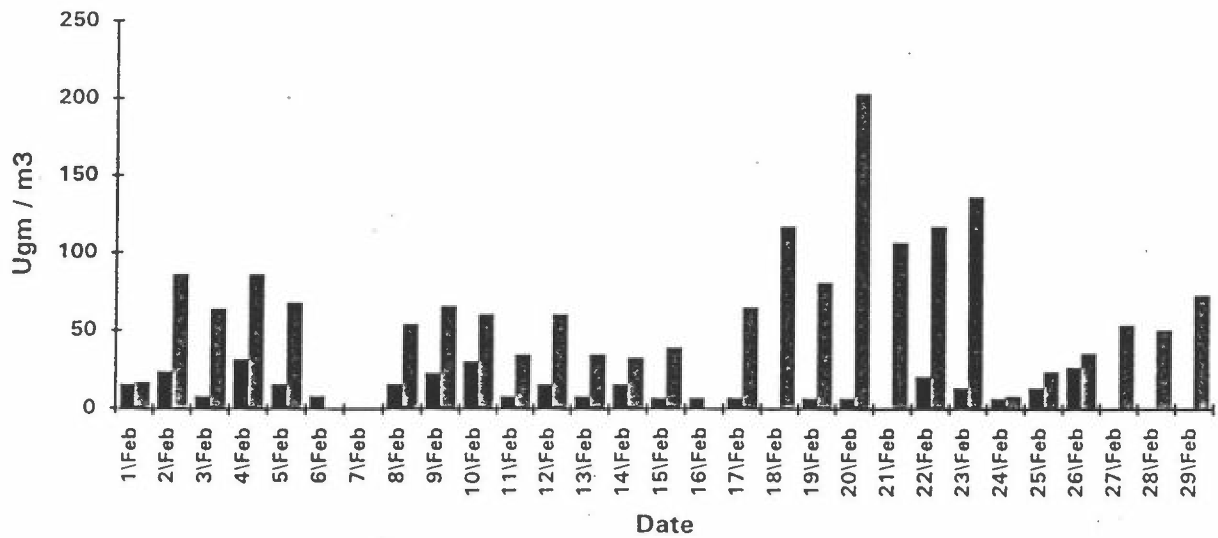

Mean Conc.Of Black Smoke in Greater Cairo During 1995
140
120
100
80
60
40
20
0
Ugm/m3
Azbakkia
ElSaheil
Nozha
Nasr City
Abo el Ssaoud
Maasarah
Helwan
Tebin
F.of Med. Ain Shams
Embaba
Ttalbia, Giza
Hawamdia
Attaba
Measurement Sites


Mean Conc. Of SO2 in Greater Cairo During 1995
Ugm / m3
60
50
40
30
20
10
0
Azbakkia
ElSaheil
Nozha
Nasr City
Abo el Ssaoud
Maasarah
Helwan
Tebin
F.of Med. Ain Shams
Embaba
Ttalbia, Giza
Hawamdia
Measurement Sites

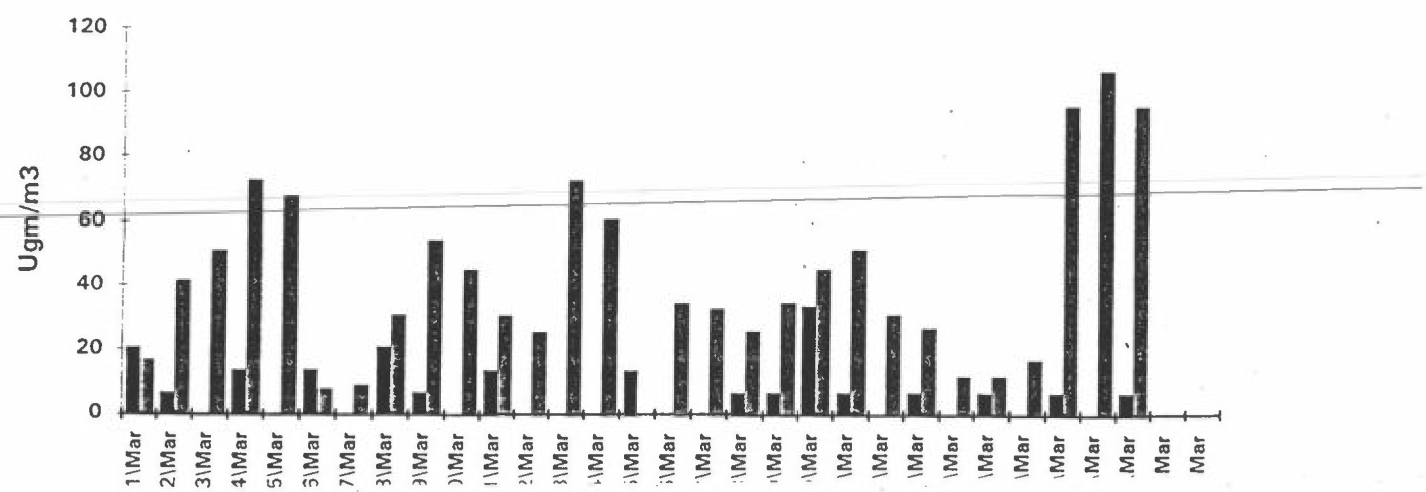
BS and SO2 Measurements in Embaba during Jan 96



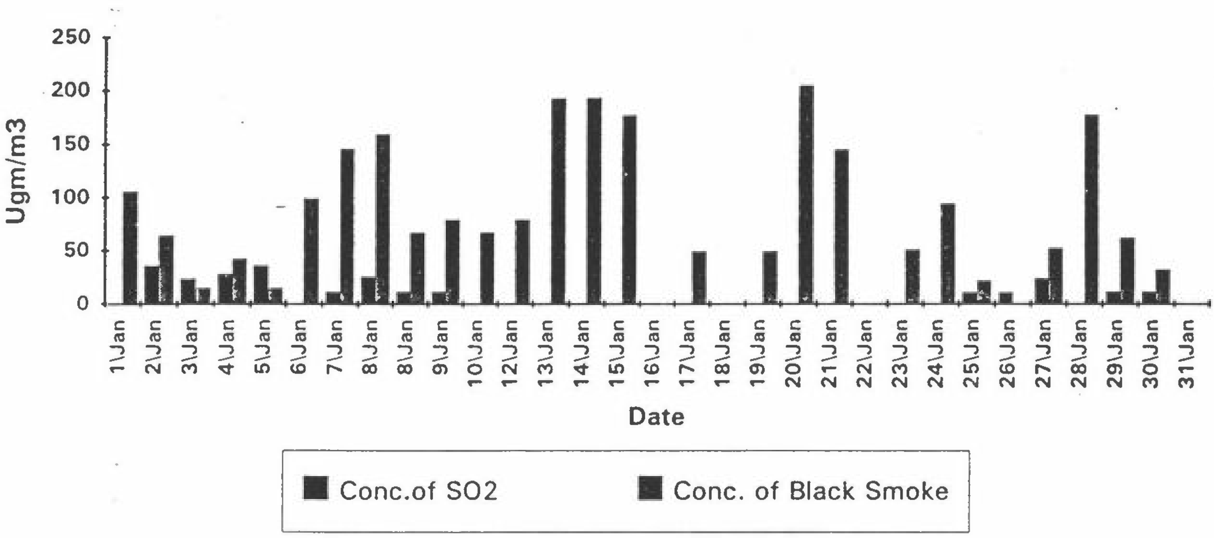
BS and SO2 Measurements in Embaba during Feb.96



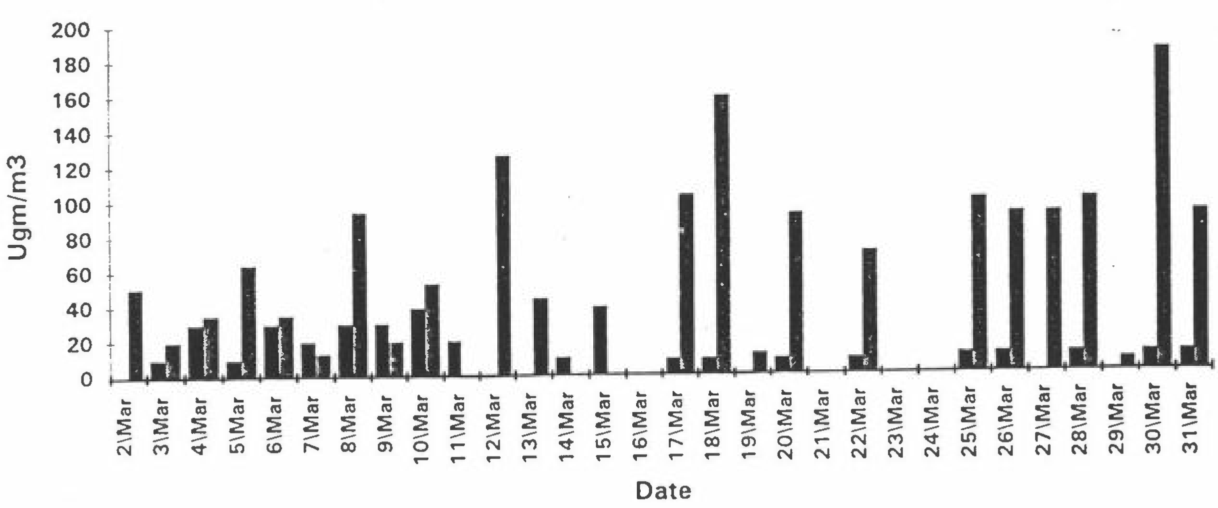
BS and SO2 Measurements in Embaba during March 96



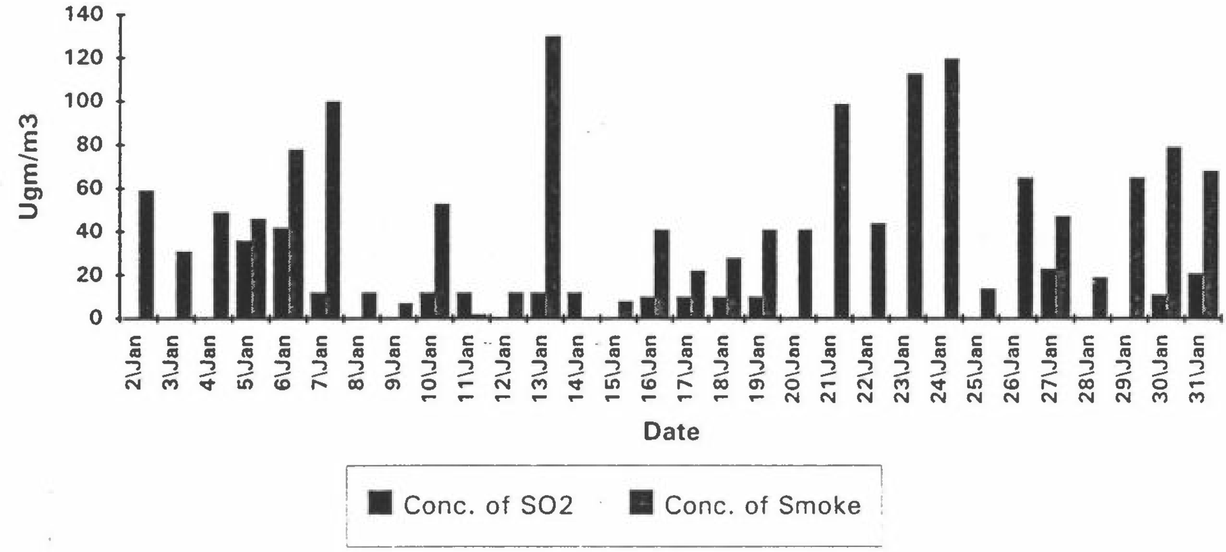
BS and SO2 Measurements in Faculty of Medicine -Ain Shams University during Jan 96



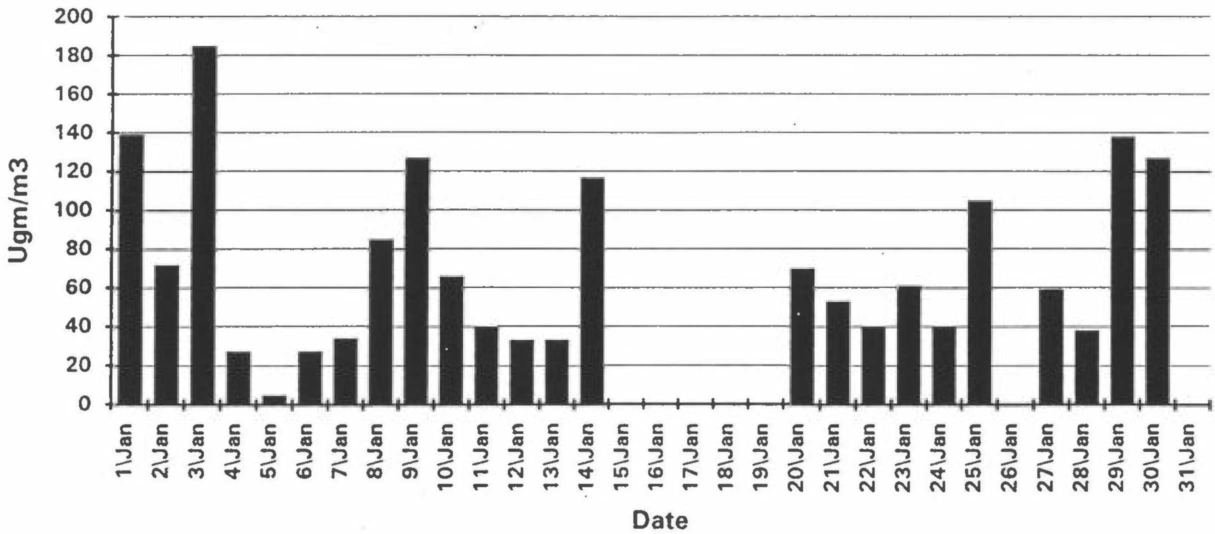
BS and SO2 Measurements in Faculty OF Medicine - Ain Shams Unviersity during March 96



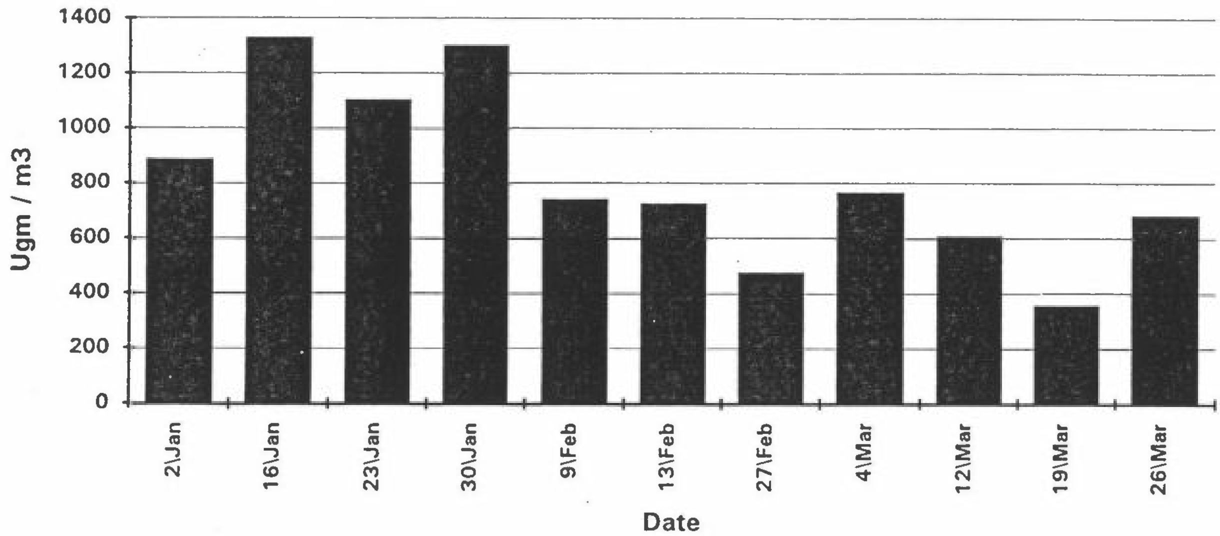
BSand SO2 Measurements in Nasr City during Jan 96



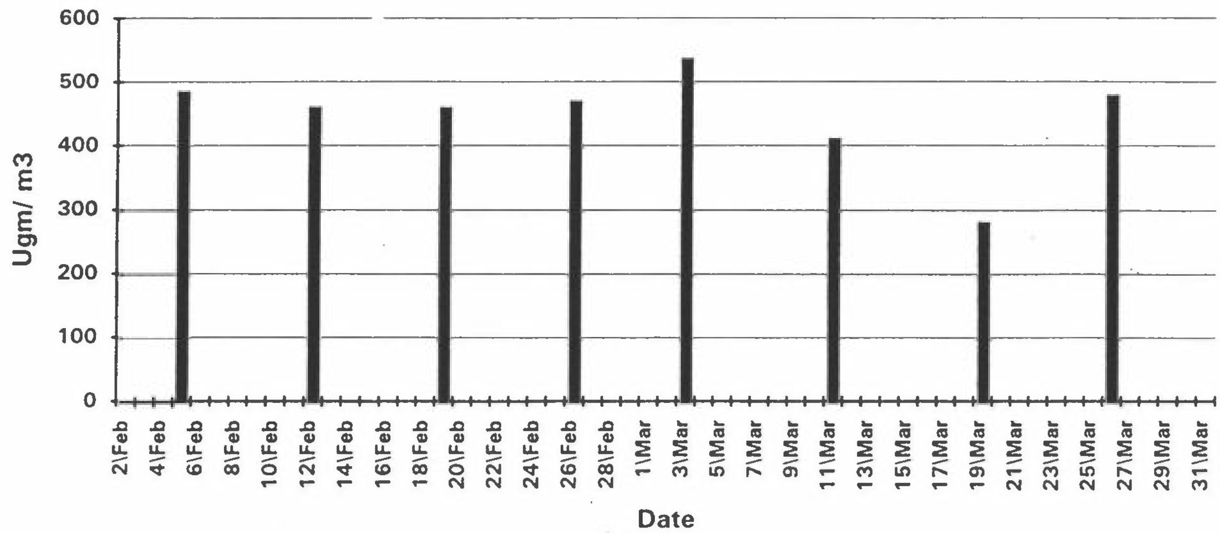
Smoke Measurements in Hawamdia during Jan 96

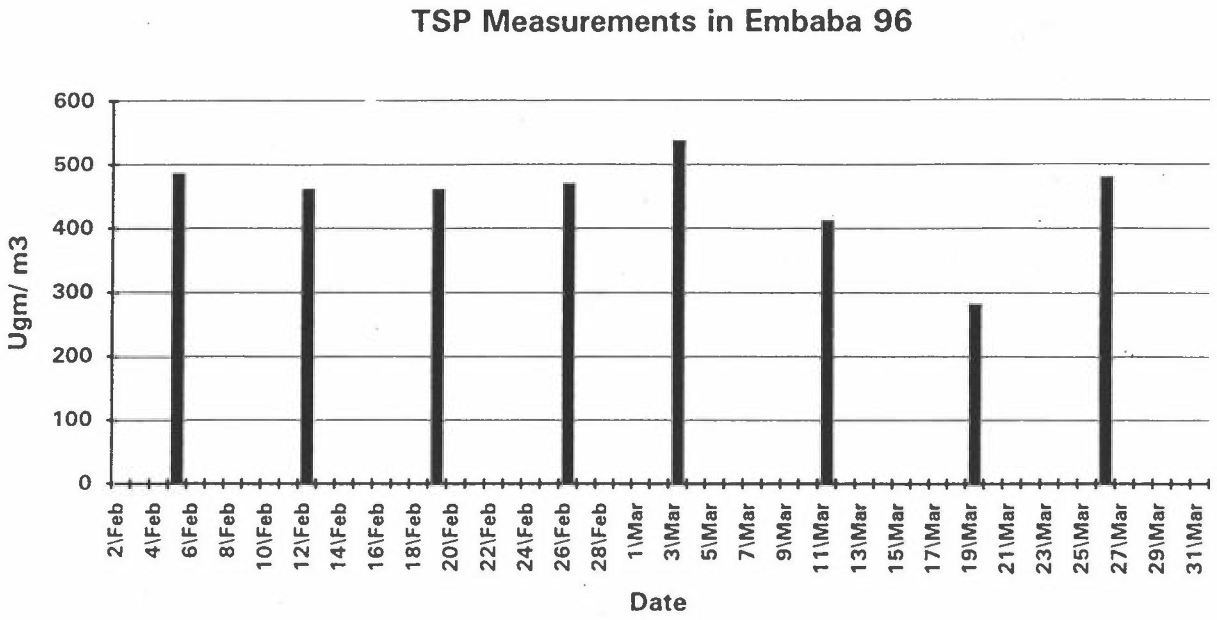


TSP Measurements in Attaba ,Cairo 96



TSP Measurements in Embaba 96




TSP Measurements in Embaba 96
600
500
400
300
200
100
0
Ugm/ m3
2\Feb
4\Feb
6\Feb
8\Feb
10\Feb
12\Feb
14\Feb
16\Feb
18\Feb
20\Feb
22\Feb
24\Feb
26\Feb
28\Feb
1\Mar
3\Mar
5\Mar
7\Mar
9\Mar
11\Mar
13\Mar
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19\Mar
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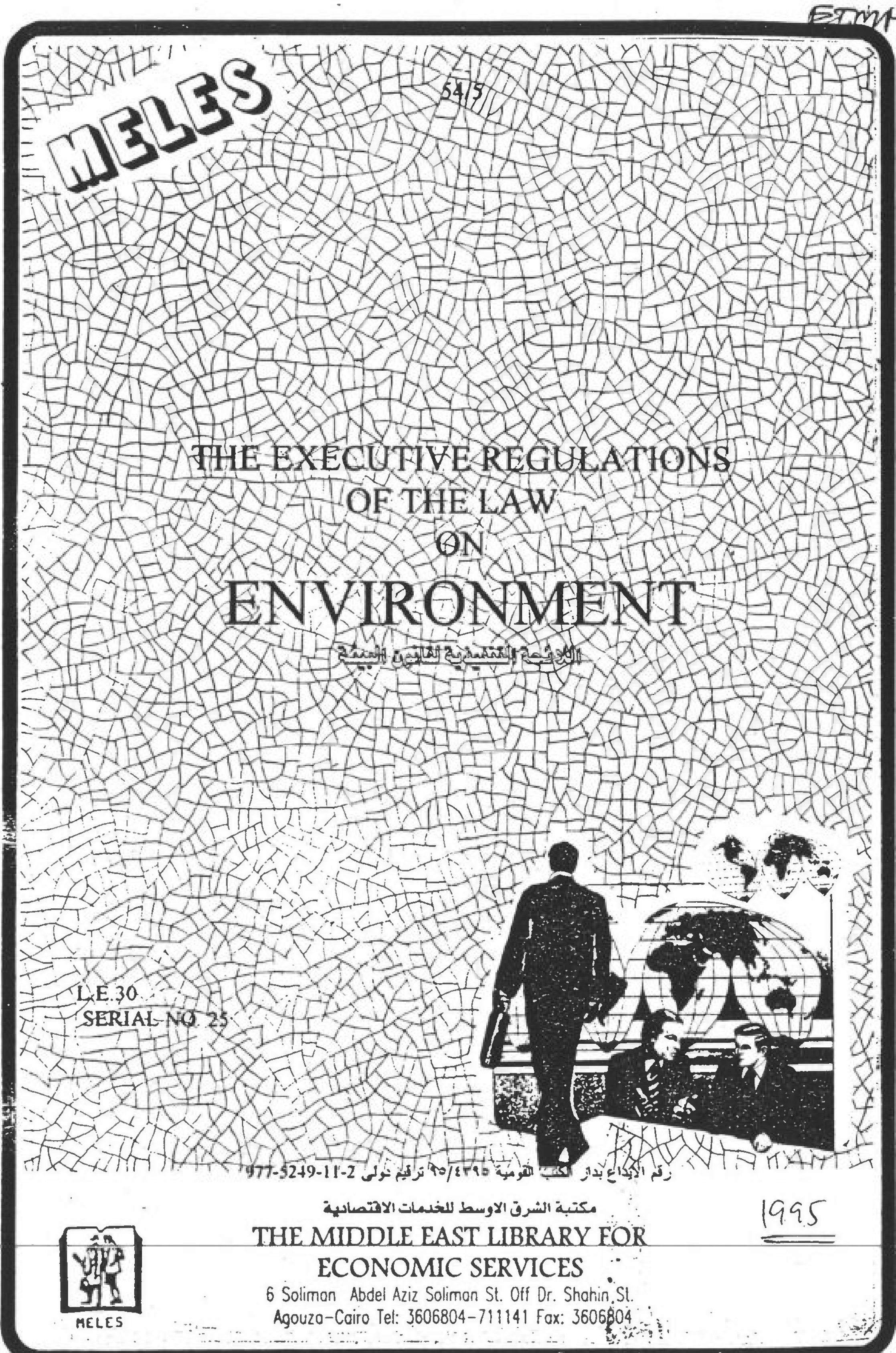
29\Mar
31\Mar
Date

Appendix G

Air Quality Standards and Guidelines


MELES

THE EXECUTIVE REGULATIONS
OF THE LAW
ON
ENVIRONMENT

اللائحة التنفيذية لقانون البيئة

L.E.30
SERIAL NO. 25

رقم الإيداع بدار الكتب القومية ٩٥/٤٣٩٥ ترقيم دولى 977-5249-11-2

مكتبة الشرق الاوسط للخدمات الاقتصادية

THE MIDDLE EAST LIBRARY FOR
ECONOMIC SERVICES

6 Soliman Abdel Aziz Soliman St. Off Dr. Shahin St.
Agouza-Cairo Tel: 3606804-711141 Fax: 3606804

MELES

ANNEX No. (5)

(1995)

MAXIMAL LIMITS OF OUTSIDE AIR POLLUTANTS
(MICROGRAMME PER CUBIC METER)

	MEXIMUM LIMIT (CEILING)	PERIOD OF EXPOSURE
SULPHUR DIOXIDE	350	1 hr
	150	24 hrs
	60	1 year
CARBON MONOXIDE	30 Milligram/M3	1 hr
	10 Milligram/M3	8 hrs
NITROGEN DIOXIDE	400	1 hr
	150	24 hrs
OZONE	200	1 hr
	120	8 hrs
PARTICLES IN SUSPENSION (Measures as black smoke)	150	24 hrs
	60	1 yr
TOTAL PARTICLES IN SUSPENSION	230	24 hrs
	90	1 yr
Chest particles (PM 10)	70	24 hrs
L E A D	1	1 yr

* * * * * * * * * * * *

ANNEX NO. (6)

PERMISSIBLE LIMITS OF AIR POLLUTANTS IN EMISSIONS.

The air pollutants concerned under this article are the gaseous, solid, liquid or steam condition pollutants as emitted from the different installations for time periods, resulting in harms and damages to public health, animal, plants, materials, or properties, or intervening with man's exercise of his daily life, and therefore they are considered as air pollutants, if from the emission of these polutants concentrations thereof exist in excess of the maximum permissible limit (ceiling) in outside air.

TABLE No. (1)

TOTAL PARTICLES

KIND OF ACTIVITY	MAXIMUM LIMIT (CEILING) OF EMISSION (milli-gramme/M3 of exhaust)	
1 - CARBON INDUSTRY	50	
2 - COKE INDUSTRY	50	
3 - PHOSPHATES INDUSTRY	50	
4 - INGOTS INDUSTRY, AND EXTRACTION OF LEAD, ZINC, COPPER, AND OTHER NON-FERROUS METALLURGICAL INDUSTRIES	100	
5 - Ferrous Industries	200	Existing
	100	New
6 - Cement INDUSTRY	500	Existing
	200	New
7 - Industrial Timber and Fibres	150	
8 - Petroleum and Oil Refining Industries	100	
9 - The rest of Industries	200	

TABLE No. (2)

MAXIMUM LIMITS (CEILINGS) OF GAS AND FUMES EMISSION FROM INDUSTRIAL INSTALLATIONS.

	POLLUTANT	MAXIMUM LIMIT (CEILING) OF EMISSION MILLIGRAM/M3 of Exhaust	
*	Aldehydes (measures ad Formaldehydes)	20	
*	Antimony	20	
*	Carbon Monoxide	500	Existing
		250	New
*	Sulphur Dioxide		
	Burning Coke and Petroleum	4000	Existing
		2500	New
	Non-ferrous Industries	3000	
	Sulphuric Acid Industry	1500	
*	Sulphur trioxide plus sulphuric acid	150	
*	Nitric Acid		
	Nitric Acid Industry	2000	
*	Hydrochloric Acid (Hydrogen Chloride)	100	
*	Hydrofluoric Acid (Hydrogen Fluoride)	15	
*	Lead	20	
*	Mercury	15	
*	Arsenic	20	

	POLLUTANT	MAXIMUM LIMIT (CEILING) OF EMISSION MILLIGRAM/M3 of Exhaust	
*	Heavy elements (grand total)	25	
*	Silicon Fluoride	10	
*	Fluorine	20	
*	Tar		
	Graphite Electrodes Industry	50	
*	Cadmium	10	
*	Hydrogen Sulphide	10	
*	Chlorine	20	
*	CARBON		
	Burning of Garbage	50	
	Electrodes Industry	250	
*	ORGANIC COMPOUNDS		
	Burning Organic liquid	50	
		0.04 % of crude (oil refining)	
*	Copper	20	
*	Nickel	20	
	Nitrogen Oxides		
	Nitric Acid Industry	3000	Existing
		400	New
	Other Industries	300	

Egyptian Air Quality Standards,ug/m3

pollutant	period	cocentraion
sulpher dioxide	1 h 24 h annual	350 150 60
nitrogen dioxide	1 h 24 h	400 150
0zone	1 h 8 h	200 120
TSP	24 h annual	230 90
PM10	24 h	70
lead	annual	1
black smoke	24 h annual	150 60
carbon monoxide	1 h 8 h	30 mg/m3 10 mg/m3

from: Nasralla,
Monitoring Networks and
Air Pollution Control in Egypt.
(EGY/CEH/001) 1994/95

Table 2: WHO guidelines, Egyptian Standards and USA Standards for Some Air Pollutants

Pollutant	USA	Egypt	WHO
Sulphur Dioxide	80 ug/m^3 (0.03 ppm) annual 356 ug/m^3 (0.14ppm) 24 hrs max.	-- 200 ug/m^3 (0.075 ppm) 24hrs max.	60 ug/m^3 (0.02 ppm) annual
Suspended Particulates	75 ug/m^3 annual 260 ug/m^3 , 24 hrs	-- 60 ug/m^3 for PM10, 24 hr	90 ug/m^3
Smoke	-- --	150 ug/m^3 , Max. 24 hr.	440 ug/m^3 annual
Carbon Monoxide	9 ppm , 8 hr. 35 ppm, 1 hr	2.5 ppm, 24 hrs. --	9 ppm, 8 hrs. 35 ppm, 1hr
Photochemical Oxidans	0.08, max. 1 hr	0.003 ppm, Max. 24 hrs	0.03 ppm, 8 hrs, 0.06 ppm, 1 hr.
Nitrogen Dioxide	0.05 ppm, annual	0.1, 24 hr	--
Dust Fall	Germany : 10.5 g/m^2 /month (Annual mean)	7g/m^2 /month residential 14 g/m^2 /month industrial	-- --

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(old before 1993)

Ref: Egyptian Environment An overview, ed: Rouchdy Saleh.

Appendix H

PRTR, Pollutants Release and Transfer Register

General Distribution

OCDE/GD(96)32

POLLUTANT RELEASE AND TRANSFER REGISTERS (PRTRS)

A Tool for Environmental Policy and Sustainable Development

GUIDANCE MANUAL FOR GOVERNMENTS

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Paris 1996

29500

FOREWORD

In early 1991, OECD Environment Ministers called for a reduction of the pollution burden as one of their major goals for the 1990s. Pollution prevention at source was seen to be a key focus for this effort since pollution which is never generated does not need to be controlled or its effects cleaned up later. In keeping with the trend toward market-based instruments to encourage pollution prevention efforts, the OECD Pollution Prevention and Control Group undertook an effort aimed at accelerating pollution prevention and reduction by examining mechanisms for compiling and publishing data about pollutant releases and transfers, i.e. pollutant release and transfer registers (PRTRs).

A PRTR system usually calls for firms to report periodically on their releases and transfers of a variety of substances of interest. This information is made publicly accessible bearing in mind legitimate needs for business confidentiality. The results provide comparative quantitative information among reporters and have stimulated investors and other affected and interested parties to ask questions of firms whose performance is significantly below normal for their sector and to demand improvement.

A PRTR thus provides a powerful incentive for reporters to cut releases and transfers. Corporate and environmental group spokespersons alike have said that PRTRs have had a stronger impact than many regulatory programmes even though a PRTR sets no improvement goals mandatorily. Simply by making pollutant release and transfer information accessible encourages firms to take pollution prevention actions. A number of OECD Member countries have implemented some version of a PRTR system.

The Manual is meant for national governments who are considering whether to implement a PRTR; it describes the key points which need to be taken into account in order to realise the benefits of a PRTR while keeping cost of the system as low as practical.

The Manual was prepared by Dr. Harvey Yakowitz of the Secretariat under the auspices of the Pollution Prevention and Control Group, assisted by Ms. Claudia Fénérol, an independent consultant.

The Guidance Manual is published on the responsibility of the Secretary-General of the OECD and derestricted on the recommendation of the OECD Pollution Prevention and Control Group. This Manual represents a contribution of the OECD as follow-up to the UN Conference on Environment and Development (Rio de Janeiro, 1992), specifically Agenda 21, Chapter 19. This publication is produced within the framework of the Inter-Organization Programme for the Sound Management of Chemicals (IOMC):

> The Inter-Organization Programme for the Sound Management of Chemicals (IOMC) was established in 1995 by UNEP, ILO, FAO, WHO, UNIDO and the OECD (the Participating Organizations), following recommendations made by the 1992 UN Conference on Environment and Development to strengthen co-operation and increase international co-ordination in the field of chemical safety. The purpose of the IOMC is to promote co-ordination of the policies and activities pursued by the Participating Organizations, jointly or separately, to achieve the sound management of chemicals in relation to human health and the environment.

INTRODUCTION

As a follow-up activity to the United Nations Conference on Environment and Development (UNCED), the OECD was asked by its Member countries and the United Nations to prepare a guidance manual for national governments considering establishing a Pollutant Release and Transfer Register (PRTR). A PRTR provides publicly accessible data about quantities of releases and/or transfers of a set of potentially harmful substances, the origin of these releases and transfers and their geographic distribution on a timely, regular periodic basis. Many OECD countries either have implemented a PRTR or intend to do so, e.g. Australia, Canada, Czech Republic, Mexico, Netherlands, Norway, United Kingdom and the United States. The European Union intends to set up a PRTR in the near future. In addition, a number of other countries are examining whether to begin a PRTR programme, e.g. Egypt, South Africa and Hungary.

The OECD efforts began in 1993 when the Pollution Prevention and Control Group, which is composed of representatives of OECD Member countries, decided to lead an effort aimed at accelerating pollution prevention and reduction by examining improved mechanisms for compiling and publishing data about pollutant releases and transfers.

The Pollution Prevention and Control Group also decided that the OECD should perform this work in the context of multi-organisation implementation of Chapter 19 of UNCED Agenda 21. These organisations included the World Health Organisation, UN Environment Programme - International Register of Potentially Toxic Chemicals, UN Institute of Training and Research and the International Programme on Chemical Safety. The Group decided that all parties who might be affected and interested in PRTRs, e.g. government at all levels, private sector interests, citizen groups, international bodies, non-OECD member representatives, etc., should participate fully in the process of developing the Guidance Manual.

Therefore, the elements of this Guidance Manual were developed by means of a process which sought to obtain wide agreement among parties who are interested and affected by PRTR activities. This process consisted of OECD convening a series of five workshops, (hosted by the European Commission, Canada, Switzerland, United Kingdom and The Netherlands) over a two-year period. Each workshop agenda called for the in-depth consideration of one of the main foundations for a PRTR including:

- Major issues in deciding whether to establish a PRTR;
- Formulating goals, objectives and a list of substances for a PRTR;
- Data handling and management in a PRTR system;
- Making PRTR outcomes publicly accessible; and
- Implementing a full PRTR system.

The workshop format consisted of convening a set of expert panellists representing affected and interested parties such as national government, local or regional government, various private sector interests (chemicals, steel, electrical, petroleum and electronic products, etc.), citizen groups, labour, international organisations and bodies and representatives of non-OECD member countries. The panels examined details of each of the main themes from a wide variety of points-of-view followed by in-depth questions and comments from the floor. About one hundred participants took an active role in each workshop. Many submitted short papers on the topic of interest; these were circulated and proved invaluable to the process of developing the Manual.

In each workshop, after two days of intensive discussion, a small drafting group was convened consisting of each affected and interested party and chaired by OECD. This drafting group was charged with the task of developing a detailed outline and overview of the main outcomes of the discussions. The object of the exercise was to provide the OECD Secretariat with a firm basis for drafting the Chapter of the Manual based on the Workshop outcomes.

On the third and final day of each workshop, a draft detailed outline and overview was provided in written form to each participant. After providing a suitable period of time for participants to review the outline and develop responses, it was discussed in plenary with a view toward revising it so as to obtain wide support of the participants for the main bases of the Chapter relating to the workshop. This was achieved in every instance.

Using the "final" detailed outline and overview as a basis, plus the papers submitted by participants, the OECD Secretariat drafted a Chapter of the Manual based on the theme of each workshop. Each Chapter was sent to all workshop participants for review and comment. At the end of the review period, the OECD Secretariat revised the draft Chapter, taking into account the comments received. The revised Chapter was then submitted to the Pollution Prevention and Control Group. This Group has formal responsibility for recommending release of the results of OECD efforts concerning pollution prevention and control; PRTR activities come under this *proviso.* When acceptable to the Group, each Chapter was then ready to be included in this Manual.

This Manual represents the efforts of affected and interested parties and has been reviewed in detail by them. As such, the Manual is meant to represent the current state of thinking on the need, the benefits, potential costs, the goals and how best to implement a PRTR as a tool for environmental policy. The Manual will help governments by indicating steps they will need to consider as they move toward implementing a PRTR appropriate to their national purposes.

CHAPTER 1

USEFULNESS OF INSTITUTING A NATIONAL POLLUTANT RELEASE AND TRANSFER REGISTER

I. What is a Pollutant Release and Transfer Register?

A Pollutant Release and Transfer Register (PRTR) is a catalogue or register of potentially harmful pollutant releases or transfers to the environment from a variety of sources. A PRTR includes information about releases or transfers to air, water and soil as well as about wastes transported to treatment and disposal sites. This register also consists of reports about specific species such as benzene, methane or mercury as contrasted with broad categories of pollution such as volatile organic compounds, greenhouse gases or heavy metals. The development and implementation of a PRTR system adapted to national needs represents a means for governments to track generation, release and the fate of various pollutants over time.

A PRTR can be an important tool in the total environment policy of a government -- providing otherwise difficult to obtain information about the pollution burden, encouraging reporters to reduce pollution, and engendering broad public support for government environmental policies. Indeed, governments may wish to set forth long-term national environmental goals to promote sustainable development and then use PRTR as an important tool to examine objectively how well these goals are being met.

II. What are the benefits of a PRTR?

One set of benefits to a national government from instituting a PRTR involves establishing the following in a consistent, defensible form:

(a) Who is generating potentially harmful releases or transfers to various environmental media?

(b) What pollutants are being released or transferred?

(c) How much is being released or transferred over a specific time period?

(d) To what media are these pollutants being released or transferred and, how much of each is going to air, water or soil?

(e) What is the geographic distribution of pollutant releases or transfers?

Once the information is correctly categorised in the PRTR system, the government authorities are in a position to track each pollutant release and transfer consistently over time. Authorities can then set priorities for reducing or even eliminating the most potentially damaging pollutant releases. One example of this is in the framework of integrated pollution prevention and control efforts undertaken to prevent or minimise the risk to humans and/or the environment.

The PRTR reporting process itself tends to promote pollution prevention by indicating to reporters, especially small- and medium-sized enterprises, the amounts of valuable material resources being released as pollutants and thus simply wasted. In countries having a PRTR system, this information has spurred firms to cut this wastage. It has resulted in avoiding costs, increasing efficiency and reducing environmental harm simultaneously.

The results of a PRTR can be instrumental in pin-pointing priority candidates for the introduction of technologies for cleaner production. Suppose, for example, that two facilities are engaged in similar activities using similar feedstocks and are producing similar outputs, but one of the two is reporting far greater releases of certain pollutants. This can be a signal that cleaner production technology would be a good investment for the more polluting facility.

For a government, a PRTR can help achieve pollution prevention, lessening the burden of control regulations, which require a large bureaucracy to monitor and enforce. Wastes not generated do not require disposal facilities, and water pollutants not created do not require wastewater treatment facilities. Since specific chemicals or classes of chemicals (alkanes, carcinogens, etc.) covered by a PRTR may differ in terms of inherent hazard, a high release/transfer total for a given pollutant may not always translate into high risk. Conversely, a pollutant having a lower release/transfer level may in reality pose a greater risk. This concept of hazard differential needs to be considered in the design of a PRTR as well as how to convey such results to the public.

PRTR results provide local, regional, national and international information. With a PRTR system in place, local or regional governments can assess the status of local environments and can use PRTR results as one input for assessing risks to human health and the environment. The use of PRTR data as a key input for assessing such risks enables national authorities or international groups to estimate and compare environmental problems on a consistent and common basis, e.g. by considering multiple pathways to exposure and movement through the environment of the pollutants covered by the PRTR. In other words, PRTR results can be used as inputs for dispersion models in order to obtain estimates of environmental status as a function of time and place.

A PRTR can provide data about accidental releases such as spills or emissions arising from a fire at an industrial facility. Moreover, PRTR data can aid in debates about land-use planning and in licencing decisions for various types of potential sources of pollutants ranging from giant facilities to small- and medium-sized firms. Also, an internationally compatible register system could be beneficial in setting and monitoring international goals and commitments. Sharing collected data can help countries maximise risk-reduction efforts.

Finally, the existence of a PRTR can serve as a major driving force for pollution reduction throughout many sectors of the economy. In fact, dissemination of PRTR data has led to a competition among generators of pollutants to reduce these releases. After all, no one wants to be perceived by the general public as a wilful spoiler of the environment or contributor to possible adverse health effects.

III. Considerations for implementing an effective PRTR

In order to realise the benefits of a PRTR, a number of decisions should be taken to ensure that the PRTR functions as desired in the areas it covers. The precise goals and objectives of the PRTR should be defined clearly. In setting the objectives, a number of points need be taken into account; these involve basic issues which affect the nature, operation and results of a PRTR. What follows describes major issues which must be considered when setting goals for a PRTR. (More detailed discussion of the PRTR goal-setting process is included in Chapter 2.)

First, the terms "release" and "transfer" need to be defined explicitly for purposes of the PRTR. In other words, what constitutes a reportable release and what constitutes a reportable transfer? For example, if some quantity of hazardous waste is generated at a facility which then pre-treats and disposes half on-site and ships the other half to a licensed disposal facility; what must the generator report for purposes of the PRTR?

Unforeseen releases and transfers also need to be considered. Examples of unforeseen releases are spills, accidents resulting in releases, and remedial actions to clean up their effects and the effects of past environmental damage (such as transfers during remedial actions concerning abandoned hazardous wastes or dealing with obsolete or discarded pesticides or paints). Including them as a separate category within a PRTR would provide a means to compare this source of releases over time and also might help motivate better control of reportable chemicals.

Second, the chemicals to be covered by the PRTR must be decided at an early stage. For example, a PRTR should be concerned about the likelihood of exposure from releases or transfers that are known to cause or can be expected to cause adverse effects to humans and/or the environment. Many lists of chemicals, species, or classes of pollutants have been compiled; countries operating PRTR systems each have published "their" list. A national government intending to institute a PRTR will probably wish to involve the public and representatives of those installations who will likely report releases in the process leading to the development of a national PRTR list. This process ensures that affected and interested parties each have an opportunity to provide information and reasoning as to why certain species are included or excluded. Moreover if certain chemicals are not generated nationally, they could be excluded *a priori*. (Hereafter, this list of reportable species will be referred to as "The List".)

Third, the scope of the PRTR must also be considered. Clearly, "point sources" such as factories are not the only contributors to releases and transfers of pollutants. "Diffuse sources" such as transport activities and agricultural operations also generate large quantities of pollutants of many types. Governments that are contemplating a PRTR may wish to include both diffuse and point sources into a single PRTR so as to obtain a view of the contribution of each set of sources.

Fourth, the role and relationship of licence (permit) conditions specifying what actions an entity must take in order to operate legally need to be clarified. Licenses are usually crafted to ensure that data provided by the licence can be used to serve one or more particular environmental purposes. For example, BOD and/or COD of releases to watercourses may be needed by the authorities in order to ensure clean water supplies. Some licenses require continuous monitoring such as of certain stack gases; others require periodic measurements. Whether all, some, or none of the data required for licenses can or should be used in PRTR reporting, and how, deserves careful examination by government during the design phase of the PRTR system.

It should also be borne in mind that PRTRs are not programmes to control chemical pollution; licenses and permits for air emissions, water discharges, etc., are designed for pollution control. PRTRs can, however, provide important insights into the effectiveness of control programmes. To some extent, PRTRs can take advantage of control programmes and of existing data that have already been collected.

Finally, the resources consumed by a particular PRTR approach must be considered in determining whether and how to implement a PRTR.

A. *Data collection and management*

The data for a PRTR are usually taken from point sources of pollution as well as from diffuse sources. In the case of point sources, individual facilities such as automobile assemblers, chemical plants, fertiliser manufacturers, power plants, research facilities, steel mills and electroplating facilities provide a set of data elements for each pollutant of concern on one form and report these data for a given time period. A listing of point sources of pollutants identifying those who may be required to report releases and/or transfers needs to be compiled. This list can include major industrial facilities, small- and medium-sized enterprises, as well as government owned or operated facilities (such as public power plants). In order to decide what specific installations might be excluded from reporting requirements, countries having a PRTR usually set thresholds such as total number of employees, minimum quantity of a pollutant release or transfer which triggers a requirement to report, or minimum throughput of a reportable substance within a facility. Most PRTRs currently in operation collect data from point sources on an annual basis.

In order to take into account diffuse sources, government will almost certainly have to rely upon data from environmental monitoring activities combined with information such as the number of motor vehicles, numbers of each type of farm animal, amounts of fertiliser, pesticides and herbicides spread onto land, fuel mix for each energy source, etc. Governments can use a combination of monitoring data, existing statistical data and emission factors to make estimates of pollutant releases based on activity areas (e.g. calculated standard emission factors). These data are then converted by statistical means into most probable indications of total pollutant releases from the diffuse sources of interest. Both the Canadian and the Netherlands PRTR systems include estimates of releases from diffuse sources.

Clearly, designers of a specific PRTR will want to balance completeness of information with the ability and resources of reporters to provide the data and to develop an estimate of how many potential reporters there would be in order to select thresholds for reporting. Countries may also wish to consider the option of electronic reporting in lieu of paper reporting and what their central collection procedure and loading of data will be. Costs of reporting need to be considered at an early date with a view to keeping costs of reporting as low as practicable, and consistent with the goals of the PRTR. (See Chapter 3 for further discussion of these costs)

Data can be reported in so-called "raw form". This simply means that every generator who must report provides data for releases or transfers per unit of time as the total amount released or transferred of each chemical on The List which he emits. Raw data are said to be very useful to various segments of the public because they allow everyone equal access to the total quantity and type of pollutants being released or transferred in local, regional and national areas. This, in turn, allows the public to participate in policy-making aimed at reducing the pollution burden on the same footing as government and the private sector. An additional reason for collecting raw data is that the total environmental burden over time is very important to track in the case of certain types of pollutants, for example persistent chemicals. This can be done only if raw data are reported to a PRTR.

Reports indicating releases per unit of product sent to market are very useful as well. If economic downturn occurs, some releases or transfers may be curtailed as a result. Later, when the economy recovers, these releases or transfers might rise in total. Releases and transfers per unit of product sent to market or per unit of feedstock entering a plant can give a realistic view of what a firm is doing to cut the pollution burden. Governments that are contemplating developing a PRTR programme could consider asking reporters to provide both raw data plus data about releases and transfers per unit of product sent to market as well as the total quantities of goods. Of course, the confidentiality concerns of the reporters would need to be taken into account.

Every item of data reported to a PRTR is unlikely to be measured discretely; rather, reporters monitor and take periodic measurements of releases and transfers. In turn, these are used by reporters to develop statistically valid estimates of total releases and transfers of each reportable chemical/species over time. Therefore, when releases and transfers are reported, one needs to know whether they are measured or are statistical estimates. A related issue is whether the PRTR design will allow a reporter to provide data which are aggregated (e.g. lead and lead compounds rather than each lead compound in use).

Since measuring releases and transfers directly to obtain all PRTR data is virtually impossible, decisions need to be taken about what must be measured and what calculational or estimation schemes are appropriate (based on these measurements) to attain consistent PRTR reports. This is an area where government will almost certainly want to consult with representatives of the public and prospective reporters in order to arrive at mutually acceptable procedures. This consultation may point out the need and desirability of classifying various types of sources of pollutants into specific categories, e.g. bulk chemicals, specialty chemicals and energy generation. The reason for this is that the calculation for the PRTR data report is likely to differ from category to category.

B. Basic design and implementation

Numerous issues are associated with designing and implementing a PRTR, but for a useful PRTR system the benefits need to outweigh the costs. There are, however, certain issues governments may wish to address at the design phase of a PRTR. For instance, this is the phase where resources and capabilities of reporters need to be considered, especially those of small- and medium-sized enterprises. In addition, special attention may be warranted when threshold reporting criteria (e.g. number of employees) are used. Sometimes a facility may be required to report because it meets a certain threshold, even though it does not release or transfer any of the pollutants of concern. Special reporting categories can be incorporated into the PRTR to avoid any unnecessary burdens.

Sources of releases and transfers can be required by law to provide reports of releases and transfers, and several countries have already implemented this approach. On the other hand, some sectors of industry have suggested that a voluntary reporting system will not only suffice but could provide a more useful and realistic overview than a mandatory PRTR system. The reasoning is that firms releasing pollutants are well aware of which releases are specific to their operations and that each site is different. Hence, a site-by-site voluntary report for the actual pollutants released or transferred in a given time period may be a more valid indicator than reporting releases and transfers dictated by a pre-ordained list.

A number of multinational firms, mostly in the chemicals sector, have published environmental reports voluntarily which do indicate releases or transfers of various species. But no small- and medium-sized enterprise issues formal reports to the public about operations of any kind; a number of privately-held firms fall into this category. Many non-governmental organisations have thus argued that a voluntary system would not allow interested members of the public to compare data properly among firms or among sectors, or to compile an accurate natural register of discrete sources and total releases and transfers.

Governments contemplating a PRTR will need to decide early about whether to make reporting mandatory, voluntary or some combination of the two. If a decision for an entirely voluntary system is taken, then some form of agreement among reporters and government will be needed as to types of releases and transfers covered, frequency of reporting (e.g. annually) as well as the means and format for reporting. The same is true of a mandatory system, except that government receives the reports and can apply sanctions against non-reporters. How to deal consistently or equitably with non-reporters (or partial reporters) in a voluntary system may be difficult to arrange.

Given that most governments have subscribed to Agenda 21 in which the public right-to-know about risks due to pollution is clearly stated, national governments will probably wish to ensure that any PRTR data are analyzed and placed into a consistent and coherent form for public review. This may be somewhat easier if the data are reported mandatorily in a form which enables government to easily provide appropriate data to the public. In a mandatory system, claims of business confidentiality by reporters can be handled in terms of national law relating to this topic; for example, in the United States, a generic entry of chemical identity is substituted when a claim of confidentiality is allowed. In that way, the PRTR data are complete and confidentiality is preserved.

The need to be consistent among each category and then to give a summary of all categories to obtain appropriate PRTR results is important in order to take proper measures about possible double counting of releases or transfers. Double counting could occur, for example, if lead and zinc in electric arc furnace steel-making dusts were lumped into the total quantity of materials classed as "wastes" by the steelmaker, but were later recycled by another firm which in turn reported releases of lead and zinc emissions to air and/or solid waste. In this case, nearly 300 kg of lead and zinc per tonne of furnace dusts would be reported to the PRTR by the steelmaker while the recycler might report a further 15 to 30 kg of these metals as released. In reality, after the recycling process, between 270 to 285 kg of lead and zinc per tonne of furnace dusts would have been reconverted to saleable metals. A proper PRTR accounting for the entire situation would be a report by the steelmaker indicating transfer of the recyclable amounts plus unrecyclable wastes. The recycling facility would report actual releases and quantity of material sent to final disposal. And the total reported to PRTR, by both steelmaker and recycler, should not exceed total steel-making dust quantity less recycled content plus any additional releases from the recycling process. This example illustrates the importance of having good clear definitions which help to minimise double counting. It also underscores the necessity to be consistent and transparent in establishing guidelines for reporting requirements.

Grouping various sources of releases and transfers enables a consistent reporting scheme for each to be developed which minimises double counting. Whether transfers of chemical species to products on The List are reportable to the PRTR becomes a key issue in the context of problems arising from double counting as well. If producers are required to report such transfers to products, then the PRTR accounting system becomes more prone to double counting since one firm's "product" may be a feedstock to another process after its purchase by a second firm.

The entire issue of the relationship of the PRTR to products will require close discussion with producers, consumers, workers and the public in order to arrive at an appropriate course of action. A PRTR will never be a tool to estimate the fate of all species on The List over their entire lifecycle.

The necessity for a step-by-step approach is underscored by the need to ensure transparency, ease of understanding and verification of the completeness and precision of reports of releases and transfers. Unless the recipients of a PRTR, various segments of the public, government at all levels and industry itself are convinced that the data are complete and factual, then the PRTR serves a more restricted purpose. The fact that reporting is mandatory and that data are available freely is said to promote both veracity and confidence in the PRTR.

C. *Data verification and transfer to the public*

The data received by the PRTR system need to be scrutinised by appropriate authorities in order to obtain an accurate and thorough opinion. They then need to be made publicly accessible in easily understood formats. Designers of a PRTR may wish to consider these formats at an early stage in order to ensure that they are compatible with the ways data are to be reported. Whether the PRTR results will be simply placed "on-file" at some place such as a government office or in a computer data base with access available to persons wishing to see the results, or whether government will actively work to publicise PRTR results and present them to the public, also needs to be decided at an early stage. Most countries that currently operate a PRTR system advocate an active role for government in bringing public attention to PRTR results. (See Chapter 4 for further details.)

This approach can also work in favour of those who report releases and transfers. Clearly, no process is likely to result in zero waste, release or transfer of some pollutants. There is a theoretical minimum of releases for all practical economic processes. The PRTR can be used to show that local, regional or national reporters are approaching this minimum, i.e. that pollution prevention is succeeding as well as it possibly can. The public cannot expect continuous reductions forever from each reporter, but policy initiatives can be directed at reducing the total pollution burden. A PRTR can serve as a good indicator that newer policy directions need to be explored in order to cut total pollution loads.

IV. AGENDA 21: Citizens' Right-to-know, basis for public participation in integrated pollution prevention and control policy-making

"What is the status of the environment in which I live and/or work, and if the quality is insufficient, what should citizens and government and non-government institutions do to prevent or reduce pollution and restore damaged areas?" A properly-implemented PRTR can help national and local governments to answer both parts of this question. The administrative burden of implementing the PRTR should be neither unduly burdensome nor costly.

A goal of every national government is to provide for improving living standards for its citizens. Governments have recognised, though, that economic development at the expense of natural resources and the environment, in general, could ultimately result in national and even global disaster. Hence, governments worldwide endorsed the concept of sustainable development at the UN Conference on Environment and Development held in Rio de Janeiro in June 1992 and adopted a broad manifesto for actions to achieve sustainability known as Agenda 21.

Governments that endorsed Agenda 21 have further agreed that they should act to reduce risks from toxic chemicals (and other pollutants) taking into account entire life cycles of the pollutants. Examples of ways to do this (as cited in Agenda 21) are by promoting technologies for cleaner production and products; product labelling; economic incentives; and limiting use of, phasing out or banning certain products and pollutants that pose an unreasonable and otherwise unmanageable risk to human health and/or the environment.

Agenda 21 provides that environmental issues are best handled with the participation of all concerned citizens and that each individual should have appropriate access to information relating to the environment. It also states that countries shall facilitate and encourage public awareness and participation by making information widely available. [Agenda 21: Principle 10 for sustainable development.}

Balanced with the right-to-know the identity and risks associated with potentially hazardous ingredients is, of course, the right of the private sector to protect confidential business information in accord with applicable national laws.

V. Overview of processes to create a PRTR

The first step is for government to select a set of preliminary objectives for its PRTR. This process may lead to obtaining data about certain releases and transfers and ensuring that they are disseminated to the public. Or, a government may seek to establish environmental monitoring systems to track diffuse sources of releases and to take account of many or all of the benefits available from instituting a PRTR. All countries which have implemented PRTR approaches have moved stepwise and have learned by doing.

The preliminary objectives, as selected by government, become the basis for initial discussion with affected and interested parties such as industry, local government, citizen groups, and government-owned or -operated installations. Unless these "stakeholders" reach agreement on the scope, objectives and details of management, implementing a PRTR successfully is likely to be difficult. Moreover, by involving the the affected and interested parties at an early stage, government will learn quickly what is possible and desirable to achieve from the PRTR process, and can also develop a preliminary schedule for the step-by-step effort to build and maintain the most useful PRTR. Box 1 describes briefly the process used in establishing the Canadian PRTR.

Items that deserve consideration by affected and interested parties and on which they and government ought to try to reach agreement include the broad issues outlined in Section III. This should then be augmented by detailed review and decisions concerning:

(a) What are the goals and objectives;
(b) The list of chemicals[1] to be reported upon;
(c) Who must report and how often;
(d) How any existing reporting requirements could be used to help attain the objectives of the PRTR, e.g. licencing requirements, voluntary company environmental reports;
(e) How reporters can minimise being subjected to duplicative reporting requirements;
(f) Whether large firms having more than one site shall report on a site-by-site basis or on a site-specific, yet firm aggregated, basis;
(g) The contents of the reporting form itself, which ideally should be as simple as possible, needs to indicate chemicals released and transferred, amount of each, medium to which released, name and co-ordinates of reporter including correct geographical descriptors;
(h) What data are to be reported and in what format;
(i) To whom the data shall be reported;
(j) How claims of confidentiality will be handled;
(k) How public sector installations and operations will be taken into account, e.g. some exemptions on the basis of national security considerations might be granted to the military;
(l) How the data will be provided to the public (N.B. This implies that governments may want to consider developing a strong PRTR data analysis capability in order to provide rapid and broad dissemination of PRTR results at low cost to citizens.);
(m) Roles of local government and local citizenry in specific applications of the PRTR, e.g. determining the situation in detail for a local area and/or the use of local PRTR data by local authorities in granting or enforcing licenses;
(n) Whether the PRTR will be mandatory in nature and if so, how its requirements will be enforced. If the PRTR will be entirely or partly voluntary, how it will be monitored; and
(o) How the PRTR will be implemented administratively and by whom, e.g. guidance issued to reporters, inspection capabilities, data reception and analysis.

Once consultations with affected and interested parties are launched, government personnel responsible for instituting the PRTR can develop proposals for what legal authorities, if any, and what financial and human resources will be needed to implement the PRTR (especially in its early stages). Box 2 gives the results of a study to determine ways, means and costs to governments for initially testing a PRTR. It indicates that a few staff plus two microcomputers can be a good start and perhaps manage a simple PRTR system. (Chapter 3 gives more details about costs to governments, reporters and users of PRTR data.)

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[1] For reasons of simplicity the word chemical(s) will be used throughout the document. However, it will mean <u>chemical species.</u> A definition of this term can be found in the Glossary of Terms at the end of this document.

Prior to implementing the PRTR, government may wish to consider training programmes for reporters, for government personnel who will receive reports, and for interested citizens wanting to know about the PRTR and its uses. This training will need to be tailored to the particular PRTR chosen. The investment in training is likely to provide strong benefits to government in the form of more complete and consistent PRTR reports, better data analysis and broad public confidence in the PRTR outcomes.

The remainder of this Guidance Manual deals in more detail with how national governments can approach each of the main issues in designing, negotiating and implementing a successful and affordable PRTR. The United Nations Institute for Training and Research (UNITAR) has implemented pilot training programmes to help interested governments to use the information in this Guidance Manual and other sources to develop appropriate national approaches for a PRTR.

Appendix I

Memos on possible co-operation between EEA and AEA Air Quality Network and the Cairo University A.Q. station

EIMP

Environmental Information
and Monitoring Programme
3 Abdil Aziz Selim street
Mohandessin, Cairo, Egypt
Tel/Fax: +20 2 361 5085

Technical note

To: EEAA, Dr. Abdil Latif Hafez, dr. Mohammed ElZarka
Copy: Jan Hassing
From Bjarne Sivertsen
Date: 1 June 1996

Re: Atomic Energy Authority, Air Quality Network

At my first visit to the Atomic Energy Authority (AEA) 27 May 1996 I met with
- Dr. Hisham Fouad Aly
- Dr.Ahmed Ahmed El- Kady
- Dr. Mokhtar S.A. Hamza.

During the visit to the main office in Kasr El-Eini street I was presented to the general aspects and plans for air quality monitoring stations that will be installed at selected sites of the radioactive monitoring network for Egypt.

AEA is at moment operating 30 radioactive monitoring statioons in Egypt. They are planning to have air pollution measurements at 14 of these locations. Three of these will be located in Cairo and include a multi gas analyzer systems. 11 stations spread over Egypt will have single gas analysers. The first multi gas analyzer station is being installed at the time inside the AEA laboratory campus in Nasr City.

On 1 June 1996 I visited the laboratories in Nasr city, where I met Dr. Hamza and Dr Aly Islam M Aly head of Siting and Environmental Department.

The multi gas monitoring station was just been assembled in a small container with air conditioning and a diesel power generator. The container was mounted on wheels and could be towed by a truck. It had been constructed and built in Cairo at a price of about 30,000.- LE.

The container included the following instrumentation mostly based upon Thermo Environmental equipment:

- Ozone monitor based on UV photometer,
- gas filter correlation CO analyzer , model 48,
- pulsed fluorescent SO_2 analyzer, model 43A,
- chemiluminiscent NO-NO2-NOx analyzer, model 42,
- total hydrocarbon, THC analyzer model 51,
- ESC 8800 data logger,
- gas calibrator model 146,
- zero air supplier,
- hydrogen generator.

There are three complete stations of this kind. One is planned for location inside the Egyptian Museum park at El Tahrir square. A second one will be located near the observatory in Helwan. The third complete container is presently located at AEA in NasrCity, but will probably in the future be located outside AEA.

In addition to these three stations AEA possessed a large number of air quality monitors of various kind. Most of these are the French made Environment S.A. type monitors. One ozone monitor was operated from the office of Dr. Hamza. During the visit it measured an ozone concentration of 67 ppb, which was claimed to lower than normal. The data were collected for a PhD theses, and no report or records of data could be presented.

The computer centre for the radioactive network was visited. Data from a network of 30 stations distributed over Egypt is being collected via modems and telephone lines every 15 minutes. The map of stations was displayed on a PC, based on a software package delivered by Eberline Environmental Monitoring System. The system displays exceedances of a pre-set alarm level, and it presents radiation levels as function of time for selected time periods (days, weeks etc..). The software package can also be used to display air quality data.

It was stressed that AEA already has trained personnel to run automatic monitoring programmes. AEA also possesses a number of field stations across Egypt. Some of these may be used for air quality monitoring.

AEA has in their posession air quality monitors amounting to a value of several million Egyptian pounds. It would be optimal to the total programme of air quality monitoring in Egypt to enable some co-operation between EEAA and AEA. At least an agreement on exchange of data should be established. This will require that the same level of quality assurance and quality controls are established for these data. The practical and political implementation of such co-operation has not been evaluated at this moment.

Dr Hamza and dr. Aly at the AEA have requested a meeting with air quality responsible personnel at EEAA to discuss such possible future co-operation for mutual use and exchange of air quality and meteorological data.

EIMP

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Technical note

b)

To: EEAA, Dr. Abdil Latif Hafez, dr. Mohammed ElZarka
Copy: Jan Hassing
From Bjarne Sivertsen
Date: 6 June 1996

Re: Co-operation with University of Cairo Air Quality Monitoring station

Representatives from the Cairo University Centre for Environmental Hazard Mitigation (CEHM) have discussed the EIMP programme's possible needs and use of data from an air quality monitoring station which is going to be established at the Cairo University.

Dr Mohamed I Sultan is the principal investigator. He is most of the time at the Argonne Natl. Laboratory in USA. The contact person in Cairo is Dr. Zeinhom El Alfy (geologist).

Funds have been given from the US Dept. of Agriculture to the Cairo University to establish the air quality station included laboratory equipment and training. The air quality monitors will be purchased before the end of June. They are building a new floor at the Chemistry building where the air quality sampling station is planned to be located.

On 4 June I met with Professor M.A.El Sharkawi, Dean of the Faculty of science and director of the CEHM programme. He was positive to a cooperation with the EEAA air quality monitoring programme, and would support an exchange of data between their air quality station at the Cairo University and EEAA.

The site for the AQ station at the third floor of the new Chemistry Building will be well suited as a kilometre scale reference station on the western side of Cairo. The room available for the equipment will have power, telephone lines and computer facilities. The station is at the moment planned for NOx-NO2 , Ozone , CO and particle monitoring. It will be possible to add SO_2 and VOC. The group at Cairo University will be interested in sharing the data with the EIMP air quality programme. How can this be arranged? In return the group at the University will be interested in meteorological data from the EIMP programme. They are building up a modelling group, and they will educate and train experts that could be used in the EEAA air quality monitoring programme in the future.

Appendix J

The Sampler - 8 - eight port.
From Glass Development Ltd England

glass developments limited

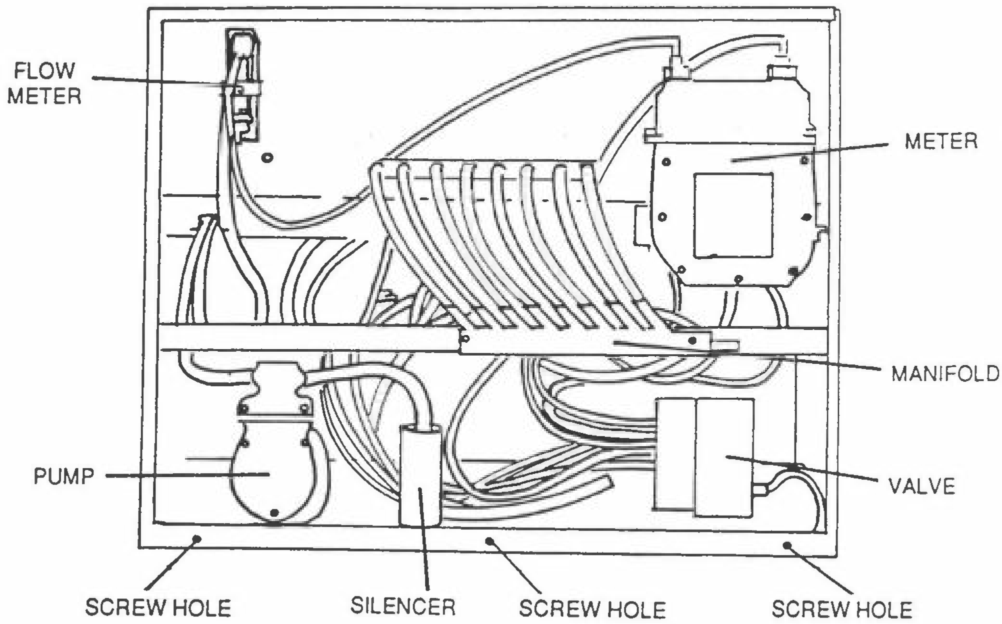
SCIENTIFIC INSTRUMENT MAKERS
Registered Office: 55 ACRE LANE • LONDON SW2 5AG • TEL: 071-733 5214 • FAX: 071-738 3441
Registered in London No. 389425 TELEX: 297761 BTIEQG

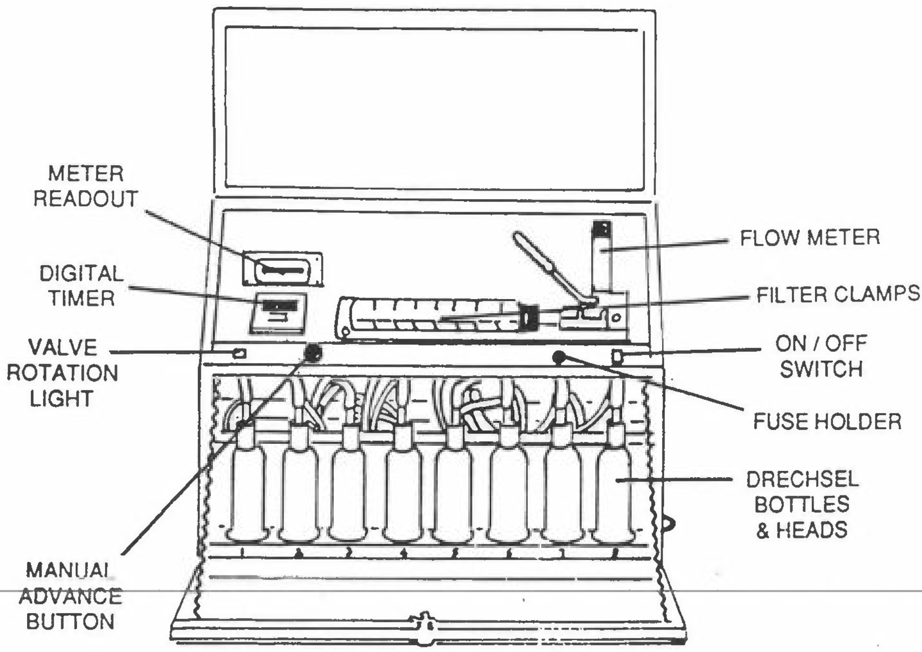
GLASS DEVELOPMENTS LTD

SAMPLER 8 - EIGHT PORT MONITOR MANUAL

Thank you for deciding to use Sampler 8 as part of your monitoring network. We strongly recommend that you read this manual in order to get the best results from your instrument.

SAMPLER 8
FRONT & REAR ELEVATION





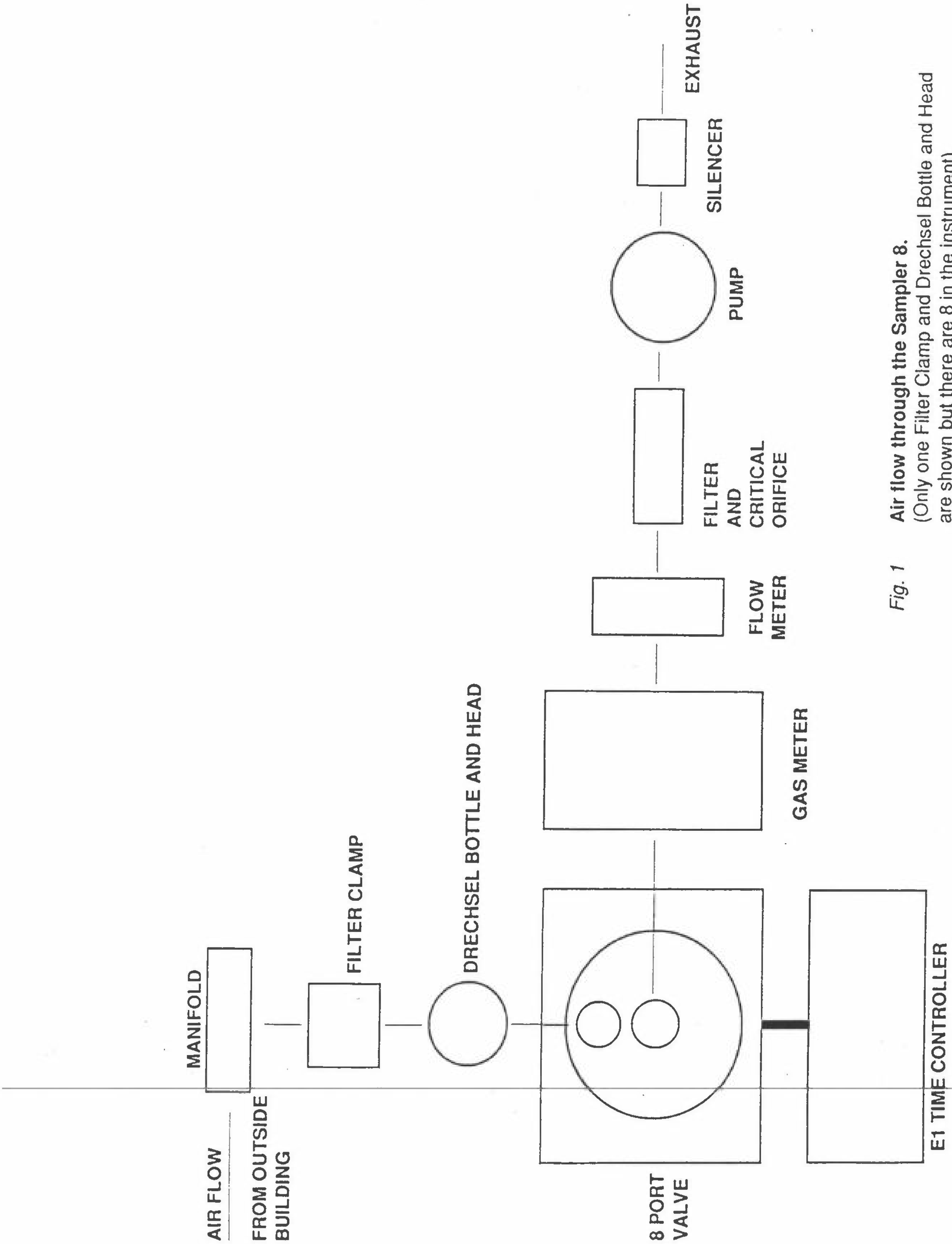
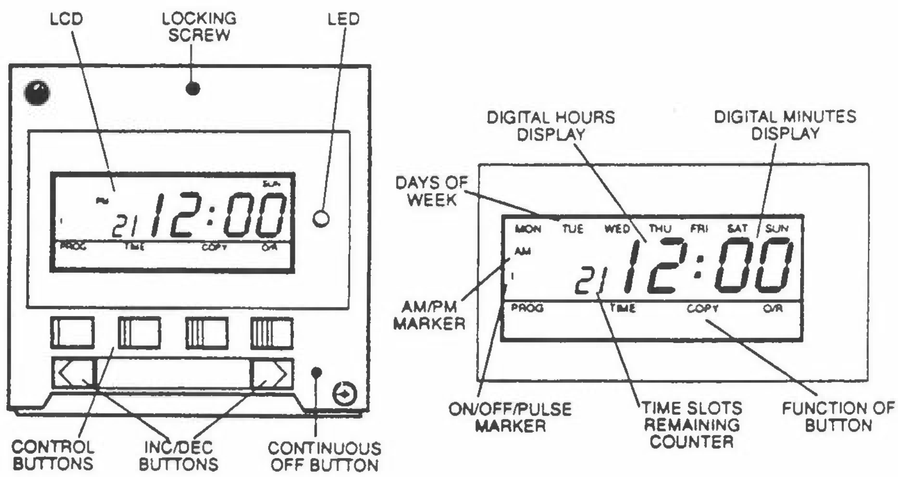


Fig. 1 **Air flow through the Sampler 8.**
(Only one Filter Clamp and Drechsel Bottle and Head are shown but there are 8 in the instrument)

The E1 Timeswitch



SECTION 1. THE PRINCIPLE

1.1. Sampler 8 is designed to measure average concentrations of smoke and sulphur dioxide in the atmosphere. Samples are collected automatically over 8 successive 24 hour periods and later analysed in the laboratory by simple techniques. The basic principle of operation of Sampler 8 is that a vacuum pump draws air from the atmosphere at a steady rate of 1.5 litres per minute.
The volume of air sampled is measured with a gas meter. Over each 24 hour sampling cycle the air is drawn through a filter paper and a gas washing bottle containing dilute hydrogen peroxide. Smoke particles are retained by the filter and form a stain.
The filtered air is then bubbled through the hydrogen peroxide and sulphur dioxide is converted to sulphuric acid by the reaction:

$$H_2O_2 + SO_2 = H_2SO_4$$

At the end of a 24 hour cycle a change-over valve switches the air intake to a fresh filter paper and hydrogen peroxide solution.
Once a week the filter papers and bottles are collected for laboratory analysis and a fresh set fitted to the Sampler 8.

1.2. To calculate the smoke concentration of a sample the darkness index of the stain on the filter paper is measured with a reflectometer. The darkness index is converted into a surface concentration (S) in micro-gm/sq cm by the British calibration curve published in BS 1747 Part 2.
The smoke concentration is then calculated as aS/V micro-gm/cu.m where V is the volume of air sampled and a is the filter clamp area.
The sulphur dioxide concentration is determined by measuring the amount of sulphuric acid converted by titration with a standard alkali solution. The volume (b) of 0.01N sodium tetraborate solution added to neutralise the sulphuric acid is measured and the concentration of sulphur dioxide calculated from 320b/V micro-gm/cu.m where V is the volume of air sampled.

1.3. The electrical supply required is 220/240V 50.HZ. The colour code of the mains lead is:

Green and yellow	Earth
Blue	Neutral
Brown	Live

1.4. A schematic diagram of the air flow through the Sampler 8 is shown in figure 1. For clarity only one filter clamp and one drechsel bottle with head are shown since the tubing runs from the manifold to the 8 port valve are identical for all 8 filter clamps and bottles (although naturally each is connected to a separate inlet port on the 8 port valve). Each component of the Sampler 8 will now be described and its function and operation explained.

SECTION 2. THE MANIFOLD

2.1. The purpose of the manifold is to distribute the sampled air to the filter clamps and drechsel bottles.
2.2. The manifold has one inlet and eight outlets, each of which is connected to a filter clamp.
2.3. The first task when preparing the Sampler 8 for operation is to connect the tubing from the inlet funnel (which is outside the building) to the manifold. Use clear PVC tubing of 8mm internal diameter.
2.4. Access to the manifold is from the rear of the Sampler. Identify the three posi-pan screws at the bottom edge of the green back panel. Unscrew (they are held captive by nylon washers).
2.5. Grip each side of the bottom of the panel and then pull towards you until the panel is released. Then ease the panel upwards to remove.
2.6. The brass manifold is mounted on an aluminium support bar and the inlet tube is to the right.
2.7. Pass the inlet tube through the access hole on the case side-panel and connect to the manifold inlet. (Dip the end of the tubing in a cup of boiling water to soften the PVC so that it will slide easily onto the manifold inlet tube).
2.8. Replace the back panel.

SECTION 3. THE FILTER CLAMP ASSEMBLY

3.1. Go to the front of the instrument and use the key to open the top and bottom access panels.

3.2. Identify the filter clamp assembly which is located on the right of the control panel shelf.

3.3. The assembly consists of eight precision machined brass filter clamps, each of which has two parts between which the filter paper is held. The internal diameter of each clamp is 25mm.

3.4. The circumference of each of the clamps rests upon two parallel stainless steel bars so that perfect alignment of both halves of each clamp is assured simply by their own weight. Precise alignment is crucial for accurate smoke measurement since if there is any misalignment the resulting stain will not be circular and the edges will not be well defined. Because of the uneven density of the stain considerable errors in the calculation of smoke concentrations will result.

3.5. Between each clamp there is a circumferential channel and this is the location for the clamp separator. This is inserted into adjacent channels and pressed firmly so that it's jaws diverge and open up the clamp in order that the filter paper may be removed without danger of wiping off any of the smoke particles collected.

3.6. The filter paper used is 5.5cm diameter Whatman No 1 (catalogue number 1001 055).

3.7. The filter paper must always be inserted with the smooth side facing the incoming air. The air flow in the Sampler 8 filter assembly is from right to left so the smooth side of the filter paper should face right. If difficulty is experienced in deciding which is the smooth side of the sheet, the paper should be held with one <u>edge</u> towards the light, when the rough side can easily be seen as the light passes across the surface.

3.8. To insert the filter papers first release the spring -loaded pressure plate by moving the clamp lever fully to the right. Insert each paper using the clamp separator. Then apply clamping pressure by moving the lever fully to the left. The spring-loaded pressure plate then will apply a uniform pressure to each clamp to ensure a good seal throughout. This is very important because if the clamps are not sufficiently tightened there will be leakage. The stain will then diffuse over too large an area for the

Continued

smoke calculation formula to apply.

3.9. When removing the paper for analysis again, use the clamp separator and take care to ensure the smooth side of the paper (on which the stain has formed) does not brush against the clamp face.

3.10. The filter papers which have been removed from the clamps should have the date and name of the site written on it **without touching the stain** and then each paper should be placed in a different clean small box until required for analysis.

3.11. **Under no circumstances should the Sampler 8 be operated without filter papers in place.** The problem is that small particles of grit drawn into the 8 port valve may damage it's working surfaces and cause leakage.

SECTION 4. THE SULPHUR DIOXIDE BUBBLERS

4.1. The eight drechsel bottles with their associated drechsel heads are held firmly in place by retaining clips in the bottle rack. The bottles are 125ml capacity and made from colourless borosilicate glass.

4.2. To remove a bottle grip it firmly by the neck and pull gently towards you to ease it out of its retaining clip. Then place it on the rubber mat and gently pull the head out of the bottle.

4.3. The drechsel bottles must be "conditioned" before use (as explained in BS 1747 Part 3) in order to remove from the glass traces of alkali which would interfere with the measurement of sulphur dioxide.

4.4. BS 1747 Part 3 explains preparation of the hydrogen peroxide solution with which the bottles are charged.

4.5. The charge of liquid should be sufficient to produce a depth of about 30mm above the bottom of the inlet tube. 50ml is usually sufficient but the amount is not critical. The reaction with sulphur dioxide which produces sulphuric acid will proceed as long as there is any peroxide present, and the amounts specified provide a wide margin of safety. Once the sulphuric acid has been formed it remains stable and can be kept if suitably stoppered until a convenient time for titration.

4.6. Each drechsel bottle is numbered and it should always be used in it's numbered position. Then any problems due to

Continued

the bottle will show up as a consistent departure from usual SO2 concentrations.

4.7. When changing the exposed solutions it is useful to have a marker (a piece of wire for example in the shape of a hook) which is placed each week on the drechsel bottle head in which sampling is taking place during the visit. Next time this bottle and six more will be replaced.

4.8. Each week the number on the marked bottle head will be different, because of the 8, only 7 are changed, but since the purpose of the numbers is only to show in which sequence the bottles are brought into action, it does not matter.

4.9. When the operator makes the weekly site visit he/she brings with him/her 7 drechsel bottles, each containing approximately 50ml of fresh hydrogen peroxide reagent.

4.10. Sampling is taking place in the last of the drechsel bottles which were put in place the previous week and will continue until midnight, so this bottle is dated (without removing it) with the current day's date.

4.11. Using this date as a reference the correct date is written on each drechsel bottle, working backwards around the circuit, without removing them.

4.12. It will be found that the last drechsel bottle to be changed carries the marker and is already dated from last weeks visit. This date should fit correctly into the sequence. The marker is transferred to the drechsel bottle where sampling is now taking place and remains untouched.

4.13. The 7 exposed drechsel bottles are removed and stoppered, being replaced by those containing the fresh reagent.

4.14. At the end of the operation the only drechsel bottle on the instrument marked with a date is the one actually sampling; it carries the marker and remains untouched. The remaining 7 bottles on the instrument have no mark.

4.15. The operator takes away with him/her 7 stoppered drechsel bottles all marked with the date of the sampling.

SECTION 5. THE 8-PORT VALVE

5.1. The 8-port valve is designed to automatically switch (at pre-programmed times) the air intake to pass through a different filter and bubbler.

5.: ; main operating parts are:
A circular stainless steel plate with 8 inlet tubes (ports) around it's circumference and a centre port.
A P.T.F.E. disc with machined slot from it's centre to just short of it's circumference.

5. :n assembled the P.T.F.E. disc is spring loaded against ; rear of the stainless steel disc and the slot becomes 'low channel to connect any one outer port to the :tral port.

5. P.T.F.E. disc is rotated by the changeover motor which energised by the E1 time controller. It's rotation is pped when the slot coincides with the next port by a /micro-switch assembly.

5. h plates are machined flat and lapped before the valve assembled and great care must be taken to avoid the ress of dirt between the two plates, otherwise the .F.E. disc, which is very soft, will become scored and valve may leak. The instrument should therefore never operated without filter papers in place.

5. outer ports are located so that the port at 12 o'clock connected to drechsel head number 1. Going in a ckwise direction the next port is to drechsel head ber 2 and so on.

5.˜ :s important to note that the above connections are all ; to the lower tubes on the drechsel heads. If the nections are made the other way round the bubbler in :ation will empty itself through the valve and into the ;r when the pump is switched on.

5. central port is connected to the gas meter.

5. :ing at the stainless steel plate, the rotation of the .F.E. disc is clockwise so the air intake is nentially switched from drechsel head 1 to 2 then from ɔ 3 and so on.

5. ; 8-port valve requires no adjustment in operation.

SECTION 6. THE E1 TIME CONTROLLER

6.1 purpose of the E1 time controller is to energise the /e change-over motor at a sequence of pre-programmed ;s.

6.2. :he U.K. national survey of air pollution, the change ;r time chosen is midnight each day.

6.3 programme instructions which follow are written for ;e change-over times but are easily modified if other

Continued

times are chosen. Please contact us for advice.

6.4. The red circular push button on the face of the unit below the time switch is used for manually changing valve ports. Depressing this button for one second will illuminate the neon indicator and this shows the change-over motor is running. The instrument ON/OFF switch (which illuminates when "ON") and fuse (250v, 1amp) are on the right of the control panel. The button should be held depressed for 1 second until the neon remains "ON" when the button is released. The motor will then continue to drive the valve to its next parked position when the neon will go "OFF" (this takes about 4 seconds). Do not attempt to use the manual change-over button when an automatically timed change-over is about to take place.

6.5. Please note that the E1 time switch contains a rechargeable battery which will maintain correct clock time and programmed sequences in the event of a temporary mains power failure. There should be no need to have to reset time and switching sequences after a power failure. However a power failure will cause the pump to stop for some time and hence the volume of air sampled by the affected filter and bubbler will be less than expected. Mains power is also required at all times to drive the valve change-over moter. Hence, should the mains power be off at the time set for valve change, the change-over will not occur, even though the time switch continues to run uninterrupted. This will result in the same filter and bubbler being used continuously for more than 24 hours. Always check that the expected bottle is seen to be bubbling when you make your routine visit to service the instrument.

6.6. When the locking screw is released the E1 control is as illustrated in figure 2.

6.7. The control functions of the E1 timeswitch consist of an L.C.D. display, an L.E.D., four programming buttons with "increase" and "decrease" buttons and a continuous OFF button.

6.8. <u>L.C.D. DISPLAY.</u> The display is divided into two sections by a horizontal line. The top section shows the day, time of day and AM or PM. It also shows if the unit is ON (shown as 1) or OFF (shown as 0) or in the PULSED output mode (shown as ⎍).

<u>IMPORTANT: NEVER USE THE PULSED OUTPUT MODE.</u>

Also during programming an indicator shows how many of the

Continued

21 on/off periods are still available for programming. The bottom section of the L.C.D. shows the functions of the four display buttons. These can change during programming so the display always shows the correct function of a button at any point in the programming sequence.

6.9. L.E.D. This indicator illuminates whenever the output of the unit is ON. When the unit is OFF the L.E.D. does not illuminate.

6.10. PROGRAMMING BUTTONS. These are marked:

[1] [11] [111] [1111]

and each button can have one of three functions, depending on the action being taken. The function of each button at any time is always shown on the bottom part of the L.C.D. screen above the relevant button. The functions operated by the buttons are:

EITHER	- PROG	TIME	COPY	O/R
OR	- REVU	CANCEL	SET	EXIT
OR	- HR	MIN	DAY	ENTER

The "INCREASE" button [>] and the "DECREASE" button [<] are used in conjunction with the programming buttons, to go forwards or backwards respectively to determine day of the week, hour, minute or to review set programmes.

NB

a. The DECREASE [<] button will not go back further than 12.00 am, nor the INCREASE [>] button further forward than 11.59 pm in any day.

b. Pressing down the [<] or [>] buttons will accelerate the change of time on the display.

6.11. In the programming instructions which follow the steps in block capitals (eg PROG, CANCEL, EXIT etc) imply that the appropriate red, rectangular control button must be pressed once and once only. For clarity the word "PRESS" has been omitted. The steps must be followed in the numbered sequence. When pressing a control button, use gentle but firm pressure applied to the centre of the button. Take care not to jam the button in a permanently "DOWN" position.

SECTION 7. PROGRAMMING THE E1 TIME CONTROLLER

Stage 1: Setting correct GMT clock time (when necessary)

7.1. TIME
7.2. DAY
7.3. INC/DEC until correct day flashes
7.4. HR
7.5. INC/DEC until correct AM or PM hour flashes
7.6. Min
7.7. INC/DEC until correct minutes flash
7.8. ENTER

Time is now set: this is the normal 'RUN' mode.

Stage 2: Clear all day and copied switching sequences

7.9. PROG
7.10. CANCEL
7.11. CANCEL
7.12. COPY
7.13. CANCEL
7.14. CANCEL

The time switch is now completely cleared of all programmed switching sequences.

Stage 3: Set time on Monday at which time the valve will operate (i.e. midnight GMT)

7.15. PROG
7.16. INC/DEC until ON/OFF mode 1 symbol flashes
7.17. ENTER
7.18. SET
7.19. DAY
7.20. INC/DEC until MON flashes
7.21. HR
7.22. INC/DEC until PM hour 11 flashes
7.23. MIN
7.24. INC/DEC until minutes 58 flashes
7.25. ENTER sets ON time of 1158 pm; switch status 1 'on' changes to O 'OFF'
7.26. HR
7.27. INC/DEC until PM hour 11 flashes
7.28. MIN

7.29. INC/DEC until minutes 59 flashes
7.30. ENTER Sets OFF time of 1159 pm which will actually take effect 1 minute later at midnight
7.31. EXIT
7.32. EXIT

Monday is now set in ON/OFF mode to trip at 1158 pm and start valve movement at midnight GMT.

Stage 4: Copy Monday's program into Tuesday through Sunday.

7.33. COPY
7.34. SET
7.35. DAY
7.36. INC/DEC until MON flashes
7.37. ENTER the 'base' day is now Monday
7.38. INC/DEC until TUE flashes
7.39. ENTER Monday's program is copied into Tuesday
7.40. DAY MON should flash (the 'base' day)
7.41. ENTER
7.42. INC/DEC until WED flashes
7.43. ENTER Monday's program is copied into Wednesday
7.44. DAY MON should flash (the 'base' day)
7.45. ENTER
7.46. INC/DEC until THU flashes
7.47. ENTER Monday's program is copied into Thursday
7.48. DAY MON should flash (the 'base' day)
7.49. ENTER
7.50. INC/DEC until FRI flashes
7.51. ENTER Monday's program is copied into Friday
7.52. DAY MON should flash (the 'base' day)
7.53. ENTER
7.54. INC/DEC until SAT flashes
7.55. ENTER Monday's program is copied into Saturday
7.56. DAY MON should flash (the 'base' day)
7.57. ENTER
7.58. INC/DEC until SUN flashes
7.59. ENTER Monday's program is copied into Sunday
7.60. EXIT
7.61. EXIT

Every day of the week is now set to be a copy of Monday. The switch status (below AM/PM) should now be 0 for OFF, and the red LED on the right hand side of the LCD display should be 'OFF'. If status is 1 for ON and the LED is 'on', press O/R once.

IMPORTANT: DO NOT TOUCH THE 'CONTINUOUS OFF BUTTON'.

If required, use the manual change-over button to step the valve until the desired bottle is seen to be bubbling.

<u>What to do if you make a mistake in the setting sequence</u>

Press ENTER/EXIT....EXIT until the LCD display shows normal time-of-day 'RUN mode. Then start again from the beginning of Stage 2.

To review the sequence programmed for Monday, <u>without altering anything:</u>

7.62. PROG
7.63. REVU
7.64. INC/DEC to view the 1 'ON' and 0 'OFF' settings
7.65. DAY
7.66. INC/DEC to select another day
7.67. ENTER
7.68. INC/DEC to view the selected day's settings

If you are curious, steps 65 through 68 may be repeated to examine any other day of your choice.

7.69. EXIT
7.70. EXIT to normal 'RUN' mode.

Note: the only day intentionally set with an ON/OFF sequence is Monday. Tuesday through Sunday will normally show <u>no</u> programmed sequence, indicated by a displayed set time of 0:00.

To review days using a copied program, <u>without altering anything:</u>

7.71. COPY
7.72. REVU MON, the 'base' day, should appear solid, while TUE through SUN should <u>all</u> flash, indicating that they are copies of Monday's sequence.
7.73. EXIT
7.74. EXIT to normal 'RUN' mode

SECTION 8. THE GAS METER

8.1. The digital display of the Remus 3G-1-6 gas meter is positioned directly above the E1 timer.
8.2. The display registers cubic metres of air flow.
8.3. The purpose of the meter is to enable the average daily volume of air sampled to be measured.
8.4. At the start of monitoring the meter reading is noted together with the time and date.
8.5. At the next weekly visit the same information is recorded.

The two meter readings are then subtracted and the average daily volume sampled calculated using the number of hours elapsed between visits.

SECTION 9. THE FLOW METER

9.1. The flow meter (Platon Flowbits type GP/1/8A/6) is mounted directly above the filter clamp assembly.
9.2. Its purpose is to provide a quick check that the flow rate is within acceptable limits.
9.3. The recommended flow rate for the Sampler 8 is 1.5 litres per minute, plus or minus 10%.
9.4. If the flow rate is observed to be decreasing over a number of visits to the site it indicates that the critical orifice of the pump is gradually becoming contaminated and it should be removed (as described in the next section) for ultrasonic cleaning.

SECTION 10: THE CRITICAL AND SAFETY FILTER

10.1. The purpose of the critical orifice is to maintain an accurate flow rate.
10.2. The purpose of the safety filter is to protect the critical orifice.
10.3. A reduction in flow rate indicates contamination of the critical orifice and it should be removed for ultrasonic cleaning as follows:-
10.4. Remove the back panel and identify the filter body. It is a black plastic cylinder screwed to the manifold support bar directly above the pump.

Appendix K

Site visit reports. Air Quality Sampling Stations in Cairo

Air quality monitoring sites in Cairo

With UTM reference locations.

Site name	Old UTM (from map)		Measured UTM (GPS)	
	x	y	X	Y
Azbakkeya	638,50	816,62	330,50	3326,62
Nozha	646,15	821,55	338,15	3331,55
ElSaheil	638,20	819,50	**330,29**	**3329,44**
Nasr City	645,80	817,45	337,80	3327,45
Abo el Ssaoud	637,20	811,85	329,20	3321,85
Maasarah	643,75	799,35	**335,79**	**3309,58**
Helwan	646,20	792,60	**337,43**	**3302,61**
Tebin	645,00	785,20		
F.of Med. Ain Shams	642,00	818,50	**334,24**	**3328,56**
Embaba	636,55	819,24	**328,73**	**3329,25**
Ttalbia, Giza	633,21	810,51	325,21	3320,51
Hawamdia	640,40	798,20	**332,37**	**3308,56**
Attaba	638,72	815,56	**330,99**	**3325,65**
Shoubra el Kheima	638,60	823,30	**330,58**	**3333,40**
Salem City			**348,02**	**3338,08**

Air quality monitoring network
Site visit report

Site **Name: Abo El Ssaoud**
Coordinates: N:30d. 0m. 53s. E: 31d. 14m. 0s. **UTM:** 329200,3321850

Access/ availability: Easy parking outside building. Small office room at second floor (working place). 50 m from traffic at Salah Salem road.

Buildings and rooms available: Local health care centre, one small room in second floor for sampling equipment. The room is being used as office. (should have found another room?).

Area description: suburban/ residential area. Salah Salem road; highly trafficated.

Local sources: Main source traffic, local waste burning, gypsum factory ($CaSO_4$) about 2 km east of site.

Representativity: Fair to good for suburban eastern Cairo..

Parameters measured: SO_2 , black smoke (BS) .

Data quality: Data availability in 1995 was 22 % for SO_2 78 & for BS. Low SO_2 concentrations (mean 11 $\mu g/m^3$) were measured due to alkaline reactions in analyses.?.

Measurement equipment: The old type sequential sampler from Glass Development Limited in England for 24 h average sampling of SO_2 and black smoke,

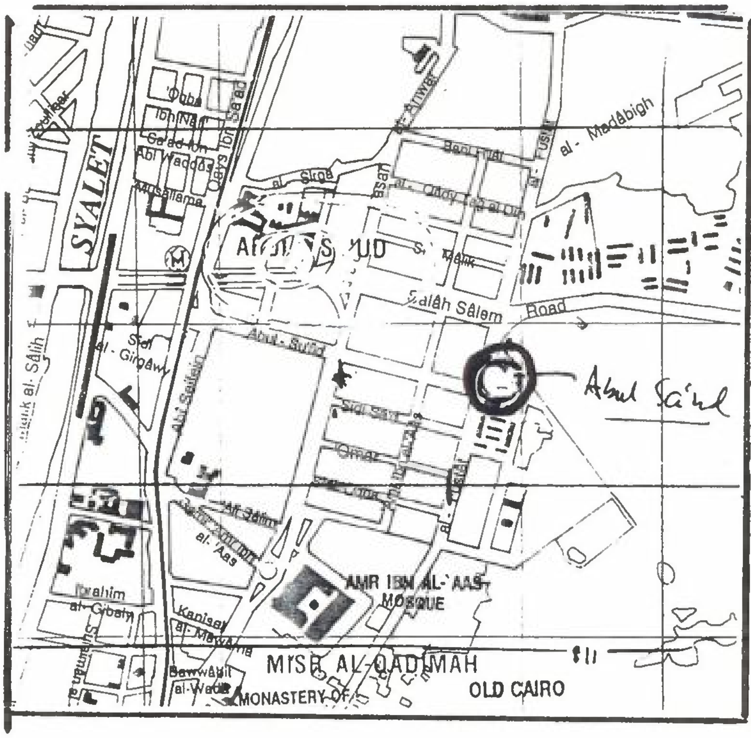
Infrastructure: Power: 220 V available in the second floor room and at the roof.
Telephone lines: One line exists in the first floor. Have to install extra line to be locked/ sealed off.
Sampler/monitor locations: TSP at upper level (open room) , SO_2 and BS at a shelf in the 2 floor room.
Air intake: For SO_2 and BS 6 m above ground 1m from the wall west side of the building.

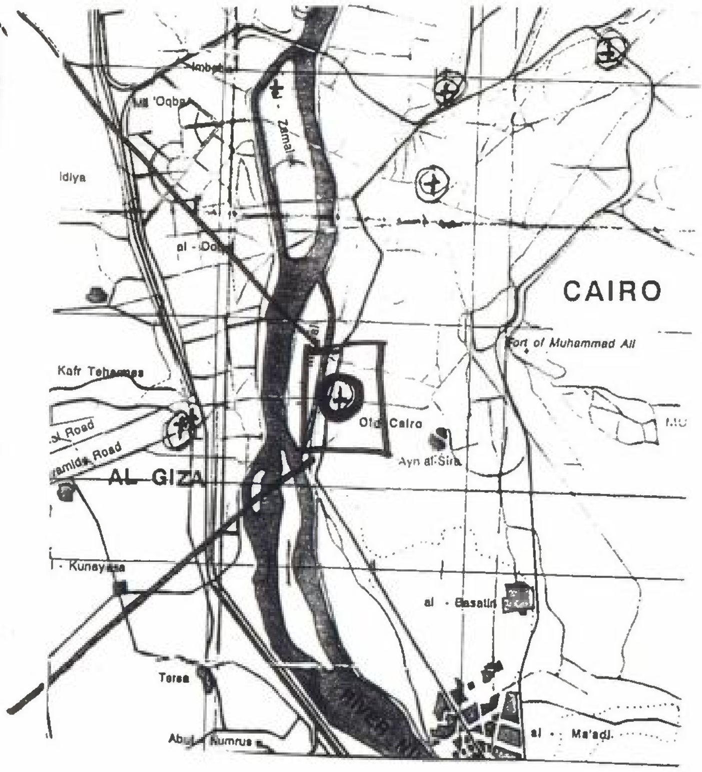
Personnel: Responsible for this station is Mr Ismahil (Technician) . Mohammed Refaye El Amawi is responsible for air sampling and analyses.

Future monitoring station: The site will be well suited for SO2, NOx and PM10 monitoring in a future monitoring network. The PM10 sampling intake if 2 filter sampler is used with intake to the same sampling room.

Air quality monitoring network
Site visit report

Site **Name: Abo El Ssaoud**
Coordinates: N:30d. 0m. 53s. E: 31d. 14m. 0s. **UTM:** 329200,3321850





Abo El Ssaod

28 May 1996

Air quality monitoring network
Site visit report

Site **Name: Azbakaya**
Coordinates:. UTM: 330500, 3326620

Access/ availability: Near Ramses square, heavy traffic, difficult to park in Gumhuraya street.

Buildings and rooms available:. Sampler located in a large room on the second floor at the director of the Health Office.

Area description: Urban area with heavy traffic and high level of activities.

Local sources: Mostly traffic close to the station. Heavy traffic on Gumuraya street just under the sampler intake.

Representativity: The site is representative for a street canyon site in central Cairo.

Parameters measured: SO_2 , black smoke (BS) (not operated at the time).

Data quality: The station is not being operated at the time due to lack of spare parts (a pump?). Data availability in 1995 was only 16 % for SO_2 and 18 % for BS. Average annual SO_2 was 31 $\mu g/m^3$, BS; 121 $\mu g/m^3$ (among the higher values in this network).

Measurement equipment: The old type sequential sampler from Glass Development Limited in England for 24 h average sampling of SO_2 and black smoke has been used, but should have been exchanged with a better sampler.

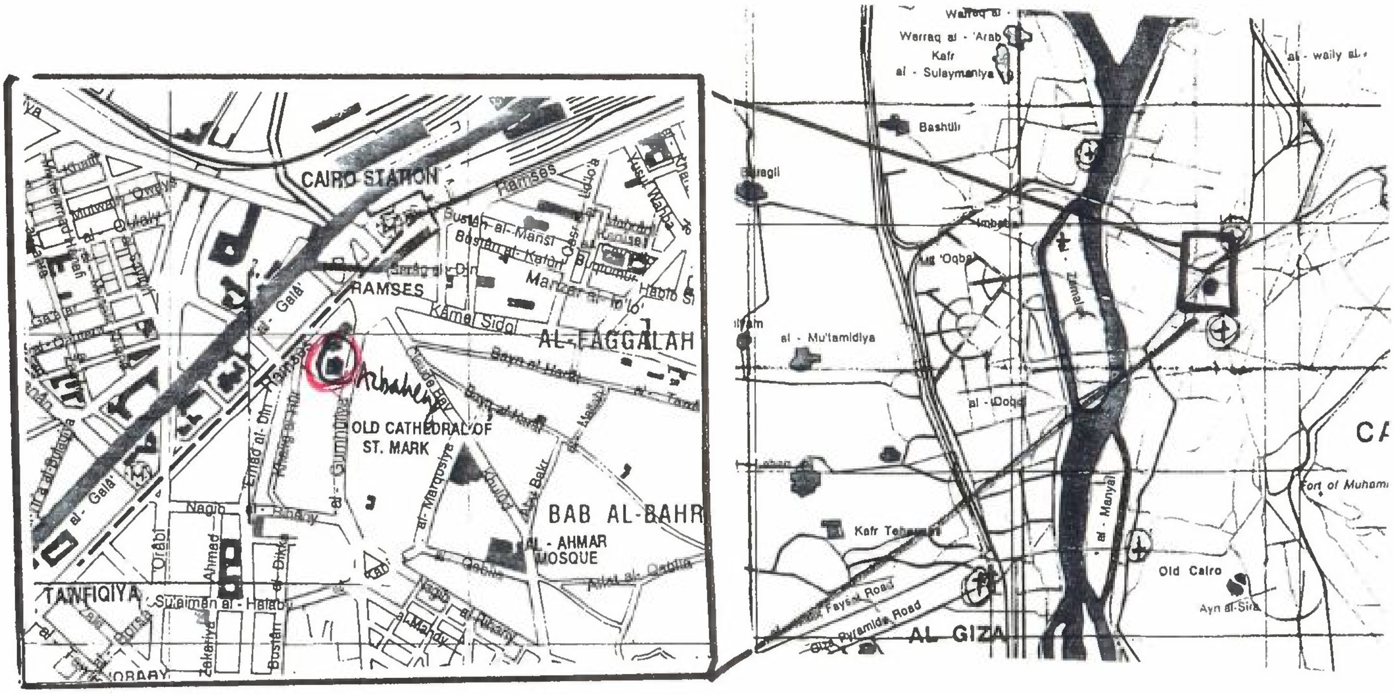
Infrastructure: Power: 220 V available in the room.
Telephone lines: New line has to be installed .
Sampler/monitor locations: On shelf in the office, 2 m from the wall.
Air intake: SO_2 and BS at intake 1 m from the wall about 8 m above the street. A balcony outside the room could be used for this sampling location.

Personnel: Technician responsible is Mr ElBhahid (sick at the moment), Mr Saber Mohammed should take over. Responsible for air sampling and analyses Mr Mohammed Refaye El Amawi.

Future monitoring station: The site will be well suited as a central Cairo street canyon station for NOx/NO2, CO, SO_2 and PM10 monitoring in a future monitoring network.

Air quality monitoring network
Site visit report

Site **Name: Azbakaya**
Coordinates:. UTM: 330500, 3326620

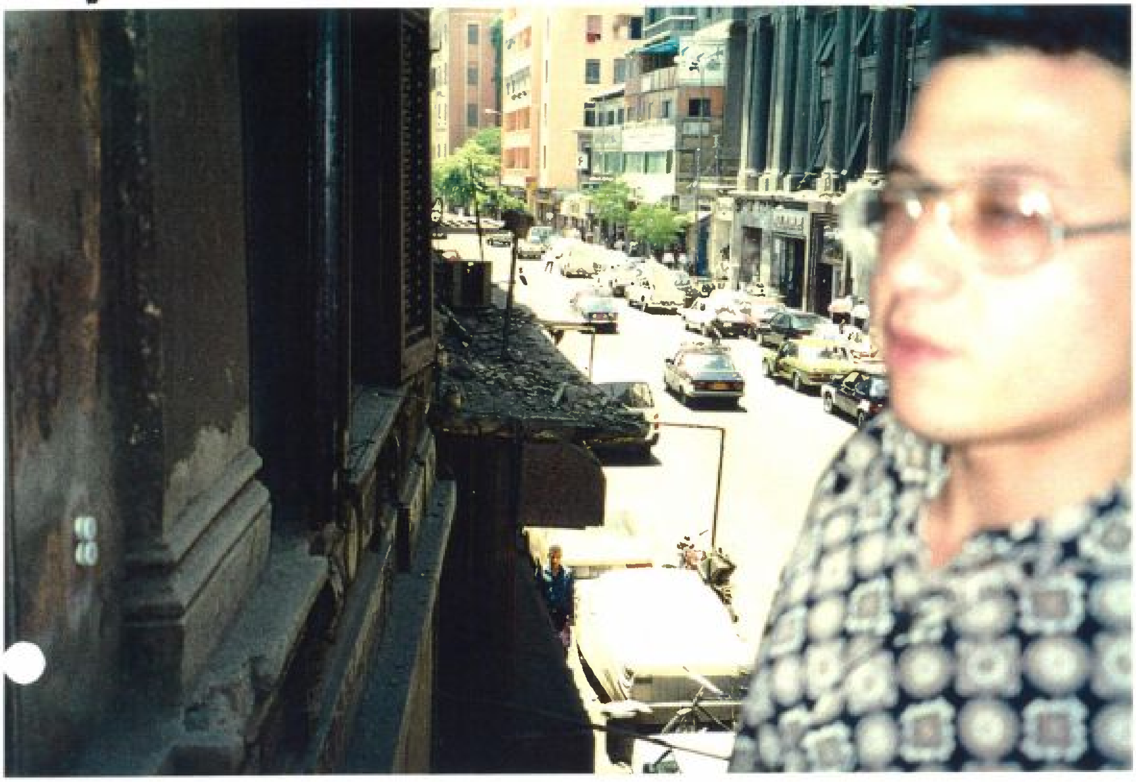


not operated at the time →

Passive samplers

Azbakaya

6 June 1996



Air quality monitoring network
Site visit report

Site Name: Attaba
Coordinates:. UTM: 330989, 3325651

Access/ availability: Near Attaba square in between fly over roads, difficult to access , impossible to par except in the near by parking house. The roof where future sampling could be undertaken is easily accessible when first inside the building.

Buildings and rooms available:. Sampler located in a large room on the second floor with intake into back yard with little traffic.

Area description: Urban area away from streets. Roof site open area.

Local sources: Mostly traffic close to the station.

Representativity: Representative for backyard inside Cairo City centre. Roof location represent kilometre scale except for parking garage near by with floors at same level as the roof.

Parameters measured: SO_2 , black smoke (BS) (not operated at the time).

Data quality: The station is not being operated at the time due to lack of spare parts (a pump?). There were no data available in 1995 except for TSP.

Measurement equipment: The old type sequential sampler from Glass Development Limited in England for 24 h average sampling of SO_2 and black smoke had been used on this station, but should have been exchanged with a better sampler. Anderson type sampler (from General Metal Works Inc.) for TSP.

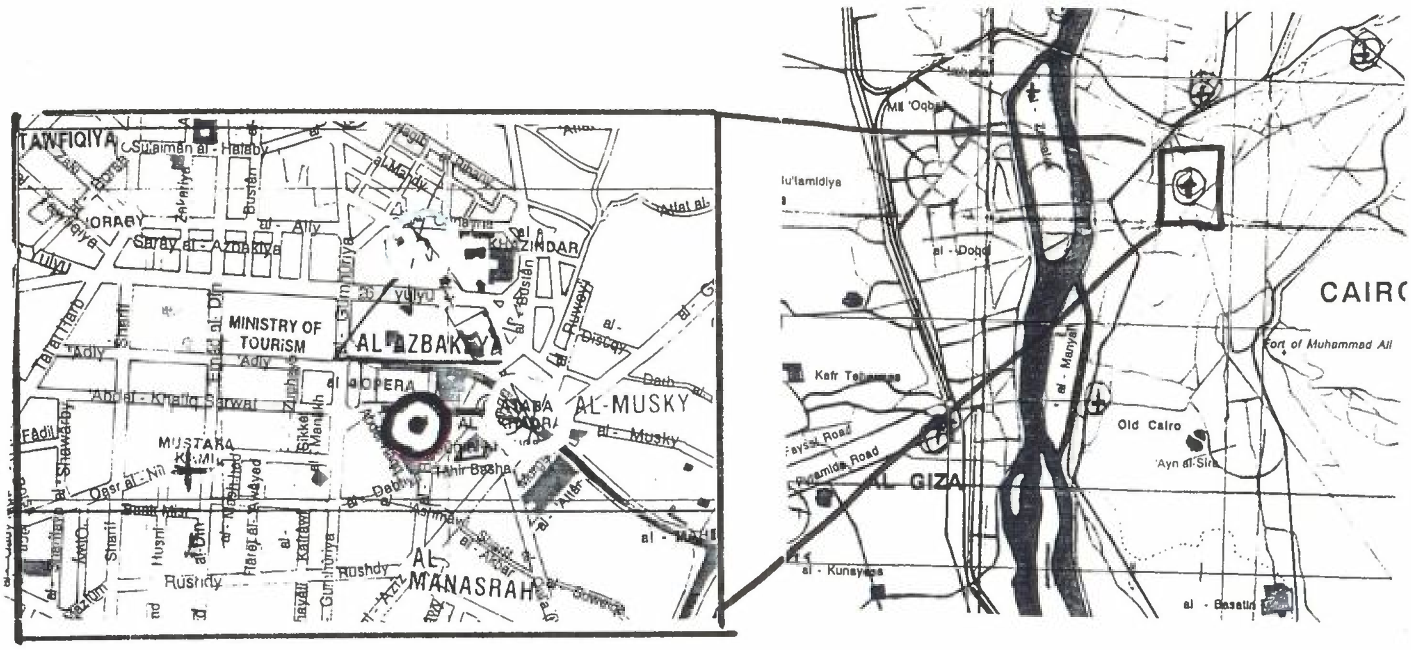
Infrastructure: Power: 220 V available in the room and at the roof.
Telephone lines: New line has to be installed .
Sampler/monitor locations: On shelf in the office.
Air intake: SO_2 and BS at intake ? TSP on the roof on open space.

Personnel: Technician responsible is Mr Mahedy Fahim. Responsible for air sampling and analyses Mr Mohammed Refaye El Amawi.

Future monitoring station: The site could be as a central Cairo roof top station for NOx/NO2, SO_2 and PM10 monitoring in a future monitoring network. A new shelter should be built to include the station.

Air quality monitoring network
Site visit report

Site **Name: Attaba**
Coordinates:. UTM: 330989, 3325651



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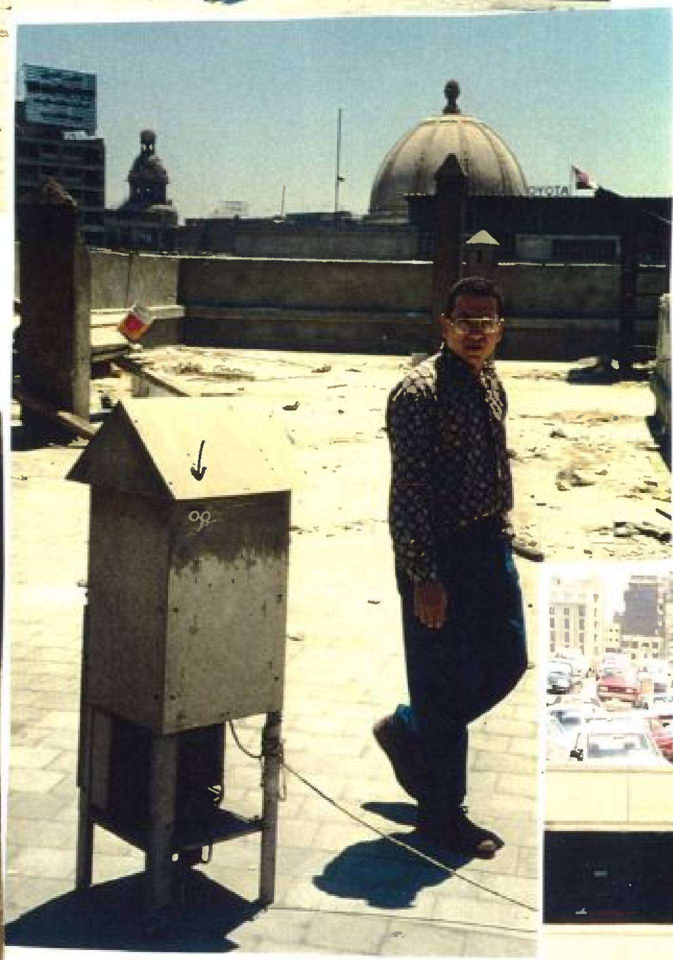
ATTABA

6 June 1996



passive samplers

possible room at stair case, for future monitors?

Parking garage next to Attaba station...

Air quality monitoring network
Site visit report

Site **Name: Embaba** at Env. Monitoring and Occupational Health Centre, Lab.
Coordinates: N:30d. 4m. 53s. E: 31d. 13m. 22s. **UTM: 328730, 3329250**

Access/ availability: Easy access from Tayar Fekri Street, parking inside tha fence possible.

Buildings and rooms available: Large laboratories, good space, sequantial sampler is located in one of the laboratories with intake through wall. Anderson Hivol sampler for TSP located at the roof. of the building (above 3. floor).

Area description: Urban to residential area. Large road; Delta Road highly trafficated 50 m from building.

Representativity: Good location for TSP sampler on the roof good. Intake for sequential sampler near trees near to the wall.

Parameters measured: SO_2 , black smoke (BS) , TSP

Data quality: Data availability in 1996 fairly good; 75,8 % for SO_2 , 85,7 % for BS SO_2 data missing due to alkaline reactions in analyses. No TSP measurements in January, 8 in February - March (once each week).
Data availability for 1995: SO_2 : 56%, BS: 72 %.

Measurement equipment: Sampler 8 monitor from Glass Development Limited in England for 24 h average sampling of SO_2 and black smoke,
Anderson Sampler for TSP. Also available small medium volume samplers for TSP, and one Anderson with 10 micron cutoff hood.

Infrastructure: Power: 220 V available in laboratory and at the roof.
Telephone lines: Available in laboratory.
Sampler/monitor locations: TSP at roof, SO_2 and BS in laboratory.
Air intake: For SO_2 and BS 6 m above ground close to north wall.

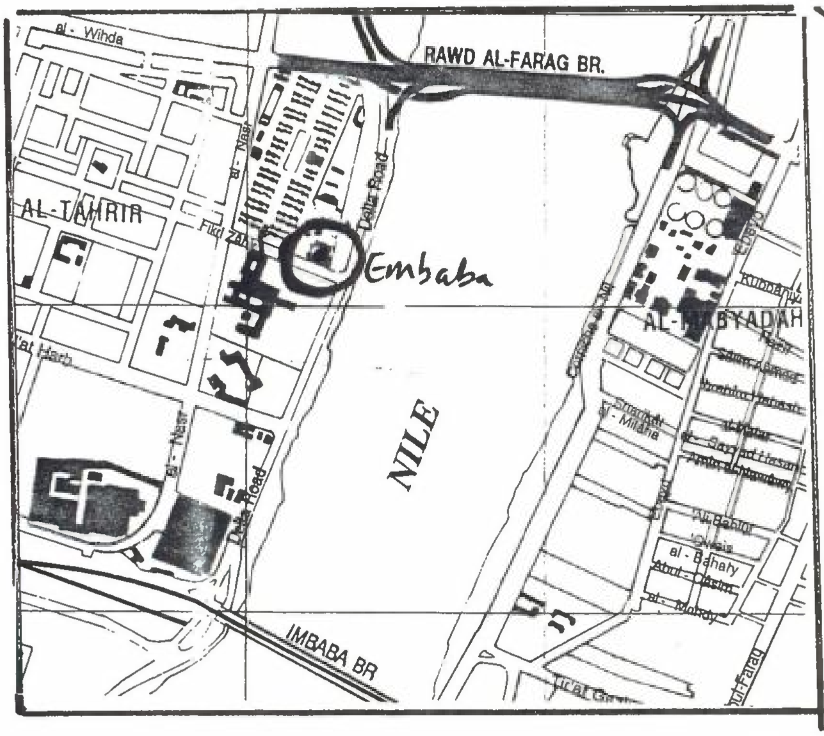
~~**Personnel**: Dr. Seham M H Hendy (head of laboratory).~~
Mr Mohammed Refaye El Amawi (responsible for air sampling and analyses).
5 employees with university degrees, 12 technicians.

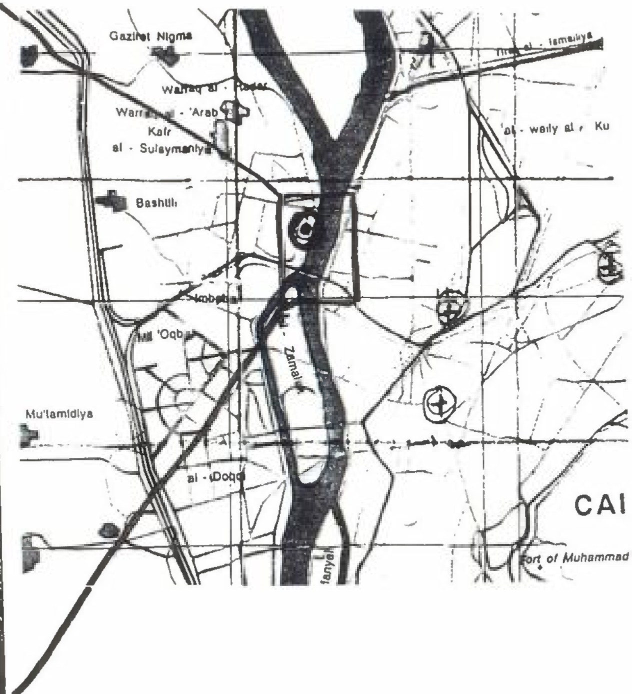
EIMP Air Quality Monitoring, Embaba

Future monitoring station: The site will be a good station in the future monitoring network. It will contain PM10 monitoring and an automatic weather station at the roof, SO_2 ,NOx and Ozone in the lab. It may also be of interest to install a road side station behind the fence at Delta Road. A mobile "house" will be available for this purpose, but will need an air contiron system.

Air quality monitoring network
Site visit report

Site **Name: Embaba** at Env. Monitoring and Occupational Health Centre, Lab.
Coordinates: N:30d. 4m. 53s. E: 31d. 13m. 22s. **UTM: 328730, 3329250**





EIMP

Embaba

June 1996

passive samplers at road

passive samplers 20m from road

Air quality monitoring network
Site visit report

Site **Name: El Saheil, Shoubra**
Coordinates:. **UTM:330290, 3329438**

Access/ availability: Difficult parking inside hospital area.

Buildings and rooms available:. Sampler located in small crowded room. No other room available in over crowded hospital serving 2 mill. people..

Area description: Urban area with many old buildings gravel roads and streets.

Local sources: No major sources close to the site. Some traffic and the highly industrialised area at Shoubra el Kheima about 5 km. to the north.

Representativity: The site may be representative for the general pollution level in this part of Cairo but the air intake is close in between buildings.

Parameters measured: SO_2 , black smoke (BS) but equipment not in operation.

Data quality: Data availability in 1995 was only 7 % for SO_2 and 16 % for BS. Average annual SO_2 was 7 $\mu g/m^3$, BS; 60 $\mu g/m^3$ The availability in 1996 (Jan-Mar) is very low as the instrument has been out of operation for 2 months. The quality at this station at the moment is poor.

Measurement equipment: The old type sequential sampler from Glass Development Limited in England for 24 h average sampling of SO_2 and black smoke is used.

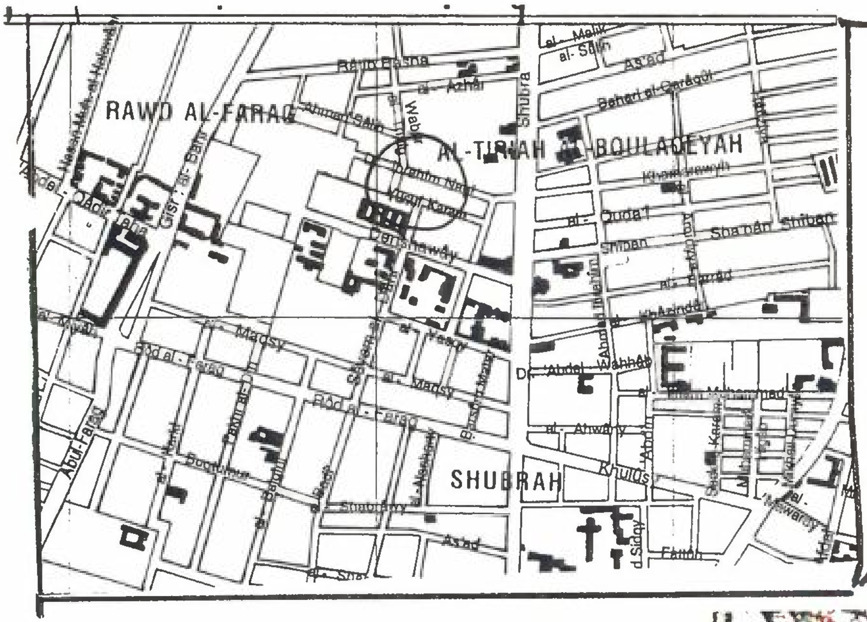
Infrastructure: Power: 220 V available.
Telephone lines: No telephone lines are available
Sampler/monitor locations: On a shelf on the wall.
Air intake: SO_2 and BS at intake 10 cm from west wall about 6 m above the ground .

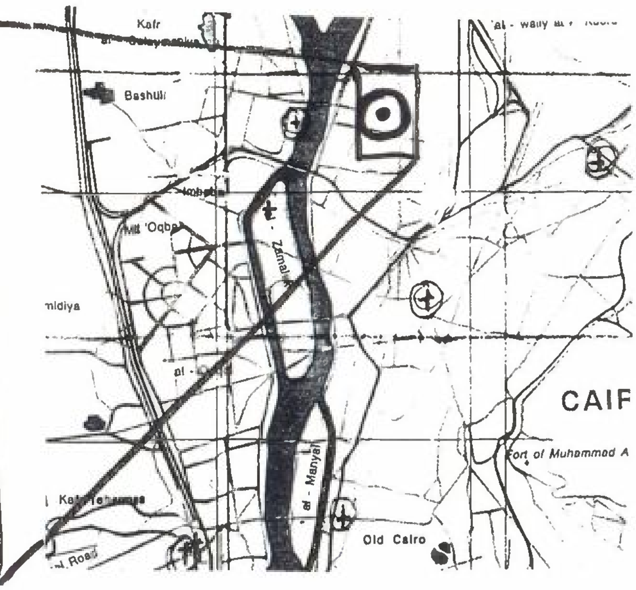
Personnel: Technician responsible is Mr Ahmed Fauso.
Responsible for air sampling and analyses Mr Mohammed Refaye El Amawi.

Future monitoring station: The site is not suited for automatic monitoring.

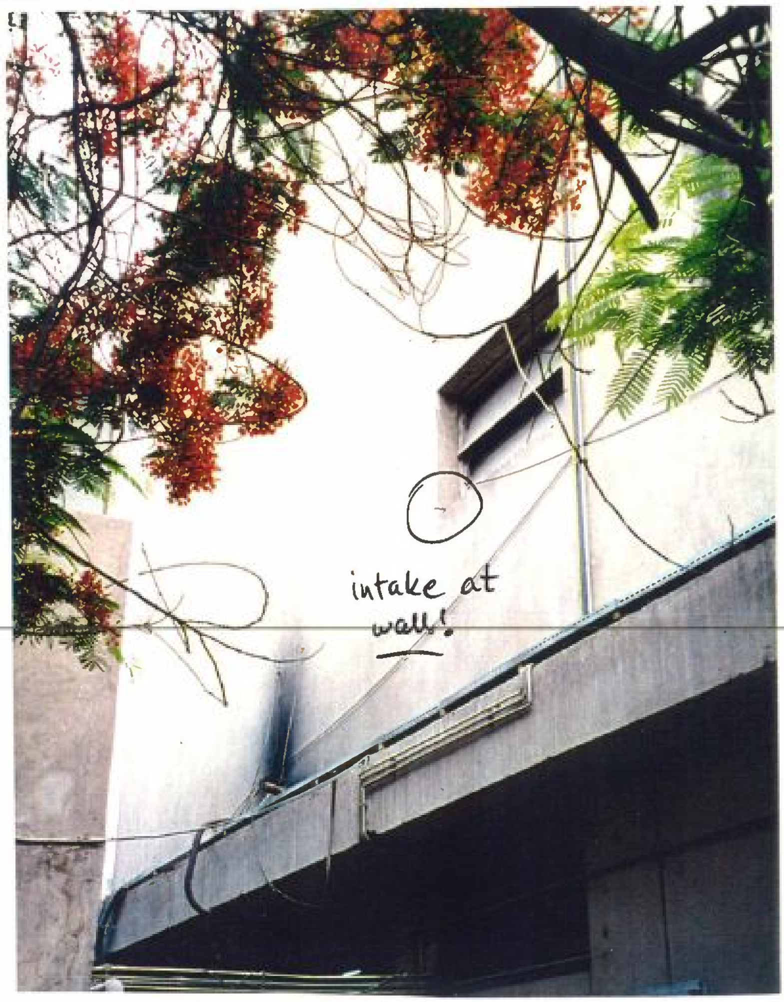
Air quality monitoring network
Site visit report

Site **Name: El Saheil, Shoubra**
Coordinates:. UTM:330290, 3329438





SO_2 intake behind trees...



Air quality monitoring network
Site visit report

Site **Name: Faculty of Medicine, Ein Shams University**
Coordinates:. **UTM:334235, 3328564**

Access/ availability: Easy parking at the Faculty of Medicine building inside Ein Shams University.

Buildings and rooms available:. Sampler located in air conditioned computer room. Large room with place for more samplers. The roof level was easily accessible.

Area description: Urban to residential area. Traffic at Ahmed Lotfy street.

Local sources: Mostly traffic close to the station. Industrial sources at Azbakaya about 2 km. to the south west.

Representativity: The site is representative for the general pollution level in this part of Cairo. The intake may be somewhat influenced by local traffic emissions.

Parameters measured: SO_2 , black smoke (BS) .

Data quality: Data availability in 1995 was 46 % for SO_2 and 59 % for BS. Average annual SO_2 was 51 $\mu g/m^3$, BS; 76 $\mu g/m^3$ (among the higher values in this network) The availability in 1996 (Jan-Mar) for SO_2 was 56 % for BS 62 %. he quality at this station at the moment seems satisfactory.

Measurement equipment: The old type sequential sampler from Glass Development Limited in England for 24 h average sampling of SO_2 and black smoke is used.

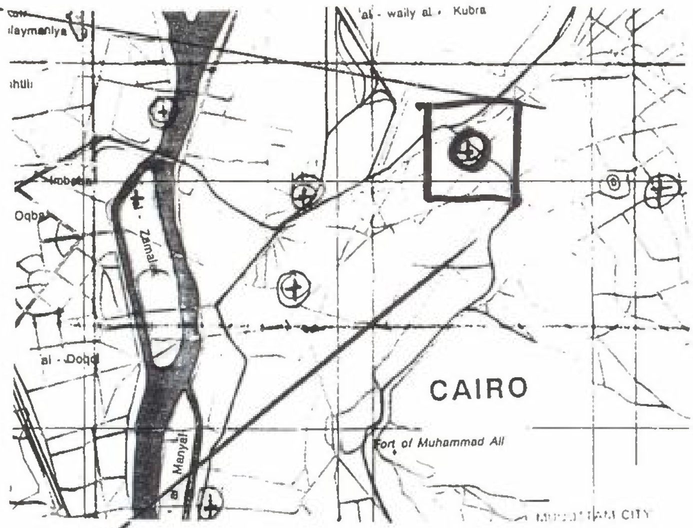
Infrastructure: Power: 220 V available in the computer room.
Telephone lines: One line is available in the room, but has to be connected via a switch board. a new line has to be installed .
Sampler/monitor locations: At the top of a cabinet computer room.
Air intake: SO_2 and BS at intake 1 m from the wall about 8 m above the ground and 6 m from curb side of Ahmed Lotfy road..

~~**Personnel**: Responsible for this station is Mr Moshil (BSc).~~
Responsible for air sampling and analyses Mr Mohammed Refaye El Amawi.

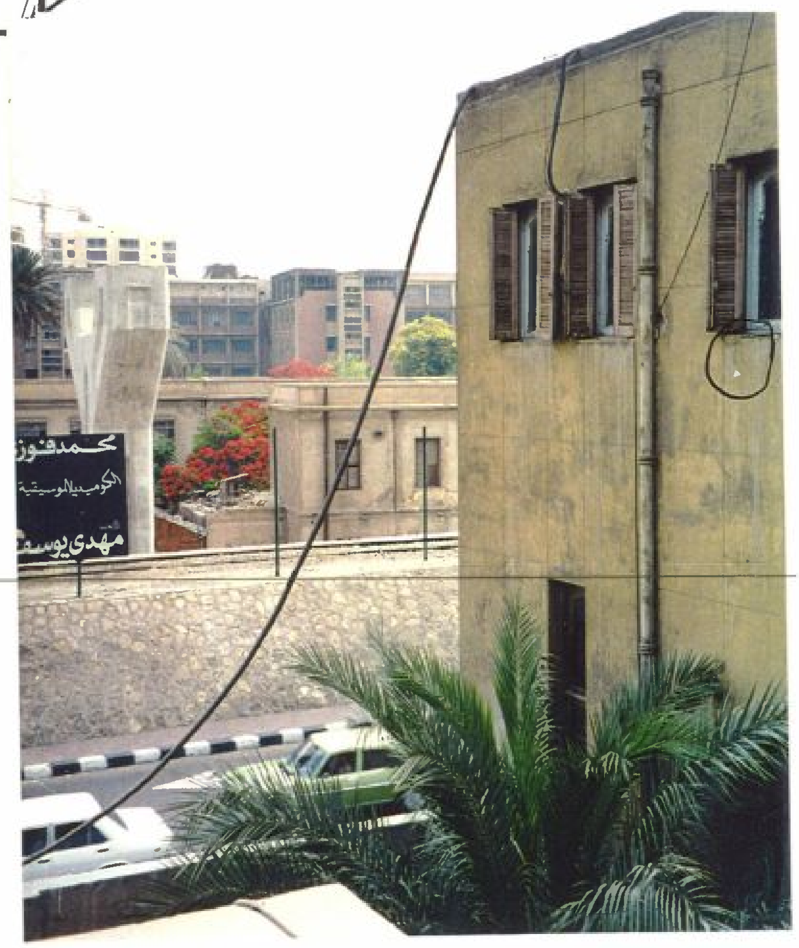
Future monitoring station: The site will be well suited for SO_2 , NOx/NO2 and PM10 monitoring in a future monitoring network. Meteorology will be considered.

Air quality monitoring network
Site visit report

Site **Name: Faculty of Medicine, Ein Shams University**
Coordinates:. UTM:334235, 3328564



SO_2 intake.



EiMP

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Faculty of Medicine

Ein Shams Univ...

2 June 1996

Computer room ←

Roof available for PM_{10} sampling →

(not used today)

Air quality monitoring network
Site visit report

Site **Name: Hawamdia**
Co-ordinates: **UTM:** 332374, 3308560

Access/ availability: Easily accessible 500 m after railway bridge. Parking outside emergency building on the Abdel Nasser street (main street) in Hawamdia. Friendly co-operative and interested people.

Buildings and rooms available: Sampler on Balcony on the second floor of the emergency building. TSP sampler on the roof.

Area description: Residential/urban area of Hawamdia.

Local sources: Traffic on the main street. About 3 km SW of Torah cement factories. Sugar factory 1 km to the east.

Representativity: The SO_2 and BS is measured right above the street. The site seems representative for the trafficked part of Hawamdia.

Parameters measured: SO_2 , black smoke (BS) and TSP.

Data quality: The station seems to be operated with good care. Data availability in 1995 was, however, only 27 % for SO_2 and 67 % for BS. Annual average SO_2 concentrations were 18 $\mu g/m^3$. The BS concentration was 41g/m^3.

Measurement equipment: The old type sequential sampler from Glass Development Limited in England for 24 h average sampling of SO_2 and black smoke. TSP high volume (Andersen type) sampler from General Metal Works Inc.

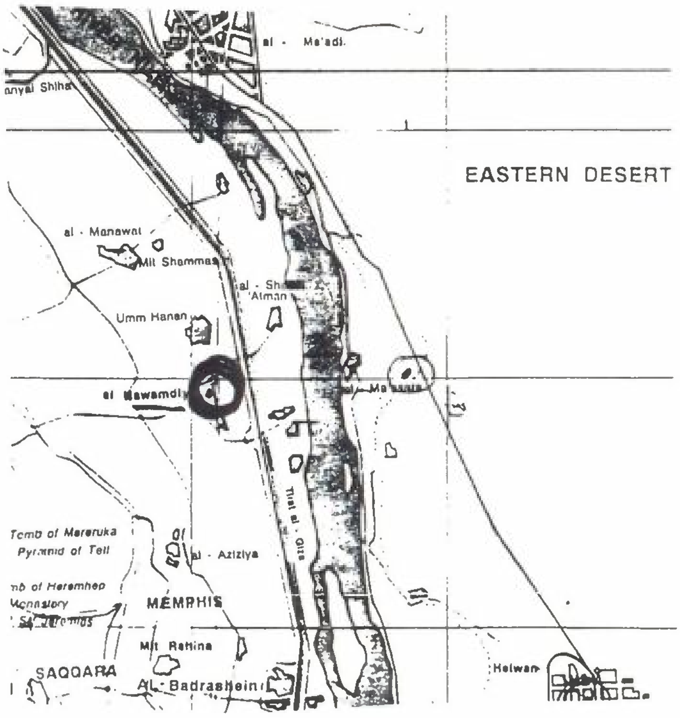
Infrastructure: Power: 220 V available in the room inside the balcony.
Telephone lines: One line exists in the building. Have to install extra line to be locked/ sealed off.
Sampler/monitor locations: SO_2 and BS on the balcony second floor. TSP sampler on the roof (clean and easily accessible).
Air intake: For SO_2 and BS 5 m above ground (street), with intake 1 m from the wall.

Personnel: Technician responsible is Mr Ahmed Fausi. Mr Mohammed Refaye El Amawi is responsible for air sampling and analyses.

Future monitoring station: The site will be well suited for particulate sampling (PM10). SO_2 and NO2 would also be relevant.

Air quality monitoring network
Site visit report

Site **Name: Hawamdia**
Co-ordinates: UTM: 332374, 3308560



Intake for air (SO_2/BS) above main street in Hawamdia

EIMP
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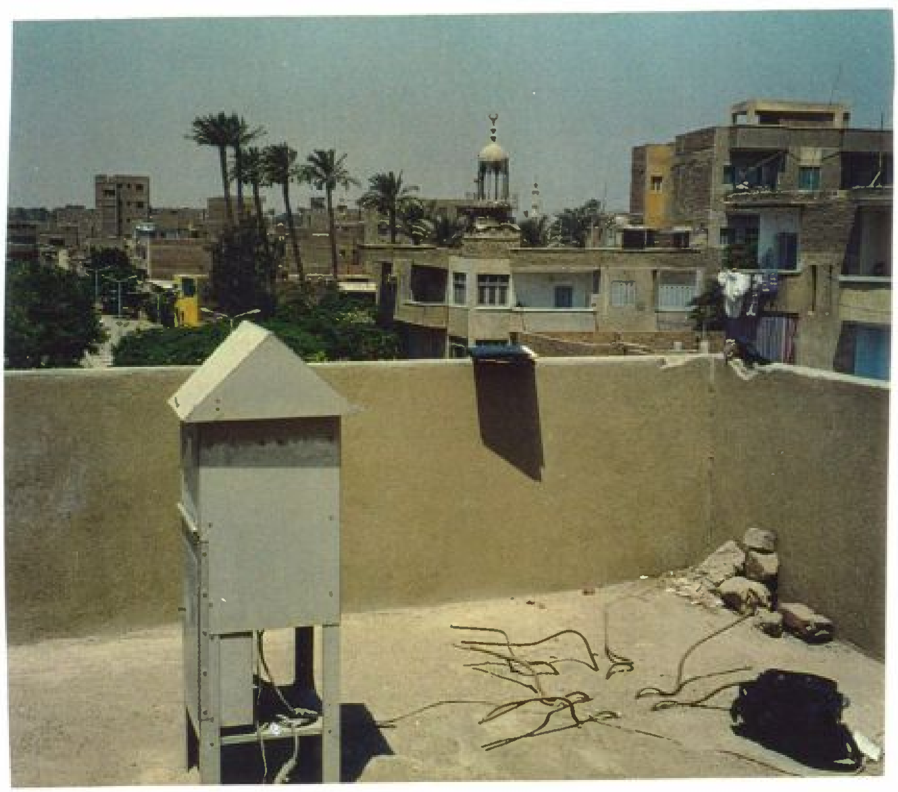
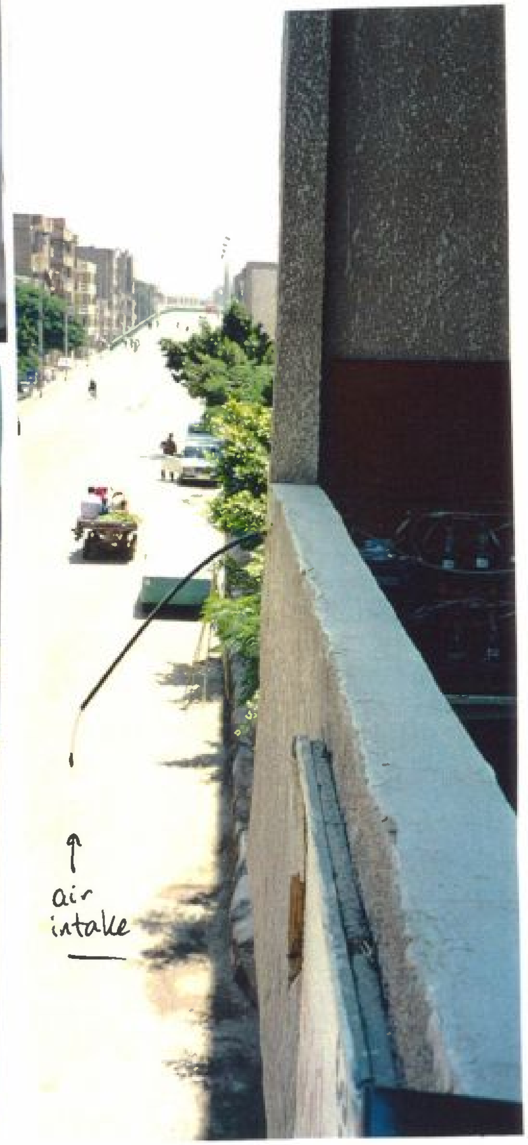
Hawamdia

5 June 1996





EIMP

Air quality monitoring network
Site visit report

Site **Name:Helwan (first health office)**
Coordinates: **UTM:** 337434, 3302610

Access/ availability: The location was difficult to fend. Road next to local metro line. Parking possible..

Buildings and rooms available: Local health office. Small building in a closed garden with instrument placed in office on first floor.

Area description: An urban area inside a highly polluted industrial area dominated by cement dust.

Local sources: Local dust from gravel roads (resuspension) , but the main sources are 4 cement factories located 2 - 6 km away in various directions.

Representativity: The site is placed in a small garden. The site should thus be representative for the polluted residential area of Helwan.

Parameters measured: SO_2 , black smoke (BS) .

Data quality: The station was not operated adequately. Data availability in 1995 was only 10 % for SO_2 and 48 % for BS. Low SO_2 concentrations (mean 5 $\mu g/m^3$) were measured due to alkaline reactions in analyses.?. The BS concentrations were only 35 $\mu g/m^3$ indicating that must of the dust is light in color.

Measurement equipment: The old type sequential sampler from Glass Development Limited in England for 24 h average sampling of SO_2 and black smoke. The sampler was not operating due to one empty bottle (no H2O2 solution) .

Infrastructure: Power: 220 V available in the room.
Telephone lines: One line exists in the first floor.
Sampler/monitor locations: SO_2 and BS in the office at first floor.
Air intake: For SO_2 and BS 2 m above ground, only a few cm from the wall.

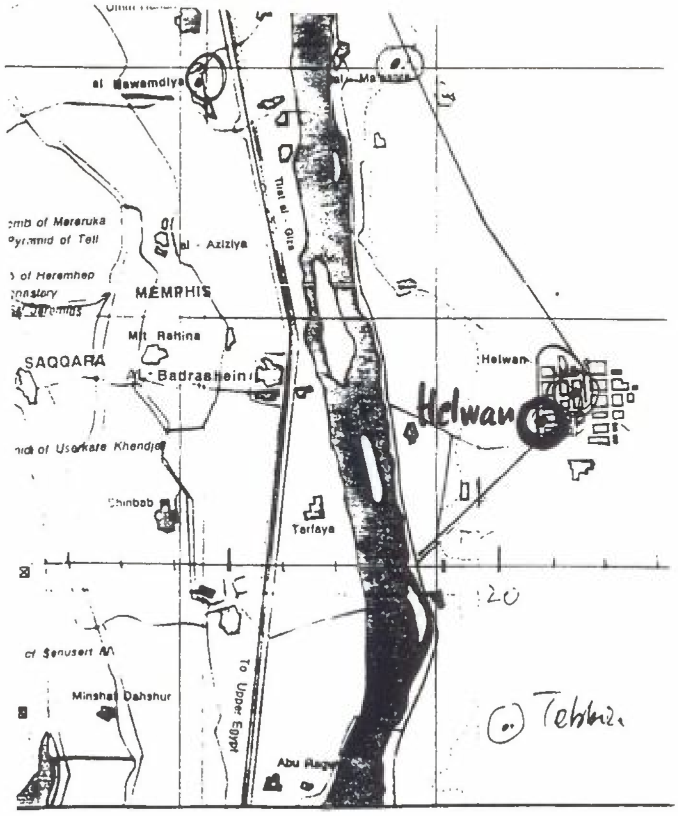
Dar Deer

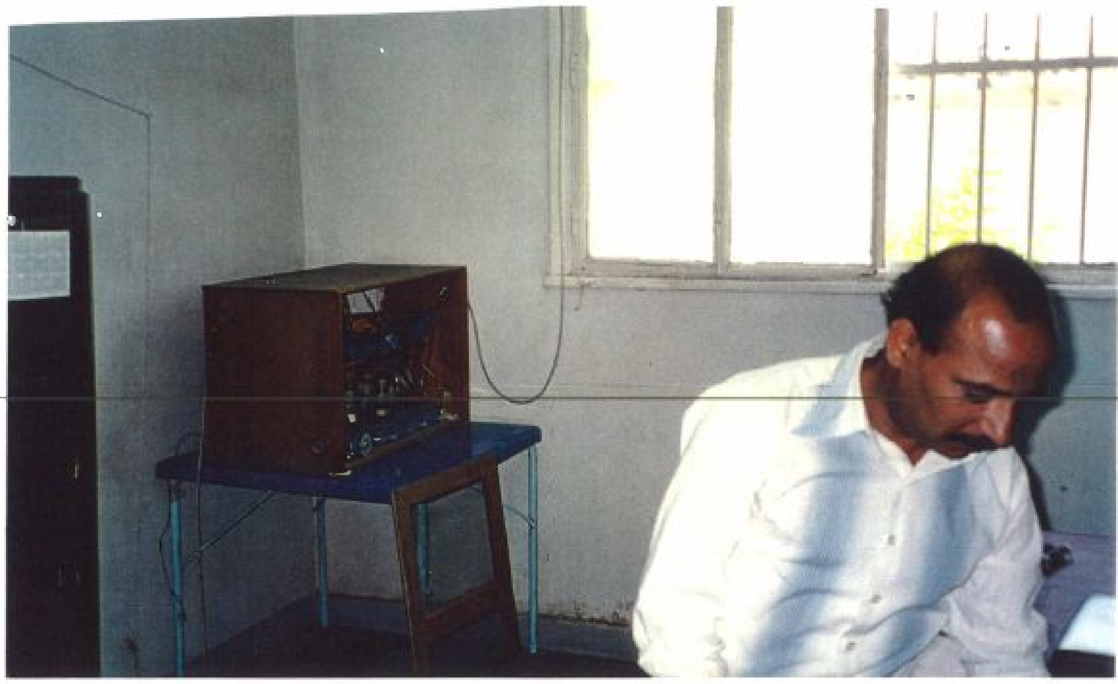
Personnel: Technician responsible is Mr Tarek der Diri. Mr Mohammed Refaye El Amawi is responsible for air sampling and analyses.

Future monitoring station: The site may be used for particulate sampling (PM10, TSP dustfall?).

Air quality monitoring network
Site visit report

Site **Name:Helwan (first health office)**
Coordinates: **UTM:** 337434, 3302610



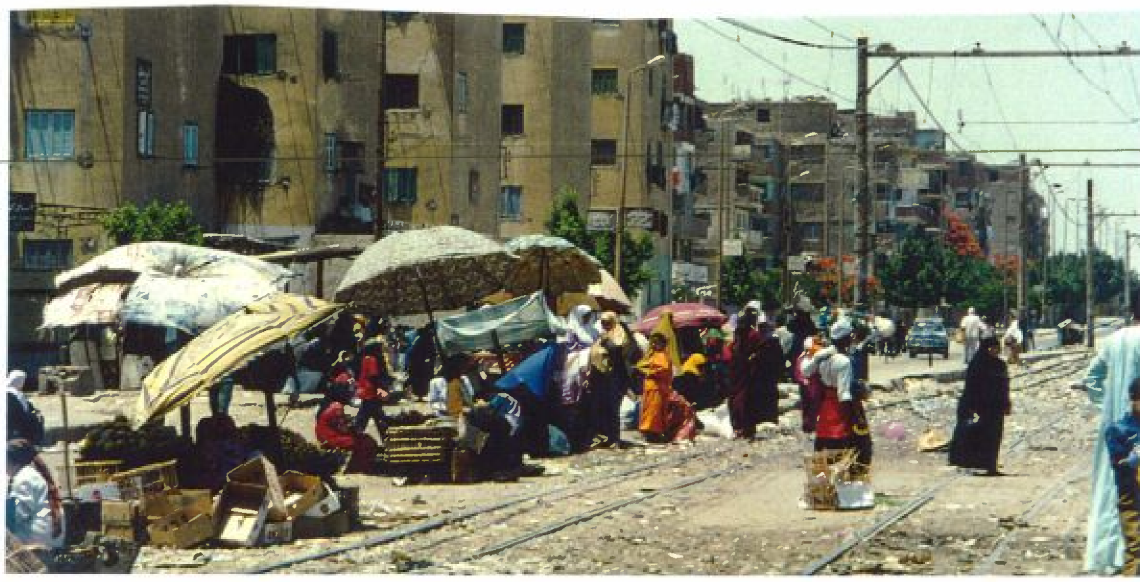


EIMP

Helwan

3 June 1996

In front of measurement site →



Air quality monitoring network
Site visit report

Site **Name: Maasarah**
Coordinates: **UTM:** 335790, 3309577

Access/ availability: Along gravel road (just after bridge from west) along metro to east side of metro station Maasarah. Parking near healt center building in Maasarah.

Buildings and rooms available: Local health centre in Maasarah, large room on second floor available.

Area description: Very polluted residential/industrial areas.

Local sources: Some waste burning close to the station. Torah cement factories 1-2 km. north of the site.Dense smoke is being transported toward the site most of the year.

Representativity: The site is representative for the dusty polluted residential area of Maasarah..

Parameters measured: SO_2 , black smoke (BS) .

Data quality: The station was not operated adequately. Data availability in 1995 was only 4 % for SO_2 and 53 % for BS. Low SO_2 concentrations (mean 18 $\mu g/m^3$) were measured due to alkaline reactions in analyses.?. The BS concentrations were only 54 $\mu g/m^3$ indicating that must of the dust is light in color.

Measurement equipment: The old type sequential sampler from Glass Development Limited in England for 24 h average sampling of SO_2 and black smoke. The sampler was turned on but bad quality control had lead to malfunctions.

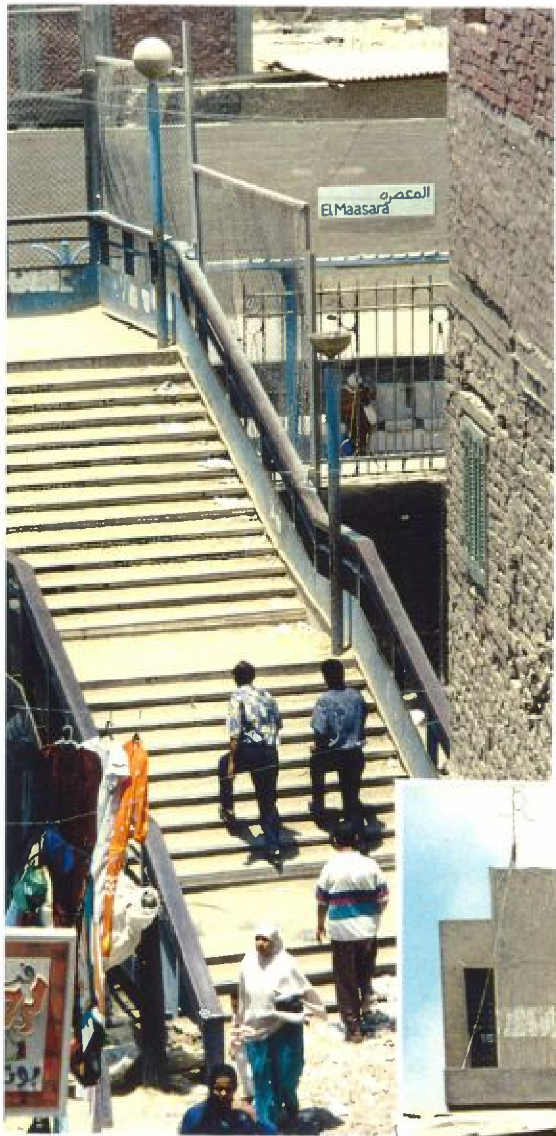
Infrastructure: Power: 220 V available in the room.
Telephone lines: One line exists in the first floor. Have to install extra line to be locked/ sealed off.
Sampler/monitor locations: SO_2 and BS in the large room.
Air intake: For SO_2 and BS 4 m above ground, 2 m above dusty roof intake 1 m from wall but intake funnel not turning.

Personnel: Technician responsible is Mr Tarek der Diri. Mr Mohammed Refaye El Amawi is responsible for air sampling and analyses.

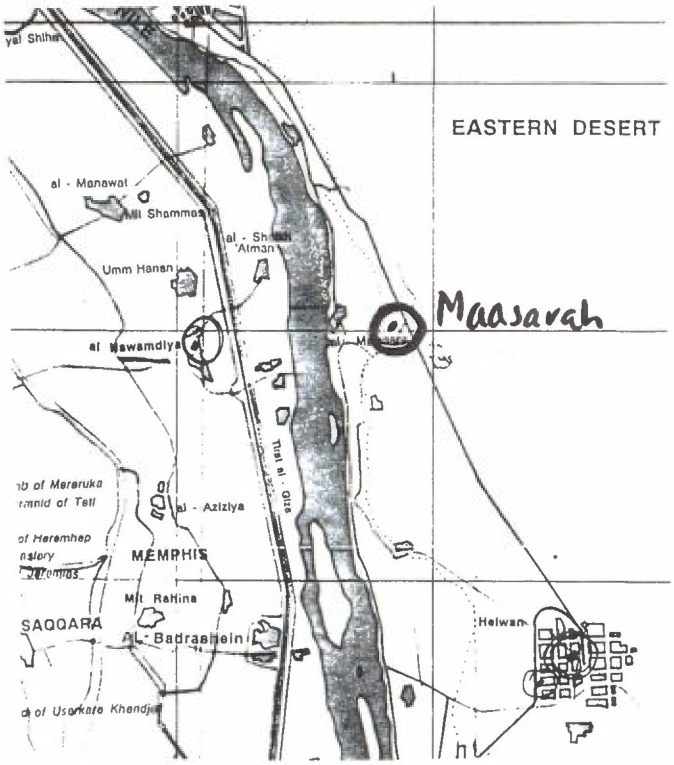
Future monitoring station: The site will be well suited for particulate sampling (PM10, TSP dustfall?). SO_2 and NOx could be considered.

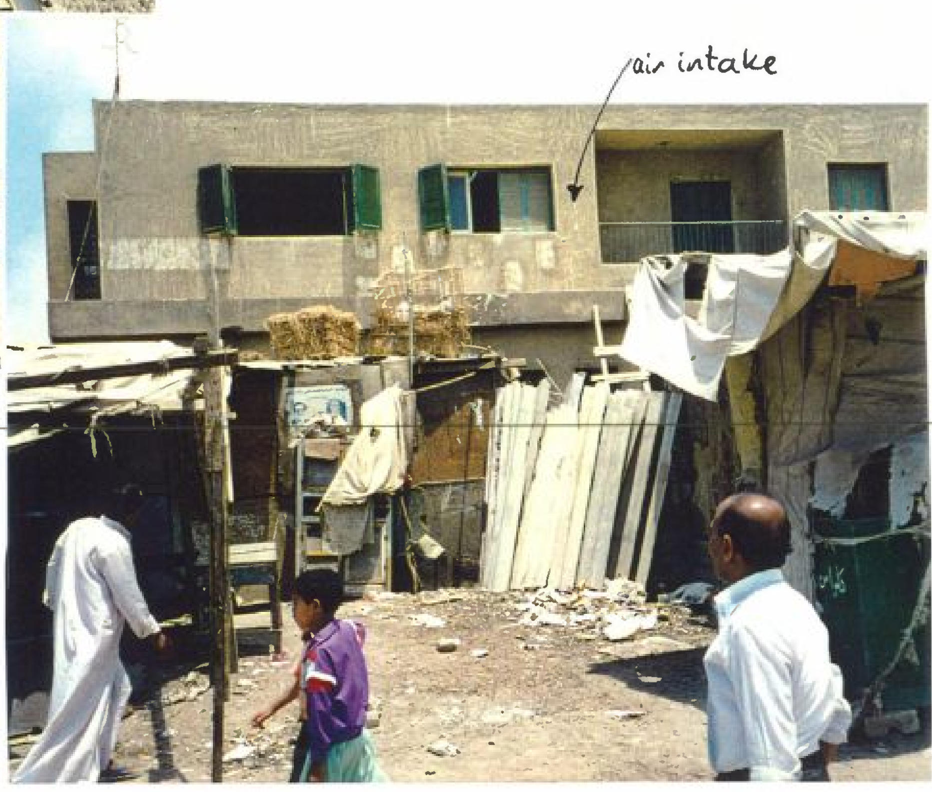
Air quality monitoring network
Site visit report

Site **Name: Maasarah**
Coordinates: **UTM:** 335790, 3309577



↑ Close to Metro

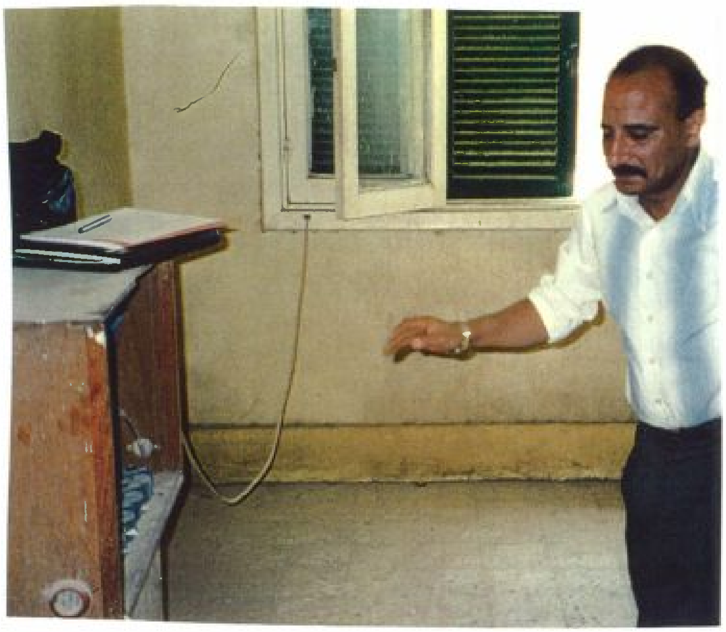




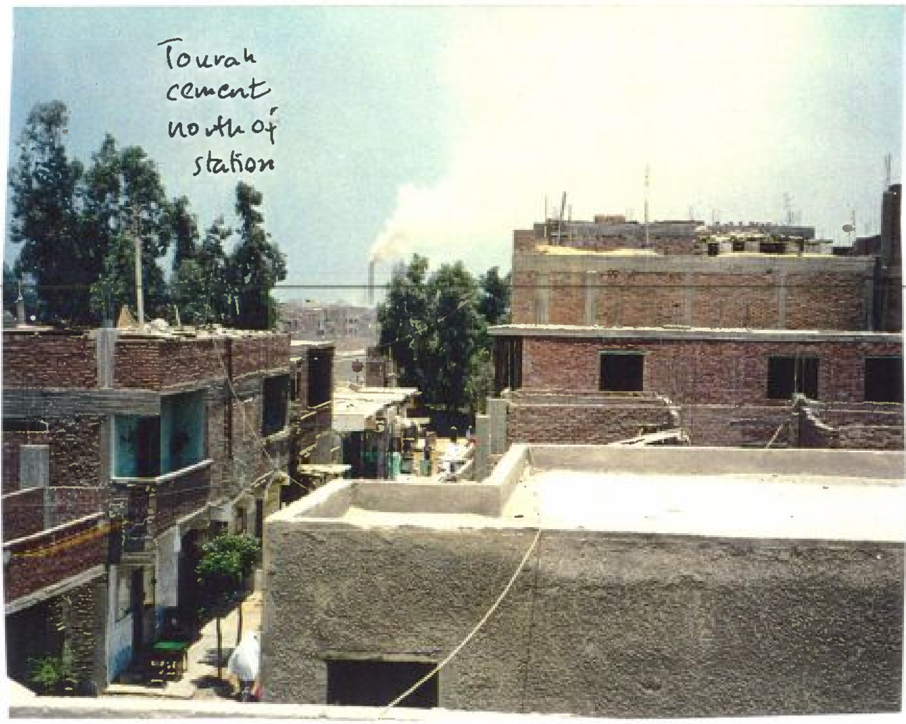
EIMP

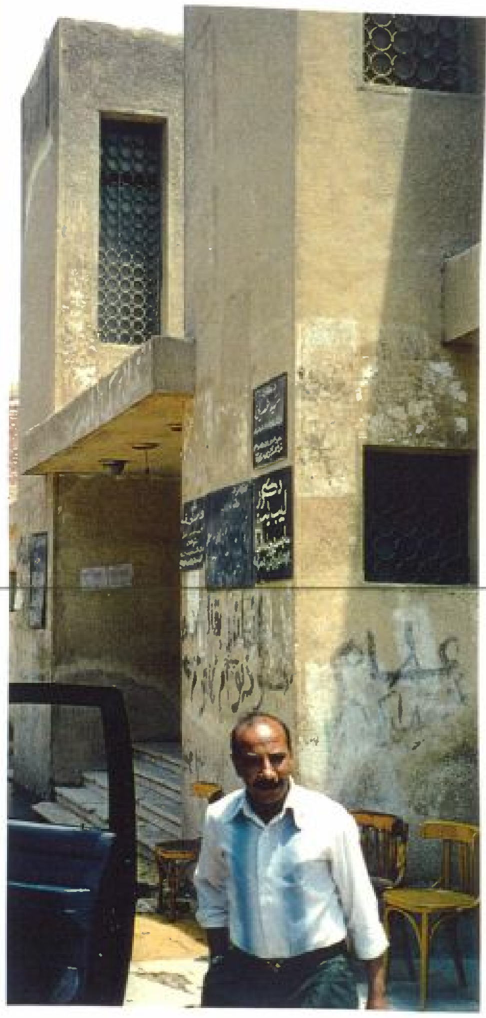
Maasarah

3 June 1996



Air intake ←





Air quality monitoring network
Site visit report

Site **Name: Nasr City**
Coordinates: N:30d. 4m. 3s. E: 31d. 19m. 18s. **UTM:** 337800, 3327450

Access/ availability: Parking on Nasr Road, access through garden og hospital..

Buildings and rooms available:. Sampler located in small office room with 3 work places on second floor.

Area description: Suburban to residential area. Large road; highly trafficated at at Nasr Road 50 m to the south of intake.

Local sources: Traffic mainly on Nasr road. No industrial sources in the area.

Representativity: The site is representative for the kilometer scale pollution in this eastern part of Cairo.The intake is far enough away from local sources not to be influenced locally.

Parameters measured: SO_2 , black smoke (BS) .

Data quality: Data availability in 1995 was 48 % for SO_2 and 65 % for BS. Low SO_2 concentrations (average 11 $\mu g/m^3$) could be due to alkaline reactions in analyses.?. The availability in 1996 (Jan-Mar) for SO_2 was 62% for BS 72 %.

Measurement equipment: The new type sequential sampler from Glass Development Limited in England for 24 h average sampling of SO_2 and black smoke is used.

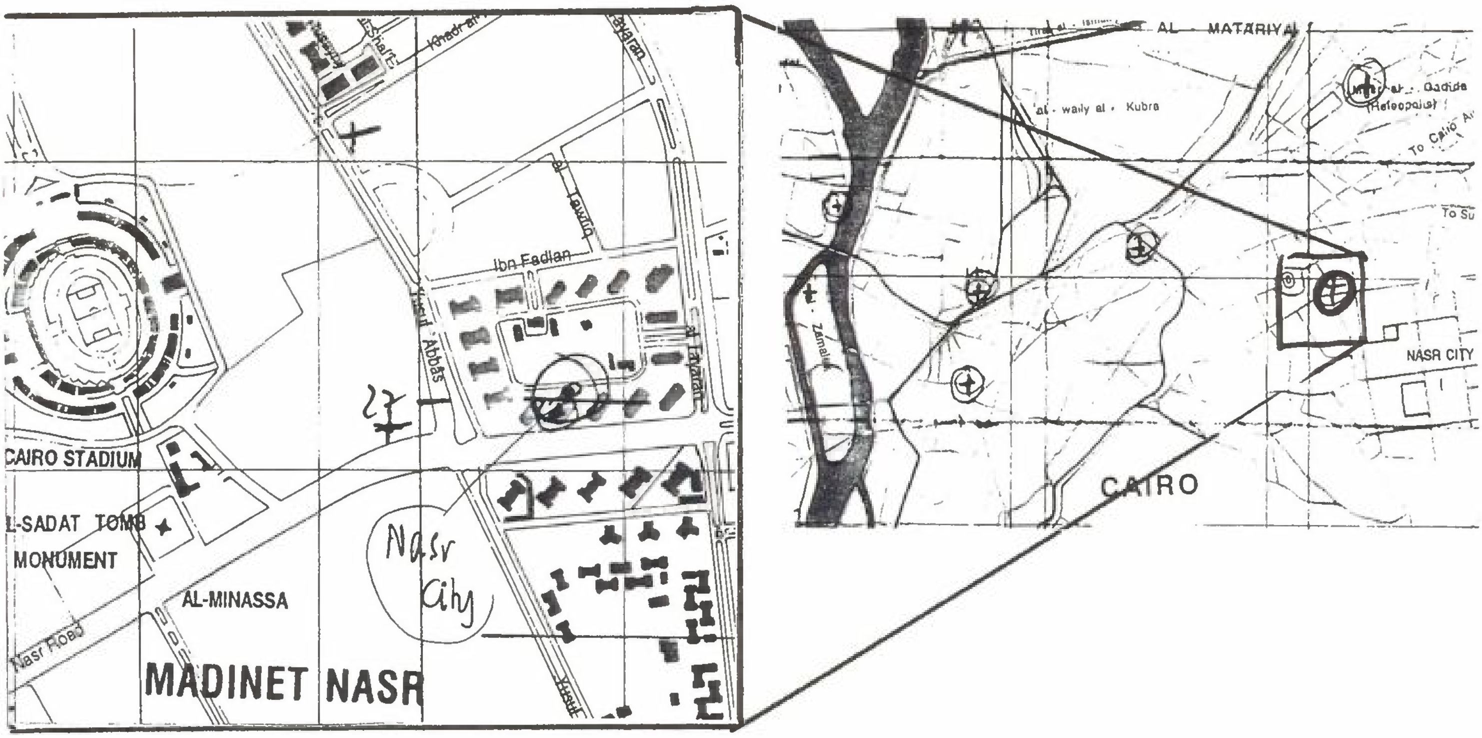
Infrastructure: Power: 220 V available in the second floor room .
Telephone lines: There is only one line available in the building New installations have to be sealed.
Sampler/monitor locations: SO_2 and BS at intake in a garden 50 m from road. Some vegetation close to the intake.
Air intake: For SO_2 and BS 3 m above ground 1 m from the west wall.

Personnel: Responsible for this station is Mr Moshir (Michael) (BSc). Responsible for air sampling and analyses Mr Mohammed Refaye El Amawi.

Future monitoring station: The site will be well suited for NOx/NO2 and PM10 monitoring in a future monitoring network. The PM10 sampling intake has to be taken through the same wall as SO_2 and BS.

Air quality monitoring network
Site visit report

Site **Name: Nasr City**
Coordinates: N:30d. 4m. 3s. E: 31d. 19m. 18s. **UTM:** 337800, 3327450



EIMP
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Nasr City

1. June 1996

air intake

New sequential
SO_2/BS Sampler.

Air quality monitoring network
Site visit report

Site **Name: Nozha**
Coordinates: N: 30d. 6m. 16s. E: 31d. 19m. 38s. **UTM: 338150, 3331550**

Access/ availability: Easy parking at entrance from Higaz street.

Buildings and rooms available:. Sampler located in small building next to the local health centre. Samplers placed in small office on the second floor. A nice roof location is used for TSP sampling.

Area description: Residential (suburban?) area. Small street 5 m from the intake.

Local sources: Only traffic. No industrial sources in the area. Some emissions from local households?

Representativity: The site is representative for the kilometre scale general pollution level in this part of Cairo. The intake is probably not influenced by local emissions.

Parameters measured: SO_2 , black smoke (BS) and TSP

Data quality: Data availability in 1995 was 59 % for SO_2 and 171 % for BS. Average annual SO_2 was 19 $\mu g/m^3$, BS; 39 $\mu g/m^3$ The availability in 1996 (Jan-Mar) was for SO_2 only 28 % for BS 25 %. The quality of the station at the visit did not look too good. The TSP sampler had not been cleaned. The filter had been in the instrument for several weeks. The SO_2 sampler was not in operation.

Measurement equipment: The old type sequential sampler from Glass Development Limited in England for 24 h average sampling of SO_2 and black smoke is used. The General Metals Works Inc. high volume sampler for TSP.

Infrastructure: Power: 220 V available in the second floor room..
Telephone lines: There is only one line available in the building. New installations have to be purchased (at about 2200 EL per line?). The line should be sealed.
Sampler locations: On a shelf on the wall.
Air intake: SO_2 and BS at intake only 10 cm from north wall about 10 m above the ground .

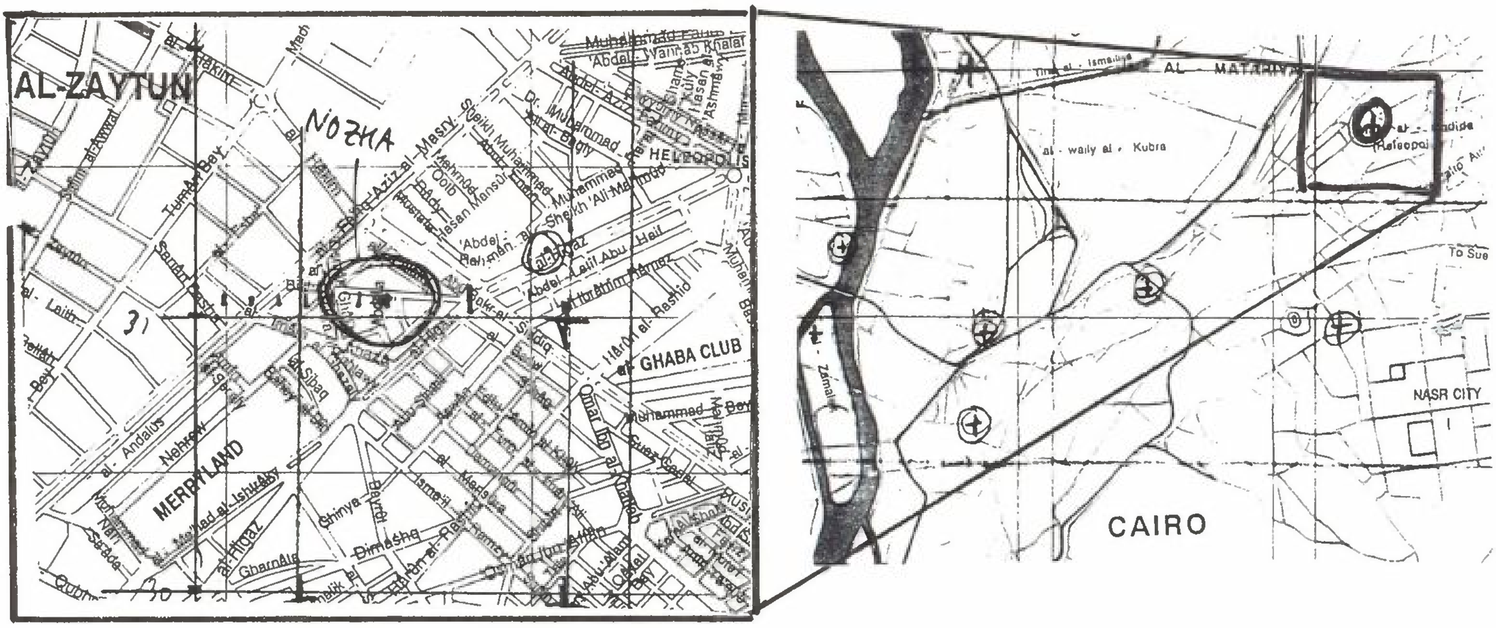
Personnel: Technician responsible is Mr Bahid, who has been sick for at least 3 weeks. Backup personnel is needed in such cases. Another person has to take over the responsibility in case of absence. Responsible for air sampling and analyses is Mr Mohammed Refaye El Amawi.

Future monitoring station: The site may be well suited for SO_2 , NOx/NO2 and PM10 monitoring in a future monitoring network. However, this location has to be considered parallel to the Nasr City site as the site for the north eastern part of Cairo. The EIMP programme will probably not install monitors at both sites..

Air quality monitoring network
Site visit report

Site **Name: Nozha**

Coordinates: N: 30d. 6m. 16s. E: 31d. 19m. 38s. **UTM: 338150, 3331550**



EIMP

Nozha

29. May 1996

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Air quality monitoring network
Site visit report

Site **Name: Shoubra el Kheima**
Coordinates:. UTM: 330578, 3333640

Access/ availability: Through a busy bus station into parj with easily parking fecilities. Easy access to the labor Organization Club building.

Buildings and rooms available:. Sampler located in the library on the second floor.

Area description: Polluted urban area with heavy traffic close to bus sation and railway..

Local sources: Highly polluted industrial area to the east. Distance to major sources about 2 km. Power plant (gas/oil) 600 m to the north.

Representativity: The site is representative for the industrial area , western part of Shoubra. The station is located west of the most impacted areas and not downwind from the major source area.

Parameters measured: SO_2 , black smoke (BS) only since 19 May 1996 at this site..

Data quality: The station is not being operated properly. One bottle completely dry (no liquid due to evaporation?? The timer was set wrong and the sampling station had not been visited in several weeks. As in all stations there is no log book for registration of mis functions.

Measurement equipment: The old type sequential sampler from Glass Development Limited in England for 24 h average sampling of SO_2 and black smoke had been moved fro Shoubra elKheima health office in May.

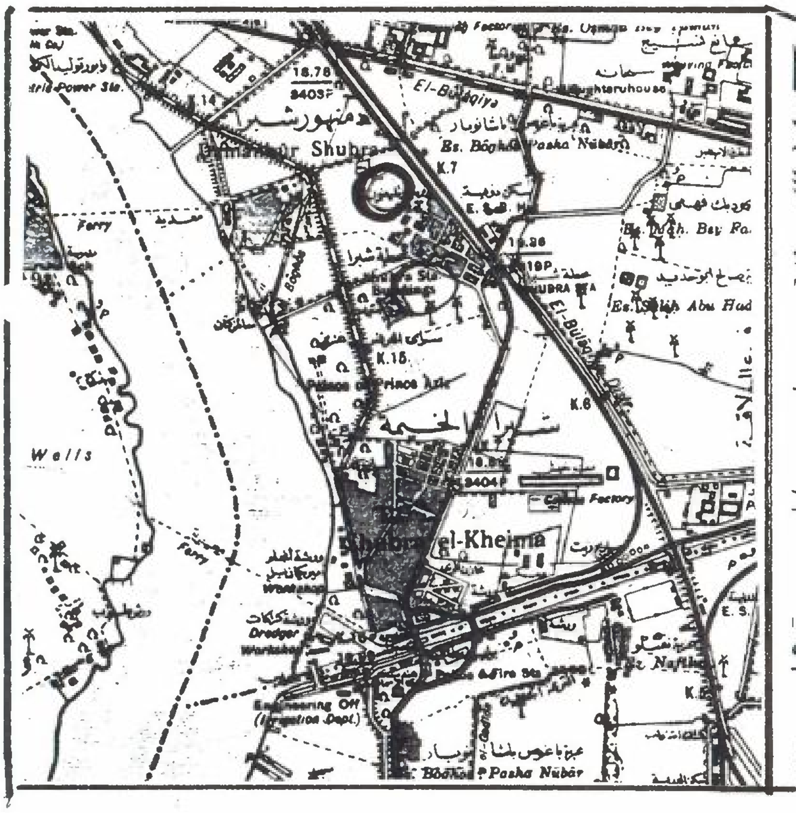
Infrastructure: Power: 220 V available in the room.
Telephone lines: New line has to be installed .
Sampler/monitor locations: On shelf in the library.(complaints about noise)
Air intake: SO_2 and BS at intake 20 cm from the east wall about 8 m above the ground.

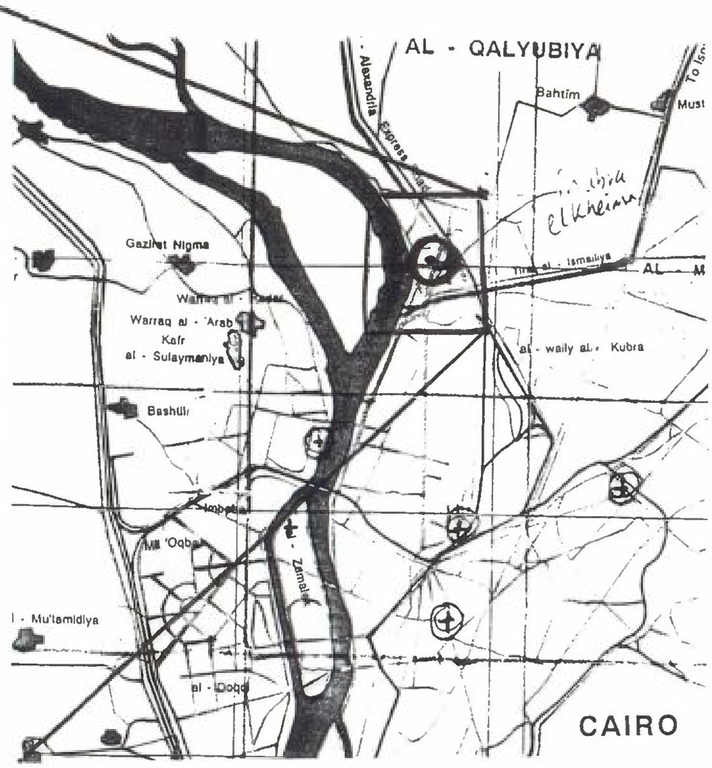
Personnel: Technician responsible is Mr Alaa Ali. Responsible for air sampling and analyses Mr Mohammed Refaye El Amawi.

Future monitoring station: The site can be used for continued sampling in the future of SO_2 and PM_{10} . A more representative site for maximum industrial impact should be selected for continuous sampling. The water purification plant near the Ismailia Canal could be one possibility.

Air quality monitoring network
Site visit report

Site **Name: Shoubra el Kheima**
Coordinates:. UTM: 330578, 3333640





EiMP
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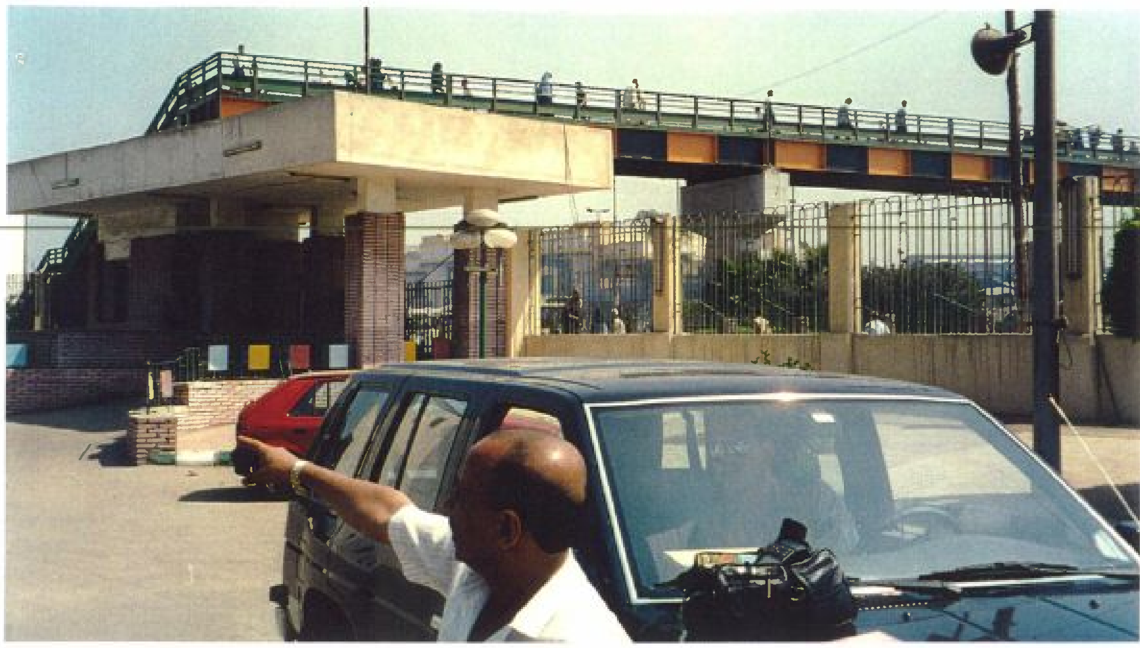
Shoubra el Kheima

10 June 1996

← Power plant 600 m north of sampler.

Industrial area of Shoubra el Kheima east of monitoring station →

near railway station →



EIMP

Air quality monitoring network
Site visit report

Site **Name: Ttalbia, Giza**
Coordinates: N:30d. 0m. 16s. E: 31d. 11m. 18s. **UTM: 325210, 3320510**

Access/ availability: Easy access from Al-Ahram street, parking possible on sidewalk..

Buildings and rooms available: Local health care center, one room in second floor for ssampling equipment. There are shelfs that can be used for monitors. Room not air conditioned (hot in July and August).

Area description: Urban to residential area. Large road; highly trafficated at AlAhram 30 m from intake.

Local sources: Traffic 30 m to the south and a pizzeria with vent stack 50 m to the east.

Representativity: Fair to good. (30m from curb side of the road, but typical for this part of the urban area.). TSP sampler on roof located in between 3 walls. Not representative?.

Parameters measured: SO_2 , black smoke (BS) , TSP

Data quality: Data availability in 1995 was 24 % for SO_2 Low SO_2 concentrations were measured due to alkaline reactions in analyses.?. The availability in 1995 for BS was 70 %, and for TSP ca. 20 %.

Measurement equipment: The old type sequential sampler from Glass Development Limited in England for 24 h average sampling of SO_2 and black smoke, Anderson Sampler (General Metal) for TSP.

Infrastructure: Power: 220 V available in the second floor room and at the roof.
Telephone lines: Available in the building (but has to be sealed).
Sampler/monitor locations: TSP at upper level (open room) , SO_2 and BS at a shelf in the 2 floor room.
Air intake: For SO_2 and BS 5 m above ground on the south wall.

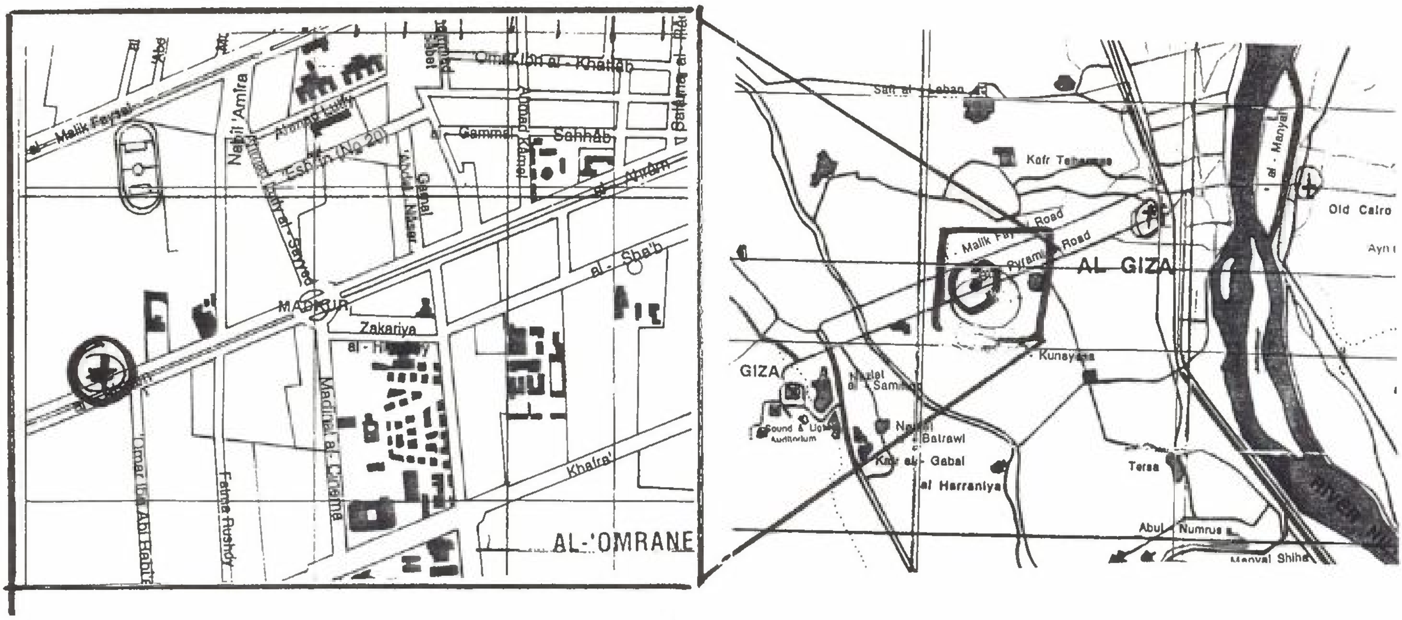
EIMP Air Quality Monitoring, Ttalbia

Personnel: Technician responsible is Mr Ismahil (BSc) , for data collection Mr Mohammed Refaye El Amawi (responsible for air sampling and analyses).

Future monitoring station: The site will be well suited for NOx and PM10 monitoring in a future monitoring network. The PM10 sampling intake has to be taken through the upper roof above the building (above roof level).

Air quality monitoring network
Site visit report

Site **Name: Ttalbia, Giza**
Coordinates: N:30d. 0m. 16s. E: 31d. 11m. 18s. **UTM: 325210, 3320510**



EINP
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Ttalbia, Giza

28 May 1996

old tupe English sequential sampler

"Giza pyramid road" Street 20m away

Air quality monitoring network
Site visit report

Site **Name: Salem City, (1 mill. inhabitants). Possible referance sattion.**
Coordinates:. **UTM: 348020, 3338080**

Access/ availability: .Easy to access the hospital area, security gate, easy parking.

Buildings and rooms available:. Two pasibble monitor/sampler location; small room in nursing school 2. floor, or on balcony through nurses changing room in private sector of the hospital.

Area description:.Residential ares in central Salem City.

Local sources:. Few local sources, some traffic on Sadat Road ca. 20 m from intake. possibly some waste burning inside city

Representativity: The site is representative for the kilometre scale in Salem City.

Parameters measured:..No measurement today..

Data quality: Not relevant

Measurement equipment:.

Infrastructure: Power: 220 V available in the room.
Telephone lines: Telephone lines available.
Sampler/monitor locations: Preferably in small shelter on balcony. PM_{10} sampler can be placed on clean easily accessable roof.
Air intake: Avaout 4 m above the ground, 20 m from street.

Personnel: Responsible for air sampling and analyses Mr Mohammed Refaye El Amawi.

Future monitoring station: The site can be used as a reference station located about 20 km outside the city centre of Cairo (north east for the city north west for the air port).Continued sampling should be performed of SO_2 , Ozone and PM_{10} possibility.

Appendix L

Meeting with EEAA staff relevant for working within the EIMP programme

Minutes of Meeting EEAA - Environmnetal Information System

Environmental Information and Monitoring Programme

EEAA - Danida - COWI

3, Abdel Aziz Street
Mohandessin, Cairo, Egypt

Tel.: +202 361 5085
Fax: +202 361 5085

E-mail: jhassing@idsc.gov.eg

Subject:	Introduction to EIMP Data man component
Date:	6 June 1996
Place:	EEAA and EIMP
Participants:	Hodi Hanafi - HH, EEAA El Sayed Sharkawy EEAA Misc counterparts DRC, Bjarne Sivertsen(BS) and JAA
Prepared by:	JAA,
checked by	DRC
Distribution:	DRC, BS, JMH, JAA

1 Hodi Hanafi

The meeting was held to introduce JAA to HH, who is responsible for the EIS. HH is head of the information center in EEAA, but does not seem to have very much staff for the purpose.

HH has designated 3 of her staff to work with EIMP:

1. Eng Mohamed Zaki, Database on pollution sources
2. Ms Eman Ahmed Abd-Allah, Coastal Water Monitoring.
3. Mr Omar Hussein Sayed, Air Pollution Monitoring

2 new person will be appointed within the next 2 months:
1. PC specialist with 8 years experience
2. Manager of Documentation, with 10 years of experience.

These should add significantly to the present staff, and likely replace persons now available to work with EIMP.

Her idea of the systems was that EIS, GIS and the Archiving system are not related and should be held separate. JAA mentioned that it could be a good idea to use an integrated hardware setup, while the databases could be kept separated.

HH stressed that if the systems should be connected, the organisation would have to be changed. She said she would raise the question with Salah Hafez.

HH informed that they were using Canadian-Egyptian McGILL University Agricultural Response training center (CEMAR) for basic computer training. CEMAR was established 10-12 years ago under the Minestry of Agriculture.

HH has the responsibility for the GIS system. The Gis system has been through a pilot project which ended in december. Since then, CIDA has been evaluating the pilot project, and CIDA is considering how the project shall continue. EEAA seems to be reluctant to continue on their own.

Therefore the GIS operators say that they have participated in the pilot project and that since then they have had no projects.

Concerning data HH told us that she had send a letter to the other heads of departments in EEAA and asked them what kind of map data they would need and also their requirement for training of their staff. The result of a meeting with CAPMAS concerning digital mapdata was that EEAA should specify their requirements. Then CAPMAS would give their quotation for delivery of the data. HH did not find it relevant to make other inquiries until the reaction from CAPMAS was known.

HH had no comments to the question about coordinate system.

HH summarized the meeting as follows:

1. She should look at their training needs

2. She would investigate the possibility of linking the computersystems into one network

3. The MAP data requirements would be followed up by EIMP via her letter to ElZarka.

4. Some new employeés were about to be employed at EEAA. They were likely to be new counterparts for EIMP

5. EIMP would investigate the coordinate system

6. HH would prepare a list of existing computer equipment

2 El Sayed Sharkawy

ESS is responsible for office automation in EEAA, and the new integrated computer system for the office in Maadi.

ESS is supervisor of Nashat and also of Eng. Zaki who was named by HH as one of the staff that should work with the data management component.

ESS was very positive on coordination and he mentioned that they had appointed a consultant who is assisting EEAA in design of their network in Maadi.

ESS told that they had been working on the archiving system for three years, and they were considering how they should deal with it in the future. (He did not mention for how long it had been working.)

3 Introduction meeting with EEAA staff

At 13.00 in the EIMP office a meeting was held with the staff that had been appointed by EEAA.

They were given an introduction to the project by DRC.

The following was noted about their experience:

1. Mohamed Zaki, Systems Engineer, phone 3601191. He has been working on the GIS (digitising of maps, extraction of features, data entry, design & analysis for thematic mapping) and on the archiving system, and he has some experience in system development using RDB Rally. Named by HH as pollution sources database person.

2. Nashat Rafat, Programmer, phone 3601326-1391. He has been involved in the planning and implementation of EEAA's archiving system. Main experience is dBase (Clipper), Visual Objects, and a little knowledge about GIS and RDB.

3. Omar Hussein Sayed, Computer Specialist, phone 3601164. He has been in the GIS group for some 3 months. He has some experience with dBase IV, and is operator on the Internet. Named by HH as air pollution monitoring data person.

4. Eman Ahmed Abd-Allah, Computer Specialist, phone 3601326-1391. She has a background in medicin. She has knowledge on Excel, dBase, Word, ARC Info PC and ARC View. She mentioned that she had been on training in Syria for 2 weeks. Named by HH as Coastal Water Monitoring person.

5. Heba Mohamed Adly, Environmental Reseacher. Userlevel experience with Word and Excel.

6. Khadiga Mohamed Kassla, Chemist in CCC. Some experience in Word.

7. Amany M. Selim, Environmentalist. Only little computer experience.

8. Naked Nessim Z. Salib. Environmental Reseacher, Environmental Quality Sector. Office user.

Appendix M

Expert group on Air Quality Sampling. Standardization in Egypt

MINUTES OF THE FIRST MEETING FOR THE MONITORING SYSTEM OF THE AIR SAMPLE

- Meeting held on Saturday 11th of May, 1996 at 11:00 o'clock at EE AA in the presence of :

• Dr. Mohamed Zarka	EEAA
• Dr. Mawaheb Aboul EL Azm	EEAA
• Dr. Abdel Aziz El Dakhakhni	High Institute of health / Alex university
• Dr. Mahmoud Nasrallah	National Research Center
• Dr. Saad Hassan	Faculty of Science / Alex University .
• Dr. Soad Darwish	Ministry of Industry / Chemical Institute
• Dr. Ahmed El Dafrawy	" " " "

I) Dr. Mohamed El Zarka said :

EEAA wish to establish a standard method for monitoring the air sample and attach it to the environmental law to create an accordance between the laboratory belonging to the ministry and research centre to facilitate the job of EEAA in executing the law on the source of air pollution .

II) Dr. Mahmoud Nasrallah said :

The committee will put a standard method to the suspended dust and specify PM 10 as it reaches the lung and cause health problem .

III) Dr.Abdel Aziz El Dakhakhni spoke about Monitoring :

He mentioned that there are lots of agencies to measure the pollutant but there are some deficiencies in the law because some other pollutant has to be added like Chlorine but (after reviewing the law it was found in table # 8 page 126)

	AVERAGE	TIME	LIMITS OF EXPOSURE	FOR A SHORT TIME
CHLORINE	Part of million	mg / m^3	Part of million	mg / m^3
	1	3	3	9

IV) Dr. Zarka mentioned :

It is possible to add other pollutant and EEAA has the authority to add it to the law .

V) Dr. Abdel Aziz Dakhakhni mentioned :

The measurement process is a business process depending on the experience of the laboratory and the people working in it . There are also some systems that are difficult to change because of the nature of the equipment .

VI) Dr. Mahmoud Nasrallah mentioned :

The high volume sampler of the suspended dust is an American technique which had been used at the ministry of health and the National research centre .
Concerning the total suspended particle system , it has been applied for years and it is possible to check the practical references in this field .
As for PM 10 micron and smaller , some people consider that it represent the biggest percentage in the air , but we can not compare the PM 10 method as it has not been used in most of the countries .
For the total volume sampler it is the most popular at the air pollution laboratory .

He also mentioned that :

1. Total Suspended particle .
2. PM 10
As PM 10 has its bad effect on the public health .

VII) Dr. Mawaheb Abou El Azm :

It is important to specify the standard method and added it to the law so that the agency can apply the law by following the pollution source & monitoring the air sample through the central laboratory which belongs to the agency together with the other governmental labs .
The above method has to match with the pollutant in the air and the equipment in the lab related to the ministry & research centres .

VIII) Dr. Mohamed Zarka :

An identical committee had been formed to put a standard method to the air and soil .

IX) Dr. Saad Hassan :

There are 3 methods to monitor the pollutant :

1. American method 2. European method 3.Japanese method

But it is very important to establish a standard method to facilitate EEAA job .

X) Dr. Ahmed EL Dafrawi & Dr. Soad Darwish mentioned :

The Chemical Institute owns a very high standard lab and they offered their service to help in finding the ideal standard method through offering scientific researches and the references they have .

AT the end of the meeting Mr. Salah Hafez welcomed the members of the committee and established the rules that the committee will follow to specify a standard method that correspond the environmental status and the budget in Egypt .

The meeting was terminated at 1:00 PM and the next meeting will be held on the 27th of May at EEAA

MINUTES OF 3RD MEETING
SYSTEM OF AIR MONITORING SAMPLES

The meeting was held on Sunday 9 / 6 / 1996 at 12:00 clock at EEAA and the participants were :

- DR. Mohamed Zarka
- Dr. Mawaheb Abou El Azm
- Dr. Abdel Latif Hafez
- Dr.Abdel Aziz Dakhakhny
- Dr.Abdel Aziz El Shafei
- Saad El Said Hassan
- Dr. Soad Darwish
- Mrs. Siham Younes
- Deleguate from JICA
- Deleguate from DANIDA (EIMP) , B. Sivertsen

Dr. Zarka welcomed the members and they reviewed the previous meeting without any comments .

Dr. Dakhakhany mentioned :

The best 2 methods to measure the SULPHUR DIOXIDE are :
- HYDROGEN PEROXIDE METHOD
- P - ROSANILINE METHOD .

Although the first one is preferable because it is not complicated and has been used in our lab since 2 years although it has a weak point that the ammoniac is affecting the SO2 percentage .

He mentioned that SO2 takes a little time to be transferred to SULPHATE . It has been noticed that the percentage of Sulphate in Cairo & Alex is very high .

Mr.ABdel Latif :

He asked if there is a procedure to calculate the percentage of Ammoniac to get a more accurate result .

DANIDA delegate :

Mentioned that the measurement related to SO2 in Egypt are not accurate and that it is not advisable to use the Hydrogen Peroxide in Egypt as there are more advanced method like PHYSICAL METHOD , (samplers) that has been applied in the world .
Example: The use of impregnated FILTER . This method is more accurate because it doesn't have the influence of NH3.

Dr. Dakhakhny :

Dr. Dakhakhny agreed with DANIDA delegate that the PHYSICAL METHOD is very good but costy and can use it the future if we can afford it , but meanwhile the hydrogen peroxide method is the best as most of the researchers used it together with other method like :
- Impregnated Filter
- Ion Chromutograf

and needs very high cost and well trained researchers which is difficult to have at the moment .
The members mentioned that the 2 methods will be put into consideration when writing the best method to monitor SO2 .

Mrs. Siham Younes :

Postpone the point of view to summarise the subject of the committee

Dr. Abdel Aziz El Shafei

Asking about the final conclusion of PM10 & TSP

Dr. Mawaheb Abou El Azm :

Mentioned that : 1- High volume
2 - Low volume will be used

Dr. Soad Darwish :

She gave the committee the most updated reference book concerning the above subject .

Dr.Saad El Sayed Hassan:

It is very important that we choose the most convenient method to Egypt .

Dr.Zarka :

It is necessary that the used method should be convenient to Egypt concerning :
- Availability of equipment .
- Availability of experience .

After asking the committee members about the best method to measure Carbon monoxide , everybody agreed upon using IR.

The meeting was terminated at 1:00 o'clock and the next meeting will be 13 / 6 / 1996 at 11:00 o'clock at EEAA .

EIMP

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and Monitoring Programme
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Mohandessin, Cairo, Egypt
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Technical note

To: Douglas Clark
From Bjarne Sivertsen
Date: 5 June 1996

Re: NILU two filter sampler

I received a message from NILU indicating that the NILU two filter sampler primarily should be used as a PM_{10} sampler only. This means that it should be used only with one stage except for measurements in clean non-dusty environments.

The sampler participated in an intercalibration test performed by the European Committee for Standardization (CEN); CEN/TC 264 / WG 6, Suspended particulate matter below 10 µm. Field tests have been evaluated and concluded that complete commercially developed sampling trains should be preferred. The samplers with specially assembled sampling systems (like the NILU sampler) performed slightly lower.

The best performance was shown by the PM_{10} high volume sampler approved by US EPA. It is equipped with a Critical Venturi Meter keeping the flow rate constant at 68 m3/h.

Also one of the PM_{10} low volume samplers performed well. The flow is controlled by a turbine flow meter and a regulating valve regulated by a processor system. The flow rate can be adjusted between 1 and 2.5 m^3/h.

The NILU PM_{10} low volume sampler consist of a PM_{10} impactor inlet, a filter holder and a regulated flow device set at 0,6 m^3/h. The impactor/filterholder is connected to a membrane pump, an electronic flow controller, a dry gas meter and a counter display for total volume of air sampled.

The experience has proven that the technical design determines the overall performance of the samplers. Sampling flow rate stability and adequate filter-weighing procedures are of utmost importance. Newly designed samplers should only be employed in extensive routine studies after elaborate field tests have been performed.

EIMP

**Environmental Information
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3 Abdil Aziz Selim street
Mohandessin, Cairo, Egypt
Tel/Fax: +20 2 361 5085**

Technical note

To: Expert committee on air quality monitoring standardisation for Egypt.
Copy: Jan Hassing
From Bjarne Sivertsen
Date: 12 June 1996

Re: Methods for SO_2 and PM_{10} sampling

With reference to the committee meeting on 9 June 1996, the following comments have been given by the Chemical Co-ordinating Centre for the European Monitoring and Evaluation Programme (EMEP) at NILU (Norwegian Institute for Air Research):

SO_2 sampling
Absorption solutions can still be used in areas where the SO_2 concentrations are high enough; urban and industrialised areas.

The discussions on SO_2 sampling stated that two wet chemical methods had been used in Egypt. Most of the routine programmes have been based on absorption in H2O2 solution following analyses by titration (total acidity).

There have been extensive problems reported in Egypt due to absorption of NH3 and other alkaline compound which neutralise the acid formed from SO_2.One main reason for bad data quality has been caused by "negative SO_2 concentrations" in these analyses.

A better method would probably be to analyse the total amount of SO_4^- by the so-called Thorin method described as one of the ISO standards. Preferably one should use ion chromatography to obtain the best analytical results for SO_2 absorbed in wet solutions or on impregnated filters.

It has been documented that the hydrogen peroxide in the solution have been decomposed in the high ambient temperatures present in Egypt. (Nasralla).If this is the case impregnated filters would be a preferred method. This will require some more preparatory work in the laboratory. In this case ion chromatography should be used for the analyses of filters. A description of the filter method used in the European EMEP programme can be found enclosed. This method is at the moment not presented as an ISO standard method. It was originally developed for background areas, low level air pollution problems with requirements for increased sensitivity, while the ISO methods are linked mainly to urban and industrial air pollution problems.

When using monitors for continuous measurements of SO_2 these should be based upon pulsed UV fluorescence analysers like the ones approved by US EPA.

PM_{10} sampling

For PM_{10} sampling the PM_{10} high volume sampler approved by the US Environmental Protection Agency should be used as a standard method. The sampler is equipped with a Critical Venturi Meter (CVM) keeping the flow at a constant rate of approximately 68 m^3/h.

Many high volume and low volume samplers exist for PM_{10} sampling, and they vary considerably in price and quality. A field test has been performed by the European Committee for Standardisation for evaluating the quality of various methods for the thoracic fraction of SPM (PM_{10}). (See Appendix).

The field tests have been evaluated and the report concluded that complete commercially developed sampling trains should be preferred.

The experience has proven that the technical design determines the overall performance of the samplers. Sampling flow rate stability and adequate filter-weighing procedures are of utmost importance. Newly designed samplers should only be employed in extensive routine studies after elaborate field tests have been performed.

SO2

3.2 Determination of sulphur dioxide and sulphate in aerosols

3.2.1 Introduction

The most commonly used methods for sulphur dioxide measurements in EMEP today is the alkaline impregnated filter method and the hydrogen peroxide absorbing solution method. Another absorbing solution method currently used is the TCM or West-Gaeke method at German sites. The recommended method is the impregnated filter method, preferably in combination of ion chromatography, because it combines a small extraction volume and low measurement uncertainty with a large air volume, and therefore gives a good measurement accuracy even at low sulphur dioxide concentrations. At sites with annual average above 10 µg S/m^3 the absorbing solution method can still be recommended and would give satisfactory results. Only few of the EMEP sites experience such concentrations at present.

3.2.2 Principle

Sulphate aerosol particles are separated from the aerosol filter mounted in front of a filter impregnated with potassium hydroxide. The impregnated filter will absorb the sulphur dioxide which reacts with potassium hydroxide to give solid potassium sulphite. The absorption is quantitative at a relative humidity above 30% and down to -10 C (Lewin et al., 1977) or lower. Oxidizing species in air e.g. ozone are believed to convert most of the sulphite to sulphate during the sampling.

The aerosol containing salts of sulphuric acid are mostly in the fraction below 1 µm. The filter material should not absorb SO_2 and should have an acceptable collection efficiency for submicron particles. Cellulose filters are acceptable for this purpose, e.g. Whatman 40 filters, but membrane filters, e.g. teflon, are preferred.

3.2.3 Interference

Salts will react with sulphuric acid if aerosol particles hit the acid on the filter during the sampling. The resulting volatile acid, e.g. nitric acid and hydrochloric acid will react with the potassium hydroxide on the impregnated filter to give potassium nitrate and potassium chloride. This will, however, not affect the measured concentration of sulphate in airborne particles or sulphur dioxide.

A bias may, however, be introduced if the aerosol filter becomes wet during sampling since it is possible to have an absorption of sulphur dioxide on cellulose based filters. This gives an overestimation of the sulphate concentrations in aerosols and a corresponding underestimation of the sulphur dioxide.

Another source of error could be that the absorption of sulphur dioxide on the impregnated filter is not 100 per cent effective. Experiments with a second KOH-impregnated filter behind the first have, however, not given measurable amount of sulphur dioxide.

It may be possible to loose sulphate and sulphur dioxide before the analysis due to incomplete extraction from the filter.

3.2.4 Sampling equipment

Air intake and filter pack

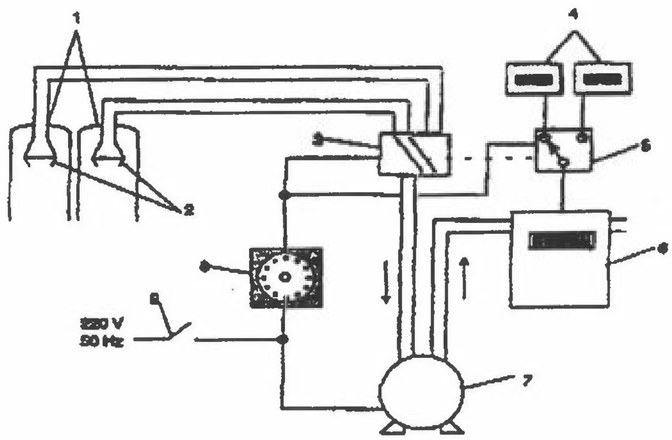
A diagram showing the sampling principle is given in Figure 3.2.1. The air intake should have a cylindrical,vertical section 15 cm wide and at least 25 cm high. This air intake reduce the sampling efficiency for particles larger than 10 µm a.e.d., such as soil dust particles, large sea spray droplets, large pollen, and fog droplets. The filter pack is placed directly in the air intake, and it should have separate supports for the aerosol and the impregnated filters in order to avoid contamination from one filter to the next. An exploded view of a filter pack and its components is shown in Figure 3.2.2.

It is important to avoid leaks in the filter pack. The filter pack in Figure 3.2.2 should be tightened to the torque specified by the producer. Care should be taken to avoid materials in the filter pack which may be a source of contamination or absorb sulphur dioxide or other air components which are to be determined. Teflon, polyethylene, polypropylene, PVC, and polycarbonate are recommended materials. Ordinary rubber and nylon contains sulphur and should be avoided. Nylon will absorb nitric acid which frequently is sampled together with sulphur dioxide.

Since the absorption of sulphur dioxide is only quantitative at relative humidities above 30, sampling with a filter pack should take place outdoor, only sheltered from the ambient air by the air inlet. Additions of glycerol may improve the absorption efficiency of the impregnated filter at low humidities. Typical air volume, sampling rate, and flow velocity through the filters are respectively 20 m³, 15 l/min., and 15 cm/s.

Pump and gas meter

The filter pack should be connected to the sampling line with an airtight seal, using either a nut and gasket, or push-fitted tubing. The sampling line connects the air intake and filter pack to a pump and a gas meter in series. The pump should be a membrane pump of sufficient capacity to allow 15 l/min. against a pressure difference of 10-20 kPA (0.1 atm.), which is the typical pressure drop across two filters. It is essential that the pump is leakproof against outside air in order to allow reliable metering of the air volume at the outlet of the pump. A dry bellows-type gas meter may be used for recording of the air sample volume. This is a relative inexpensive instrument which is readily available commercially. The accuracy of commercial gas meters is typically within ± 5%, calibration at regular intervals is therefore mandatory. Better accuracy is obtainable with a wet gas meter. Both devices will record the air volume at the temperature and pressure conditions in the pump. If the pump and gas meter is kept at room temperature, no corrections are usually required, and the air volume is then assumed to be the sample air volume at 20 °C. If deviations of more than ± 5 °C are expected, the temperature in the gas meter surroundings has to be recorded and the air volume corrected accordingly.



1. Funnel
2. Filter pack
3. Solenoid valve
4. Air volume counters
5. Relay
6. Gas meter
7. Pump
8. Timer
9. Power switch (on/off)

Figure 3.2.1: Sampling principle.

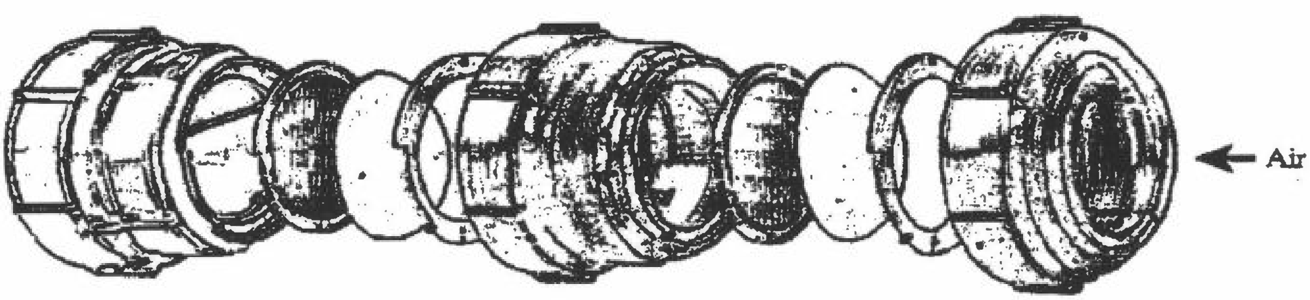


Figure 3.2.2: Filter pack with one aerosol filter and one impregnated filter for gases.

Sequential sampling
In order to facilitate operation of the sampler, it is possible to connect two or more air inlet and filter pack units to the same pump and gas metering device, letting timers control valves. This enables a collection of samples (exposed filter packs) and an inserting of new filter packs at a convenient time and without interruption of the sampling process. A schematic indication of how this may be carried out is indicated in Figure 3.2.1.

Mass flow controllers
It is possible to use mass flow controllers to control the sampling rate or to provide dynamic dilution of span gases for calibration purposes. In principle, these determine the heat capacity of the gas or air flowing through a capillary, and the temperature difference between two points is used to control the position of a needle valve. The disadvantage of this system is, besides the costs, the pressure differences 0.7–1.1 atm (10–16 psi) required over the needle valve to make the control function reliable. This makes it impractical to use this type of device to control the sampling rate in front of the pump unless the needle valve is replaced by another control valve requiring less pressure drop. The device can, however, preferably be used at the outlet of the pump to keep the sampling rate constant over the sampling period. Low-pressure mass flow controllers are available. The flowmeter must be properly calibrated, and a suitable recording instrument added, if a mass flowmeter is to be used as the only measure of the sample volume.

Commercial supply
A list containing only some of the suppliers of the various types of equipment is given below:

Prefilter for collection of aerosols:
Teflon filter by Gelman, Zefluor 2 µm.

Cellulose filters for impregnation with potassium hydroxide to be used for sampling of sulphur dioxide:
47 mm Whatman 40 (W40) cellulose filter
Whatman International Ltd., Maidstone, England

Filter packs for two or three filters, with clamp and wrench:
Norwegian Institute for Air Research, Kjeller, Norway

Membrane pump:
GAST, Model DOA-P101-BN
MFG. Corp., Benton Harbor, Mich. USA

Gas meter:
FLONIDAN
Gallus 2000 G1.6
Islandsvej 29
DK-8700 Horsens, Denmark

Mass flow controller:
TYLAN GmbH
Kirchhoffstrasse 8
Eching, Germany

3.2.4.1 Site requirements

The sampler should be located at least 100 m from small scale local sources, e.g. generators or houses heated with petroleum, coal, or wood.

Samplers for sulphur dioxide and sulphate in aerosols should normally be located in a shelter with temperature regulation. The gas meter should be kept at 20 °C ± 5 °C.

3.2.4.2 Sampling procedure

Mounting and dismounting of filter packs
It is recommended that the filter pack is assembled and dismounted in the laboratory only. When assembling the filter pack, the parts should be tightened to the torque specified by the manufacturer to prevent leaks. Airtight protection covers need to be mounted in both ends of the filter pack. One random selected complete filter pack should be checked every second week for leaks. Each filter pack should be tagged with the site code in the laboratory before it is sent to the site.

Exposed filter packs should be opened in the laboratory and the filters put into plastic bags, which in advance, have been tagged with site code, start and stop of sampling, and filter type. The filters are now ready for a chemical treatment and the analysis. Normally there is a delay between this step and the time when actual chemical treatment and the analysis takes place. During this period the samples are to be kept in a refrigerator.

It is important to wear a pair of disposable plastic gloves when working with the filters and the filter packs.

Changing of filter packs at the site
At the site, and before the filter pack is mounted in the sampling line, the site operator has to write the start date on the filter pack, and likewise the end date of the sampling after exposure. Further details are to be written into the site journal and copied into site reporting forms, worked out for this purpose.

The sampling procedures may be slightly different from one air sampling system to another. When a two line sampling system is used, with a timer which starts the exposure of a new filter pack at a preset time, an example of a recommended procedure at the site is as given below. The start and end of exposure should be between 0700 - 0900 local time:

- mark an unexposed filter pack with start date,
- read the pressure behind the exposed filter pack and record the reading in the journal,
- read the counter in the volume meter and record the volume in the journal,

- remove (unscrew) the air intake or funnel covering the exposed filter pack and remove (unscrew) the filter pack,
- dismount the covers from the new unexposed filter pack and mount them on the exposed filter pack,
- mount the new unexposed filter pack and the air intake,
- read the pressure behind the unexposed filter pack and record the reading in the journal,
- reset if necessary the counter or volume meter of the new filter pack,
- write the start of the exposure of the new filter pack in the journal,
- activate or programme the timer if necessary,
- put the exposed old filter pack in a plastic bag, seal it and put it in the refrigerator,
- copy the information from the journal into the site reporting form.

Transportation of samples from and to the laboratory

It is recommended to ship a one weeks supply of filter packs from the laboratory to the site, and vice versa, once every week. One extra filter pack, complete with filters, should be added as a field blank (i.e. one field blank every week). This filter pack should be handled in every way as the ones to be exposed, returned with the other filter packs from the batch, dismounted, and the filters given the same chemical treatment and analysis as the exposed filters.

Once every week the field operator fetch the seven exposed filters from the refrigerator as well as the one unexposed (field blank) filter pack, and put the filter packs in the transportation box together with the site reporting form covering the past week. Field reporting forms should always be put in a separate plastic bag in case of accidental leaks from precipitation samples which may be contained in the same transportation box. Mail the transportation box to the laboratory.

Maintenance and calibration

The sampling equipment should be maintained in accordance with the manufacturers specification.

Accurate volume readings are important for the resulting measurements accuracy, and the volume meters may need frequent calibrations. Calibrations should under no circumstances be less frequent than once or twice every year. The accuracy must be better than 5%.

Written instructions for maintenance and calibration need to be available at the site, and the operator should be familiar with the contents.

3.2.4.3 Preparation of samples and chemical analysis

Handling of filters in general

The filters and extraction solutions should not be exposed to air longer than necessary due to a possible uptake of gases e.g. ammonia by acid filters or solutions. Disposable plastic gloves and tweezers should always be used when handling filters.

The extraction of exposed filters should take place the same day the filters are moved from the filter pack.

KOH impregnation of filters
The complete procedure for cleaning and impregnation of filters is described in Section 3.5.

The potassium hydroxide impregnated filters are prepared by dripping 1 N KOH/ 10% (v/v) glycerol/metanol solution on the filter surface. The filters can be air dried for 30 min., and then put in air-tight plastic bags.

In order to avoid excessive blank values, the Whatman 40 filters used for acid gases may be washed in 0.1 M K_2CO_3 . If the SO_2, HNO_3 or NH_3 concentrations are high in the laboratory, the filters should be dried in a dry box which is supplied with clean air.

Extraction of KOH impregnated filters
The complete procedure is described in Section 3.6.

The exposed impregnated filters are put into a test tube or other suitable vessel with additions of water and hydrogen peroxide solution in order to oxidize any remaining sulphite to sulphate. During the extraction process the impregnated cellulose filters need to be handled carefully in order to avoid loosening of fibers which may cause problems during the analysis. The tubes should be kept in the refrigerator until analysis.

Pretreatment of extract from KOH impregnated filters for subsequent analysis by the Thorin method
The complete procedure is described in Section 3.6.

In this case the extracted solution has to be treated with a cation exchange resin to remove the potassium and to neutralise the solution.

The manual version of the Thorin method can easily give inaccurate results and is not recommended.

Extraction of aerosol filter
The complete procedure is described in Section 3.6.

Use of filter blanks
It is recommended that 10 samples from each new batch of filters are analysed as laboratory filter blanks. The purpose of the filter blanks is to control the quality of the filters rather than to estimate the laboratory detection limit. Normally the blank values should be sufficiently low that their values can be ignored. If high blank values are found a problem has occurred which has to be identified and solved, e.g. by using filters or chemicals from another batch, and by inspection of the routines in the laboratory.

Measurement precision
The procedure for calculation of the precision has been given in Section 5.6.

The measurement precision is more useful for a data user as a measure of the random errors than is the laboratory precision. The measurement precision needs to be evaluated from a parallel sampling with two identical measurement devices and procedures.

3.2.4.4 Calculation of results

The concentrations of sulphur dioxide in the air sample expressed in µg S/m³ is given by:

$$C = \frac{a \cdot v_1}{v_2}$$

a is concentration of sulphur in mg/l read from the calibration curve,
v_1 is the liquid volume containing the sulphate ions, e.g. 10 ml if a 10 ml extraction solution were used,
v_2 is the air volume from the sampler, in cubic meter at approximately 20 °C, and corrected for height from elevated sites.

3.2.4.5 Quality assurance

Handling of filters and filter packs in the laboratory

- Always wear disposable plastic gloves and use a pair of tweezers when handling filters,
- keep the impregnated filters in air-tight plastic bags,
- air-tight covers must be mounted in both ends of the filter pack once the filter pack has been assembled,
- filter packs should be tightened to the specified torque to avoid leaks after assembly,
- one filter pack selected at random should be checked for leaks every second week,
- each filter pack should be tagged with site code in the laboratory,
- exposed filter packs should only be opened in the laboratory, and the filters kept in air-tight plastic bags in a refrigerator before further chemical treatment.

Handling of filters and filter packs in field

- Filters should only be handled in the laboratory,
- each filter pack should be tagged with start time (day-hour-minute) by the field operator before being mounted in the sampling line, and with stop time when dismounted after exposure,
- covers removed from the new filter pack should be mounted on the exposed one when the samples are changed,
- filter packs should be kept in a plastic bag in the refrigerator at the site.

Maintenance and calibration of field equipment

- Maintenance performed in accordance with written instructions for the field instruments in question,
- calibrations of measuring devices at least once every year.

Analysis by ion chromatography
There are several manufacturers of ion chromatographs. Recommended procedures and currently used columns when using Dionex or Waters chromatographs are given in Section 4.1.

10 ml of the extraction solutions in 12 ml polystyrene tubes with polyethylene stoppers fits the autosampler for the ion chromatograph.

Analysis by automatic Thorin method
The method is described in the previous version of the Manual (EMEP/Chem 3/77).

Field blanks

- As a field blank, one complete filter pack should follow the other filter packs every week,
- the field blanks should be analysed as the normally exposed samples to control the performance of the measurement system, and to give data for the assessment of the measurement detection limit.

Chemical analysis

- Calibration should be carried out in the beginning, and end of a series of samples, not to exceed 50, and at the end of the day at the latest. The average of the calibrations before and after a sample series should be applied,
- 5% of the samples should be split and the results used to quantify the analytical precision,
- 5% of the samples should have known, and realistic, concentrations and should be run between the normal samples to control the performance of the analytical system,
- 5% of the samples should be blank samples used to quantify the analytical detection limit.

Transportation

- Transportation time should be kept as short as possible.

3.2.4.6 References

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CEN/TC 264/WG 6 N72

PM10

CEN · European Committee for Standardization · Comité Européen de Normalisation · Europäisches Komitee für Normung

Air Quality

Ambient Air

CEN/TC 264 /WG 6
Suspended particulate matter below 10 µm

Evaluation of the designated CEN field test procedure to demonstrate equivalence of sampling methods for the thoracic fraction of suspended particulate matter (SPM) with a reference sampling method for the thoracic fraction of SPM

April 1996

Members of CEN/TC 264/Working Group 6

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This study was performed in fulfilling a standardization order commissioned to CEN by the European Commission (DG XI) and the EFTA Secretariat within the framework of EU Mandate B4 - 3040 - 93/00367.

PM10

3.1.1 PM10 High Volume Sampler, coded B

The impactor inlet of the PM10 High Volume Air Sampler is approved by the US Environmental Protection Agency (US Federal Register, 1987). From the former WRAC study (Laskus, 1989; Holländer, 1990) it is known that the PM10 HVS meets very exactly the criteria for thoracic particle sampling.
The PM10-HVS is equipped with a Critical Venturi Meter (CVM - venturi device combined with a critical orifice) keeping the flow at a constant rate of approximately 68 m^3/h.
The filter holder, blower and motor, CVM and the further electric compounds are installed in the usual protective HV-shelter.
Inside the pre-impactor, the particles greater than 10 μm aerodynamic diameter impact onto a greased impaction shim. Nevertheless, the field experiments conducted at the site Cottbus have shown that dry coarse dust particles impacted onto the first dust layers of the shim and deposited beside the shim onto the walls of the impactor cup can easily be resuspended by the air flow and be carried further to the filter. Hence, to avoid this effect all interior walls of the impactor cup and the shim have been provided with a thick grease layer frequently.

3.1.2 PM10 Low Volume Sampler, coded C

The PM10 sampling head with the filter holder is connected with the regulated flow device by means of a suction pipe.
The filter diameter is 50 mm; the diameter of the loaded filter area amounts to 41 mm.
The rotary vacuum pump of the flow device is flow-controlled by means of a turbine flow meter and a regulating valve which is regulated by a processor system. The controller has a deviation of ± 1 - 2% of the set point. The desired flow rate can be adjusted in steps of 0.1 m^3/h between 1.0 and 2.5 m^3/h, using a two-digit BCD-switch included in the front panel. The flow rate can be checked by means of e.g. a precision rotameter which is to be attached to the suction pipe instead of the sampling head. The flow controller's processor system can easily be recalibrated, also using e.g. a precision rotameter and a valve attached between the rotameter and the flow device in order to adjust different flow resistances.
For cleaning and greasing of the impactor inlet the impaction plate can be pulled out of the inlet. Necessary spare parts are vanes for the rotary vacuum pump and separation filter for the abrasive carbon dust of the vanes. These parts had to be changed in regular intervals of some thousand of operating hours.

3.1.3 PM10 Low Volume Sampler, coded D ← NILU PM_{10} Sampler.

The sampler consists of an PM10 impactor inlet, a filter holder and a regulated flow device, set at 0.6 m^3/h.
The PM10 impactor is a multi-jet impactor device; it consists of a nozzle plate with 6 circular jets (4.6 mm diameter), equally spaced around a circle of 26 mm diameter. The distance between collection and nozzle plate is 5 mm. The actual impactor is preceeded by an inlet tube of 37 mm inner diameter and 80 mm length. The entire unit is made from aluminum, mounted with the inlet facing down. Subsequently, the impactor / filterholder unit is connected to a GAST DOA-P108-FD membrane pump, an electronic flow control device (Tylan General FC-280), a dry gas meter and a counter display for the total volume of air sampled.
The collector plate of the impactor are routinely cleaned and greased (using Chesebrough waterfree vaseline) in order to avoid build-up of (coarse) particles.

- *Federal Environmental Agency (UBA), Institute for Water, Soil and Air Hygiene*, Berlin, Germany,
  taking care of the field measurements at the German testsite in Cottbus, and
  all data-acquisition, database management and statistical evaluations.
- *EU Joint Research Centre, Central Laboratory of Air Pollution (JRC)*, Ispra, Italy,
  taking care of the field measurements at the Italian testsite in Ispra, and
  the procurement of all candidate instruments and spare parts used in the field study.
- *Instituto Salud Carlos III*, Madrid, Spain,
  taking care of the field measurements at the Spanish testsite in Madrid.
- *Buro Blauw*, Wageningen, the Netherlands, and *RIVM*,
  taking care of the field measurements at the coastal testsite in the Netherlands.

The field test programme started after the *EU mandate* (CEC,1993) was officially granted and was run from January 1994 to April 1995. Because of the extraordinary aerosol situation at the German test site (caused by the partly pure brown coal emissions) the tests had to be conducted over a longer, twice interrupted period from January 1994 up to April 1995 in order to optimize the WRAC impactors as well as the preimpactors of the candidate instruments regarding a correct preseparation of the coarse dust.

3.1 Candidate samplers for thoracic particles

Only commonly employed so-called PM10 samplers (with a 50% cut-off diameter of 10 µm) were included in the field test programme as candidate samplers for the thoracic particles:

- 1 type of *HVS-PM10* sampler (flow rate of 68 m^3/h) and
- 4 types of *LVS-PM10* samplers equipped with *impactor sampling heads* (flow rates of 0.6, 1.0, 1.2 and 2.3 m^3/h), and
- 1 type of *LVS-PM10* sampler equipped with a *cyclone sampling head* (flow rate of 3 m^3/h).

A complete sampling system, consisting of a thoracic particle inlet, a dust collection substrate and a regulated flow device, is to be used for purposes of reference equivalence testing. Hence, the procedure started with a sampling inlet, followed by conventional filtration of a measured volume of sampled air, and ended with determination of the net weight gain of the filter using standard gravimetric procedures.

It is worthwhile noting here that the selected PM10 candidate samplers differed with regard to the following aspects:
- PM10 size selection performed either by impactor or cyclone pre-separators
  i.e. samplers coded **B, C, D, E, F** vs. **G**;
- sampling flow ranged from so-called High to Low Volume Sampling
  i.e. samplers coded **B** vs. **C, D, E, F, G**;
- flow control performed either by pneumatic or electronic devices
  i.e. samplers coded **B, E, F** vs. **C, D, G**;
- fully commercially available sampling systems or specially assembled systems were available
  i.e. samplers coded **B, C, G** vs. **D, E, F**

Relevant technical details of the employed candidate samplers are described in the following subsections.

procedure, can be employed as transfer reference samplers. The B *HVS-PM10* and the C *LVS-PM10 samplers* can most adequately serve this purpose.

- For the characterization of the measuring sites (i.e. to assess the proportion of the thoracic particles to SPM) the A *HVS-total* sampler can be most conveniently used.

Also, once again bitter experience has proven that:

- The technical design determines the overall performance of the samplers. Sampling flow-rate stability and adequate filter-weighing procedures are of utmost importance.
- Newly designed samplers should only be employed in extensive routine studies after elaborate field tests have been performed.

Table 1. Comparison of data with the proposed provisory requirements for reference equivalence

	Comparability: candidate 1 vs. 2 *Mean difference*	Comparability: candidate vs. reference *Reference equivalence function*	
WRAC(10 um)	2.2 μg/m^3; 3.5 %;		
WRAC(total)	5.9 μg/m^3; 11.2 %;		
A: HVS-total (68 m^3/h)	3.2 μg/m^3; 3.4 %;		
Candidate sampler	≤ 5 μg/m^3 or ≤ 5 %	≤ 10 μg/m^3 or ≤ 10 %	$R^2 \geq 0.95$
B: HVS-PM10 (68 m^3/h)	2.9 μg/m^3; 4.0 %;	Yes	0.98
C: LVS-PM10 impactor (2.3 m^3/h)	4.3 μg/m^3; 4.1 %;	Yes	0.95
F: LVS-PM10 impactor (1.2 m^3/h)	7.5 μg/m^3; 9.0 %;	Yes	0.89
E: LVS-PM10 impactor (1.0 m^3/h)	7.6 μg/m^3; 11.7 %;	Yes	0.95
D: LVS-PM10 impactor (0.6 m^3/h)	12.3 μg/m^3; 12.9 %;	Yes	0.77
G: LVS-PM10 cyclone (3 m^3/h)	10.0 μg/m^3; 19.8 %;	No	0.77

6 CONCLUSIONS

The designated ambient field test procedure has been shown to be a practical one, enabling European institutions or industries to assess candidate sampling systems under ambient conditions. The field test procedure can be completed within circa three months, according to the requirements stipulated in the designated draft standard (CEN, 1996). Hence, the testing efforts are of limited, reasonable proportions, provided the technical competence of the testing laboratories is in accordance with the general criteria specified in EN45001.

The use of a two-sided acceptance envelope to test the reference equivalence was found to be a straightforward strategy, greatly *facilitated by the possibilities offered* through visual judgement.

Although the WRAC system can serve as provisional reference instrument, the practicability of the WRAC presents, unfortunately, *the* major drawback. For this reason, the following practical working option has been suggested:

- ~~Sampling instruments possessing the required performance to measure the thoracic particles,~~ as shown in a field test based on the requirements of the designated reference equivalence

Appendix N

Procurement specification Example SO_2 monitors.

Procurement specifications

C.1.2. Air quality monitoring equipment

Equipment: Sulphur dioxide monitors

Quantity of equipment: 20

Purpose
The SO_2 monitors will be needed to continuously measure the SO_2 concentration levels at selected sites in Egypt. The data will be logged and transferred automatically to a central computer at the EMOHC laboratory in Embaba Cairo. Six of the instruments will be used in greater Cairo, 2 in Alexandria. The rest in various areas of Egypt.

Qualifification requirements:
1. SO_2 should be measured from the fluorescent signal generated by exciting SO_2 with UV light.
2. It should contain a internal zero span self check option included a temperature controlled permeation tube, TFE zero span valves and a zero air scrubber.
3. Zero check and calibration should be performed remotely through a RS232 command.
4. Power requirement 220 - 240 V
5. Telephone modem connection should be available.
6. Lower detection level 1 ppb.
7. Response time should be less than one minute.

Spare parts
Accessory and spare parts for five years operation , according to suppliers experience. Budget for spare parts must be clarified and co-ordinated for the total set of 20 monitors.

Packing and delivery
Delivery of equipment in Cairo including insurance, packing and transportation should be provided by the supplier.
The delivery shall take place less than two months after acceptance of the contract.
The deliveries of SO_2 monitors in Cairo should be in a maximum of three lots according to further instructions.
The bidder is responsible for a packaging that ensures against damage during transportation to Cairo.

Installation and training
The SO_2 monitors will be installed in Cairo according to detailed project plans. Instructions and specifications should be supported at delivery, preferably in English and Arabic. Installations and some basic training should be supported by experts from the supplier.

Operation and maintenance
A service maintenance agreement has to be presented by the supplier. A data a quality assurance programme and data retrieval system will be part of the delivery. Operations , final data QA and input to the data base will be supported by the EIMP programme.

Warranty
??

Appendix O

Local sales representatives for air quality monitoring equipment in Egypt

EIMP

**Environmental Information
and Monitoring Programme
3 Abdil Aziz Selim street
Mohandessin, Cairo, Egypt
Tel/Fax: +20 2 361 5085**

Local sales representatives for air quality monitoring equipment in Egypt

Instrument	Local Company	Address	Telephone Fax	Contact person
Environnement S.A.	Value Link Engineering System	5 Road 277 New Maadi, Cairo	T: 202 517 0258 F: 202 517 0259	Hassan Z Abdalla
Horiba	Noor Scientific & Trade	10 El Salam Street Kornish el Nile Agakhan-Soubra PC 11 241 Cairo	T: 202 203 4350 F: 202 203 4350	
Thermo Environment	Chemical and Technical Services Cairo		T: 201 35 52 560 F: 202 35 51 356	Dr. Elsuine
Monitor lab	Etico Scientific Company		T: 202 340 3041 202 340 7733 F: 202 341 0681	Mr Michael Giergies
API monitors (not any more?)	Scientific Instr. Technical Agency (SITA)	15 Min. of Agriculture str. AlDokki, Giza	T: 202 714 4450 F: 202 348 7760	Mr A saleh (dir)
Monitor lab	Nashco Engineering Trading		T: 202 299 3078 F: 202 299 3820	Mustafa Nashat
Vaisala, Meteorlogical equipment, weather st.	Integrated Systems Organization	ElWazeer Str., Zahraa City, Box 73, Helmia Zaiton, 2 El-Zohoor Tower, Cairo		
Young Meteorological	Meteo Tech ltd	11 Moshe Sneh TelAviv 69350	T: 972 349 2962 F: 972 364 1443	Dr.Noah Wolfson
Eberline, PM_{10} monitors	Chemical and Technical Services Cairo	4 Maamal El-Sokkar street, Garden City, Cairo	T: 202 355 2560 F: 202 355 1356	Mr. Amr El- Soueni

"Ambient air" monitors :

SO_2

- **up-to-date technology**
- **a complete and homogeneous line**
- **accurate and reliable measurements**
- **worldwide experience**

The Environnement SA line of gas and suspended particulate monitors designed to measure low concentrations in ambient air or inert gases:

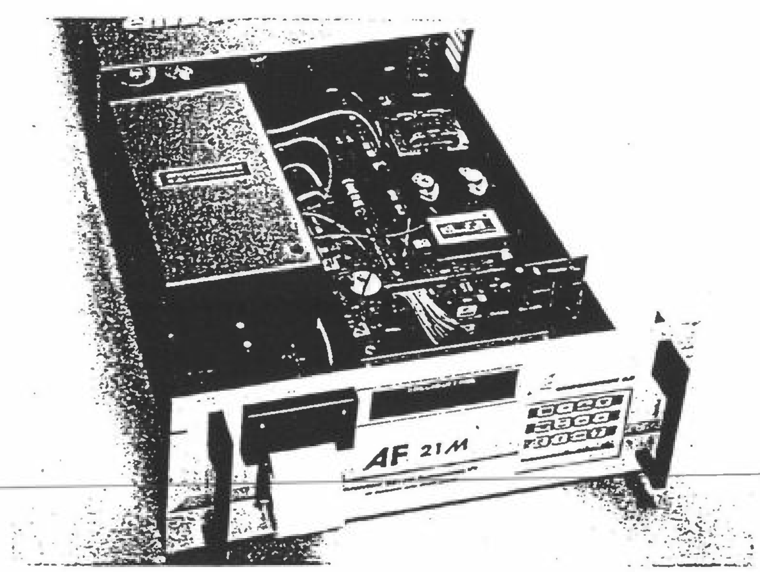
□ is the result of years of improvement and mastery of the latest technology,

□ uses internationally accepted and standardized techniques and methods of measurement
- UV fluorescence
- chemiluminescence
- gas filter correlation /NDIR
- UV absorption
- beta ray absorption,

□ constitutes a homogeneous set of monitors which are extremely modular and similar in their design and production (identical components and modules, interchangeable electronic PCB,...) leading to simplified and low cost maintenance,

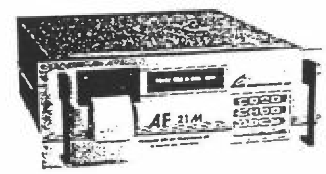
□ assures the user accurate and reliable measurements (numerical treatment of signals by microprocessor) as well as their validity (permanent monitoring of important parameters with alpha-numerical display and transmission of possible malfunctions),

□ advanced user interface and maintenance facilities (keyboard, internal clock, self-diagnostic tests, remote functions, 1/4 hour values stored on 15 days, optional built-in printer, optional transmission protocol via RS 232 to computer...)



environnement s.a

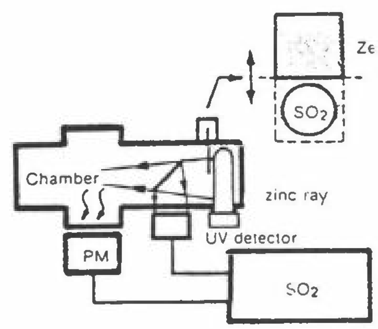
EXPERTS IN MEASUREMENT



UV fluorescent SO_2 analyzer model AF 21 M

New SO_2 analyzer with zinc ray UV lamp with stabilized power supply, continuous UV energy monitoring and compensation for measurement at constant energy level.

Integrated carbon "kicker" for continuous removal of interfering hydrocarbons.



signal p

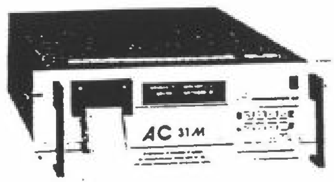
Ranges:	0-0.1/0.25/0.5/1/10 ppm (programmables)
Lower detectable limit:	1 ppb
Zero drift:	< 1 ppb/7days
Span drift:	< 1 %/7 days
Linearity:	± 1 %
Resp. time:	from 10 to 90 sec. (programmable)
Output:	0-1 V, 0-10 V, 0-20 mA or 4-20 mA

Options:
- **built-in permeation bench with SO_2 tube (50-month lifetime)**
- **built-in printer**
- **serial RS 232 output**

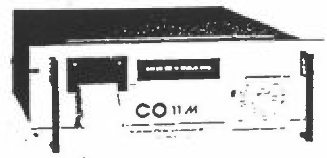
H_2S and SO_2/H_2S

UV fluorescent analyzers

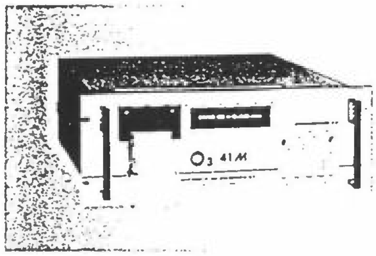
NO-NO_2 — CO — O_3



Chemiluminescent dual channel NO-NO_x-NO_2 analyzer model AC 31 M



Gas filter correlation CO analyzer model CO 11 M



UV Photometric ozone analyzer O_3 41 M

second generation of microprocessor-based monitors

The ultimate NO-NO_x- NO_2 monitor:

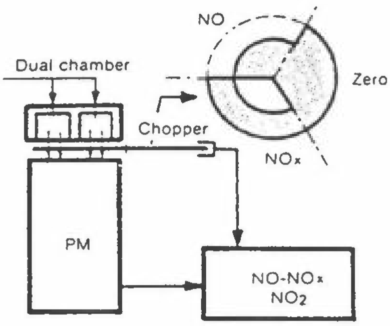
- reliability (measurement on the same sample), dual chamber, and one PM
- high sensitivity (0,4 ppb) low sample flow long life (2 years) NO_x converter

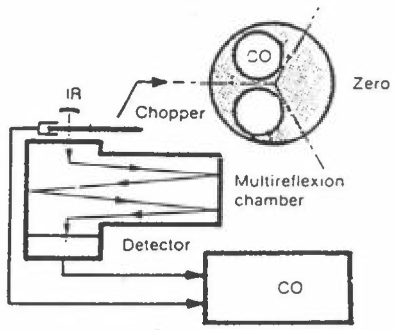
Optimum development of the NDIR correlation photometry principle for CO measurement together with the maximum user facilities for operating and maintenance.

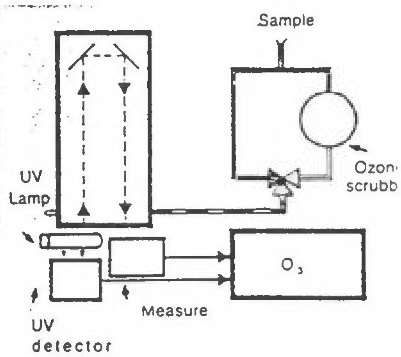
- high sensitivity and interferent rejection
- insensitive to vibration

New O_3 computerized analyzer with UV energy, temperature and pressure compensation, real time clock, keyboard for programmation, presented in 4U rack.

- Absolute measurement based on Beer Lambert's Law.
- Specific, stable and accurate measurement.







sing and continuous zero control by microprocessor

zero filter, zero-span solenoid valves and pump included

Ranges:	0-0.1/0.25/0.5/1/10 ppm (programmables)
Lower detectable limit:	0,4 ppb
Zero drift:	< 1 ppb/7 days
Span drift:	< 2%/15 days
Resp. time:	from 20 to 300 sec. (automatic-programmable)
Linearity:	± 1%
Sample flow:	0,57 l/min

Ranges:	0-10/25/50/100 ppm (programmables)
Lower detectable limit:	0,1 ppm
Zero drift:	< 0,2 ppm/15 days
Span drift:	< 1 %/15 days
Resp. time:	from 20 to 120 sec. (programmable)
Rejection rate:	H_2O: 1/200 000 CO_2: 1/70 000

Ranges:	0-0.1/0.25/0.5/1 ppm (programmables)
Lower detectable limit:	less than 1 ppb
Zero drift:	< 1 ppb/7 days
Span drift:	< 1 %/7 days
Linearity:	± 1 %
Resp. time:	from 10 to 90 sec. (programmable)
Output:	0-1 V, 0-10 V, 0-20 mA or 4-20 mA

metrology and maintenance assisted by microprocessor: automatic permanent tests (chopper, lamps, flow rates, temperatures...) with alphanumeric display and remote functions.

Output: 0-1 V, 0-10 V, 0-20 mA or 4-20 mA

Options:

- built-in printer
- serial RS 232 output
- built-in permeation bench
- dual calibration NO and NO_2

NO_x-NH_3 chemiluminescent analyzers

Linearity: ± 1 %

Output: 0-1 V, 0-10 V, 0-20 mA or 4-20 mA

Options:

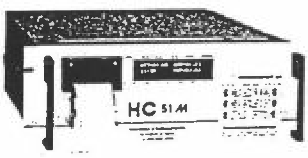
- built-in printer
- serial RS 232 output
- range: 0-200 ppm

Options:

- built-in printer
- serial RS 232 output
- internal O_3 generator
- other ranges

EIMP

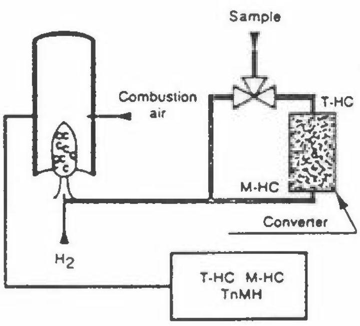
THC-TnMH



Flame ionisation detection hydrocarbons analyzer HC 51 M

Flame ionisation detection total hydrocarbons analyzer, methane, non methane.

- new high sensitivity and stability FID detector.
- sample circuit kept at constant temperature to avoid condensation (from the heated pump to the heated sampling inlet).
- electronic control of parameters such as flow, pressure...

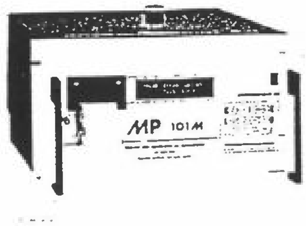


Ranges :	equivalent CH_4 0-10/0-50/0-100/0-500/0-1000 ppm
Lower detectable limit :	< 0,05 ppm
Zero drift :	< 0,05 ppm
Span drift :	< 1 %/7 days
Linearity :	± 0,5 %
Reponse time :	5 to 60 sec. (programmable)

Options :

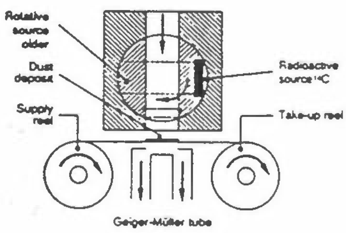
- built-in zero air generator
- methane and non methane hydrocarbons built-in converter
- built-in printer
- serial output RS232

Particulates



Beta Gauge ambient suspended particulate monitor MP 101 M

- Weight measurement not influenced by the physico-chemical nature, color or particle size of dust.
- Very low activity (< 90 μCi) sealed flat source (Carbone 14) with a very long lifetime.
- Air flow control : high accuracy differential pressure method.
- Radioactivity monitoring of deposited dust (alarm threshold programmable).



- Heated sampling duct (standard 1m, optional : 2m, 2m75).
- Standard AFNOR or PM 10 sampling inlet available (inhalable suspended particulates < 10μ).

Ranges : programmable 0-100/0-200/0-500/0-1000/0-2000/0-5000/0-10000 μg/m³.

Lower detectable limit : 0,5 μ /m³ for a 24h cycle at 1m³/h.

Measurement cycles : 1/2, 1, 2, 3, 6, 12, 24h.

Measurement output : cumulated, average or periodic : 1/4, 1/2, 1, 2 ou 3 hours.

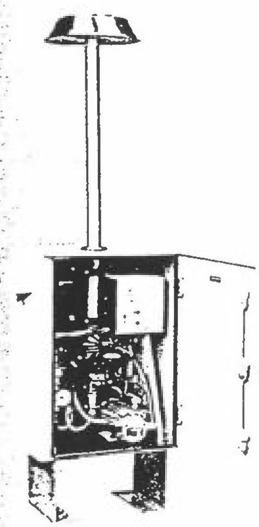
Autonomy : 1350 measurements, or more than 3 years with one sampling a day.

- Standard version : Rack 19", 6U.

Output signal : 0-1 V, 0-10 V, 0-20 mA or 4-20 mA / Alarm control.

Options :

- built-in printer
- serial output RS232
- outdoor version (direct on site installation) delivered in a compact waterproof cabinet with an inside temperature regulation system.



Automatic suspended particulate sampler model PPA 60

Delivered in a weatherproof fiberglass enclosure for direct site installation, this unit is specially designed to achieve sequential automatic sampling of suspended particulates on filter substrates...

Inlet: heated, specially designed for suspended particulate sampling.

Capacity: 8 filters (8 days).

Sampling cycle: 24 hours (other cycles available).

Filters: Ø 47 mm, 0.8 or 1 μm cellulose nitrate, teflon...

Flow-rate: 1.5 m³/h adjustable and automatically regulated.

Clock: electronic.

Operating temperature: - 10 to + 40 °C.

Overall dimensions (with sampling head in position) :

height: 2 m, width: 60 cm, depth: 39 cm.

Reinforced model (option) :

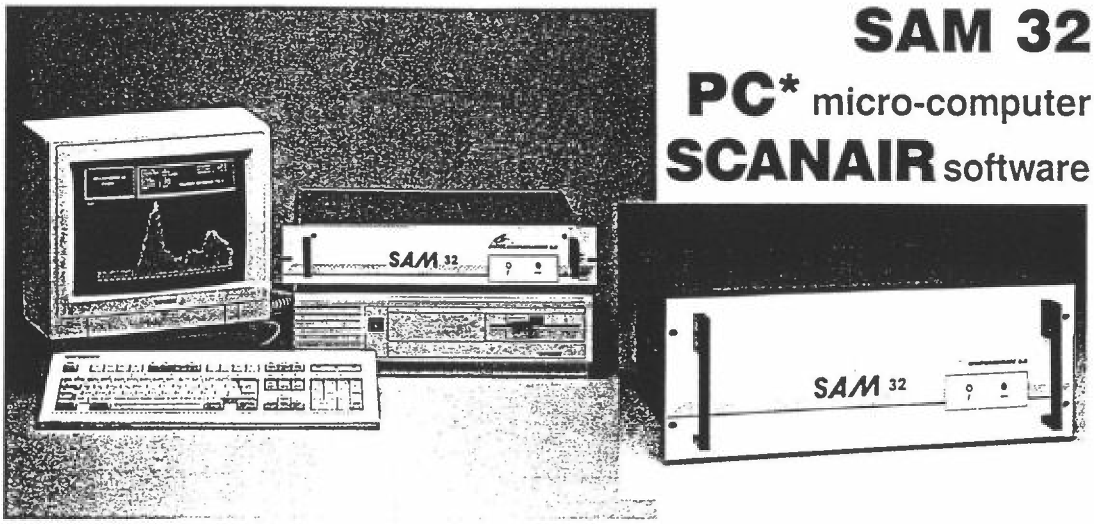
Delivered in a reinforced cabinet with isolation transformer and lightning arrester device for outdoor installation on public thoroughfares.

Multiparameter Acquisition System

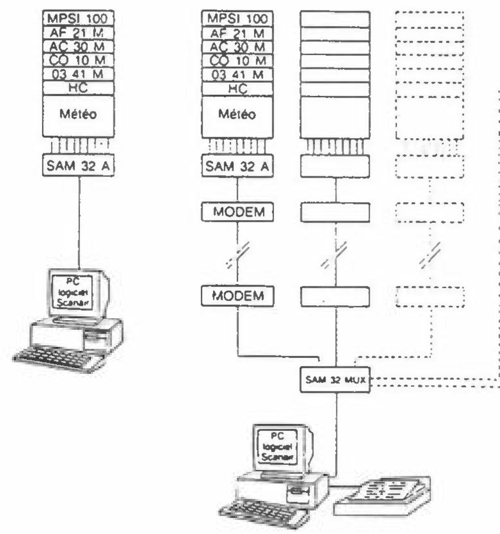
SAM 32

PC* micro-computer

SCANAIR software



This new data acquisition system has been specially developed to receive the measurement values emitted by one or several gas or dust analyzers, meteorological sensors or other parameters - more particularly in the atmospheric pollution control multiparameter stations - for transmitting them to a microcomputer on site or at a distance.



SAM 32 A model

The multiparameter acquisition system can manage analog and logic output acquisition and storage, and transmit them, in numerical form, to a central microcomputer, directly if it is close by, or with a Modem.

- 16 analog signal inputs (0-1 V or 0-20 mA or 4-20 mA).
- Acquisition of the data on 5 sec. time basis
- Calculation of the average value per minute of each data and transmission at computer request.
- Calculation of the average value per quarter hour of each data, 5 days storage, transmission at computer request.
- 12 logic outputs (relays) for external zero and span solenoid valve remote control.
- Acquisition of analyzer' status (alarm, zero, calibration) with 16 logic inputs (16 TTL).
- Presentation :
  — rack mounting 19", 4U (for cabinet installation)
  — table mounting 19", 2U.

SAM 32 MUX model

This multiplex acquisition system, installed in the central room, receives the data transmitted by several stations equipped with SAM 32 A system.

- Digital scanning from 2 to 7 SAM 32 A (10 or 14 in option).
- 12 relay outputs : threshold and analyzer alarms for each station (20 relay outputs in option).
- Presentation :
  — rack mounting 19", 4U (for cabinet installation)
  — table mounting 19", 2U.

SCANAIR software

The SCANAIR software manages acquisition, edition and storage of the data issued by SAM 32 A and SAM 32 MUX systems. It operates with a PC* compatible micro-computer. It is used particularly for managing data from atmospheric pollution work stations, optionally linked to the central station by phone or radio hook-ups in the context of the atmospheric pollution control networks.

Configuration

- The configuration of the SCANAIR software can be totally determined by the operator (station names, parameter names, units, adjusting scale, automatic calibration, etc...).

Acquisition

- Acquisition of 1 minute integrated values or of average 1/4 hour values.
- Display of operating alarms, limit overshoots, etc...
- Possibility of receiving meteorological parameters (wind speed and direction, temperature, pressure, humidity, etc...) with dominating wind calculation.

Files facilities

- Quarter hour (stored on hard disk) data files available for external use by the operator.
- Back-up of quarter hourly data not received (5 day storage in SAM 32 A station).

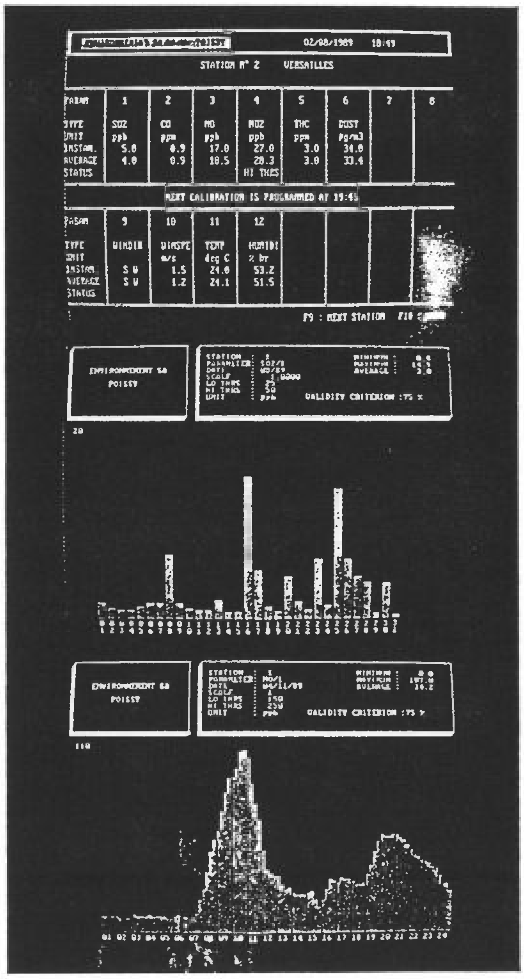
Edition

- Choice of display, on the micro-computer screen, of the one-minute integrated values and average 1/4 hour values :
  a) for all the measurements of one station
  b) for one specific measurement of one station.
- Overall daily display of quarter hour average stored values, including status.
- Continuous printing every 1 min. 15 min, 30 min or 60 min of all parameters.
- Printing of **daily report,** per station or per channel of quarter-hourly, half-hourly, or hourly average values including validation criteria ; mini, maxi, daily average values and number of exceeding threshold values.
- Printing of **monthly report,** per station or per channel of daily average values including validation criteria ; mini, maxi and average monthly values and number of exceeding threshold values.
- Display and/or printing of **daily histogram** per parameter of quarter-hourly, half-hourly, hourly values with validation criteria ; mini, maxi and average daily values, programmed threshold values.
- Display and/or printing of **monthly histogram** per parameter of daily average values including validation criteria ; mini, maxi and average monthly values, programmed threshold values.

Calibration Operation

- Cycle for zero and span remote control, programmable for each channel.
- Automatic calibration for each channel on the 24 h cycle basis.
- Calibration report.

* *IBM registered trademark*



* Specifications subject to change without prior notice

Appendix P

The Institute of Graduent Studies and Research (IGSR) University of Alexandria

A Profile of

THE INSTITUTE OF GRADUATE STUDIES AND RESEARCH

IGSR

of the

UNIVERSITY OF ALEXANDRIA

Address : 163 Horreya Avenue, Chatby
P.O.Box 832, Alexandria, Egypt

Fax : (203) 4215792

Tel : (203) 4225007 - 4227688

Telex : 54476 UNIVY UN

Air Pollution Monitoring Laboratory

Radiation Monitoring Laboratory

Background

The need for multidisciplinary postgraduate education has become evident in various sectors of development nationally and internationally. As a result, the Institute of Graduate Studies and Research, University of Alexandria was established by the Presidential Decree 239 / 1983. The institute has special features: mission oriented and diagnostic type of research, problem identification and solution, linking the academic institutions with production sectors, and providing continuous and post-experience training and consultancies. International cooperation is considered one of the institute's main priorities. For example, several projects have been conducted in collaboration with the following organizations: Ford Foundation, Third World Academy of Science, ISESCO, EEC, FAO, UNEP/MED POL, IDRC, USA-AID. With respect to foreign universities, the institute has links with many such as University of London, University of Manchester, UMIST (U.K) Arab Gulf University, and Ankara University.

The institute now encompasses four multidisciplinary departments, in addition to the University of Alexandria Research Center (UNARC) as a special unit. It offers degrees of Ph.D.,M. Sc. and Diploma. The departments of the institute are:

1- Environmental Studies.

2- Materials Science.

3- Information Technology.

4- Bioscience and Technology.

Enrollment and General Information for Students

Students with B.Sc. or an equivalent degree from a recognized university can apply in any of the above mentioned departments, their acceptance depends on their interests, original background, qualification and grades. As the four departments are of multidisciplinary nature, with a relatively limited numbers of new students who are accepted yearly, the selection process considers covering various unidisciplines needed for each department.

A B.Sc. from a recognized university is required with a minimum grade "Good" for students applying for M.Sc. degree and a minimum of pass for Diploma. Students are required to attend and pass a first year (2 semesters) eight core courses before they register the point of research. In their second year they are also required to pass specialized courses (equivalent to one semester) taken concurrently with work on their research projects, upon finishing the project, the student is then qualified to submit a thesis. A minimum of two years is required for M.Sc. degree. A minimum of another two years are required for the Ph.D. degree.

Students of Diploma are required to attend and pass courses in two semesters and a summer term project. Diplomas require 12 months (full time), or 24 months (part time) for completion.

1. Department of Environmental Studies

The department accepts graduates from all university disciplines in five branches :

1. *Physical Sciences .*
2. *Technological Sciences .*
3. *Biological Sciences .*
4. *Health Sciences .*
5. *Environmental Economics, Management and Law .*

It offers M. Sc. and Ph.D. degrees in Environmental Studies, Diploma of Environmental Studies, and a Diploma of Energy Conservation. Detailed syllabus of courses is available upon request .

The Department of Environmental Studies addresses issues of natural resources, energy and pollution . It concentrates on actual environmental problems and their physical, biological and socioeconomic impacts.

The facilities of the department include laboratories for Remote Sensing and GIS, Air Pollution, Radiation Monitoring, Meteorological Measurements, Spectroscopic Analysis, Environmental Chemistry, Environmental Biology (Carcinogenicity, Toxicity, Biochemistry, Microbiology, Genetics and Ecology), Marine Pollution, in addition to a Computation and Modelling Laboratory .

2. Department of Materials Science

The department accepts graduates from physical, chemical, and engineering disciplines in two branches:

1. *Materials Science .*
2. *Materials Technology .*

The department offers degrees of M. Sc., Ph.D. and Diploma in Materials Science . The Department of Materials Science addresses the venture of new materials and their applications in industrial fields. It concentrates on the correlation of the internal structure of materials at the molecular level and their performance and properties. Detailed syllabus of courses i available upon request .

Facilities available include laboratories for Material thermal analysis, Solar cell fabrication, Infrared spectrometry Mechanical properties, Instrumentation and Polymer chemistry

3. Department of Information Technology

The Department of Information Technology accepts student from various disciplines and offers degrees of M. Sc . Ph.D. an Diploma of Information Technology. It has facilities of comput laboratories . Alexandria ENSTINET node of the Academy Scientific Research is also located at the department an technically managed by the department staff members. Tl Department of Information Technology addresses problems building up, managing and analyzing information from variou interdisciplinary fields. Research interests include design information systems, applications of Expert Systems, Knowled Based Systems, Information Management Systems an applications in various disciplines of community needs. The activities are performed in cooperation with other departments the institute .

4. Department of Bioscience and Technology

The department of Bioscience and Technology accep graduates from chemical, biological, medical, physical an engineering disciplines and offers degrees of M. Sc., Ph.D. an Diploma in Bioscience and Technology.

The department addresses problems and applications recently developed biotechniques in various industrial sectors. has facilities including laboratories for Molecular Biolog Molecular Genetics and Enzyme Technology, Fermentatio Tissue Culture and Environmental Biotechnology. Work carried out in cooperation with other interdisciplina laboratories at the institute .

5. UNARC (University of Alexandria Researc Center)

The institute has a special unit responsible for coordinati teams of experts to carry out research and consultation requi by governmental agencies, industry and private investors. P experience courses, specially tailored to the needs of vario scientific and technical organizations are also carried out .

The institute acts in such a way to upgrade and promote t link between various academic departments and the industr community of the city of Alexandria .

Appendix Q

Air Quality and Meteorology in Alexandria

Table XXIII : Levels of particulates in µg/m³, and gases in ppm, in traffic and community air pollution.

	POLLUTANT							
	PARTICULATES (µg/m³)						GASES (ppm)	
	TSP	Pb	BSOM	COMBUSTIBLE MATTERS	SO_4^{-2}	NO_3^-	NO_2	CO
TRAFFIC AIR POLLUTION								
ALEXANDRIA	499.7	0.74	29.4	211.3	12.7	2.1	0.027	4.4
OTHERS	80-330	1.4-2.5	5.6-28	--	2-20	0.4-4.2	0.011-0.05	0-20
REFERENCE	4, 71	88-89	10	--	97	102	57-58	44, 49
COMMUNITY AIR POLLUTION								
ALEXANDRIA	192.9	0.25	9.6	81.0	19.6	1.3	0.015	< 5
OTHERS	80-249	0.01-0.5	4.5-17.5	--	5-23	0.9-6.5	0.04-0.062	2
REFERENCE	158, 176	153	158	--	158	158	162	177

41.

WIND DATA ALEXANDRIA

a)

Table (8): Monthly average wind speed by direction (km/hr) during July 1994-May 1995.

Month	Average Wind Speed							
	N	NE	E	SE	S	SW	W	NW
July 1994	13.8	3.7	5.1	1.85	3.7	6.5	16.3	19.1
August	1.85	-	3.7	1.85	5.6	1.85	11.8	17.8
September	12.5	7.4	1.85	1.85	2.7	6.2	10.5	14.3
October	12.0	13.0	9.7	6.5	5.1	1.85	10.1	11.8
November	9.3	3.2	2.5	1.85	13.1	12.9	11.5	8.4
December	4.7	2.2	2.2	1.85	5.4	10.8	8.4	28.2
Jan. 1995	5.4	2.5	2.0	3.0	6.3	9.8	8.4	7.5
February	9.0	9.3	2.7	2.3	6.0	19.3	18.2	13.8
March	12.1	11.7	10.1	6.9	5.6	6.3	10.3	13.0
April	15.2	12.4	12.1	13.0	9.3	9.9	27.0	20.2
May	13.9	14.9	7.6	3.7	4.9	3.7	13.3	14.4
Yearly Average	11.1	7.1	5.4	3.9	6.2	9.6	12.9	15.1

Table (7): Monthly frequency percent of wind direction during July 1994-May 1995.

Month	Wind Direction								
	N	NE	E	SE	S	SW	W	NW	Calm
July 1994	30.2	0.4	1.6	0.4	1.6	0.8	13.3	50	1.6
August	37.1	-	0.4	0.4	1.2	0.8	6.5	53.2	0.4
September	55	1.2	0.8	0.8	4.6	1.7	3.8	32.1	-
October	38.7	10.1	12.5	1.6	10.5	0.4	7.3	16.5	1.6
November	15	6.7	3.3	0.4	23.3	9.2	10.8	25.8	1.7
December	10.9	4.8	6.8	2.8	26.6	8.5	11.7	22.6	5.2
Jan. 1995	6.5	4.8	7.7	2.0	34.7	13.3	16.9	12.1	1.6
February	21.9	11.1	6.7	1.8	11.1	4.9	22.8	18.3	1.3
March	21.4	8.1	7.3	1.6	16.1	5.6	14.5	23.8	1.6
April	34.2	26.2	7.1	1.7	10	1.2	4.2	15	0.4
May	59.3	10.1	4.0	0.4	7.7	0.8	2.0	12.5	2.8
Yearly Average	30.0	75	5.3	1.3	13.4	4.3	10.2	25.7	1.7

Appendix R

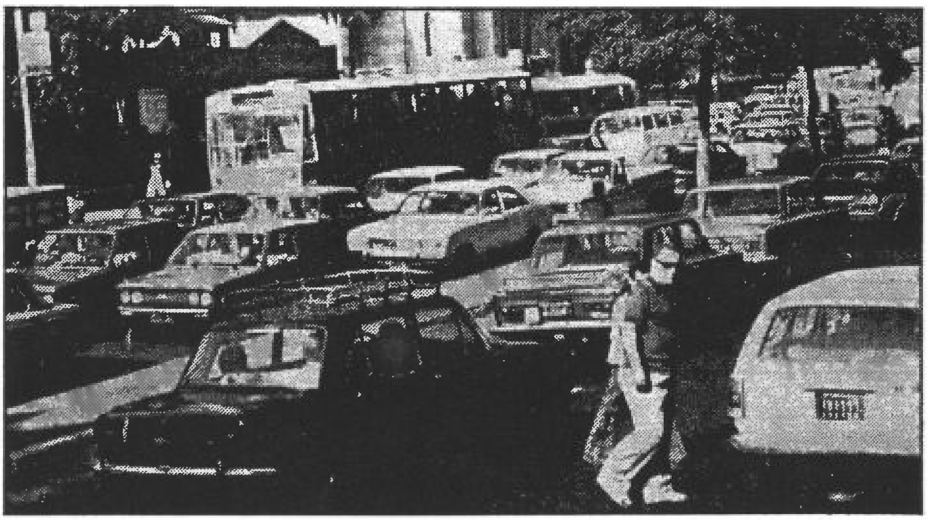
Traffic, a major air pollution source in Cairo

Egyptian M

Vehicles responsible for 60 pct of Cairo's pollution

THERE ARE more than one million motor vehicles on the move in Cairo governorate daily. Such a large number adds to the pollution problems and makes the city one of the most polluted in the world. It is worth mentioning that vehicles exhaust fumes represent 60% of the pollution in Cairo. Further, there is an annual rise, estimated at 34%, in the number of vehicles in the city. The noise produced by the vehicles is another form of pollution which is extremely detrimental to a person's health and has far reaching social and economic effects.

Due to the importance of this issue, several masters and Ph.D thesis have focused on it. The most recent of which was entitled "Environmental Pollution Produced by Vehicles in Cairo City", by police officer Rifaat Al Basiouni.



AIR pollution is increasing in Cairo due to the ever growing number of cars.

Al Basiouni stated that man pays for human development which has largely contributed to environmental pollution, and has had a hazardous impact on the ozone layer. Air pollution, he added, particularly that produced by vehicles is one of the prime pollution problems facing big cities such as London, New York, Tokyo and Cairo. The pollutants produced by vehicles comprises carbon monoxide, nitrogen oxides, lead, smoke and dust. Studies proved that the most dangerous pollutant is lead, as a high percentage of it can lead to children developing learning difficulties.

In a report issued recently by Cairo-based USAID, it was confirmed that lead negatively affects all the human body's functions and systems, particularly the respiratory, circulatory and nervous system.

Another study submitted to the Energy, Development and Environment Conference held in Cairo in 1994, confirmed that vehicles in Cairo produce 80 million kg of different pollutants annually including 120,000 kg of lead.

Al Basiouni outlined that all vehicles are dangerous contributors to environmental pollution due to the exhaust fumes and noise they produce. Their impact is augmented by

mounting expense of medical treatment, building maintenance and repairs.

Mr Al Basiouni forwarded proposals for redressing the pollution problem, the most prominent being: decreasing as much as possible the number of vehicles, and using a cleaner type of fuel. He likewise urged the ncessity of providing devices to measure the degree of pollution from cars, widening main roads and building them away from places that would be affected by noise, such as schools and hospitals.

The thesis also recommended replanning car parks, improving pavements, putting traffic signs in their proper places and ensuring drivers' abidance by them.

The thesis proposed trains, trams and underground metros should substitute buses, cars and other vehicles causing pollution. Such substitutes can be operated inside cities as they consume less energy and cause less pollution.

The thesis also focused on the media's role in acquainting people with the hazardous impacts of pollution through books, or audio-visual means. It pointed out that the government role is restricted to making law, whereas the individuals' role is much greater, as they have to abide by these laws.

The thesis touched upon the government's stance regarding the environmental pollution problems. It set up the Environmental Affairs Authority in 1982, and since then it has continued to work with scientific and academic authorities. However, the traffic law does not directly mention the required norms for determining the degree of pollution triggered by acts polluting the environment, and the degree of pollution produced by vehicles transporting animals. Neither did it include any articles necessitating public measurement of pollution and noise produced by vehicles.

Mr Al Basiouni urged passing a comprehensive criminal law which would comprise of many aspects of environmental protection, setting norms for measuring vehicles' pollution, and avoid licensing vehicles except after measuring the degree of pollution from the exhaust, plus improving vehicles' design specifications so they decrease the degree of the pollution, and use super 90 petrol on a wide scale.

He also called for adding environment awareness programmes to schools syllabuses, setting up a highly-efficient public transport network, ensuring sound traffic planning in new cities or urban extensions of old cities, and to take into consideration suitable norms on setting up bridges and new roads.

At the end of his thesis, Mr Al Basiouni emphasised the importance of individuals' roles on environmental protection.

Other important studies and research which have tackled this issue proved a close correlation between pollution, noise and mental and physical diseases. A researcher confirmed that the first victims of air pollution are traffic officers as they are exposed to the maximum degree of pollutants.

The study pointed out that after twenty years, the traffic law proved to be inept in safeguarding the environment from pollution.

The study recommended replacing petrol with natural gas or using lead free petrol, setting up stations for technical examinations of vehicles and supplying them with devices to measure the poisonous gases produced by the vehicles, stretching green areas and decreasing buildings' height to facilitate air circulation, building more wide roads, setting up isolating regions around factories and selecting more suitable places for hospitals and schools.

In response to this important research, campaigns have been launched to measure the degree of pollution in Cairo's squares.

JNE 9, 1996

is Week

Con

Making Cairo less polluted

RECENT statistics submitted the cabinet show that the number of vehicles in Cairo has hit a million, and accounts for some 65 per cent of the total number of cars in Egypt. By the year 2000, the number will have shot to 1.5 million in Cairo alone, the statistics predict.

So it seems there will be no end to the traffic jams plaguing the swollen city, nor will there be a solution to the acute pollution problem that gets more complicated every day. Car fumes thicken the blanket of pollutants gently covering the city. Nearly a quarter of the cars in Cairo are over 20 years old, and 67 per cent of these are over a decade old, which means that huge amounts of fumes are spewed into the air over the city.

By the year 2000, over a million and a half cars will Jam Cairo streets.

Head of the biochemistry section at the faculty of science, Munofia University, Dr Ibrahim Abu Zeid, says these old cars do not use their fuel efficiently, which produces large amounts of poisonous gases, notably carbon monoxide and dioxide and lead, considered the most detrimental pollutant to the environment. Lead oxides accumulate in the soil, especially in the areas flanking the main roads and expressways. Lead then finds its way to the tissues of plants cultivated in these areas and accordingly to meat and the milk of cattle grazing there. Besides, hydrocarbons particularly halogenated ones, which include elements like flourine, chlorine, bromine, iodine and astatine, can cause cancer in humans. Some of these elements are even used at research centres to create tumours in lab animals.

Dr Abu Zeid says the best way to reduce pollution is by using lead-free gasoline. In Western countries, lead-free gasoline is used widely as cars have catalytic converters. These converters are destroyed if the driver fuels his car with leaded gasoline. The converter is costly and the driver has to think twice before using any other fuel than lead-free gasoline. Here, drivers refrain from buying lead-free gasoline as it is still far more expensive than the leaded fuel. So the government should work for bringing the price of lead-free gasoline down, even if it has to subsidies it.

Besides, technical examination of cars at the traffic police departments should be developed. In advanced countries vehicles undergo technical examinations, and isnpectors fix an apparatus at the nozzle of the exhaust pipe to measure the rate of emitted gases. Licences are only issued to the cars meeting government specifications.

Now there is a commendable trend to use natural gas as fuel for public buses and cars whose owners back the new idea. For this to prove effective in cutting down the rate of pollution in Cairo, microbuses, believed to be the major cause of pollution in the city, should be required to use natural gas for fuel.

The Governor of Cairo also decided that almost 40 per cent of the trains ending their trips at Ramses Station should use the Sobra el-Kheima station as their terminal as of the beginning of October, the date set for the opening of the first phase of the second underground metro line, running from Shobra to Tahrir. The Governor has assigned Nabil el-Mazni, Chairman of the Cairo Public Transport Authority, to finish plans to set up bus terminals outside the city centre and slash the number of buses running downtown and in the areas served by the second metro line. The plans also include the building of several multistorey garages at the main metro stations. It is envisaged that such plans will help make Cairo less polluted and traffic less congested. Let's pray this dream comes true soon.

Appendix S

Typical instrument shelter

06/06 '96 TOR 14:03 FAX +47 63898050 NILU 002

HAKO MODUL A.S

TEKNISK BESKRIVELSE AV HUS FOR BASESTASJONER

Tegn. 201305

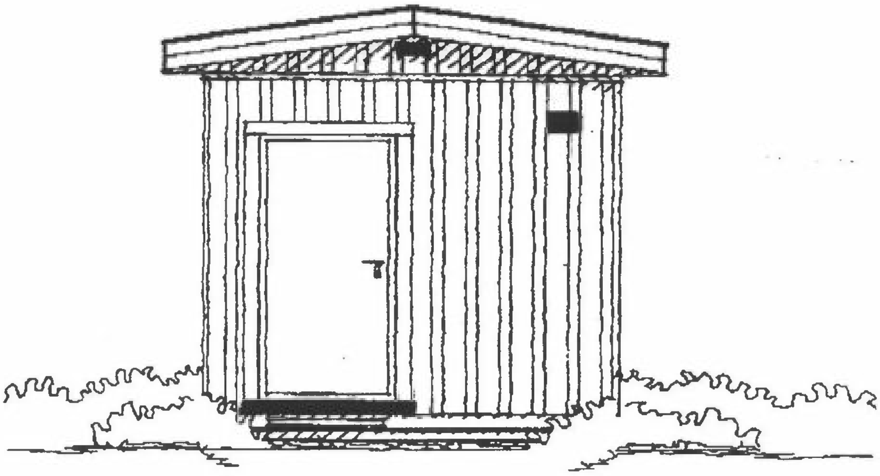
Stålramme:	Stålramme av UNP - 120 i langsgående og UNP 100 i tverrgående bjelker. 4 stk støtteben og 4 stk løfteører i ramme
Gulvelement:	Stubbloft 6 mm vannfast spon Gulvbjelker 36 x 198 mm Isolering 150 mm mineralull Gulvspon 22 mm hellimt til bjelkelag Gulvbelegg 1,5 mm gulvbelegg er limt ca 100 mm opp på vegg
Vegger:	Innvendige veggplater foliert spon, antikhvit Diffusjonsfolie Veggstolper/svill 36 x 73 Isolering 75 mm mineralull A Utvendig kledning sporet og malt Flakeboard
Mønetak:	Takplater TRP 20 0,5 mm Lekter Sutakplate 3,5 mm Takstoler Isolering 125 mm mineralull A Diffusjonsfolie 12 mm foliert sponplate
Dør:	A 60 enf. ståldør 90 x 210 cm med microbryter og karmoverføring.
Kjøleaggregat/ Ventilasjon:	Enhetsaggregat monteres ved siden av inngangsdøra som vist på plantegn 201305. Kapasiteten på aggregatet er ca 3400 W Det monteres galler for beskyttelse av aggregatet på ytterveggen. 2 stk 160 mm ventiler m/filter Ytterveggsgaller og innvendig tallerken-ventil monteres.
El. inst.: Bæresystemer	For fremføring av antennekabler mm. monteres kabelstige B=300 på vegg. Veggjennomføring for kabler monteres som brann/gasstett ramme.

06/08 '96 TOR 14:15 FAX +47 83898050 NILU 003

HAKO MODUL A.S

Jording	Innvendig ringjord med cu-wire 25 mm2 tilknyttet jordingspunkt. Ekvipotensialforbindelse til alle utsatte anleggsdeler. Utvendig fundamentjord tilpasses anleggstedet.
Inntak/ stigeledning	Utvendig inntaksskap m/kombinert overbelastning og kortslutningsvern 32 A. Nødvendig lynbarriere montert. Stigeledning PFSP 3 x 10 via aggregatvender eller innvendig apparatinntak til fordelingstavle.
Fordelings- tavle	Komplett montert med hovedbryter 8 stk kurser 1 fas 10 - 16 A og 1 stk 3 fas 16 A. Som sikring benyttes elementautomater.
Kursopplegg lys og stikk	- 3 stk pkt. for dobb. stikk m/jord - 1 " pkt. for 3 fas stikk m/jord - 2 " pkt. for lys Lys og stikkontaktkurser dimensjoneres for den belastning som utstyret medfører
Lysutstyr	- 2 stk interiørarmatur 2/36 W m/skjerm
Kursopplegg varme	- 1 stk pkt. for varmeovn
Varmeovner	- 1 stk 750 W panelovn m/termostat
Alarmanlegg:	Alarmanlegg type Aritech monteres Sentralen m/8 seksjoner plasseres ved utgangs-døra. Tilkobling til utgangsdør, røkvarsler og temperaturgiver inngår. Programmering av alarmsentral forutsettes utført av byggherren.
Nødlys:	2 stk nødlys 1 x 8 W monteres Bryter m/gravering Nødlys plasseres ved utgangsdør.
Diverse:	Det leveres utv. trapp som henges opp i braketter festet til gulvbjelkelaget.

Brumunddal, 13.03.92

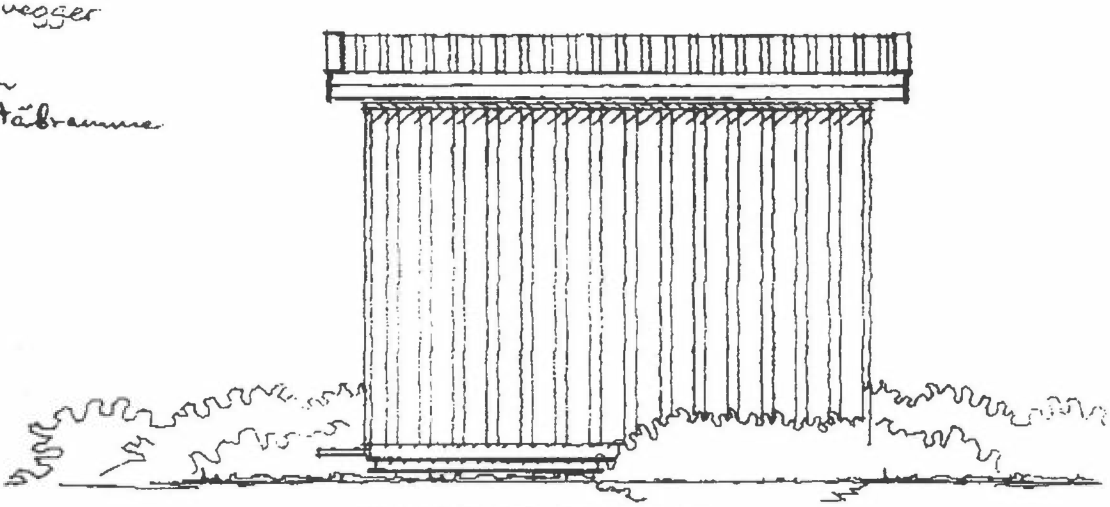


FASADE FRONT

armert)

15 tak/gulv
10 vegger

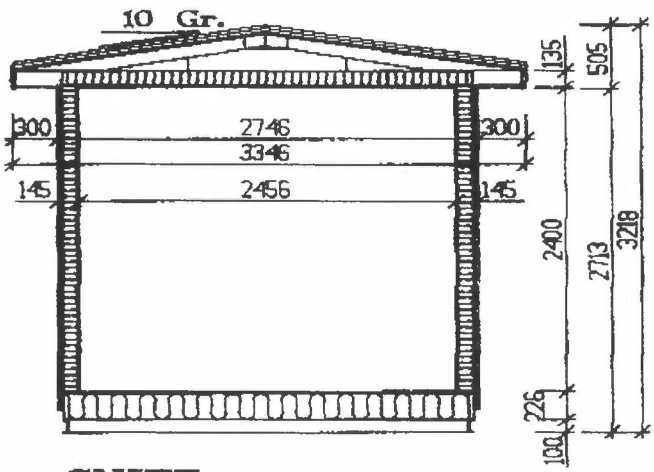
ståldør/karm
+2000 ståbramme



FASADE HØYRE

Telekiosk	PLAN, SNITT OG FASADER			
HAKO MODUL A.S	Data. 920930	Tegn. aeg	Godkj.	
Postboks 182, N 2381 Brumunddal. - Tlf. 065 45 115	Målestokk. 1: 50	Tegn. nr. 1097–01		Rev.

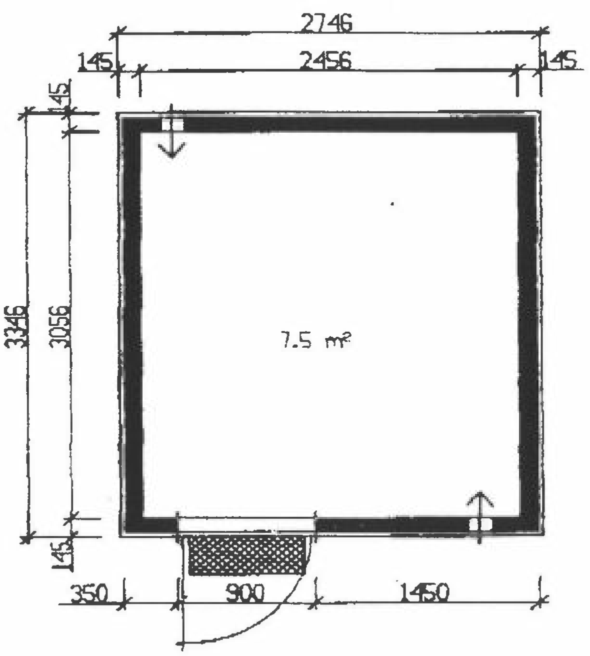
DENNE TEGNING ER VAR EIENDOM OG KAN IKKE KOPIERES UTEN VART SKRIFTLIGE SAMTYKKE



SNITT

PVC (polyes.
Plater

5.8 m²
2.4 × 2.4 inv.
2600.-
+ el
5-6 t.
1.9 takh. /2.4
uten stålramm



PLAN

Bys/varme
3-5 Kod. kurser
3 fase

48000,- inkl. ut
+ M

Appendix T

USAID project: A source apportionment analysis of airborne particulate matter in Cairo

USAID

UNITED STATES AGENCY for INTERNATIONAL DEVELOPMENT

CAIRO, EGYPT

Date:	Wed Jun 12 12:31:54 1996
TO:	Mr. D. Clark
Company:	USAID/Cairo
Fax No.:	3411780
From:	James L.Goggin
Fax No.:	3562932, 3572233
ice No.:	357-3277
Subject:	Presentation, June 19, 1996

DATE: June 12, 1996

TO:
- Eng. Salah Hafez, Chairman, EEAA
- Dr. Tarek Genena, Director, TCOE
- Dr. Ibrahim Abdel Gelil, Chairman, OECP
- Mr. Sultan Mohammed and Mr. Neil Sturchio, Cairo University
- Dr. Ahmed Gamal, Chief of Party, EP3
- Eng. A. Gad, TIMS
- Mr. Douglas Clark, DANIDA Project
- Mr. Yasser Sherif, EPAP/World Bank

SUBJECT: Presentation on Source Apportionment Analysis of Airborne Particulate Matter in Cairo: June 19, 1996, from 2:00 - 3:00 p.m., at USAID/Cairo

USAID's Environmental Health Project, in technical collaboration with the Research Triangle Institute in the U.S., National Research Center, and the Tabbin Institute for Metallurgical Studies has conducted a detailed assessment of the source categories of airborne particulate matter in Cairo. The results of this study will be presented at USAID on Wednesday, June 19, 1996, from 2:00 p.m. to 3:30 p.m.. This is the first comprehensive study of particulate sources and includes findings of interest to those interested in the quality of air in Cairo.

You, or representatives of your organization, are invited to attend this presentation, to be held at USAID's 9th floor large conference room.

Regards,
James Goggin
Acting Office Director, DR/ENV

An Assessment and Source Apportionment of Airborne Particulate Matter in Cairo, Egypt

Charles E. Rodes, PhD
Philip A. Lawless, PhD
Research Triangle Institute
Research Triangle Park,
NC 27709 USA

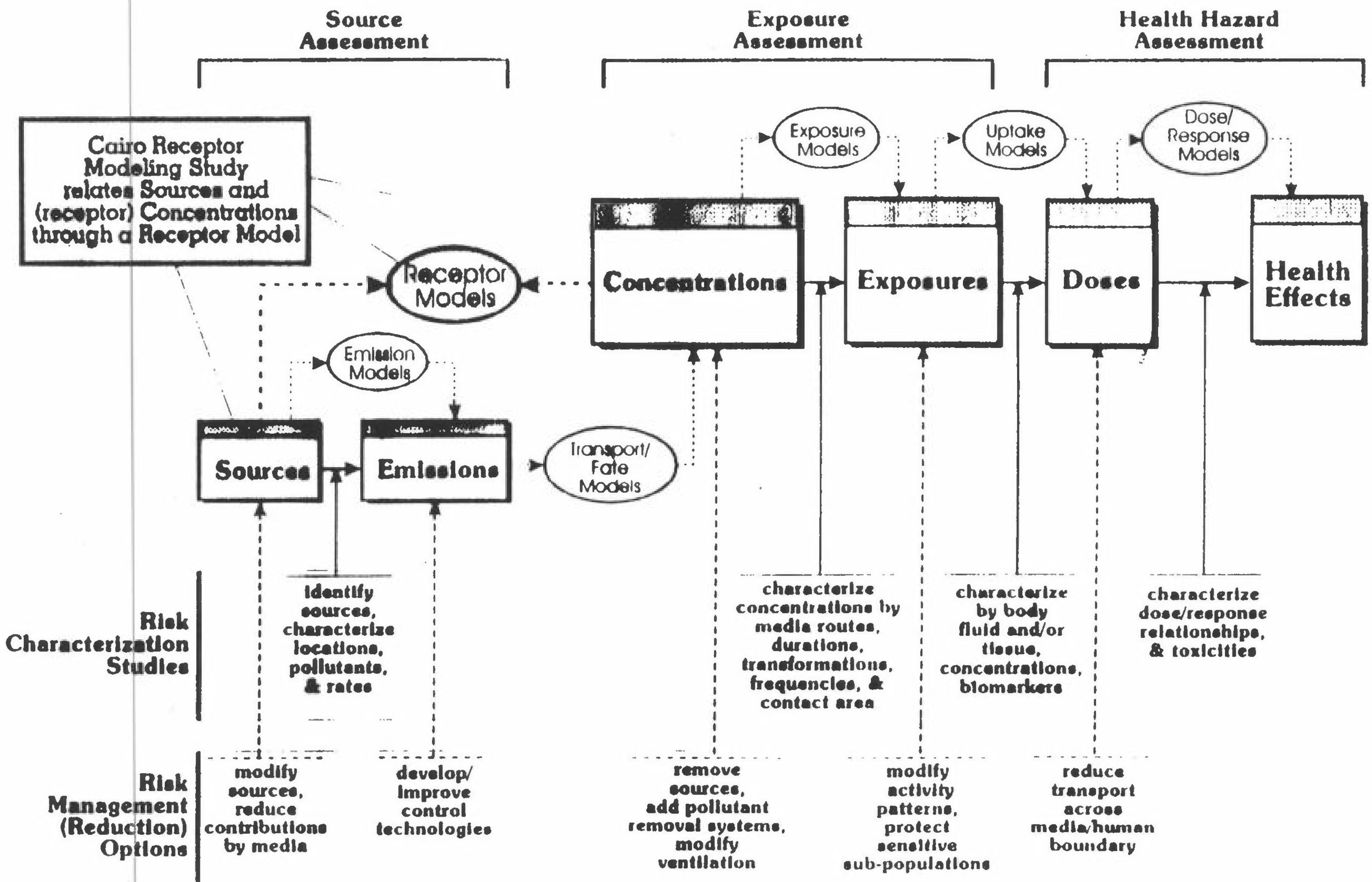
Mahmoud M. Nasralla, PhD
Air Pollution Department
Egyptian National Research Centre
Cairo, Egypt

presented to the

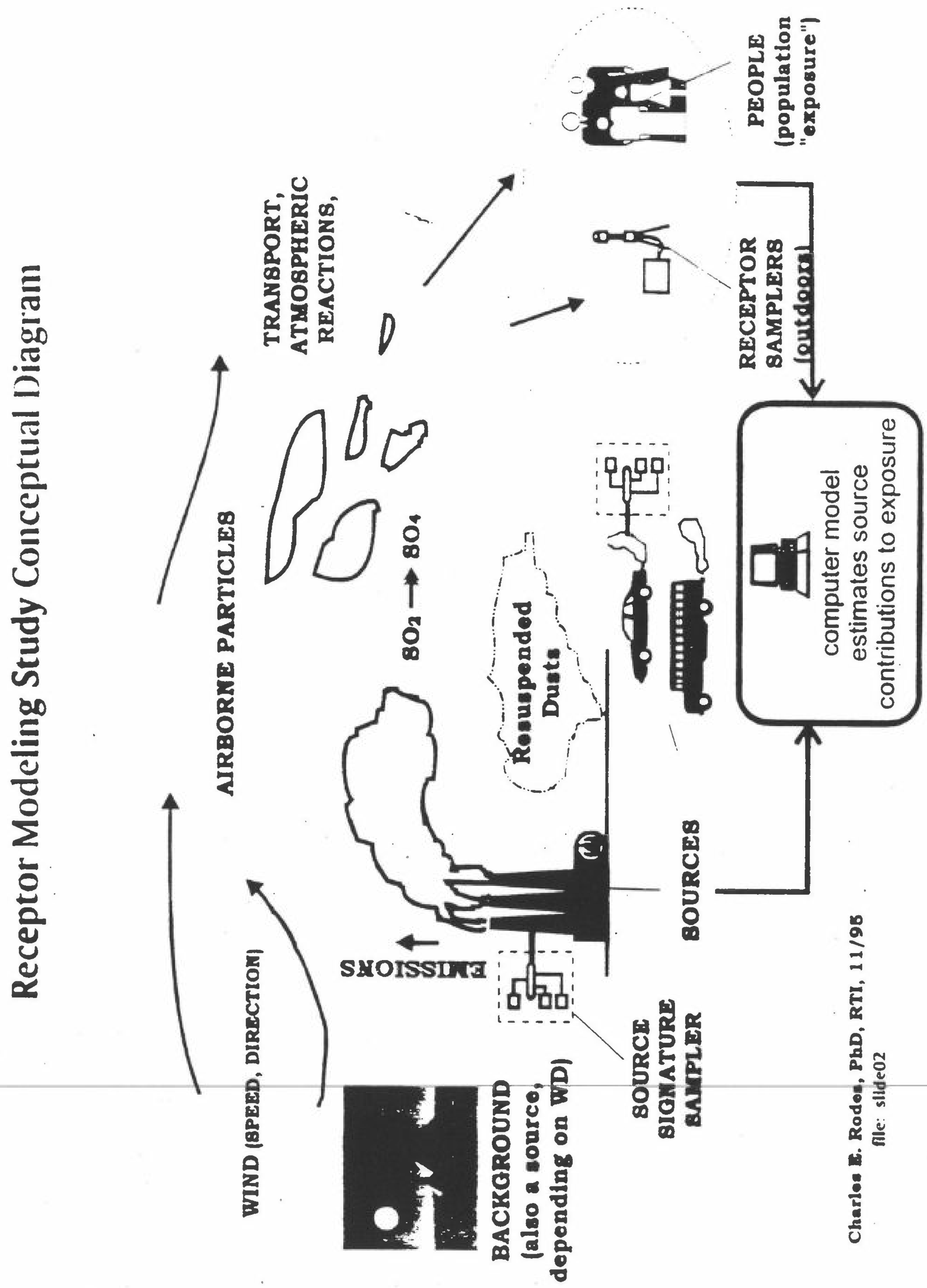
Cairo Mission
U. S. Agency for International Development
Cairo, Egypt

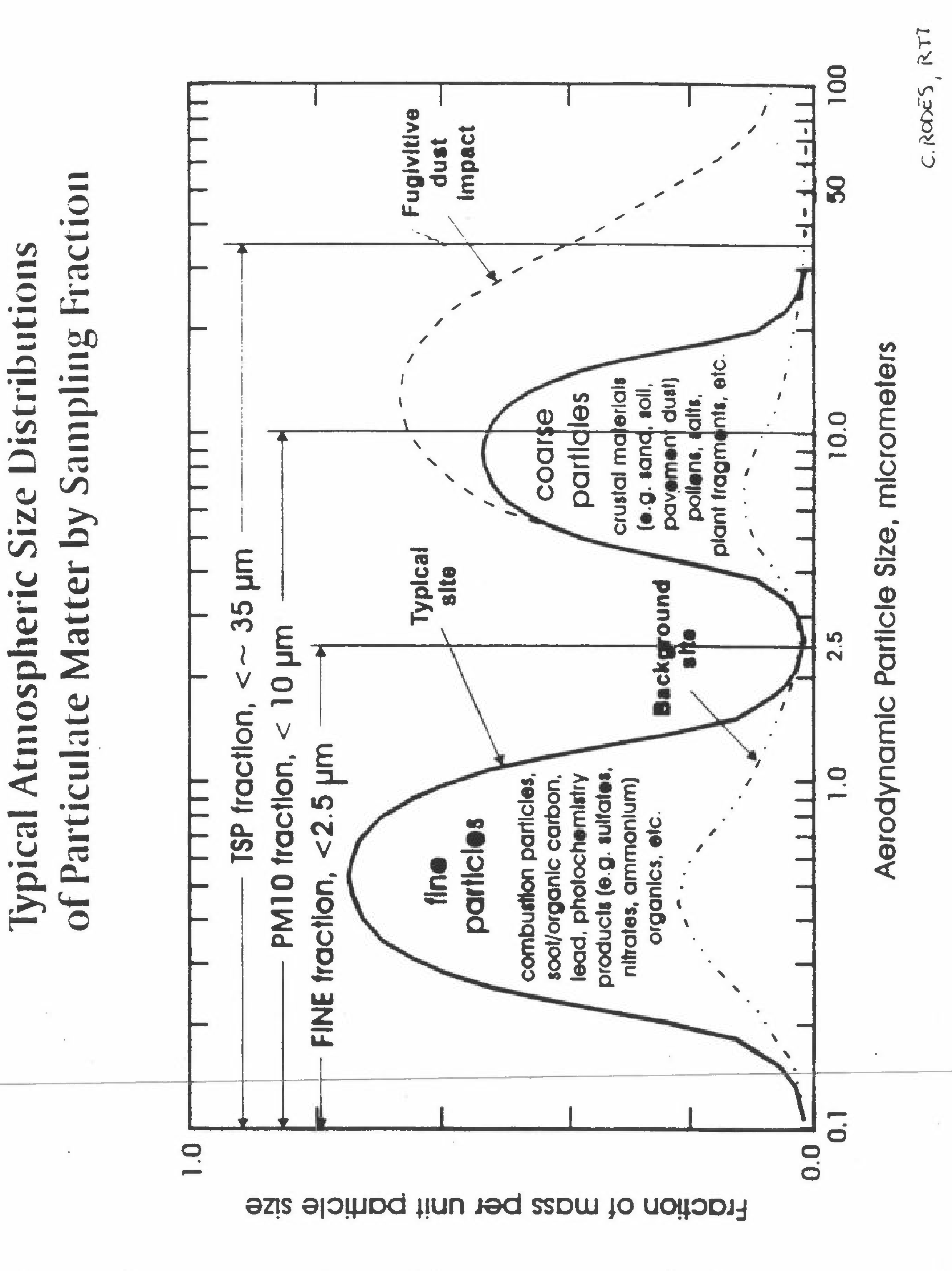
19 June, 1996

Elements of the Risk Characterization Paradigm Addressed by this Study

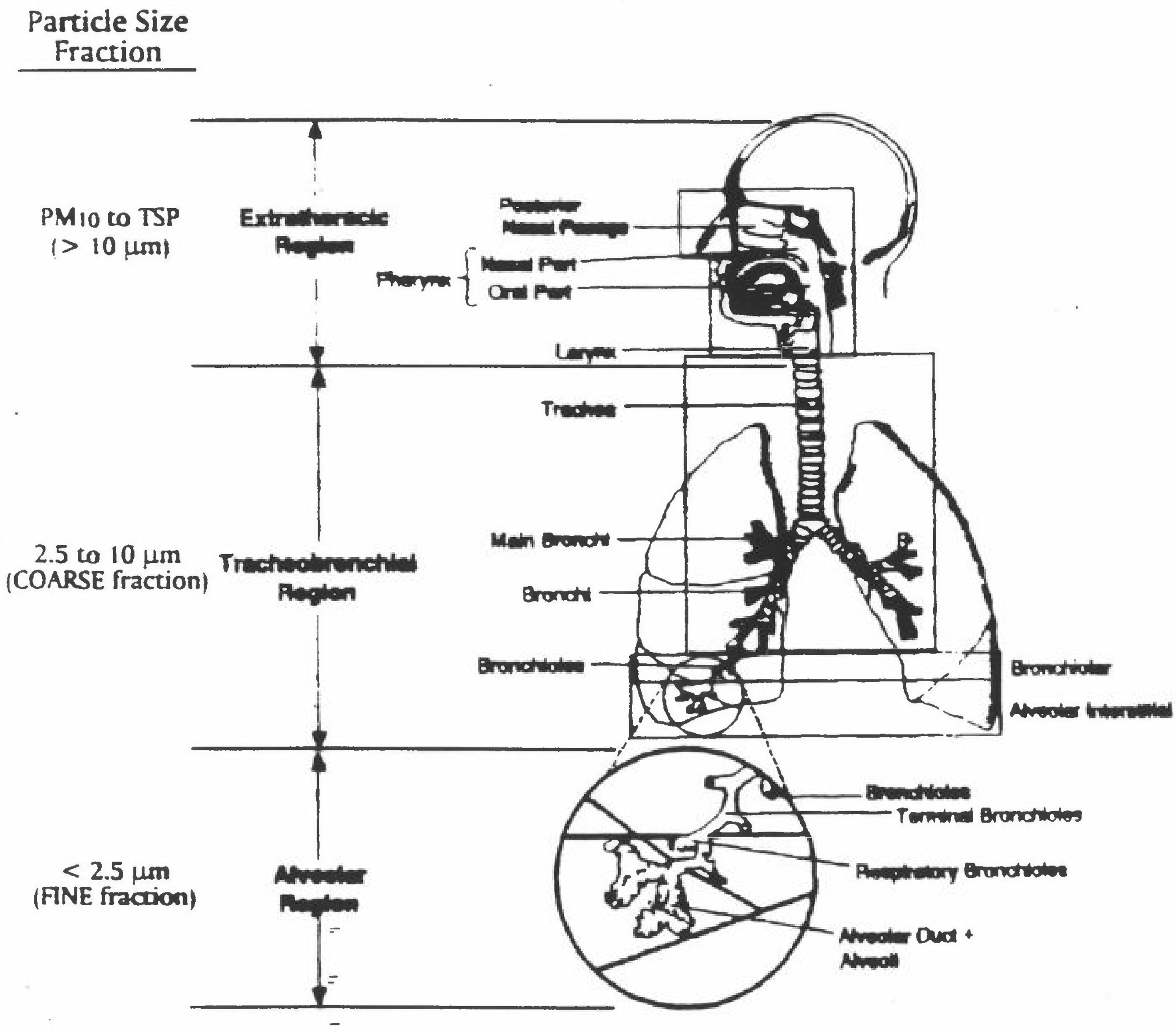


C. E. Rodes, PhD, Research Triangle Institute, 3/96, file: riskparc


Receptor Modeling Study Conceptual Diagram
WIND (SPEED, DIRECTION)
AIRBORNE PARTICLES
TRANSPORT, ATMOSPHERIC REACTIONS,
EMISSIONS
$SO_2 \rightarrow SO_4$
Resuspended Dusts
BACKGROUND (also a source, depending on WD)
SOURCE SIGNATURE SAMPLER
SOURCES
RECEPTOR SAMPLERS (outdoors)
PEOPLE (population "exposure")
computer model estimates source contributions to exposure
Charles E. Rodes, PhD, RTI, 11/95
file: slide02

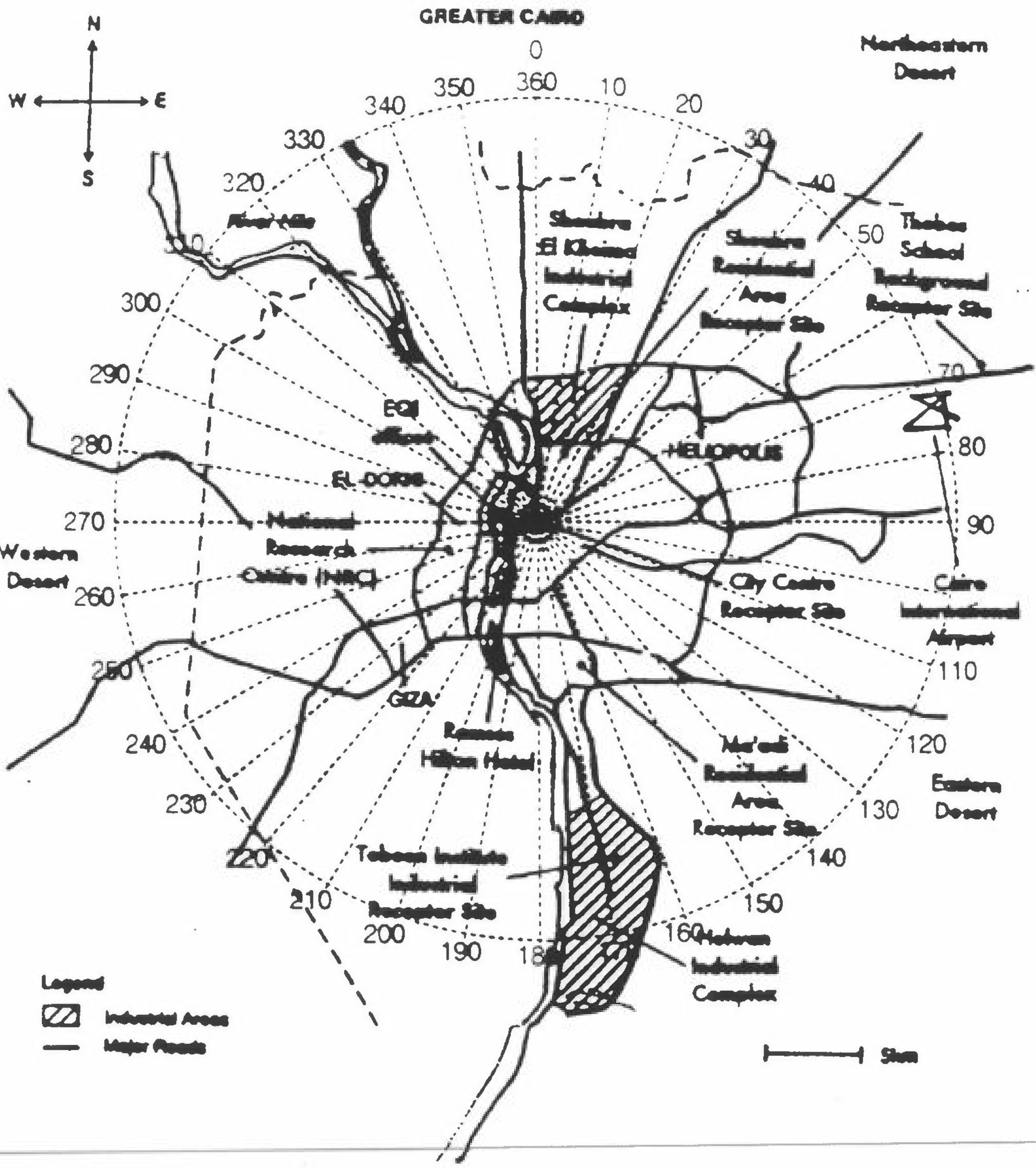

Typical Atmospheric Size Distributions
of Particulate Matter by Sampling Fraction
TSP fraction, <~ 35 µm
PM10 fraction, < 10 µm
FINE fraction, <2.5 µm
Fugivitive dust impact
Typical site
Background site
fine particles
combustion particles, soot/organic carbon, lead, photochemistry products (e.g. sulfates, nitrates, ammonium) organics, etc.
coarse particles
crustal materials (e.g. sand, soil, pavement dust) pollens, salts, plant fragments, etc.
Fraction of mass per unit particle size
1.0
0.0
0.1
1.0
2.5
10.0
50
100
Aerodynamic Particle Size, micrometers
C. RODES, RTI

Relationship of Particle Size Fraction to Deposition Location in the Respiratory System



C. Rodes, RTI, 6/96,
adapted from USEPA Air Quality Criteria for Particulate Matter, EPA/600/P-95/001bF, April, 1996

Metropolitan Area Map of Cairo, Egypt
Showing Study Landmarks
Compass Overlay on City Centre Receptor Site

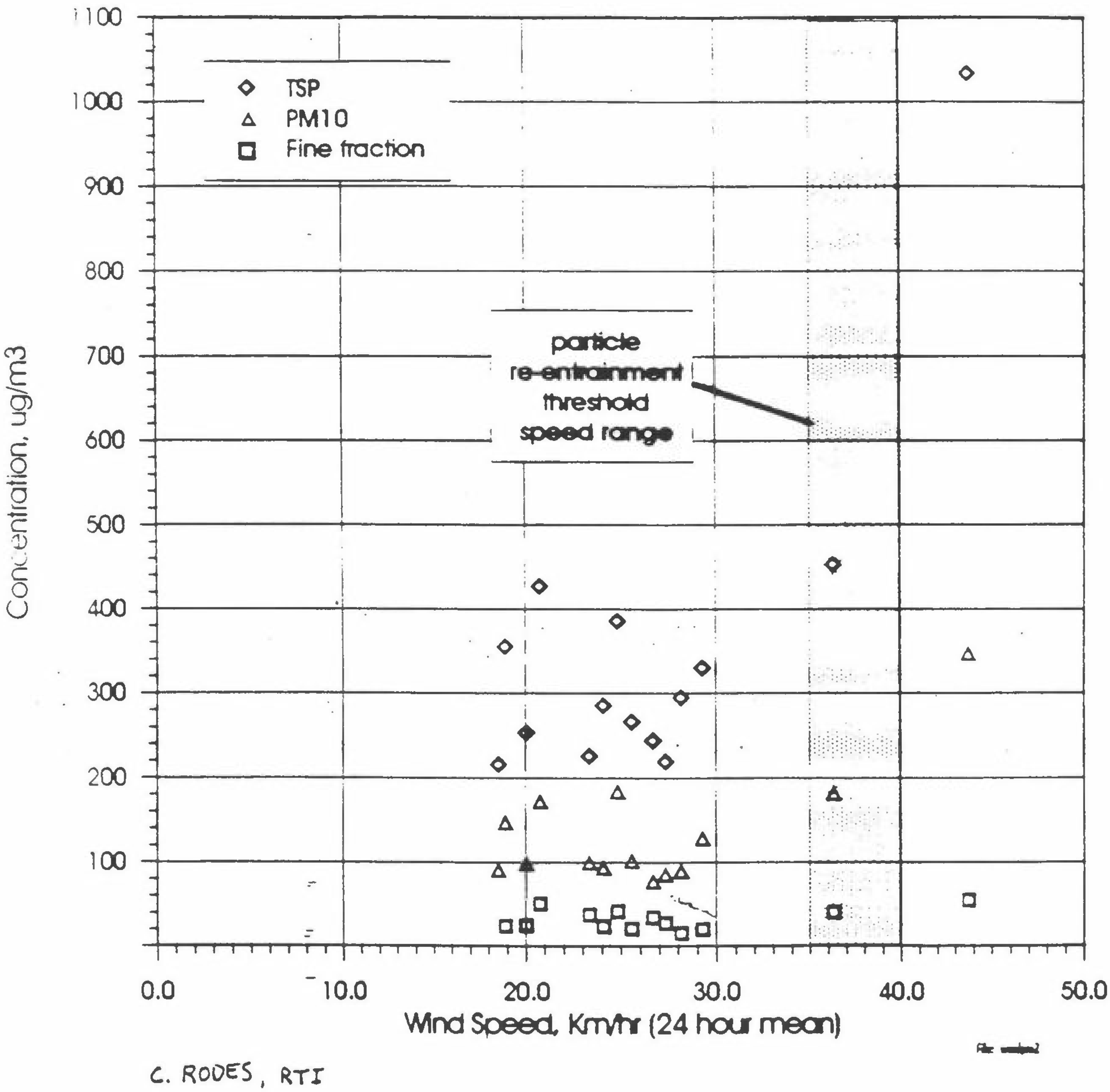


Cairo Receptor Modeling Study Mass Concentration Sampling Summary

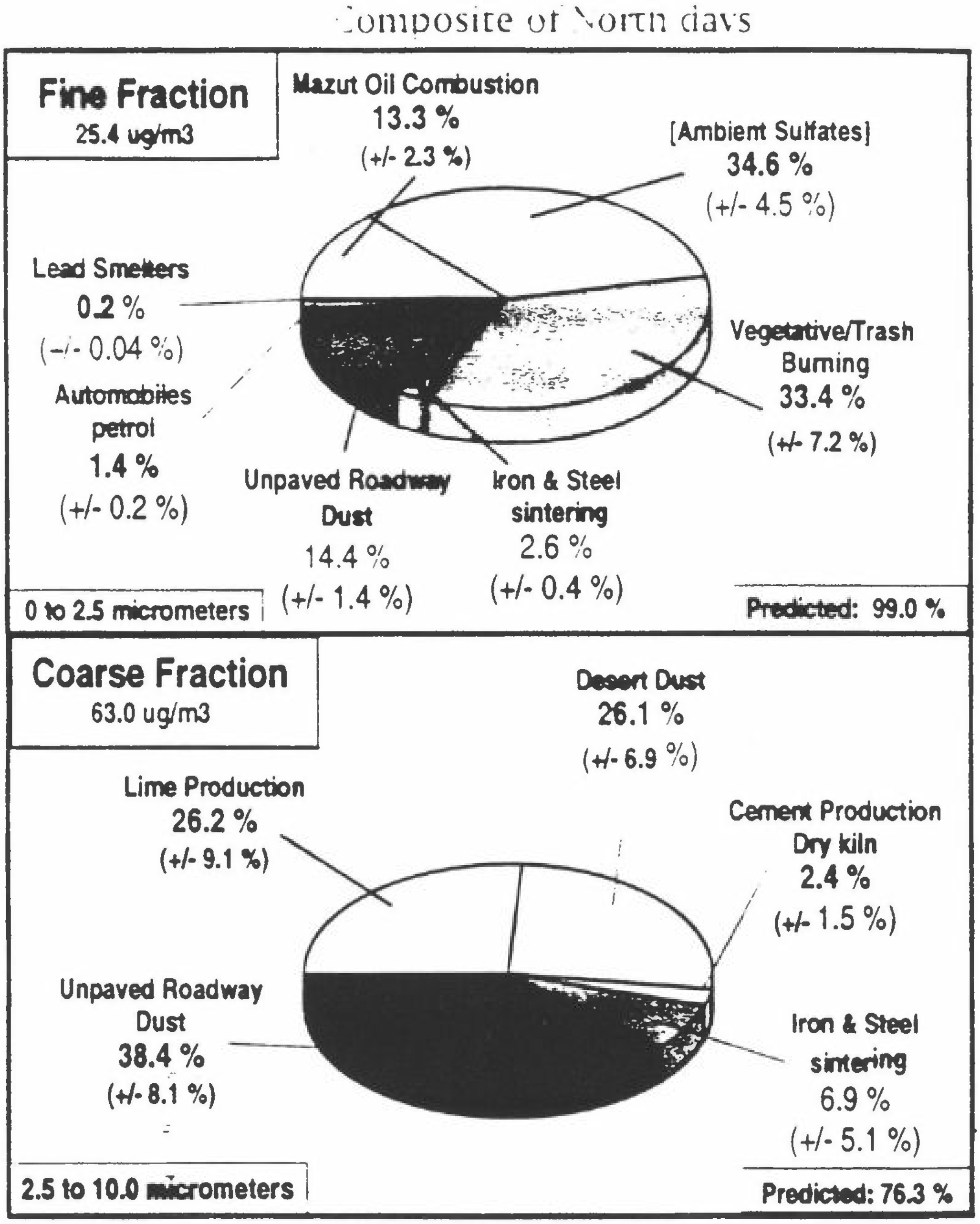
Sample Period #	Sampling Date: Start End	Receptor Sampling Site	Days	Mean Mass Concentrations in ug/m3					Comments
				Dichotomous Sampler			Hi Vol		
				Fine	Coarse	PM10	PM10	TSP	
1	27-Jan-95 8-Feb-95	City Centre	5	81.4	83.7	165.1	164.8	na	Training
2	15-Feb-96 23-Mar-96	City Centre	15	72.4	118.9	191.3	201.4	674.9	
3	27-Mar-96 30-Mar-96	Background (Thebes School)	4	24.9	65.7	90.6	121.1	293.0	
4	12-Apr-96 7-May-96	Maadi	13	32.6	93.6	126.2	133.2	360.5	
5	31-May-96 6-Jun-96	Helwan (Tebeen Institute)	5	51.1	163.9	215.0	230.4	596.4	
6	1-Aug-96 7-Aug-96	Shoubra El-Kheima	6	59.8	129.7	189.5	na	na	
7	19-Aug-96 30-Aug-96	City Centre	6	54.4	68.1	122.4	na	na	
8	6-Sep-96 26-Sep-96	Background (Thebes School)	7	27.9	45.8	73.7	na	na	

Total Sampling Days: 61

Wind Speed Versus Particle Concentration at Maadi



Maadi
Particle Mass Apportionment

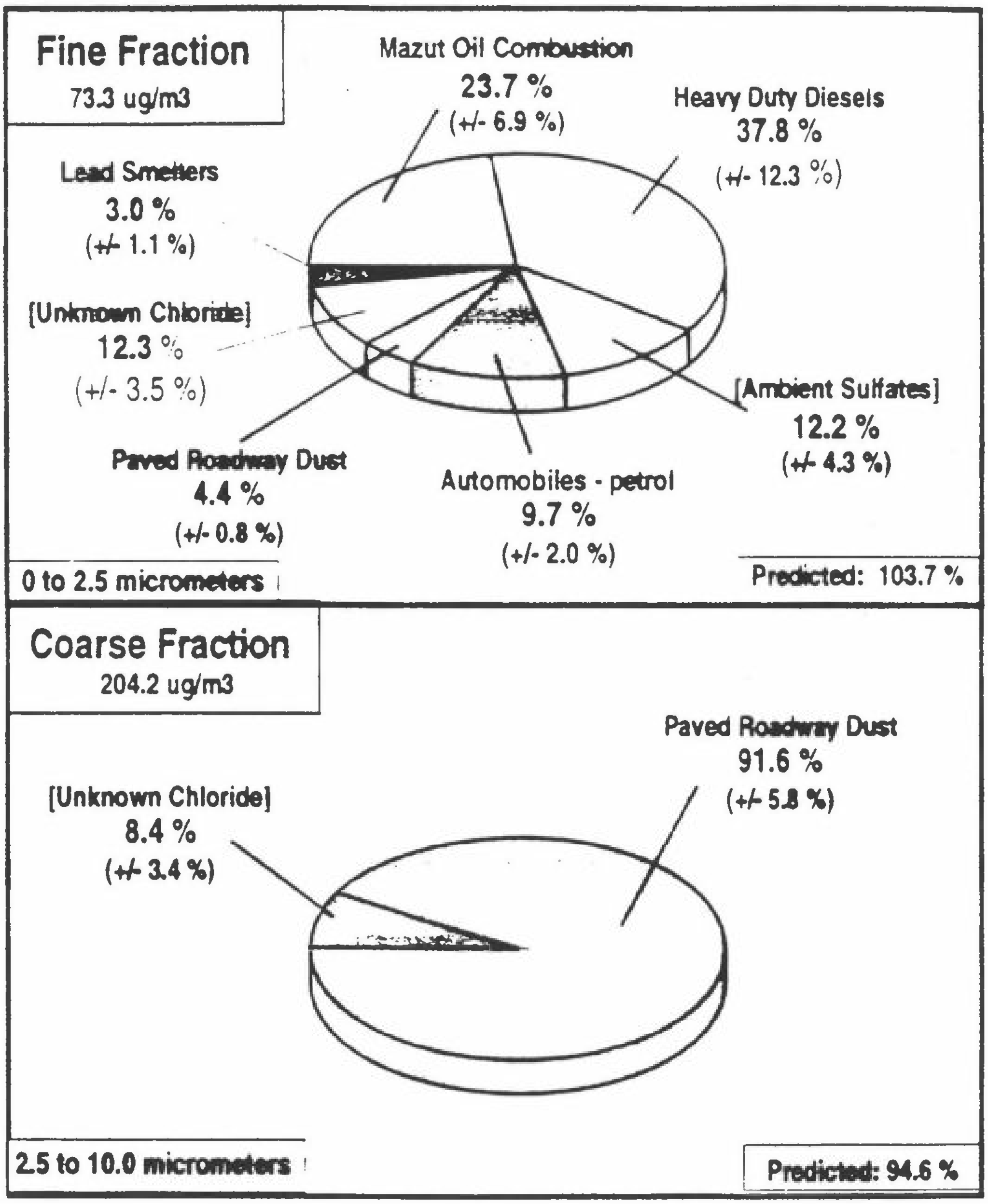


Note: Source categories in brackets [ ] are not from Cairo signatures

File: sgms14a

Cairo City Centre
Particle Mass Apportionment

Composite of North days

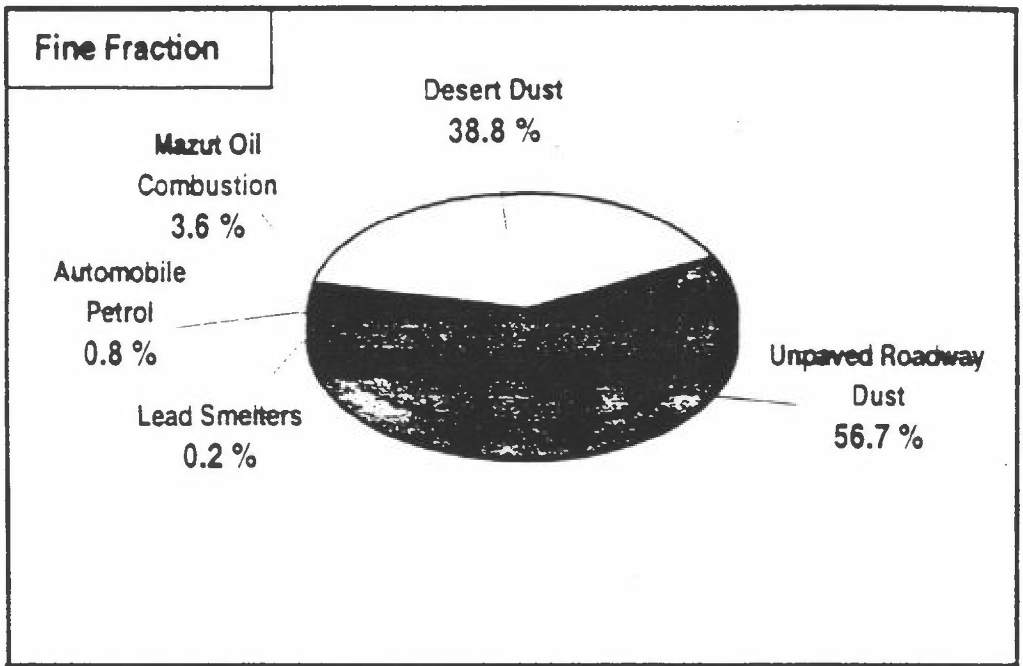


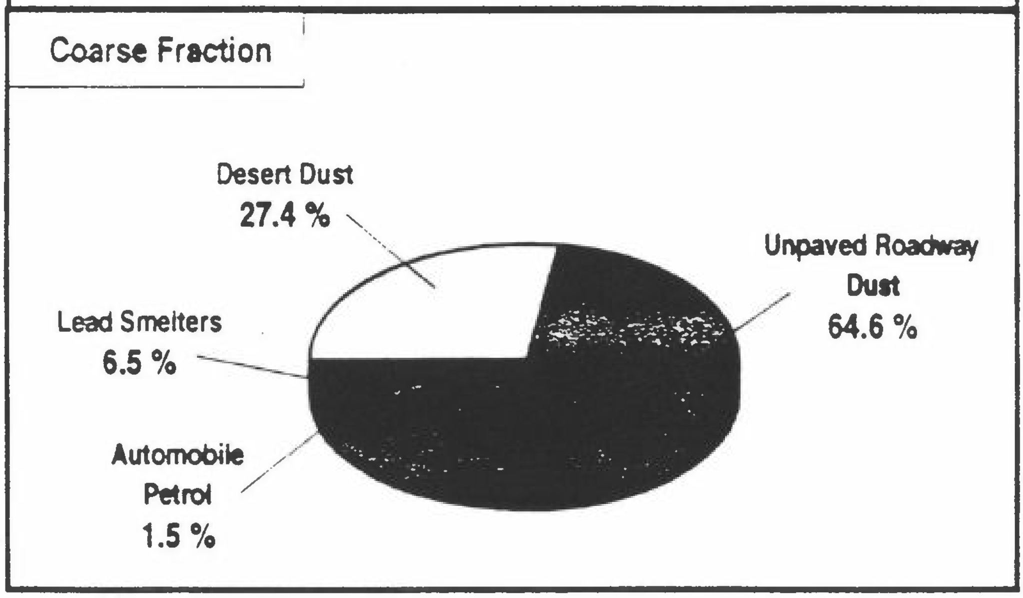
Note: Source categories in brackets [ ] are not from Cairo signatures

file: sgms3a

Composite Source Signature Apportionment

Paved Roadway Dust





File: sgms21

Cairo Source Signature Analytes by Category

Source Category	Signature Analytes	Comments
Agricultural Soil Dust	**Si, Ca, Al, Fe, K, Ti, S,** La, Cl, P, Mn, Zn, Sr, Pb, Cu	
Automobiles - Petrol	**OC**, Pb, **Br**, **EC**, Al, Ca, Zn, **Fe**, P, Cu, Cr, Mn, Ni	
Cement Production - Bypass Stack	**Cl, K, S, Ca**, OC, Rb, Br, Fe, Zn, Pb, Mn, Ti, Sr, Cu, V, Cr, Cd, Zr, Ni	
Cement Production - Wet Kiln	**Ca, K, Cl, S, Si, Fe, Al**, OC, Sr, Rb, Ti, Pb, Zn, Br, Mn, Cu, Cd, Zr	
Desert Dust	**Ca, Si, OC, Fe, Al, S, Cl, K,** Ti, Zn, P, Ba, Sr, Pb, Cu, Mn, Cr	
Heavy Duty Diesel (Bus)	**OC, EC, S, Fe**, Zn, Pb, **K, Ca, Cl**, Si, Sb, Br, **Al**, Cu, Mn, Ni, Cr, Sr	Mixed source category -
Heavy Oil (Mazut) Combustion	**EC, OC**, S, Si, Zn, Sn, Fe, V, Ni, Pb, Ca, Al, K, Cu, Sr,	
Iron and Steel (Sintering)	**Cl, K, Fe, OC, Zn**, Pb, Ca, **Mn**, Ti, Al, Rb, Ba, P, Cd, Cu, Se, Br, **Sn, Mo**, Sr, Zr	
Iron and Steel (Converter)	**Fe, Cl, K, Mn, Ca**, S, Zn, **Si**, Pb, P, Sr, Cu, Rb, Al	
Lead (Pb) Smelter	Pb, **Cl, Fe**, Zn, OC, Cu, Mn, EC, V, Ni	Mixed Source Category -
Light Oil (Solaar) Combustion	**S**, OC, EC, Si, Sn, Ca, Fe, K, Pb, Zn, Se, **Br, Sr**	Unknown signature error - OC & EC undersampled
Lime Kiln	**Cl, Ca, K, OC**, Fe, EC, P, Rb, Pb, Zn, Mn, Sr, Ti, Cd, Cu, Br, Cr, Ni	
Paved Roadway Dust	**Ca, Si, Fe, Al, S, EC, K, Cl,** Ti, Pb, Zn, **P**, Sr, Mn, Br, Cu, Cr, Zr, Ni	Mixed Source Category - Pb = 0.42 % PM_{10}
Unpaved Roadway Dust	**Ca, Si, OC, Fe, Al, S, Cl, K,** Ti, Zn, P, Sr, Pb, Cu, **Mn**, Cr, Br, Ni, Zr	Pb = 0.19 % PM_{10}
Vegetative/Trash Burning	**OC**, Cl, S, Ca, K, Fe, Si, EC, Al, **Br**, Pb, Zn	

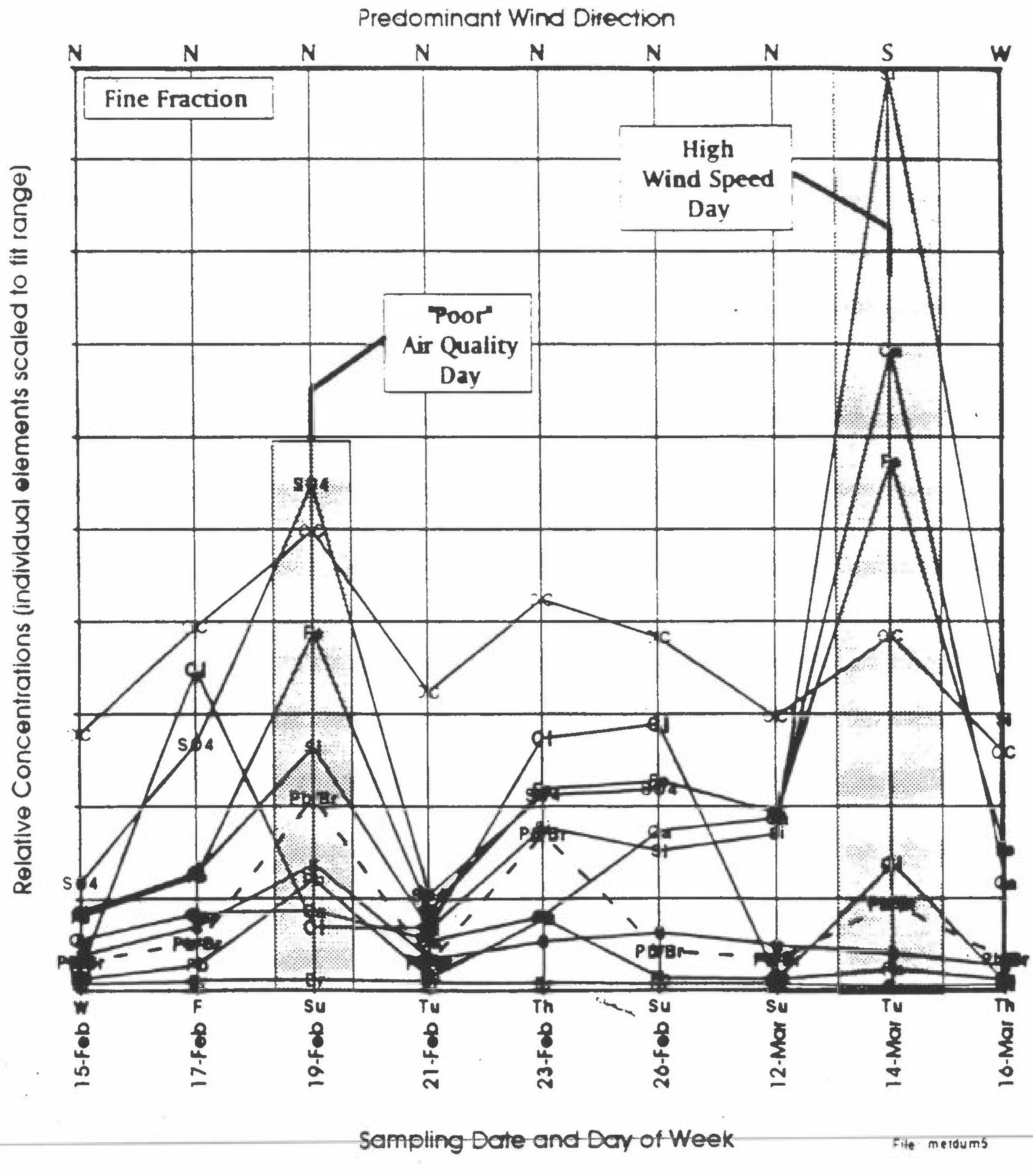
Notes: Analytes are listed in order of decreasing PM_{10} mass fraction.
Bold analytes exceed a 1.0 % contribution by mass; EC - elemental carbon; OC - organic carbon

Cairo Source Signature Samples Collected

	Source Category	Sample Type	Collection Location
1	Agricultural Soil Dust	bulk dust	Farm field N of Cairo
2	Automobiles - Petrol	air sample	Confined space sampling
3	Cement Production - Bypass Stack	air sample	Helwan cement plant
4	Cement Production - Wet Kiln	air sample	Helwan cement plant
5	Desert Dust	bulk dust	Multiple desert composite
6	Heavy Duty Diesel (Bus)	air sample	City Centre bus station
7	Heavy Oil (Mazut) Combustion	air sample	Shoubra El-Kheima glass plant boiler
8	Iron and Steel (Sintering)	air sample	Helwan iron and steel plant
9	Iron and Steel (Converter)	air sample	Helwan iron and steel plant
10	Lead (Pb) Smelter	air sample	Helwan secondary Lead smelter
11	Light Oil (Solaar) Combustion	air sample	City Centre bakery
12	Lime Kiln	air sample	Shoubra El-Kheima Lime Plant
13	Paved Roadway Dust	bulk dust	Multiple roadway composite
14	Unpaved Roadway Dust	bulk dust	Multiple roadway composite
15	Vegetative/Trash Burning	air sample	Controlled burn at the NRC

Note: Iron and steel - arc furnace samples were also collected, but were determined to be too heavily loaded (plus particle mass lost in transit) for chemical analyses

Daily Fluctuations in Fine Fraction Analytes for City Centre Site



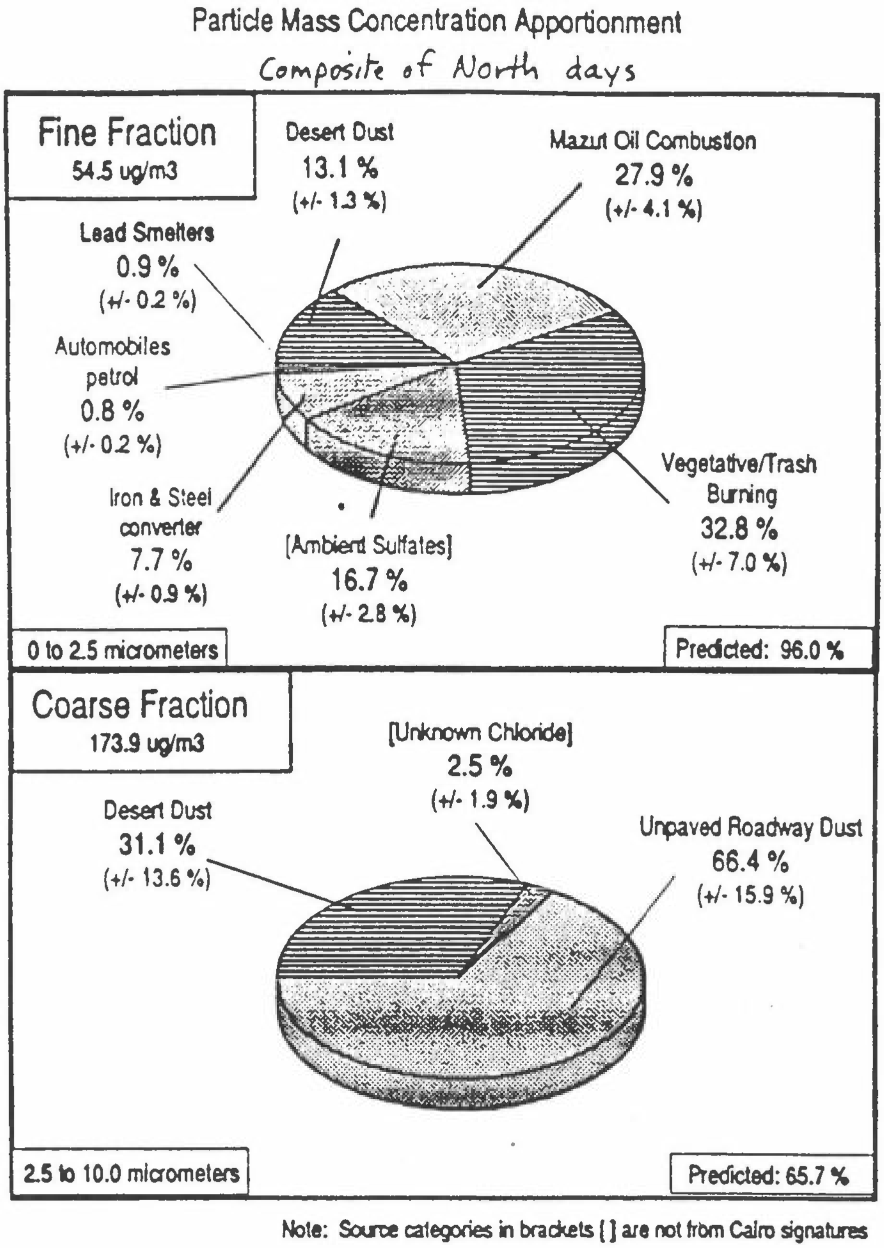
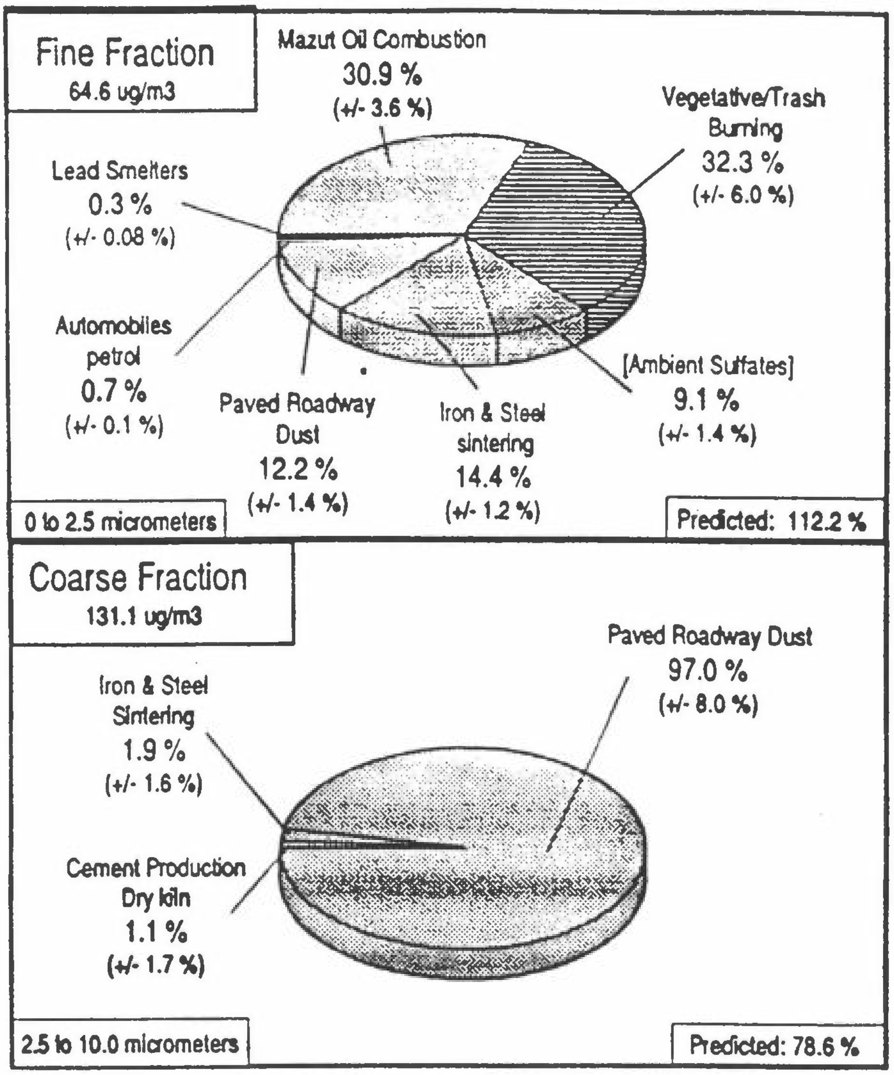


Figure 4-12. Helwan Particle Mass Apportionment

File: sgms16

Particle Mass Concentration Apportionment

Composite of North wind days

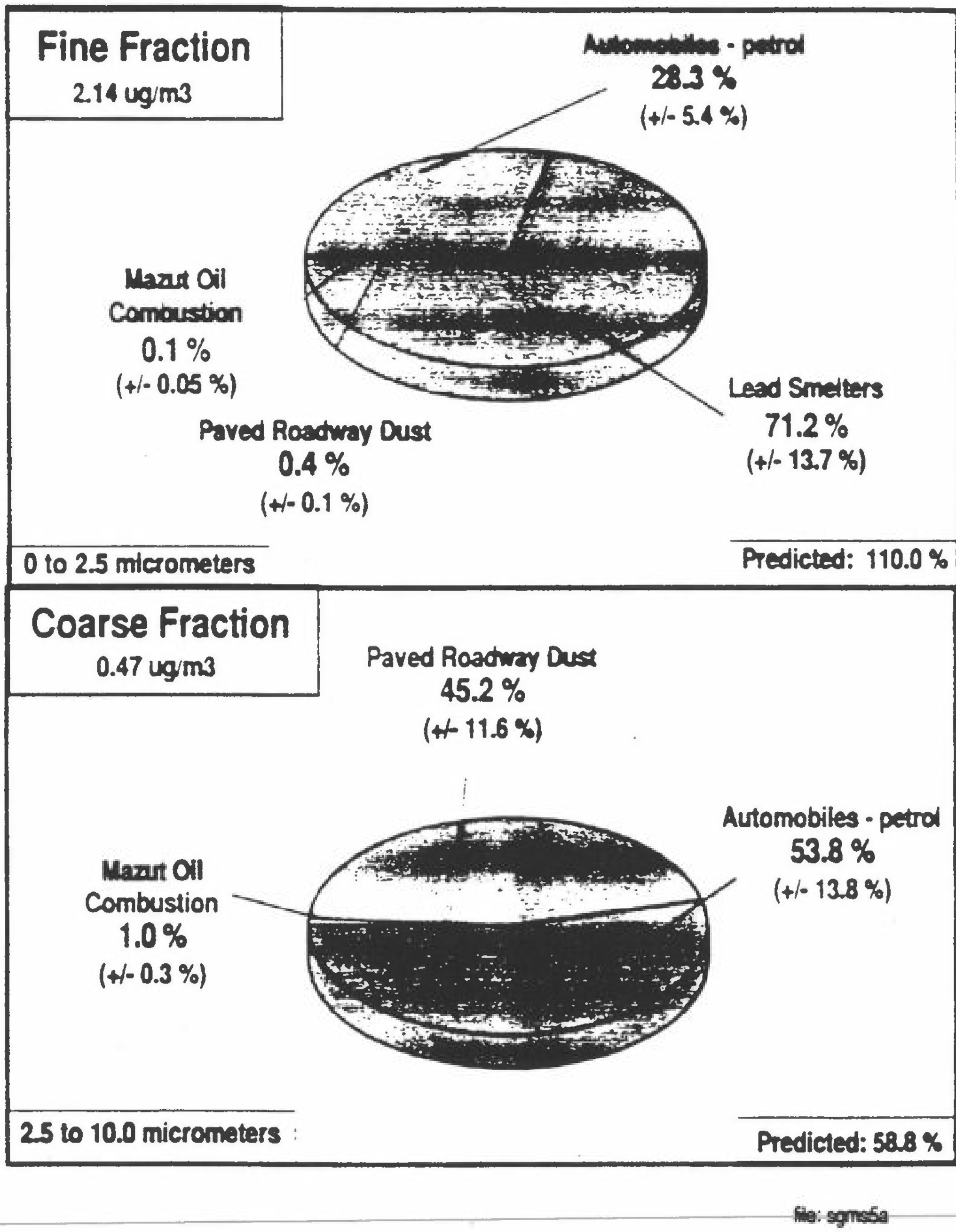


Note: Source categories in brackets [ ] are not from Cairo signatures

Figure 4-13. Shoubra El-Kheima Particle Mass Apportionment

File: sgms15

Cairo City Centre
Particle Lead (Pb) Apportionment



Summary/Conclusions
(characterization)

- At the City Centre site, the PM_{10} concentration averaged over 150 μg/m^3, with approximately 50% being in the Fine particle fraction.

- At the background site, the PM_{10} concentrations averaged 45 to 65 μg/m^3 during typical wind speed periods, suggesting that this is the minimum level attainable.

- Elevated wind speeds exceeding 35 to 40 km/hr, approximately double the particle mass concentrations in Cairo air.

- Paved roadway dust in Cairo averaged 0.42% Pb, and contributed substantially to the Coarse particle air concentrations from re-entrainment.

- Secondary Pb smelter (battery reclamation) stack emissions averaged 64% Pb.

Summary/Conclusions
(apportionments)

- At the City Centre site during North winds, over 50% of the Fine particle mass was produced by oil combustion (Mazut and diesel vehicle), with ambient sulfates and automobiles contributing approximately 10% each. Roadway dusts and Pb smelters contributed 3-5% each. Wind blown dusts from the desert, paved and unpaved roadways contributed over 90% of the Coarse particle mass.

- At the City Centre site during South winds, over 50% of the Fine particle mass was produced by diesel vehicles, 30% from roadway dust, and 1 to 3% from Pb smelters and automobiles.

- At the Maadi site during North winds, approximately 1/3 of the Fine particle mass was from vegetative/trash burning, 1/3 was from ambient sulfates, 15% was from roadway dust, and 1 to 3% from Iron & Steel production and automobiles. Wind blown dusts from the desert, paved and unpaved roadways contributed over 60%, cement and lime production contributed approximately 30% and Iron & Steel production 7% of the Coarse particle mass.

- At the City Centre site, approximately 70% of the Fine particle Pb was attributed to Pb smelters, with automobiles contributing the balance. Over 95% of the Coarse particle Pb was attributed to the combination of automobiles and re-entrained roadway dust.

Uncertainties and Qualifying Factors

- Some significant source categories may not have been addressed for model input - e.g. Pb sources (initially not the major objective of the study)

- The limited number of days encountered with South winds during the study makes it difficult to accurately assess the influence of sources in Helwan on the Cairo area.

- The similarity (collinearity) of the surface dust signatures made it difficult to distinguish between their contributions

- Re-entrained surface dusts in locations experiencing fall-out from a nearby source (e.g. cement plant dust near Maadi) contain deposited material from previous periods, biasing the model.

- The inaccurate signature for Solaar oil combustion reduced its importance in the model outputs

Appendix U

Equipment list for the Minilab Network EEAA CCC, JICA project

EQUIPMENT LIST

(PHASE 1)

for

Mini-Lab. Net Work

Mar.15 1996

EEAA

Egyptian Environmental Affairs Agency

Branches Affairs

Dr.Mawaheb Abu El Azm,Director of C.C.C.

JICA

Japan International Cooperation Agency

JICA Expert

Inspection Certificate(1) Jan.30 1996 JICA-Expert M.OKUMURA (1/3)

No.	Name of Equipment	Equipment Type	◎ ; YES X ; NO	Remark	Che'd Mawahb
JG1001	UV-VIS Spectrophotometer	UV-1601	◎		/
JG1002	Automatic atomic analysis system	AA-6401G	◎		/
JG1003	Atomic absorption spectrometr for Hg	HG-200	◎		/
JG1004	Total organic carbon analyzer	TOC-5000A	◎		/
JG1005	Wastewater treatment equipment	APC-50A-3R	◎		/
JG1006	Laboratory washer	LA-1	◎		/
JG1007	Purewater equipment	GS-990	◎		/
JG1008	Draft chamber(Hume hoods)	GS-1800	◎		/
JG1009	Biochemical oxygen demand tester	BOD-2000	◎		/
JG1010	Chemical Oxygen Demand Analyzer	COD-50S	◎		/
JG1011	Chemical oxygen demand tester	HC-407	◎		/
JG1012	Direct-reading ballance	AEG-220	◎		/
JG1013	pH Meter	HM-30V	◎		/
JG1014	Vibration Apparatus	SR-2DB	◎		/
JG1015	Dissolve oxygen meter	OM-14-L1	◎		/
JG1016	Muffle Furness	KL-280	◎		/
JG1017	Dryer	FS-620	◎		/
JG1018	Incubater	CI-610	◎		/
JG1019	Dry Sterilization Apparatus	SP-450	◎		/
JG1020	Centrifugal separator	$H-108M_2$	◎		/
JG1021	Thermostat Bath	LF-380	◎		/

Inspection Certificate(2) (2/3)

No.	Name of Equipment	Equipment Type	◎ ; YES X ; NO	Maker	Che'd OKUMURA
JG1022	Water Bath	LB-160	◎		/
JG1023	Electric conductivity tester	UC-35	◎		/
JG1024	Permeability Meter	MT-100	◎		/
JG1025	Laboratory stirrer	MZ-200	◎		/
JG1026	Pipet Cleaner	P-2P	◎		/
JG1027	Super sonic type pipet cleaner	UT-55	◎		/
JG1028	Rotary Evaporator	N-1NW	◎		/
JG1029	Hot plate	TP-420	◎		/
JG1030	Handy aspirator	AS-75	◎		/
JG1031	High pressure type sterilizer	SV-242	◎		/
JG1032	Distilling Apparatus for Annmonium	P-361ELS	◎		/
JG1033	Oil Analyzer	OCMA - 220	◎		/
JG1034	Dryer for analytical tools	FS-420	◎		/
JG1035	Micro Scope	BX50-32000	◎		/
JG1036	BOD meter	HC Unit	◎		/
JG1037	Concentrator	KD-5S-WBS	◎		/
JG1038	Jar Tester	MJS-8	◎		/
JG1039	Floatation Tester	MS-9000	◎		/
JG1040	Active sludge treatment tester	ASS-20PS	◎		/
JG1041	Leaf tester for sludge	VR-23	◎		/
JG1042	Pure Water Suppling Facility	WO-242N	◎		/

Inspection Certificate(3) (3/3)

No.	Name of Equipment	Equipment Type	◎ ; YES X ; NO	Maker	Che'd OKUMURA
JG1043	Clean Checker	CCW101	◎		/
JG1044	Dust Meter	LD-1	◎		/
JG1045	Poison Gas Detector(Basic model)	TG-500-KA	◎		/
JG1046	Smoke Tester	Smoke Tester	◎		/
JG1047	Asbestes Sampler	ASP-3	◎		/
JG1048	Noize meter	SL-2A	◎		/
JG1049	Sludge Sampler	M-SD	◎		/
JG1050	Automatic water sampler	900(SIGMA)	◎		/
JG1051	Salt Detector	AG 100	◎		/
JG1052	Vibration Analyzer	1022	◎		/

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ABSTRACT
Summaries of the second mission to Egypt as part of the EIMP programme included meetings and site visit reports. The air quality monitoring programme was designed for Cairo and Alexandria. Sites and air quality indicators have been specified. Visits have been paid to different institutions for discussion of potential future co-operation. Discussions and specifications of counterparts in Egypt were presented.

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