Department of Natural Resources and Environment (DONRE) Ho Chi Minh City

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Ho Chi Minh City Environmental Improvement Project
Air Quality Monitoring and Reference Laboratory

Mission 6, May 2005; Status report (MR1-2), Station audits, design reference laboratory and training

NILU
Norwegian Institute for Air Research

HCMC EIA
Ho Chi Minh City
Environmental Improvement Project
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List of Abbreviations

ADACS	Automatic Data Acquisition System
AQI	Air Quality Index
CO	Carbon monoxide
CEN	European Committee for Standardisation
CLRTAP	Convention on Long Range Transport of Air Pollutants
DANIDA	Danish International Development Assistance
DONRE	Department of Natural Resources and Environment
DOSTE	Department of Science, Technology and Environment.
EDC	Environmental Data Centre at DONRE
EPU	Environmental Protection Unit
EQMA	Division of Environmental Quality, Monitoring and Assessment
GIS	Geographical Information System
HCMC	Ho Chi Minh City
HEIA	HCMC **E**nvironmental **I**mprovement Project **A**ir Quality Monitoring component
HEIP	HCMC **E**nvironmental **I**mprovement Project
ISO	International Organization for Standardization
NEA	National Environmental Agency
NILU	Norwegian Institute for Air Research
NO_2	Nitrogen dioxide
NORAD	Norwegian Agency for Development Cooperation
MPI	Ministry of Planning and Investment
PM_{10}	Particulate matter with diameter Less than 10 micrometer
$PM_{2,5}$	Particulate matter with diameter Less than 2,5 micrometer
PIU	Project Implementing Unit (PIU)
QA	Quality Assurance
QC	Quality Control
SO_2	Sulphur dioxide
SOP	Standard Operating Procedures
SVN	Schmidt Vietnam Co. Ltd

1 Air Quality Monitoring and Reference Laboratory

1.1 Introduction

The Norwegian Institute for Air Research, NILU, has installed the main part of an air quality monitoring and management system for Ho Chi Minh City (HCMC). The Norwegian Agency for Development Cooperation (NORAD) supported the project, which was the second phase of an earlier project funded by DANIDA. The Executing Agency for the **H**o Chi Minh City **E**nvironmental **I**mprovement Project **A**ir Quality Monitoring component (HEIA) was HCMC Environmental Protection Agency (HEPA), which is an agency under the Department of Natural Resources and Environment (DONRE).

On 16 November 2004 an extension of the project was signed between DONRE and NILU. The new project is named the Ho Chi Minh City Environmental Improvement Project; Air Quality Monitoring Component, Reference Laboratory and Training (HEIA-R). NORAD shall make payment for supplies and services provided under the new Contract.

A first mission during the new phase of the NORAD project was paid to HCMC during 28 January to 4 February 2005. In Hanoi we had meetings with NORAD to discuss the continuation of the HEIA programme and to report on the status of the project. In HCMC we analysed air quality data, performed corrected actions and did some training on the data assessment at the computer centre. Procedures for data quality controls after imported to the database were also developed. Plans were also developed for the continuation of the HEIA project.

During the first phase of the HEIA project HEPA experts have received training and is now operating the measurements as well as the air quality management system AirQUIS. However, experience has shown that much more training is needed to keep up an adequate quality in all parts of the programme. Training will be given as part of the installations of a reference laboratory and during upgrading of the operational procedures.

We have decided to continue the Mission report numbering from the last Mission 5 report as of December 2004. This Mission to HCMC will therefore be number 6 and took place from 1 May 2005 to 14 May 2005.

Some of the tasks undertaken during Mission 6 were:

- Verify the quality of the collected data (GIS, measurement and emission) since our last visit in November-December 2004
- Present and discuss 24-h average data and the QA/QC procedures
- Perform gap analysis of the existing data regarding improvement of the quality of data, data checking procedures at HEPA computer centre
- Improvement of emission data (point sources (positions), line sources (traffic count) and area sources (wards and population data)
- Prepare a report of the air quality data together with the HEPA team
- Upgrade the existing AirQUIS version
- Undertake complete audit of the measurement stations
- Start the repair and maintenance training
- Perform passive sampling of NO_2 and SO_2 as functions of distance from streets where we know traffic density and have continuous measurements
- Reference laboratory planning, instruments and room
- Meeting with DONRE on Reference laboratory facilities

The daily schedule for Mission 6 is presented in Appendix A1

2 Monitoring and Reference Laboratory design and update

2.1 Monitoring sites operated

The air quality monitoring programme in HCMC consists of 9 automatic stations in addition to some manually operated stations reported by HEPA. The monitoring stations installed during the Danida/NORAD projects are presented in Table 2.1.

Table 2.1: Air pollution measurement sites in HCMC, site characteristics and positions.

Stations				Indicators					UTM 84 N	
ID	Code	Name	Charact.	PM10	NO2	SO2	O3	CO	X coordin (m)	Y coordin (m)
1	DO	DOSTE	Traffic		X	X	X	X	684,430	1,192,220
2	HB	Hong Bang	Traffic		X		X	X	681,620	1,189,460
3	TD	Thu duc	Res/Ind		X	X			693,640	1,199,790
4	TS	Tan Son Hoa	Urb Bkg		X	X	X	X	682,830	1,193,930
5	TN	Thong Nhat	Traffic	X	X	X		X	680,690	1,193,530
6	BC	Binh Chanh	Traffic	X	X	X		X	674,500	1,183,000
7	ZO	Zoo	Urb Bkg	X	X	X	X		686,420	1,193,370
8	D2	District 2	Res/ind	X	X	X	X		691,160	1,193,510
9	QT	Quang Trung	Urb Bkg	X	X	X	X		677,940	1,200,080

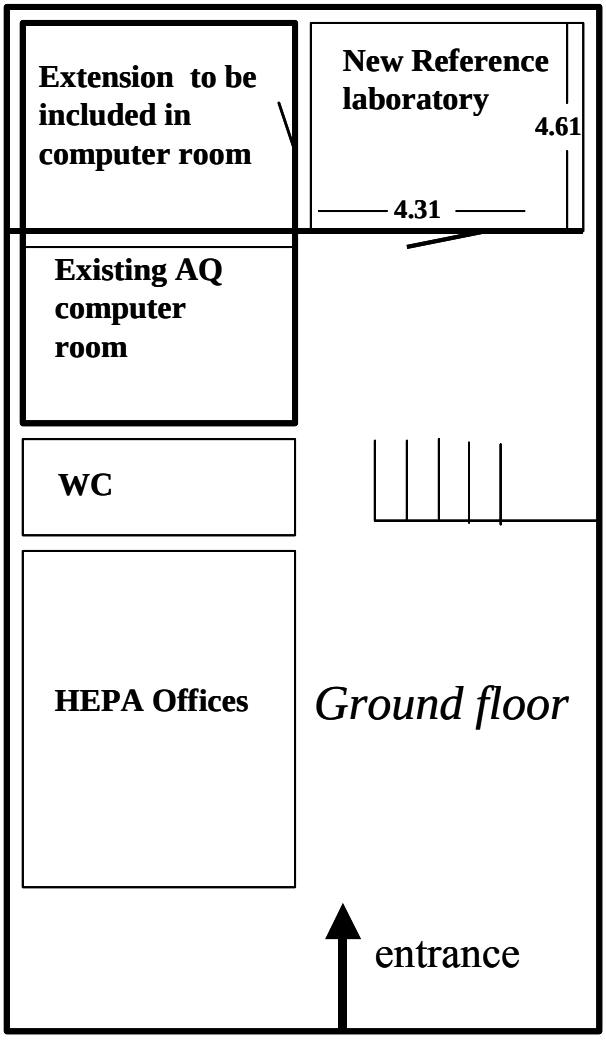
2.2 Reference laboratory

The Reference Laboratory including maintenance and repair capacity building, plus additional training for the application of the AirQUIS system for air quality planning in HCMC is all part of the HEIA-R project.

The main tasks to be undertaken in the project during 2005 are:

1. Specify and approve the physical location and features of the laboratory
2. Design the reference laboratory
3. Procure equipment
4. Test and verify equipment

5. Shipping of equipment
6. Install, verify and test the equipment in the laboratory
7. Develop training programme for maintenance, repair and calibration
8. Develop QA/QC programme related to Reference laboratory activities
9. Perform audits and train the ref-lab personnel
10. Update the database and collect input data
11. Meteorological data, training and improve instruments
12. Perform training in air quality assessment, seminar
13. Improve modelling capacity
14. Undertake impact evaluation
15. Prepare HEPA for undertaking abatement planning
16. Improve data dissemination and information



The space for the new Reference Laboratory was inspected. The location is in the first floor of the HEPA building. The size of the room is 4.60m x 4.31 m and the height is 2.15 at the lowest point and about 3.5 m at the highest point.
The computer extension room is 3.8 x 4.6 m.

According to the time schedule agreed between NORAD, DONRE and NILU the installations of the Reference Laboratory must be undertaken in September 2005. Instruments have already been ordered in Norway, and they will be ready for shipment in August.

The facilities available at HEPA to day are not adequate for the air quality monitoring and management programme. This was also agreed between Mr Khoa and Vice Director Chien in a meeting on 6 May 2005 (See Appendix H3).

Vice Director Chien also emphasized that HEPA would be located in 137 Nguyen Dinh Chinh Street for many years to come.

HEPA has already applied to People Committee for financial support to undertake construction work necessary to facilitate the computer centre and the new Reference Laboratory.

3 Procure and install Reference Laboratory

3.1 Specifications

The procurement of instruments for the Reference Laboratory has been finalised. These specifications have been used to request an offer from API. After receipt of the offer, NILU evaluated the content as well as prices and placed a new request at Industriell Måleteknikk in Norway. They also delivered all the instruments for the NORAD financed part of the monitoring system in HCMC (Appendix B).

NILU has obtained a compatible price from the Norwegian company and the order was placed at the end of April 2005.

The further plan is to have all equipment available in HCMC before the end of August 2005 for installations in the Reference laboratory in September, when also testing will start. Benches and shelves will have to be purchased locally and prepared together with the room.

3.2 Installations of instruments at Reference Laboratory

When the room for the Reference Laboratory has been prepared instruments will be installed in a rack. To keep to the time schedule instruments should be installed in September 2005.

The NILU instrument expert will prepare installations. Some training will be given to the HEPA experts during the installations.

NILU also plan to install a new meteorological station for HEPA during the same period. This station will be located at the tower at DOST near Dien Bin Phu street in District 3.

4 Quality Assurance (QA/QC)

4.1 Design QA/QC and documentation materials

The establishment of the Reference and maintenance/repair laboratory will ensure that the programme will sustain good quality. A detailed evaluation of the available data in the HEPA database, as well as the results of the Audit undertaken during Mission 6 clearly demonstrated the needs for a thorough evaluation and upgrading of the QA/QC system at HEPA.

4.2 Quality control at data retrieval

Quality control of data received at the Division of Environmental Quality, Monitoring and Assessment (EQMA) at HEPA has to be undertaken on a daily and weekly basis. A complete evaluation undertaken by NILU before Mission 6 shows that the quality of the data has been reduced during the last months. There are many reasons for this drop in quality; some instruments are out of operation, calibrations have not been followed up, frequent power breaks, Danida stations are out of calibration (span) gas, lack of maintenance and the routine site visits and calibrations are not consistent.

New quality control routines for data quality assessment after retrieving the data into the database which was introduced during Mission 5 (Appendix E, Mission 5 report) does not seem to have been followed completely.

To further improve this part of the data quality assessment it was decided during Mission 6 that printouts of all data, which is supposed to be collected in a special designed file, will be E-mailed to NILU. NILU experts will then evaluate the data and report back to the QA/QC officer at HEPA.

4.3 QA/QC training

Evaluation of data for the first years of measurements has indicated that some of quality routines will have to be updated. All routine operations and the use of standard operational procedures (SOP) and monitoring operations seem to have been followed up adequately. Additional training concerning quality assurance, calibrations, repair and maintenance will be performed as part of the establishment of the Reference Laboratory at HEPA.

4.4 Station Audits

The NILU instrument expert performed a complete station audit between 7 May and 12 May 2005 (See Appendix C). The NILU procedures for system evaluation audits have been followed.
The station audit included several controls including:

- The station itself (infrastructures)
- Instrument performance including
  - Performance evaluation audit - gas monitors
  - Performance evaluation audit - PM_{10} monitors
  - Evaluation of Meteorological equipment
- Documents and operational reporting procedures

A non-compliance report has also been prepared after the completion of the audits. A separate report has been prepared as a result of t he audit. A brief summary of the status is presented below:

Quang Trung station (id 9) was visited at 11:00 hrs on 7 May 2005. At 11:04 the power for the whole area was taken and the audit was not adequately completed. Power was not available when we left the site at 12:00.
The NOx monitor seemed to be out of order and the SO_2 monitor had no zero calibration. The PM_{10} monitor was out of paper, which means that there was presently no recording of PM_{10} concentrations. The ozone monitor seemed to work properly. Calibration sheets and information of previous calibrations were not available in the shelter. This information had been brought to the computer centre at HEPA. It was agreed that copies of these forms had to be available at the station.

District 2, D2 station (id 8) was visited from 13:00 hrs on 7 May 2005. The air conditioner at this station had broken down, and the temperature in the shelter, when we opened the door, exceeded 60 deg C.! All instruments were immediately turned off. Logbooks were inspected and found okay.
The station was re-visited on 12 May 2005. The handrail on roof had collapsed. The air conditioning unit was now repaired and worked well. Temperature was now + 29 °C. The air intake manifold pump vibrates and makes a lot of noise. The PM_{10} monitor was not running. It had been shut down after an attempt to repair squealing noise by introducing RP7 into the pump. The pump did not survive.
The gas monitors seemed to work OK, although the RCEL pressure in the NO_x monitor was 20 % under minimum with no alarms.

Zoo, District 1 (id 7) was visited at 14:00 hrs on 7 May 2005. The computer hard disk had problems for some time. The hard disk was taken to HEPA for repair, but without any success. The hard disk had then been returned to the station and presently no data was being stored in the station computer.
The monitors at Zoo seemed to be working well as far as we could see. The paper roll was always empty and will have to be changed soon. PM_{10} concentration was recorded at 50 $\mu g/m^3$.

At **Binh Chanh** was visited 9 May 2005. The shelter looks OK, but is influenced by heavy traffic on the main road. One could wash the shelter to make it appear like a well cared for unit.

No lights in the shelter due to faulty lamp for a long time. It makes inspection and detection much easier if you have good work light.
The shelter temperature was read as + 31° C.
The Zero Air Generator (ZAG) at Binh Chanh has been running since last visit.
The FH 62 PM10 dust monitor had been stopped. The reason was broken sampling tape. This was not recorded in Station Manual. No spare filter rolls in shelter.
API 200 A NO_x monitor was running, however not working.
API 300 CO monitor. The was hot due to pump jammed.
internal pump was jammed with power applied to the pump. It was quite hot.
Station log books were not adequately filled in and historical log for the different instruments were missing
All calibration data should be kept at site, copies at EQMA.

At **Hong Bang** the external pump connection to intake manifold (glass) was broken and repaired with tape.
Last maintenance visit was 24 Jan 2005 for O_3
Last maintenance visit was 23 Feb 2004 for NO_x
Last maintenance visit was 24 Apr 2005 for CO
24 Apr 2005 The API 300 was switched off. Source warning and sample flow warning, no measurements.
11 May 2005 Testing API 300 (CO) shows Sync warning and source warning. The filter wheel is probably stuck and IR-source is broken.
The DANIDA sites have not been properly run since the span gas cylinders were empty in 2002/2003.

DOST API 200 A (NOx) system reset message indicates power break. A zero warning could be malfunctioning Last maintenance visit 28 Apr 2005 showed API 200 A RCELpress warning.
Previous visit was 16 Aug 2004!
API 100 (SO_2) was moved to EQMA HQ 14 June 2004.
Last maintenance check on API 300 was on 28 Apr 2005.
Previous visit was 4 Oct 2004!

Thon Son Hoa was visited 11 May 2005 at 14:00 hrs. There were no interior lights.
No charcoal filter on the NO_x pumps exhaust from API 200 A (NOx).
The API 300 (CO) and API 100 A (SO_2) are at EQMA HQ.
Ozone monitor seem to work.

4.5 Change in QA/QC routines

It was suggested after the audits to all stations that it may have been a better procedure to divide the nine sites between three persons. Then they have three sites each to run with better control of the situation. In addition the field operators may also specialise in different monitors. The normal routine calibrations and controls at each site will be

adequately undertaken. In cases of specific instrument problems the person responsible for the site can seek expert help from the colleague who is specially trained to maintain the particular monitor.

The span gas cylinder pressure should be recorded for every span check. This is to keep a track on consumption. The field operators have to be very careful in closing the main valve after use. An open cylinder with closed regulator that is leaking will empty in a day or so.

Once the data are collected and there are anomalies, the person responsible for the site should be contacted immediately to check out where the problem lies and appropriate action should be taken. If, for example, the PM_{10} yields no data, the tape may have run out. Then it is very important to stop the sampler to avoid contamination of the measuring head. Reserve paper tapes should always be available at the site.

A **plan for service/ maintenance** of monitors and equipment should be prepared at least half a year ahead. In this way the chance of being stuck with a malfunctioning monitor or other essential pieces of equipment could be reduced. The spare part situation will also have to be foreseen. It is advisable to have some extra pumps and parts that are hard to come by.

4.6 Local wind and temperature data

The meteorological sensors are still not functioning according to expectations. Correction factors were introduced during Mission 5 for obtaining better wind direction data. Also lower temperatures have to be estimated based on upper temperature measurements.

These procedures will have to be followed until a new weather station will be provided by NILU in September 2005. A new weather station, produced by Vaisala OY, arrived at NILU on 28 April 2005. This new type of automatic weather station will be tested and equipped with the new NILU data logger. The plan is to install the station at DOST in September 2005 as a “gift” from the NORAD/NILU project.

5 Install and improve AirQUIS performance

5.1 Prepare AirQUIS platform and GIS

New updated version of AirQUIS was installed and verified at HEPA during Mission 6. The shape files for Wards in HCMC have been prepared and installed in AirQUIS.

The modelling area in AirQUIS has been identified and the grid system for modelling was decided before Mission 6. The grid consists of 43 EW and 35 NS points with 1 km resolution. Also stack coordinates for the large point sources have been re-inspected and new co-ordinates introduced in AirQUIS.

5.2 Further development and testing

NILU is continuing to improve AirQUIS regarding stability, performance and features, and new releases of AirQUIS have been made available for HEPA during the whole HEIA project period.

During Mission 6 a number of activities and deliveries have been identified in Appendix D. Documents such as AirQUIS manuals (PDF format) and descriptions are not included in the appendix of this report. However, the delivery list (Appendix D1) includes all items delivered to HEPA.

The work concerning the use of AirQUIS for monitoring data as well as for modelling and air quality planning is a continuous process. To update the system the following challenges have been solved:

1. Reinstall the latest update and workable AirQUIS (See Appendix D2).
2. Import HCMC's Wards shape file into GIS of AirQUIS (See Appendix D3)
3. Revise and input traffic counting data into AirQUIS
4. Import correct locations of point sources

Also air quality data will have to be corrected according to tests and corrections that have been undertaken at NILU.

Area sources (Wards), traffic sources (counting data) and point sources have to be updated, and test runs for concentration distributions will have to be prepared during the next Mission in May 2005.

Training was given concerning the creation of a local Oracle database with AirQUIS, and three memos were produced on how to install the Oracle 9i client for AirQUIS.

New routines for export and import of AirQUIS projects have been developed and presented. NILU has improved the export and import routines by introducing batch-files.

The operator needs only to modify the following variables in the import.bat and export.bat files before running the routine.

6 Air Quality Modelling

6.1 Prepare input data

The input data to the model module of AirQUIS is still being collected and prepared. Emissions can be stored as field data sets for area sources, line and field data sets for road links and point data sets for point sources.

The main data are

- Emission data (or consumption/production data)
- Emission factors
- Meteorological data

After raw data have been collected the model may have to perform spatial transformations, and scale the resulting values in order to convert to the desired units for the resulting data set.

6.2 Emission inventories

Visits were paid to two Districts in HCMC to identify industrial areas and potential emission sources. In **Tan Binh District** we met Mme Tien, who could point out 8 industrial areas where emissions to air could occur. A map of the area is shown in Appendix E. Most of the small and medium scale (SMS) industries have already been stopped or moved out of the city.
The following industrial areas were, however, identified (See map Appendix E):

1. Multi industrial area of SMS industries, Khu Cong Nghiep Tanh Binh
2. Glass recycling in Ward 9
3. Paper factory + vegetable oil factory
4. Paper factory, recycling paper (Mai Lam & VIEN Donex?) (in database!)
5. Plastic production, electric heater (EVA) (will move out in 2006?)
6. Food processing and textile (boiler) + rubber factory
7. Steel mill (closed)
8. SMS industries: a) textile b) food processing (in database!)

In District 11 we met with Mr. Hien. He also pointed out that the traditionally heavily polluted District 11 is now much cleaner. The main industries still remaining in District 11 are textile dying, plastics and pharmaceutical industries. Many of the industries have already been moved out of the city, and some have been terminated. Some small industries were identified:

9. Paper recycling + textile and food processing
10. Plastic factory included boiler (to move in 2007) cashew nuts, VOC emissions
11. Textile factory (in database)
12. Plastic bag production, no emissions to air?
13. Pharmaceutical industry, boiler
14. Ten small glass blowing factories, find oil consumption!

Some of the small industries identified above are already in the AirQUIS database.

6.2.1 Point sources

The point sources already available during Mission 5 have been checked, corrected and verified. The updated co-ordinates and correct positions are now available in AirQUIS. During Mission 6 another 35 industrial areas have been identified. Data for all these areas were prepared and installed into the AirQUIS database.

6.2.2 Population distribution, area sources

To improve the quality of area source estimates population distributions for each ward within every District of HCMC was obtained during Mission 5.

An example for District 1 in the central part of HCMC was shown in Mission 5 report. The Wards have now been imported to AirQUIS. It remains to distribute the emission estimates for each Ward into area source emissions based on one-kilometre grid squares.

6.2.3 Line sources and traffic emission data

All main line sources (major roads in HCMC) have been imported into AirQUIS. The data have been verified, and are ready for modelling. Some model tests have been performed and further model runs will be executed after Mission 6.

6.3 Meteorological data input

The meteorological data collected at the tower at DOST is not of very good quality. The most important parameter for the evaluation of air quality as well as input to the models is wind speed and wind directions.

To check the validity of the wind field generated from the measurements taken from the tower at DOST, NILU has collected wind data from weather forecast models. Data have been available every 6-hour for grid points surrounding HCMC. We have selected one grid point located just north of HCMC.

Figure 6.1 shows the occurrence of wind directions and wind speeds taken from the weather forecast data and from data at the tower. The periods are not the same in this example. Still we see that there is some resemblance in the data. The prevailing winds

are from around east and south-easterly directions. The tower data being more from south east while the forecast data are more from east.

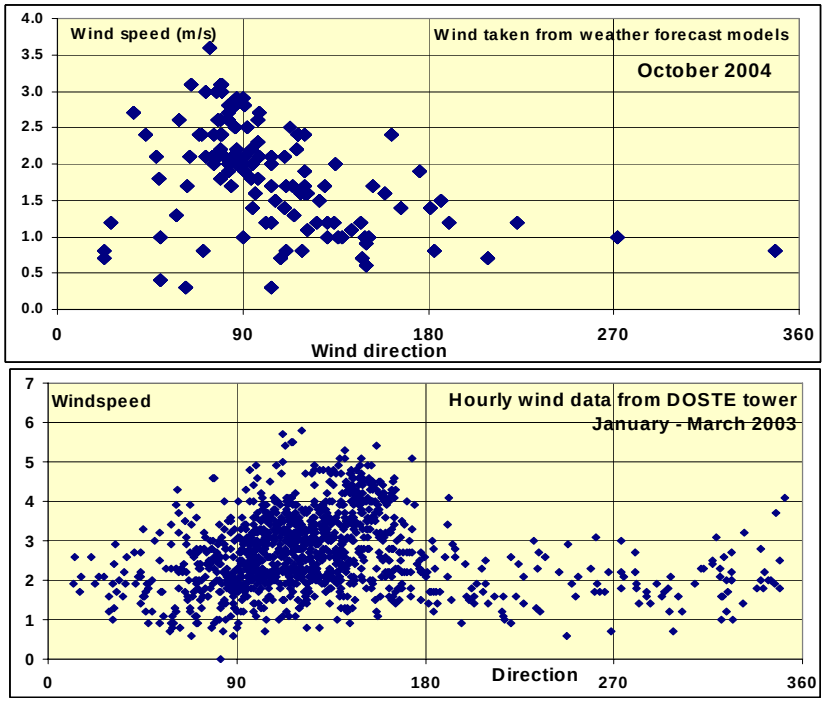


Figure 6.1: Individual plots of simultaneous observations of wind speeds and wind directions based on data from weather prediction models and from measurements at the tower at Dost in HCMC.

This information will further be used to verify and correct possible errors in the local data. They may also be used as direct input to the models as two alternative wind data sets.

Model results will also be verified with measurement data. This task will start during 2005, and NILU experts will be involved together with HEPA experts to perform these verifications in a process to improve model performance.

6.4 Dispersion modelling

Some test runs have been performed using the AirQUIS models. Even if the input data have not been completed it has been interesting to evaluate the model performance in HCMC.

The models need considerable testing and modification before it may be called operational. An example of estimated PM_{10} concentrations is presented in Figure 6.2.

The AirQUIS models will require good quality meteorological input data. We are still not satisfied with the situation regarding this issue, but we are working together with HEPA to solve the problem.

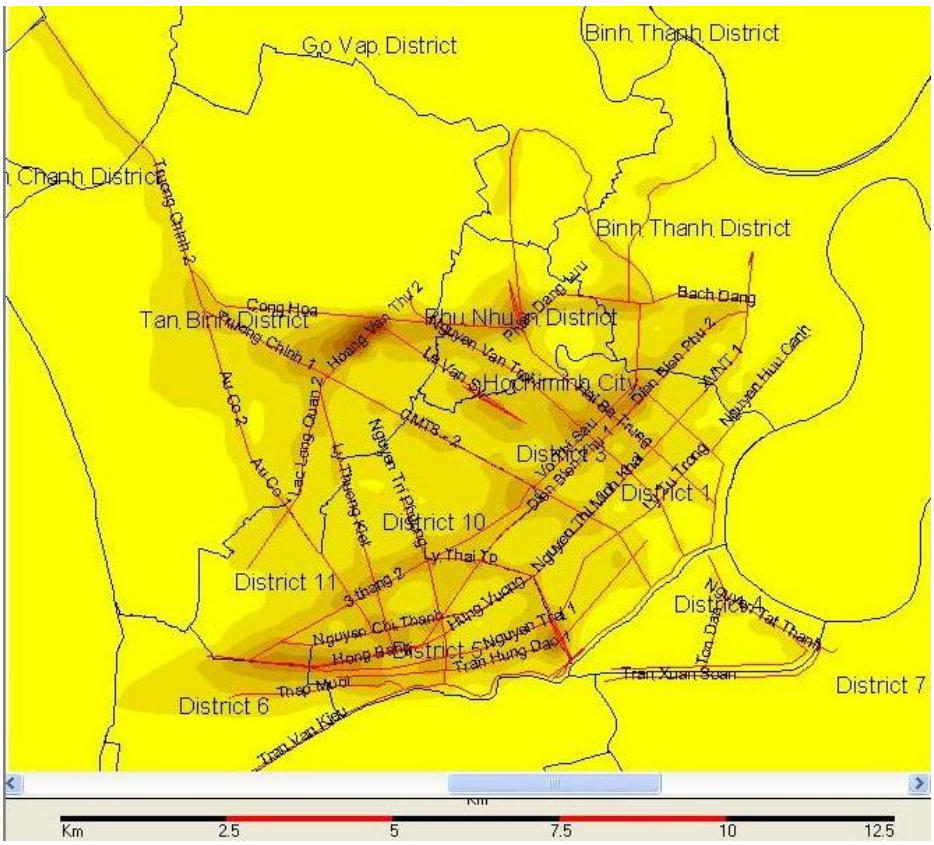


Figure 6.2: One hour average PM10 concentrations estimated by models based on emissions from the first set of main roads.

Some additional information has also been collected using passive sampling as presented in November 2002 (Sivertsen, 2003), and in the Chapter below.

6.5 Passive sampling of NO_2 and SO_2, May 2003

Concentrations of NO_2 and SO_2 were measured along selected roads and streets in HCMC using passive samplers. The sampling period for most of the samplers were from 4 to 12 May 2005.

A summary of the results is presented in Figure 6.3 below. Concentrations of SO_2 ranged between 16 and 53 $\mu g/m^3$ as an average over 8 days of sampling. Similarly the NO_2 concentrations varied from 24 $\mu g/m^3$ at the urban background site at Ton Son Hoa to 84 $\mu g/m^3$ in Ly Tuong Kiet Street near Thong Nhat hospital.

It is also worth noting that the average concentration at the fifth floor at Liberty 2 hotel near the Binh Thanh marked was as high as 79 $\mu g/m^3$ for NO_2 and 39 $\mu g/m^3$ for SO_2. These concentrations may be typical for the average exposure in the city centre (District 1) of HCMC.

Passive air pollution sampling

Tel. 9320121 /Mail:aqvie1702@hcm.vnn.vn

Field observations **Observer:_Bjarne Sivertsen & Mr Huy**

Sampling period				Site name	UTM coord.		Sampler concentrations ($\mu g/m^3$) and comments		
From:		To:		(Position)			SO_2	NO2	Comments
Date	Hr.	Date	hr.		East	North	(red)	(blue)	
4May05	0920	12May	1320	HEPA balcony	683325	1193905	4	37	
4May05	0925	12May	1145	Street near HEPA	683210	1193910		39	90 m from Nguyen van Troi rd.
4May05		12May	1100	South side road	683163	1193890	47	39	
4May05		12May	1105	60 m from road	683129	1193846		26	
4May05	1015	12May	1115	DOST fence	684491	1192199	40	72	
4May05		12May	1117	DOST shelter	684503	1192205		61	
4May05		12May	1120	DOST building	684487	1192225	16	**47**	30 m from street
4May05		12May	1125	DOST tower	684440	1192205		51	
4May05		12May	1010	TN 50 from street	680735	1193377	25	34	
4May05		12May	0950	Ly Thuong Kiet str	680702	1193449	53	84	
4May05		12May	1000	Ly Thuong Kiet str	680670	1193420		46	50 m west of street
4May05		12May	1030	Tan SonHoa	682920	1193856	18	24	
4May05	1650	12May	1600	Liberty 2 , 5 floor			39	79	
10 May	0930	12May	1330	HEPA gate in street				**48**	5 left of gate in Dinh Ching str
4May05	1130	12May	1045	TonSonHoa fence	682884	1193887		24	100m from Nguyen van Troi rd.

Developed by: Norwegian Institute for Air Research (NILU), POBox 100, N-2007 Kjeller, Norway

The concentrations of NO_2 decrease significantly with the distance from the road. Along the road and on the sidewalk concentrations of NO_2 ranged between 60 and 85 $\mu g/m^3$, beyond 50 m from the road the concentrations levelled at about 40 $\mu g/m^3$, which seems to be the typical urban background concentration of NO_2.

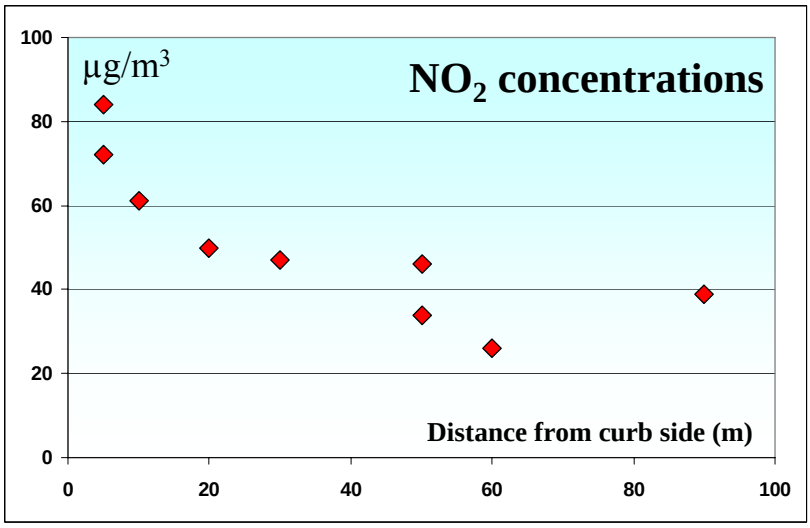


Figure 6.3: NO_2 concentrations measured as a function of the distance from major roads.

Details concerning the passive sampling procedures, locations, traffic density on the main roads and results are presented in a separate memo.

7 Field Operations

7.1 Operational phase

Field operations undertaken by the trained monitoring experts using the QA/QC system at all levels seem to work adequately. There are still some procedures described in the SOPs that will have to be repeated and updated as part of the establishment of the reference laboratory, See also the daily reports from the station Audits in Appendix C.

Some of the monitors have been out of order for shorter or longer periods due to lack of spare parts. These matters have all been discussed and it is believed that the operations might be still improved.

Instrument status was reported in April 2005 as shown in the Table below.

Instrument	Error description	Error Date	Actions Done	Status	Station
API 100A	Can not do Calibration (PMT unstability)	04 Apr 05	Calibration can not be done	Not OK	QuangTrung
API 100A	Sample Flow Warning; Shutter warning; conc= -38.8	11 Nov 03	Turn off	Not OK	Doste
API 100A	Shutter warning	28 Jun 04	Turn off	Not OK	TanSonHoa
API 100A	Shutter warning; Sample flow warning(336)	28 Jul 04	Turn off	Not OK	ThuDuc
API 200A	Can not do Optic test (PMT: 951 mV)	06 Apr 05	Adjust PMT	Not OK	Zoo
API 200A	Can not do Optic test (PMT: 1712 mV)	04 Apr 05	Adjust PMT	Not OK	District 2
API 200A	Azero warning	16 Aug 04	Clean PMT cell.Turn off	Not OK	ThuDuc
API 200A	Azero warning	23 Fer 04	Turn off	Not OK	HongBang
API 200A	Azero warning (5000) PMT unstability	15 Oct 04	Turn off	Not OK	ThongNhat
API 200A	Can not do Calibration (PMT unstability)	04 Apr 05	Calibration can not be done	Not OK	QuangTrung
API 300	Sample flow warning	29 Aug 04	Turn off	Not OK	TanSonHoa
API 400A	O3 Ref: 2898; O3 Meas: 2897	06 Apr 05	Adjust O3 Ref	Not OK	Zoo
API 400A	O3 Ref: 2941; O3 Meas: 2939	04 Apr 05	Adjust O3 Ref	Not OK	QuangTrung
API 400A	O3 Ref: 2877; O3 Meas: 2976	04 Apr 05	Adjust O3 Ref	Not OK	District 2
API 100A	Optic test : 1586	21 Mar 05	No	OK	ThongNhat
API 200A	Can not do Optic test (PMT: 2290 mV)	08 Apr 05	No	OK	BinhChanh
API 300	Sample Flow Warning (443)	29 Mar 05	Clean lines	OK	HongBang
API 300	CO Ref: 3104.9; CO Meas: 3660.8; Electrical Test: 28.9	21 Mar 05	No	OK	ThongNhat
API 300	CO Ref: 2743; CO Meas: 3203; Electrical Test: 17.1	08 Apr 05	No	OK	BinhChanh
API 400A	Orifice flow warning	07 Apr 05	No	OK	Doste

NILU discussed the status and it was concluded that at least some of these instruments could be operated again after installations of adequate spare parts. For the API 100A it should be determined whether this is an electrical or mechanical fault. Was there any

chance of strong light leak? UV or PMT dark offset < 200 mV? It was questioned whether they had tried factory calibration procedure?

The status of the instruments and stations are also reported every week. This report has been presented to Mr Khoa and Mr Dam. An example of the weekly status as presented for week 20 and week 28 is shown in Appendix F1.

7.2 Field zero/span calibration

Field zero/span check and calibrations are undertaken at the sites every 2-week. However the site visits frequency seems to vary. At the Danida stations these controls cannot be undertaken at all, due to lack of gas.

The ozone monitors have been calibrated by Smith Vietnam. However, it is difficult from the logbooks to identify these calibrations.

Concerning calibrations there seem to have been limited or no control of the span gas quality.

7.3 Maintenance and service

Some instruments (from Danida) have now been operated for more than 5 years. The lifetime of some of these monitors are between 5 and 10 years. To keep up good quality data they need to be checked and maintained properly. NILU normally recommends a yearly overhaul of the instruments. This will in the future be one of the tasks of the reference and maintenance laboratory.

As part of the establishment of the reference laboratory it is expected that the possibilities for instrument follow-ups, repairs and maintenance will be improved. It is still a chance that some of the instruments should be

7.4 Reference laboratory functions

The new Reference laboratory will have to undertake advanced quality assurance and maintenance routines. Once every year the monitors should undergo a dynamic calibration and overhaul at the Reference Laboratory.

The field operations require that trained monitoring experts are visiting the stations every week. Other experts are being trained for using the data retrieval systems and the databases. QA/QC at all levels is an important issue that should be kept alive through regular Auditing of the system.

Regular maintenance of the instruments is usually performed at the station during routine service visits. In addition to the regular maintenance NILU recommends a yearly overhaul where the instrument is examined, cleaned and adjusted more thoroughly. The overhaul will typically take two to three days. Due to limited space at the station and to prevent the overhaul activities from disturbing the other instruments at

the station the overhaul should be performed in the laboratory. In addition the overhaul usually requires spare parts, consumables and tools that is easier accessible in the laboratory then at the station. Before and after the yearly overhaul the monitor should undergo a linearity check to document the response after the last measurement period and before the next period respectively.

The yearly linearity check as recommended by CEN and the yearly overhaul as recommended by NILU should be combined and performed at the same time in the laboratory. The linearity check requires a complete dilution/calibration unit. The three-monthly calibration of the monitor requires only two gas concentrations, zero and a fixed span level and should be performed at the station. The two-point calibration requires a zero air generator and a span gas cylinder containing a fixed “outdoor” concentration.

7.5 Consumables and spare parts

During the HEIA project NILU has supported consumables and spare parts. This service has terminated. However, NILU has still given advice and support to HEPA.

A list of available spare parts had been presented in April 2005. This was checked and updated during Mission 6 as presented in Appendix F2.

8 Data interpretations

8.1 Understanding AQ

Further evaluation of the data has been undertaken before and during Mission 6. All data have been transformed into 24-hour average concentrations for evaluation of data quality and comparisons with limit values.

Training on the understanding of frequency statistics and air quality evaluation was undertaken during Mission 6. We also prepared the content of future monthly reports as part of this training.

Surface ozone concentrations seem to be a major element in the high air pollution cases in HCMC. Data shows nice diurnal variations at all sites as shown in Figure 8.1.

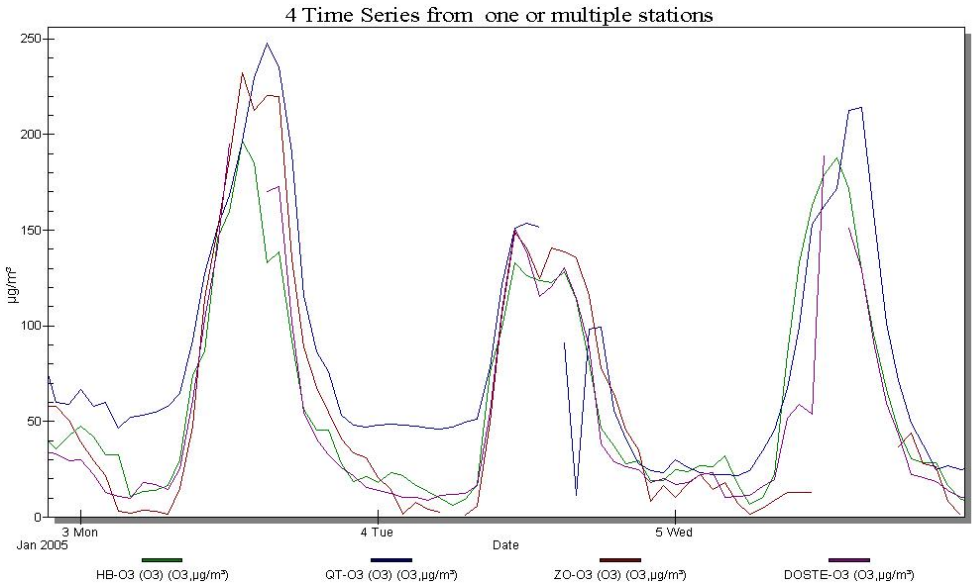


Figure 8.1: Three days of ozone concentrations measured at 4 sites in HCMC.

The highest afternoon ozone concentrations reach about 240 µg/m^3. The average diurnal variation of ozone as measured in January 2005 is presented in Figure 8.2.

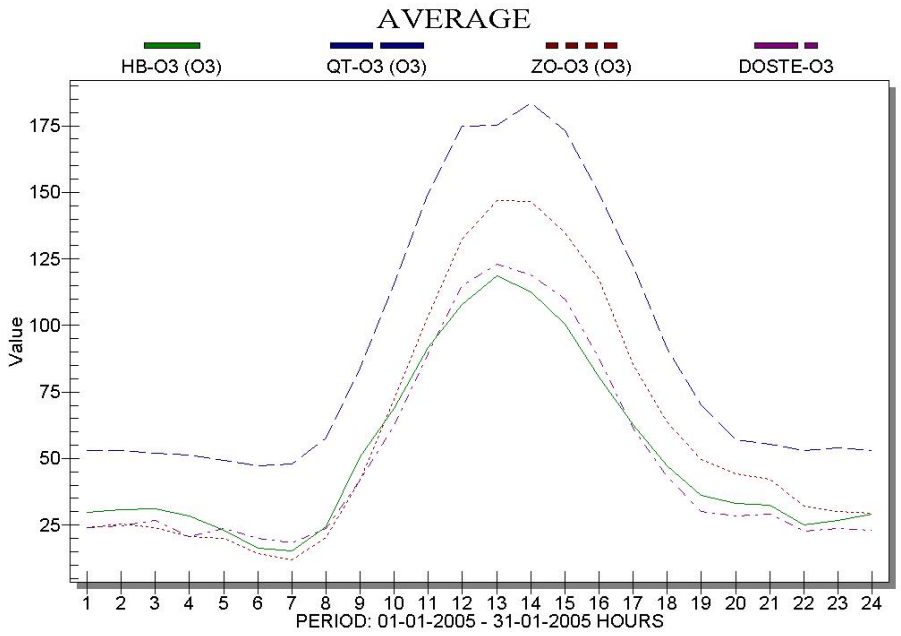


Figure 8.2: The average diurnal variation of ozone at 4 sites in HCMC, January 2005.

The highest average ozone concentrations occurred at the background station at Quang Trung. The average afternoon concentration was about 175 µg/m^3. At the roadside stations Hong Bangh and Doste the afternoon maximum concentrations were about 120 µg/m^3.

8.2 Meteorological data

The problems obtaining good quality meteorological data remains as stated in Chapters 4.6 and 6.3. Only the upper temperature data and wind speed data at the DOST station seem to be of adequate quality.

8.3 AQI and statistics

The Air Quality Index (AQI) procedures developed in 2003 have been generated automatically every day for more than a year. The air quality data available in the AirQUIS database has also been used to prepare statistics for monthly and annual reports.

8.4 Internet presentations

NILU supported HEPA in establishing an Internet presentation of air quality data online. Establishing of this web site was not a part of this project. However, HEPA asked assistance from NILU and the data can be found at www.hepa.gov.vn and www.luftkvalitet.info for more information about NILU as Air Quality Service Provider.

9 Air Quality Assessment

9.1 Use of AirQUIS

The AirQUIS system is now being used by HEPA for producing air quality statistics, and for preparing input to the monthly reports (See Appendix G). AirQUIS is also the basis for air quality management and planning, and the preparations of input data for modelling purposes is continuously going on in AirQUIS (See Chapters 5 and 6).

More training is still needed for the full understanding of the use of models. However, at least two experts are now using the AirQUIS modelling modules. Further training is being planned during the Autumn 2005.

9.2 Improved model estimates for exposure evaluations

Some model estimates have been undertaken as part of the testing of input data (See Chapter 6.4). Further studies are needed and will be undertaken during 2005.

As part of future requirements for model estimates it has been our hope that experts from HEPA would be able to visit NILU for some weeks to modify and improve the modelling capacity for HCMC. Some of the possible improvements necessary to achieve good quality estimated concentrations were indicated in Mission 5 report.

Simulated concentration fields may be used together with the AirQUIS assimilation module, which adjusts model results using updated observational data interpolated onto the model domain. This module uses local positional adjustment, scaling factor calculation, observational field interpolation and weighting factor field calculations to improve the concentration fields.

9.3 Abatement and impact assessment

Model estimates have already been undertaken to evaluate the impact of different sources in selected areas of HCMC. Training will continue during the new phase of the HEIA project, and it is anticipated that HEPA experts will be able in the future to undertake assessment and planning studies.

10 Task 11. Capacity building

The additional funds made available from NORAD for the establishment of a reference laboratory will help to improve the operational capacity and the Quality Assurance part of the air quality monitoring programme and also improve the capacity concerning air quality management and abatement strategy planning.

10.1 Instruments, monitors and QA/QC procedures

Additional training will be a key issue in the development of the Reference Laboratory. This training will also include maintenance and repair of instruments in addition to the procedures for dynamical calibrations of the monitors.

Additional training in the use of the AirQUIS system for daily quality check of data was undertaken during Mission 5 and was continued during Mission 6. New procedures as well as updated Standard Operations Procedures (SOP) will be developed during the new phase of the project. Seminars and workshops covering these QA/QC procedures have been planned and will be held late autumn 2005.

10.2 AirQUIS training

The basic training in the application of the AirQUIS system was given at NILU during the first phase of the HEIA project. This training is more or less continuously followed up by NILU answering questions and solving any problems raised by the HEPA experts.

We consider also the additional training needed for modelling as part of the AirQUIS training. In this way the remaining training will more or less be considered as on-the-job training. Updated user guidelines have been handed over to the HEPA experts during Mission 5 and 6.

10.3 Use of models

A basic tool in the air quality planning process is the use of atmospheric dispersion models. Models have been part of the AirQUIS deliveries. To make the users able to fully understand the input data as well as the results from these model estimates, practical on-the job training is being undertaken.

HoChiMinh City (HCMC) has been selected for a health study; Air Pollution Poverty and Health (APPH) initiated by the Asian Development Bank (ADB). If this project will be a reality we have planned to add more training in modelling and model applications. The seminars to be held during the autumn 2005 will also include some more input to understand the dispersion models.

However, most of the additional training in modelling will be as part of the model improvement and through visits to NILU.

10.4 Statistics and reporting

During Mission 6 some time was spent on the preparation of status reports such as the monthly report filed by HEPA to DONRE every month. After the Mission a report for the month of March 2005 was prepared. This report was then discussed and changed, and an English version of the report is available in Appendix G.

10.5 Assessment and impact evaluation

The first model estimates will be performed as soon as adequate input data, such as emission inventories and meteorological data are available. Impact evaluations have been performed for single sources, selected industries or selected roads and streets.

Further exercises will be part of the training programme, and the objective is to collect as complete input database as possible, so that an optimal abatement strategy process can start. As part of the process it will be possible to evaluate the relative importance of the impact from selected sources or categories of sources.

10.6 Further institutional building

As part of the continued NORAD funded project NILU will do its best to update and to assure that the new Division of Environmental Quality, Monitoring and Assessment (EQMA) at HEPA have the best tools available and that adequate training is being given to the staff. These EQMA experts need to have updated knowledge of methods and data to represent the key personnel in the future.

As long as NILU is part of the air quality projects undertaken in HCMC we will see that there is a continuous flow of information back and forth between the two institutions. It is in everybody's interest that the HEPA experts will be able to communicate and use the tools provided by the NORAD funds in the best possible manner.

11 Administrative meetings

Several meetings were organised at DONRE and HEPA during Mission 6. The results of these meetings are reported in the Appendices as Minutes from the meetings or in various memos. Project meetings have also been held at NILU.

11.1 Project meetings

Project meetings have been held at NILU to follow-up the project. Minutes of these meetings have been sent to HEPA/DONRE immediately after each meeting.

As part of Project Meeting number 10 in February tasks and time schedules for the further work in HCMC was presented (See Appendix H1). This included both the work needed to continue second part of the HEIA project as well as some preparations needed to meet the requirements of the APPH project.

Work indicated after December 2005 is mainly related to the ADB Health (APPH) project, where NILU/HEPA need to provide concentration estimates in specific areas or at specified receptor points.

In Project Meeting number 11 in April 2005 it was indicated that a new meteorological station to be placed at DOSTE has been requested from Vaisiala OY in Finland. The existing weather station at DOSTE, installed during the Danida project, has never been operated adequately as stated in several Mission reports. HEPA and NILU have agreed to use money from the budget to procure and install a new weather station at DOSTE (See Appendix H2).

11.2 Meeting at DONRE head office

A meeting was arranged Vice Director Nguyen Van Chien at DONRE to discuss the establishment of the reference laboratory and to deliver the last invoice for verification before sending it to NORAD (See Appendix H3 and H4).

It was pointed out that it is important that the facilities and the adequate manpower are being made available at HEPA. To maintain the good reputation and quality of the HEPA air quality monitoring network in HCMC an example of manpower needed was presented. The different options and possibilities were discussed as referred in Appendix H3.

In the meeting concerning the last invoice a memo was prepared to specify the tasks undertaken from January to April 2005 (See Appendix H4). The following tasks were briefly summarised from the first quarter 2005, relating to the invoice dated 29 April 2005:

- Data quality assurance and training
- Daily concentrations
- Preparing audits
- Instrument status and spare parts
- Preparing the Reference Laboratory at HEPA
- Procurement of instruments
- New weather station for HEPA at DOST
- AirQUIS status and upgrades
- Modelling data input
- Internet pages
- Project meetings

Comments and conclusions are given in Appendix H4.

11.3 Preparations for the new reference-laboratory

Several meetings were held in preparation for the new reference laboratory (See Chapter 2.2). The rooms and facilities were discussed, and a plan for renovating parts of the HEPA building was agreed upon.

Instruments, as well as spare parts and consumables have been discussed, and NILU will further see that the necessary equipment will be made available in September 2005. Some local purchases will have to be specified such as computers, air condition systems and other practical tools to be installed in the new reference laboratory. Specifications are already available in the reference laboratory technical proposal and contract.

The further plan is to have all equipment available in HCMC before the end of August 2005 for installations in the Reference laboratory in September, when also testing will start.

11.4 Future tasks and obligations

A meeting was held at the end of Mission 6 to summarise the performances so far and to specify tasks and obligations to be undertaken during the next phase of the project. A list of 22 tasks are summarised in Appendix H5. It is anticipated that all responsible experts will undertake these tasks accordingly.

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Appendix A

Time schedules and personnel

Appendix A1: Daily schedules

Mission 6, May 2005

A number of tasks have been identified for Mission 6 to be carried out in May 2005:

1. Verify the quality of the collected data (GIS, measurement and emission) since our last visit in November 2004
2. Present and discuss 24-h average data and the QA/QC procedures
3. Perform gap analysis of the existing data regarding improvement of the quality of data, data checking procedures at HEPA computer centre
4. Improvement of emission data (point sources (positions), line sources (traffic count) and area sources (wards and population data)
5. Prepare a report of the air quality data together with the HEPA team
6. Upgrade the existing AirQUIS version
7. Undertake complete audit of the measurement stations
8. Start the repair and maintenance training
9. Perform passive sampling of NO_2 and SO_2 as functions of distance from streets where we know traffic density and have continuous measurements
10. Reference laboratory planning, instruments and room
11. Meeting with DONRE on Reference laboratory facilities

Daily schedules

Day	Hr.	Assignment	NILU	HEPA/ DONRE	Done
Monday 2 May		Arrival in HCMC	BS		
Tuesday 3 May	0830	Preparations, Check bank account Work with the AirQUIS database	BS		ok
Wednes 4 May	0830 0900 1500	Short introductory meeting, discuss schedules and tasks for Mission Locate passive samplers Data discussions	BS BS BS	LVK, NDT NTH, LSQT operators+	ok ok ok
Thursda 5 May	0830 1000 1400	Plan Audits Correct and check data control Start collect more emission data	BS BS BS	Operators NTH ? DTMH	ok ok
Friday 2 6 May	0900 1700	Meeting with DONRE on RefLab Instruments and spare parts Training maintenance Data quality control procedures Detailed plans for Audits Harald Willoch to HCMC	BS BS BS	LVK, NTTH	ok ok ok
Saturday -Sunday		Start audits to selected measurement sites	HW, BS	operators	ok
Monday 9 May	0900 1400 1500	Audits to stations continue Data retrieval system at HEPA corrected Data quality control continue Data report, discussions and evaluation Correct PC at Zoo station	HW TNT BS BS TNT	NBQ,oper NTH LVK, VTD VTD VTD	ok ok ok ok ok
10 May	0830	Finalise audit to stations Install new AirQUIS, transfer data Import data and control data quality	HW TNT TNT,BS	operators DTMH, VTD VTD,DTMH	ok ok ok

Day	Hr.	Assignment	NILU	HEPA/ DONRE	Done
		Check emission data input Discuss modelling results	BS,TNT	DTMH,VYD	ok
11 May	0900	Status AirQUIS, modelling data Repair and maintain monitors, training on ThuDuc station Data quality control continues	TNT HW BS,TNT HW	DTMH NBQ NTH	ok ok
	1400	Emission data, visit District 11 and Tanh Binh District	BS	LVK, NTHD,	ok
12 May	0830	Maintenance and repair, training Last visit to stations AirQUIS training, emissions and modelling Reporting, data quality H Willoch leave HCMC	HW TNT BS HW	NBQ NTHD ++ DTMH ++ LVK,NTH	 ok ok ok
13 May	0900	Summary of data quality Final meetings, Discussions, tasks and responsibilities Summary and next Mission	BS, TNT BS	LVK,VTD all LVK	ok ok ok

The staff

DONRE/HEPA	
Nguyen Dinh Tuan (NDT)	Director of HEPA
Le Van Khoa (LVK),	Project Manager HEPA/DONRE
Le Sanh Quoc Than (LSQT)	Instruments expert, field operations
Vo Thanh Dam (VTD),	EDC, data retrieval, reporting, field
Nguyen Bao Quoc (NBQ),	Instrument expert, field operations
Nguyen Thanh Huy (NTH)	QA/QC, field operations, instruments
Nguyen Toan Hung Dung (NTHD)	Instruments and monitors, repair
Miss Duong Thi Minh Hang (DTMH)	Emission data, modelling
DONRE	
Nguyen Van Chien	Deputy Director of DONRE
Nguyen Thi Tuyet Hoa (NTTH)	DONRE Secretary
NILU	
Bjarne Sivertsen (BS)	Project Manager
The Nguyen Thanh (TNT)	IT Manager, Computer expert
Harald Willoch (HW)	Instrument expert

Appendix B

Procure Reference laboratory equipment

Reference Laboratory Ho Chi Minh City
Deliveries from Norway

Pos 1: **SO2 Monitor**
1 pc API M100E, UV fluoresence SO2 monitor
Programable measuring range from 0-50 ppb to 0-20 ppm
May be set for autoranging
RS 232 with cable
Analogue output adjustable 0-0,1, 0-1, 0-5 and 0-10 V
Internal data logging, 1 min to 24 h averages
Operating temperature: 5-40 °C (with EPA equivalency)
Internal pump
230 V, 50 Hz, CE-marked

Pos 2: **NOx Monitor**
1 pc API M200E, chemiluminisence NO-NO2-NOx monitor
Programable measuring range from 0-50 ppb to 0-20 ppm
May be set for autoranging or different measuring ranges for each gas, (NO, NO2, NOx).
Permapure drier for O3 generator (Silica gel is NOT used)
Catalytic ozon scrubber
Analogue output adjustable 0-0,1, 0-1, 0-5 and 0-10 V
Internal data logging, 1 min to 24 h averages
Operating temperature: 5-40 °C (with EPA equivalency)
Separate pump (NOT for rack mounting)
230 V, 50 Hz, CE-marked

Pos 3: **O3 Monitor**
1 pc API M400E, UV absorption O3 monitor
EPA approval EQOA 0992-087
Programable measuring range from 0-100 ppb to 0-10 ppm
May be set for autoranging
Analogue output adjustable 0-0,1, 0-1, 0-5 and 0-10 V
Internal data logging, 1 min to 24 h averages
Internal pump
230 V, 50 Hz, CE-marked

Pos 4: **CO Monitor**
1 pc API M300E, Gas filter correlation CO monitor
Programable measuring range from 0-1 to 0-1000 ppm
May be set for autoranging
Analogue output adjustable 0-0,1, 0-1, 0-5 and 0-10 V
Internal data logging, 1 min to 24 h averages
Operating temperature: 5-40 °C
Internal pump
230 V, 50 Hz, CE-marked

Pos 5: **Zero Air Generator**
1 pc API M701 Zero Air Generator with 10 slpm compressor, regenerative dryer, scrubber for SO2, NOx and O3 and with catalytic CO scrubber
230 V, 50 Hz, CE marked

Pos 6: **Calibrator**
1 pc API modell 700, multigas calibrator
Manual, automatic and remote control
Optical feedback and GPT mixing chamber
UV Photometer module
1 zero air inlet, 0-5 l/min
4 source gas inlets, 0-50 ml/min
RS 232 and digital status
230 V, 50 Hz, CE marked

Pos 7: **Accessories**
5 pc RS232 Cable, 1,8 m 4 pc RS232 Multi-Drop for E-series 1 pc RS232 Multi-Drop for A-series 6 pc Cable for 230 V, 50 Hz, 2 m,
Norwegian type connector 6 pc Rack mount for one unit with 26" Chassis slides

PACKING: Included (Standard API cartons) WARRANTY: 1 year from delivery

To be delivered separately

PC with monitor	GW P5-133
PC Software	MS Office
PC printer	HP 682C DJ
Rack for monitors (2 pcs)	EDR20086
Lab. env., Rel. Hum.+Temp.	Va HMP 231
Lab. env., Air Pressure	Va PTB 201AD
Lab. env., CO detector	SA 3000 SI
Flow calibrator	BIOS DryCal
Repair tools	BACO
Laboratory items	Fittings, filters etc.
Aircon etc	local
Furnitures	local

Calibration gases

SO_2 cal. gas, 100 ppm, ref std.	NIST
NO cal. gas, 100 ppm, ref std.	NIST
CO cal. gas, 5000 ppm, ref std.	NIST

Appendix C

Daily report from Audits

Daily reports from instrument expert (HW)

06 May 2005.
Arrived HCMC International Airport at 1720 local time.
Taxi to Liberty 2 Hotel. Met by Mr. Bjarne Sivertsen from NILU.

07 May 2005.
Left Hotel at 0900
Arrived at HQ at 0930
We met Mr. Quoc, Dong and Huy and set off for Quang Trung (Software City).

Arrived at **Quang Trung** at 1055.
Shelter looked fine from the outside, but there were watermarks on the floor inside. This could either be a leak through the roof or condensation water from the zero air generators. One noticed that the zero air generator drain is right above the PM_{10} pump. As a precaution one should install a tube leading possible condensation water into an appropriate container on the floor. It is also advisable to check all intakes through the roof. Clean up around all intakes on top of roof and reseal with silicone if necessary.

There was a power break three minutes after arrival i.e. at 1058. It turned out that the power failure was outside both the shelter and our control. It was not possible to establish neither the cause or when it would be re-established. Power problems have also previously been recorded. Try to solve that problem. The PM_{10} monitor will advance the filter tape every time it restarts when power is restored. Tape will run out if not changed in time. It is very important to stop the pump immediately to avoid contamination of sampling chamber.
Could not find calibration results. Station Audit was aborted because of power failure.

Arrived at **ZOO** at 1340.
Another short audit since no data had been recorded since breakdown of OPSIS data logger from 16 April 2005. The instruments seemed to work OK.
Left ZOO at 1410 hrs.

Arrived at **District 2** at 1500 hrs.
The Air Conditioning (A/C) unit was running without cooling on arrival. The temperature inside the shelter was approximately 70°C. One could not touch the walls. Everything was switched off immediately. Consequently no audit was undertaken. Station Log revealed that there had been an attempt on calibration on 19 April 2005. This was interrupted by a power break outside the shelter. The power failure was not recorded in the Station Log. The next visit was on 25 April. The room temperature recorded as + 41°C. Next entry on 26 April indicates that the A/C might have been repaired.
Left District 2 at 1540 hrs.

08 May 2005.
Survey of local traffic patterns and flow. Introduced to pedestrian behaviour vs. traffic. Study of fresh food market and silk trade. Culinary introduction to Viet Nam.

09 May 2005.
Left Hotel at 0845.
Arrived HQ at 0915. Used the time to write reports while waiting for different key persons to show up. Set off for Station Audit after lunch.
Traffic was acceptable due to rain showers.

Arrived **Binh Chanh** at 1440 local time.
The shelter looks OK, but is of course influenced by heavy traffic on the main road.
One could hose down (wash) the shelter to make it appear like a well cared for unit.

On arrival first apparent problem was interior lights. They have been faulty for a very long time as far as one could understand. It makes inspection and detection much easier if you have good work light.
The door was thus left open to give the little light there was. One has stressed that the door must be closed during visits to avoid dust entering and most important to achieve stable temperatures while calibrating.

The shelter temperature was read as + 31° C.

The Zero Air Generator (ZAG) at Binh Chanh was still running at arrival. Must have been on since last visit.

The FH 62 PM10 dust monitor had been stopped. The reason was broken sampling tape. This was not recorded in Station Manual. No spare filter roll in shelter. The one lying in the drawer turned out to be used.

API 200 A NO_x monitor was running, however not working.

API 300 CO monitor. The internal pump was jammed with power applied to the pump. It was quite hot. Exhaust line from pump was full of black dust. One of the pump suspension bolts had worked away the rubber sleeve. This has not been recorded. There are so few words in the entries that one can hardly decipher. Write as if someone strange (the auditor) should read it.

One misses a historical log for the different instruments showing in correct sequence all that occurs. This form should be with boxes for each entry, clearly timed, dated and signed.
All calibration data should be entered into a similar form and kept at site. These sheets should be brought to HQ for copying into appropriate files and then RETURNED to site in order to always have control at site over developments and trends.
There were no tools either in shelter or in Station Visit Kit.

Always bring a torch with fresh batteries and a mirror to inspect awkward places.
The person responsible for data collection from sites should immediately contact the person responsible for site once data irregularities occur. It is in your own interest that the quality and amount of data are optimal.

One should make a **plan for service/ maintenance** of monitors and equipment at least half a year ahead. In this way you reduce the chance of being stuck with a malfunctioning monitor or other essential pieces of equipment. That is if you have foreseen the spare part situation. It is good to have some extra pumps and parts that are hard to come by.

It is very good that you look into the shelter any unscheduled time you are in the area and report to the person responsible.

ZAG at Thong Nhat was very noisy. Sounded like main bearing is about to jam. Do something about it!

10 May 2005
Stayed at hotel because of illness

11 May 2005
Arrived at HQ at approximately 0915
Sorting out data and double-checking calibration values while waiting for car.
Discussion with Mr. Quoc revealed that they do not have equipment for ozone calibration. Calibration is done by SVN and zero check is done by HEPA. They also lack procedures for carbon vane replacement in the PM_{10} pump.

Left for Hong Bang at 1140
Arrived **Hong Bang** at 1205
The external pump connection to intake manifold (glass) was broken and repaired with tape.
Last maintenance visit was 24 Jan 2005 for O_3
Last maintenance visit was 23 Feb 2004 for NO_x
Last maintenance visit was 24 Apr 2005 for CO
24 Apr 2005 The API 300 was switched off. Source warning and sample flow warning, no measurements.
11 May 2005 Testing API 300 (CO) shows Sync warning and source warning. The filter wheel is probably stuck and IR-source is broken.
The DANIDA sites have not been properly run since the span gas cylinders were empty in 2002/2003.
Left Hong Bang at 1255

Arrived **DOSTE** at 1310
API 200 A (NOx); System reset message indicates power break. A zero warning could be malfunctioning Azero solenoids. The pump is making a terrible noise. Although flows are OK, the RCEL press is 50 % above max. The SAMP pressure is just a fraction under max limit. All this indicates that pump service or replacement is urgently needed. You don't get correct measurements outside the permitted range.

Last maintenance visit 28 Apr 2005 showed API 200 A RCELpress warning.
Previous visit was 16 Aug 2004!
API 100 A was moved to HQ 14 Jun 2005.
Last maintenance check on API 300 was on 28 Apr 2005.

Previous visit was 04 Oct 2004!
Left DOSTE at 1350

Arrived **Thon Son Hoa** at 1400.
No interior lights.
No charcoal filter on the NO_x pump exhaust from API 200 A (NOx).
The API 300 (CO) and API 100 A (SO_2) is at HQ.
Left Thon Son Hoa at 1425
Back at HQ 1435.
Difficulties in finding calibration data due to the fact that there has not been any calibration by HEPA since span gas cylinders were emptied. One understands that this task has been performed by SVN. In that case where are the calibration results??

12 May 2005
0915 arrived HQ.
0925 left for District 2.
1000 arrived **District 2**.
The tree close to the gangway on the roof has pressed against the handrail such that the handrail had collapsed. Closer inspection revealed that corrosion had done much of the pre-work. Pressure from the tree did the rest. The tree must be cut down for two reasons; one to avoid reoccurrence, two to avoid influence on the air sampling intakes.
The air conditioning unit was now repaired and worked well. Temperature was now + 29 °C.
The air intake manifold pump vibrates and makes a lot of noise. Try to dampen the vibration.
The PM_{10} monitor was not running. It had been shut down after an attempt to repair squealing noise by introducing RP7 into the pump. The pump did not survive. The "super universal fix all" spray most probably caked carbon dust inside and thus made it stall. These pumps are designed to run dry. The solution is to dismantle the pump, clean out the chamber and the vanes before reassembling.
The gas monitors seemed to work OK, although the RCEL pressure in the NO_x monitor was 20 % under minimum with no alarms.

One suggests that span gas cylinder pressure should be recorded for every span check. This is to keep a track on consumption. Be very careful in closing the main valve after use. An open cylinder with closed regulator that is leaking will empty in a day or so.
The small set of drawers is really not suited to hold all the manuals. A small shelf on the wall will be better and make the manual more accessible.
1055 left District 2 for HQ.
1140 arrived HQ.

One understands that running 9 sites can be quite a challenge. A suggestion would be to divide the nine sites between three persons. Then they have three sites each to run with better control of the situation. They may also specialise in different monitors. The normal routine will be run well by the person responsible, but he/she can seek expert help from the colleague who has that particular monitor as his/her field if need be.

Once the data are collected and there are anomalies, the person responsible for the site should be contacted immediately to check out where the problem lies and appropriate action should be taken. If, for example, the PM_{10} yields no data, the tape may have run out. Then it is very important to stop the sampler to avoid contamination of the measuring head.

Appendix D

AirQUIS Performance

Appendix D1

Delivery List

Page 1 of 1

Project Name	HEIA
Project No	101143
Customer	HEPA
Date	16 May 2005

No of Items	Item Description	Status
	AirQUIS Documentation on file (PDF)	
1	1-2004-administration	Delivered
1	2-2004-import templates	Delivered
1	3-2004-measurement	Delivered
1	5-2004-model	Delivered
1	6-2004-GIS	Delivered
	AirQUIS Software	
1	AirQUIS_Setup_407	Delivered
1	AirQUIS 473 DLL directory	Delivered
1	CreateKernelAndInitData	Delivered
	Dump routines and data	
1	import.bat	Delivered
1	export.bat	Delivered
1	export_model_empty16May05.DMP	Delivered
	Documentation Forms on file (DOC)	
1	Datalogger specifications	Delivered
1	Export log	Delivered
1	How to establish the total AirQUIS system	Delivered
1	How to establish the total AirQUIS system	Delivered
1	How to install ORACLE 9i client for AirQUIS	Delivered
1	How to install ORACLE 9i server for AirQUIS	Delivered
1	How to Patch Oracle 9203 for Windows server	Delivered
1	Operational tips (updated)	Delivered
1	Password list (updated)	Delivered
	Consultancy	
1	Installation of total AirQUIS system (MHANG – Duong Thi Minh Hang)	Delivered
1	Short repetition of technical operation of AirQUIS and Operational tips (Nguyen Thanh Huy)	Delivered
1	Short repetition of import data into AirQUIS by using Drag-and-Drop method (Duong Thi Minh Hang)	Delivered

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Appendix D2

How to establish the total AirQUIS system

Project Name	HEIA
Project No	101143
Customer	HEPA
Date	16 May 2005

Step by step for how to establish the total AirQUIS system

Server

- Install Oracle server on the AirQUIS server. Please see documentation for How to install ORACLE 9i server for AirQUIS.
- Create the AirQUIS database on the AirQUIS server. Please see documentation for How to create ORACLE 9i database for AirQUIS.
- Configure ORACLE 9i client if you are running the server and the client on a same computer, if not skip this step.
- Log into Oracle database as system user e.g. with SQLPlus and run the initial setup SQL-script for AirQUIS CreateKernelAndInitData.sql.

PC Client

- Install the ORACLE 9i client on the AirQUIS client-PC. Please see documentation for How to install ORACLE 9i client for AirQUIS.
- Run the AirQUIS setup application e.g. AirQUIS_Setup_407.exe on the client-PC.
- Run the latest Service Pack for AirQUIS on the client-PC provided by NILU or when available from www.airquis.com.

Problems

If you encounter problems using the system and you are not able to solve them locally you should report the problems to NILU. Use the Procedure for Reporting Problems.

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Appendix D3

How to export and import AirQUIS projects

Project Name	HEIA
Project No	101143
Customer	HEPA
Date	12 May 2005

Routines for export and import AirQUIS projects

NILU has improved the export and import routines by introducing batch-files.

The operator needs only to modify the following variables in the import.bat and export.bat files before running the routine:

Import

Set ProjectName=	Fill in the project name to be imported e.g. hcmc
Set ProjectPassword=	Fill in the password for the project to be imported e.g. nilu
Set Database=	Fill in the name of the database e.g. airquis
Set DumpFile=	Fill in the path and the name of the dump file. The extension must be named DMP e.g. Z:\hcmc11May05.DMP
Set LogFile=	Fill in the path and the name of the log file e.g. Z:\import11May05.txt

Export

Set ProjectName=	Fill in the project name to be exported e.g. hcmc_mo
Set ProjectPassword=	Fill in the password for the project to be exported e.g. nilu
Set Database=	Fill in the name of the database e.g. airquis
Set DumpFile=	Fill in the path and the name of the dump file. The extension must be named DMP e.g. Z:\hcmcMo11May05.DMP
Set LogFile=	Fill in the path and the name of the log file e.g. Z:\export11May05.txt

More information

Please see AirQUIS - Administration User Guide for more detail explanations of the syntax.

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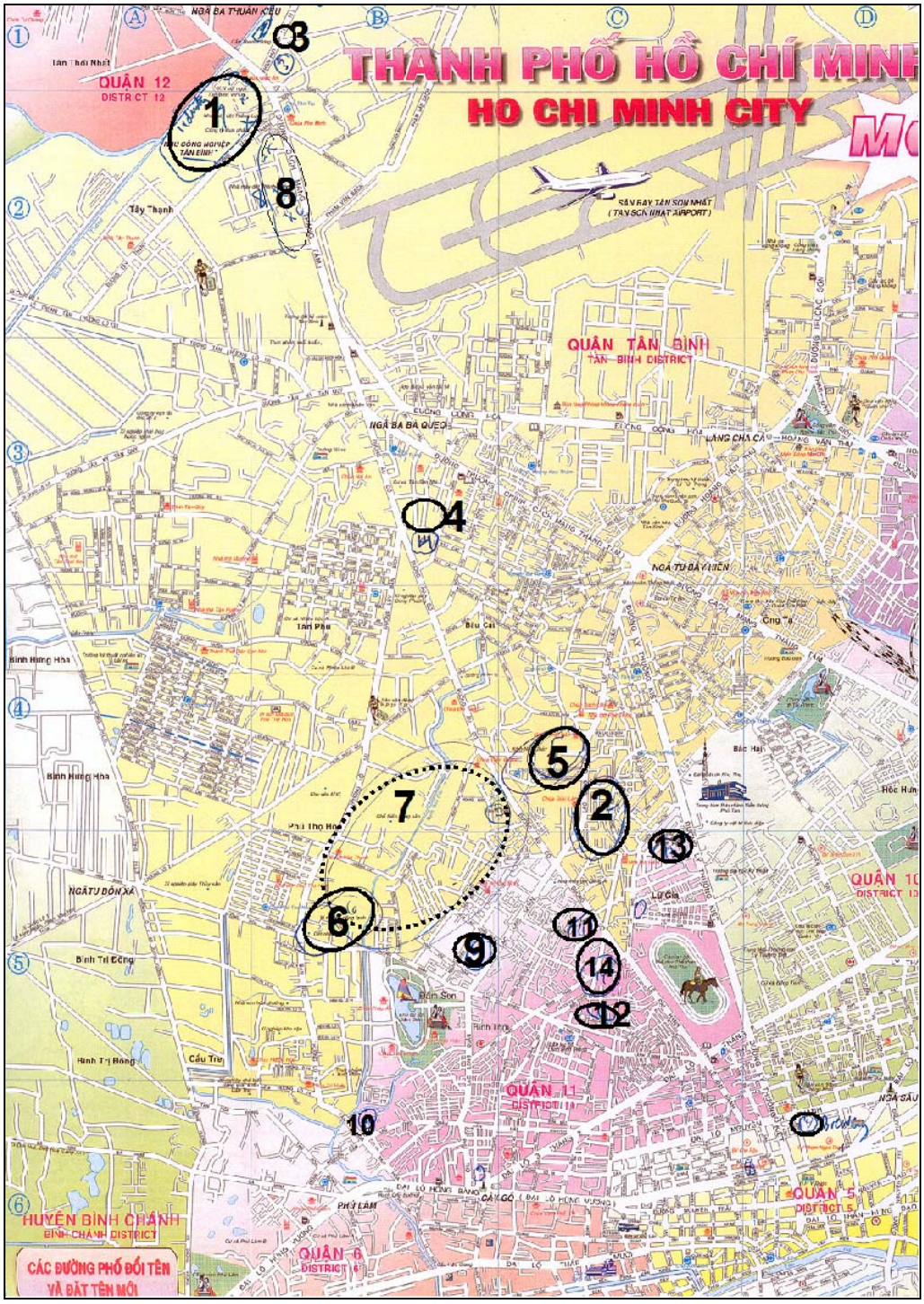
Appendix E

Industrial areas

Industrial areas in Tan Binh District and in District 11

A survey has been undertaken in the Tanh Binh District and in District11. Areas with industrial emissions to the atmosphere are indicated on the map below.



Tan Binh industries (from: Le Van Khoa, Relocation polluting industries)

Tan Binh is an inner district with an area of 38.45 km^2 and population of 657,000 people (dated 12/2001). Tan Binh is considered as the industry district of Ho Chi Minh City with many industrial activities (both in small scale and large scale). Statistically, at the end of 2001, except 82 state-owned enterprises, or foreign-invested enterprises directly under central government and city government, Tan Binh had also 5,131 industrial enterprises, including 6 state-owned enterprises, 11 co-operative enterprises, 216 limited-trade companies, 114 private companies, and 4,810 family-based enterprises, together employing about 50,000 labourers. Besides, Tan Binh Industrial Park has 93 enterprises that hire land, of which 36 enterprises now are operating.

From 1996 to 2000, industrial production and small-scale industry of Tan Binh had increased with an average of 15% per year. In 2001, the total value of industrial production of Tan Binh District was 3,289 billion VND (219 million USD). It rose 17.6% as compared to 2000 and constituted 18.2% of the total production value of private enterprises of HCMC.

The economic development of Tan Binh District not only has contributed to the budget of the district, but also created many jobs for residents in the district and city. The industrial and commercial tax of Tan Binh has contributed to 65-70% of the total income of the district and Tan Binh industrial enterprises have attracted over 10,000 new labourers per year over the last years.

At the end of 2001, there were 387 out of 4,500 enterprises relocated or being closed by the PC of Tan Binh District. As part of the Relocation Programme, there are 399 among the 4,300 enterprises, which are required to be defined to relocate before 2004, because of their serious environmental pollution. 3,901 industries will be relocated in the following years. In order to facilitate this task, Tan Binh District has conducted some community-based interviews in which the enterprises and the related management units sit together to find out the best ways for the relocation process. However so far only 51 SMEs were moved to the suburban areas.

	Temp. (oC)	Dust (mg/m^3)	SO_2 (mg/m^3)	NOx (mg/m^3)	CO (mg/m^3)
Range of pollutant concentration	78 - 407	22 -226	1,420 - 4,812	186 - 626	10 - 473
Average concentration		166.3	3,452	529	95
TCVN-5939-1995 -A - applied for enterprises who started operation before 6/3/1995		600	1,500	2,500	1,500
TCVN-5939-1995-B - applied for enterprises who started operation after 6/3/1995		400	500	1,000	500

Appendix F

Status reports

Appendix F1

Weekly instrument status report

HEPA

HCMC, 15-07-2005

Environmental Quality Monitoring & Assessment Division *week 28*

	DOSTE	TSH	TD	HB	ZOO	QT	D2	TN	BC
SO_2	In repair	PMT temp warning (=11..9)	Run OK.Need to do zero, span Cal			Run OK. But can not do CAL	Shutter warn . =>Cleared. Do zero & span CAL	System reset . =>Cleared. . Do zero & span CAL	
NOx	Ok	Azero warning	Run OK.Need to do Zero, Span CAL	In Repair	Ozone Flow warning=> Cleared. . Do zero & span CAL	Turn off	System reset . =>Cleared. . Do zero & span CAL	Turn off	Ok. . Do zero & span CAL
CO	Ok	In Repair		Ok				System reset . =>Cleared. . Do zero & span CAL	Ok . Do zero & span CAL
O_3	Ok	Ok		Ok	Ok	OK	System reset . =>Cleared		
PM10	OFF	OFF			0000.00 Offset: -64%	0000.00 offset: 19%	0000.00 offset: 8%	0000-00 Offset:-27%	0000-00 Offset: -21%
Power	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok
Tel	Ok.	Ok.	Ok	Ok	Ok	Ok	Ok	Ok	Ok
Trans Data	Ok	Ok	Not Ok.	Ok	Not Ok.	Not Ok.	Ok	Not Ok.	Ok
Other devices			Datat logger doesn't run.		PM10 data can't tranfer to datalogger				
Comment									

HCMC, 20-05-2005

Environmental Quality Monitoring & Assessment Division *week 20*

	DOSTE	TSH	TD	HB	ZOO	QT	D2	TN	BC
SO_2	In repair.	In Repair.	In Repair			System reset; Can't transfer data to datalogger	Ok.	System reset	
NOx	Ok.	Ok.	In Repair.	In Repair	Ok.	Turn off.	Rcell pres warn Ozone fl warn Sample fl warn => Cleared	Turn off	Ozone flow warn. Sf warn => cleared
CO	Ok.	In Repair		Turn off.				System reset	Ok.
O_3	Ok.	Ok.		Ok	Ok.	System reset; Vacuum press warn; Orifice temp warn => Cleared	Ok.		
PM10	OFF	OFF			0000.00 Offset: -59%	0000.00 offset: 40%	0000.00 offset: -62%	0000-00 Offset:-71% => turn Off	0000-00 Offset: -17%
Power	Ok	Ok	Off	Ok	Ok	Ok	Ok	Ok	Ok
Tel	Ok.	Ok.	Ok	Ok	Ok	Not Ok.	Not Ok.	Ok	Ok
Trans Data	Ok	Not Ok.	Not Ok.	Ok	Ok	Ok	Ok	Ok	Ok
Other devices	new rebuildkit O3=> OK					Adjust offset (-74%=> 40%) and replace new filter; Change new rebuildkit O3=> OK			Adjust offset (-74%=> -17%) and replace new filter new rebuildkit CO => OK
Comment				CO:need to replace new IR source					

Appendix F2

Overview of spare parts as of June 2005

Part No.	Monitor	Item	Qty	Status	Delivery date
057-000010	API 100 A	CD, PMT, NOx low noise	1	Ordered	19.apr.04
057-000000	API 200 A	CD, PMT, SO2 low noise	2	Ordered	19.apr.04
KIT000124	?	CPU Card Assy	1	Ordered	19.apr.04
002620100	API 100 A	UV lamp assy	2	Ordered	19.apr.04
005140300	API 100 A	V/F Card Assy	1	Ordered	19.apr.04
013400000	API 100 A	PMT, SO2	1	Not ordered	
014610000	API 100 A	Cooler Assy	1	Not ordered	
FL 0000001	API 100 A	Sintered filter for orifice	1	Not ordered	
KIT000093	API 100 A	214 nm UV Filter new p/n 002710000	1	Ordered	19.apr.04
OP 0000012	API 100 A	UV detector	1	Not ordered	
OR 0000001	API 100 A	O-ring flow control	10	Not ordered	
OR 0000004	API 100 A	O-ring optic/cell, cell/trap	5	Not ordered	
OR 0000006	API 100 A	O-ring cell/PMT	5	Not ordered	
OR 0000007	API 100 A	O-ring PMT, Barrel, Cell	5	Not ordered	
OR 0000013	API 100 A	O-ring UV Detector	5	Not ordered	
OR 0000015	API 100 A	O-ring PMT Filter	5	Not ordered	
OR 0000016	API 100 A	O-ring UV Lens	5	Not ordered	
OR 0000018	API 100 A	O-ring Sample Filter	5	Not ordered	
OR 0000025	API 100 A	O-ring Zero Air Scrubber	5	Not ordered	
OR 0000042	API 100 A	O-ring Sensor Assy	5	Not ordered	
OR 0000046	API 100 A	O-ring Permeation Oven		Not ordered	
PU0000022	API 100 A/3	Pump rebuild kit, KNF Mod. NO5ATI		Ordered	19.apr.04
PU0000022	API 300	Pump rebuild kit, KNF Mod. NO5ATI	11	Ordered	19.apr.04
PU0000022	API 400 A	Pump rebuild kit, KNF Mod. NO5ATI		Ordered	19.apr.04
000940400	API 200 A	Critical orifice (blue) 4 mils	10	Not ordered	
000940600	API 200 A	Critical orifice (red) 10 mils	10	Not ordered	
002270100	API 200 A	Gasket (RxCell) qty 12	2	Not ordered	
002730000	API 200 A	Filter window Rx Cell chamber	1	Not ordered	
005140300	API 200 A	V/F Board	1	Ordered	19.apr.04
011930000	API 200 A	PMT NOx	1	Not ordered	
014080100	API 200 A	HVPS	2	Ordered	19.apr.04
016810400	API 200 A	O3 Generator assy	1	Not ordered	
021070000	API 200 A	PMT preamp Card	1	Ordered	19.apr.04
FL 0000001	API 200 A	Sintered filter for orifice	10	Not ordered	
KIT0000019	API 200 A	Replacement Cooler Assy for 100A and 200 A	1	Not ordered	
KIT0000110	API 200 A	Moly Converter w/o valves	1	Not ordered	
OR 0000001	API 200 A	O-ring flow control	10	Not ordered	
OR 0000002	API 200 A	O-ring both ends reaction chamber sleeve	5	Not ordered	

Appendix G

Report on Air Quality in HoChiMinh City

AIR QUALITY IN HOCHIMINH CITY

March 2005

1 Introduction

Air quality and environmental monitoring is an important part of controlling the environmental quality and represents the basis for identifying solutions for improvements and protection of the natural environment.

The HCMC Environmental Protection Agency (HEPA) is responsible for the air quality monitoring programme in Ho Chi Minh City. The purpose of these tasks is to (1) evaluate the state of the environment; (2) identify and predict the environmental quality; (3) publish and disseminate environmental quality monitoring results; (4) consult and suggest the environmental strategies for the HCMC authorities.

2 The automat air quality monitoring network in HCMC

The automatic air quality monitoring network has been operated since June 2000. The first phase was supported by UNDP and DANIDA. Four sites were installed in 1999; the two urban background stations (Tan Son Hoa – 56 Truong Quoc Dung and Thu Duc) and 2 roadside stations (DOSTE – 244 Dien Bien Phu Dist. 3 and The Hong Bang Secondary School – Dist. 5). From November 2002, the automatic air quality monitoring network was increased and improved by the establishment of 5 sites more that financed by NORAD.

Figure 1: The air quality monitoring sites in HCMC. March 2005.

1

The NORAD stations consist of 2 urban background stations (Quang Trung and Zoo), 2 roadside stations (Thong Nhat Hospital and Binh Chanh) and one residential/industrial station (District 2).

3 Meteorology

Results from the meteorological measurements taken at the DOSTE station is presented as wind frequency distribution (wind rose) in the Figure 3-1.

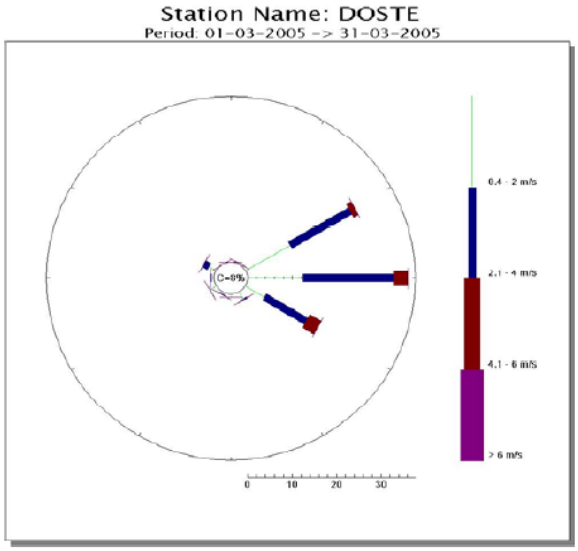


Figure 3-1. The frequency of wind directions in 12 sectors (wind rose) measured at the DOSTE station from 1 March 2005 to 31 March 2005.

The prevailing wind direction in March 2005 was from around east ± 45 deg, and the wind speeds were most often less than 4 m/s.

4 The air quality in HCMC (March 2005)

The air quality standards given for Vietnam are presented in Table 4-1. Both the existing standards from 1995 and the new proposed standards to be used from 2005 are presented in the table.

Table 4-1. Vietnam Standard for the ambient and roadside air quality

No	Variables	TCVN 5937 – 1995			TCVN 5937 – 2005			
		1 hour	8 hour	24 -hr	1 hour	8 hour	24 hr	1 year
1	CO (mg/m^3)	40	10	5	30	10	-	-
2	TSD (µg/m^3)	0,3	-	0,2	300	-	200	140
3	PM10(µg/m^3)				-	-	150	50
4	O_3 (µg/m^3)	200	-	60	120	-	80	-
5	NO_2 (µg/m^3)	400	-	100	200	-	-	40
6	SO_2 (µg/m^3)	500	-	300	-	-	125	50

Notes: "-" have no regulation; "TCVN 5937 – 2005": not yet enforced.

The air quality monitoring results and the data quality are summarized in the *Table 4-2*.

Table 4-2. Monthly data availability, max hour and monthly concentration in March 2005

Variables	Sites	Total N	Valid N	%	Percentile 98	Max hour	Average 03-2005	Average 03-2004
PM10 µg/m^3	BC	731	668	91.3	207.	248.	110.0	71.4
	QT	731	699	95.6	201	246	101.6	-
	TN	731	727	99.4	157	304.	52.0	67.8
	ZO	731	705	96.4	216	248	90.0	73.9
	D2	731	720	98.4	193	300	71.4	64.3
O_3 µg/m^3	ZO	731	720	98.4	164	205	49.9	60.8
	DOSTE	697	669	95.9	147	199	44.7	3.6
	QT	731	721	98.6	195	246	68.4	43.0
	D2	731	721	98.6	181	215	53.4	44.4
	HB	731	726	99.3	127	190	41.6	37.4
CO mg/m^3	BC	731	661	90.4	7.8	11	2.8	4.5
	HB	731	506	69.2	8.9	18	3.0	2.5
	DOSTE	696	622	89.3	10.9	15	4.3	-
	TN	731	730	99.8	10.1	16	2.9	2.7
NO_2 µg/m^3	BC	731	664	90.8	92.8	128	44.0	37.8
	D2	731	723	98.9	39.9	70	16.7	13.5
	TN	731	373	51.0	37.7	148	34.5	74.8
	ZO	731	729	99.7	48.4	107	21.5	19.6
SO_2 µg/m^3	QT	731	141	19.2	74.6	83	16.9	34.7
	TN	731	727	99.4	97.0	185	26.0	17.7
	D2	731	643	87.9	102.5	168	35.8	14.9

We see that for most of the data we had more than 90 % data availability in March 2005. The SO_2 and NO_2 concentrations are not extremely high, and they never exceeded the Vietnam standards. PM_{10} and ozone concentrations on the other hand were high and standards may have been exceeded.

4.1 Roadside air quality

4.1.1 PM10 concentrations

The hourly concentrations of PM_{10} varied considerably over the day as seen in Figure 4-1. The PM_{10} concentration during working hours (8h – 17h) was higher than this in the night time (0h – 5h). This was a result from the high activities of the traffic, construction work and industrial activities during day time. In addition, the PM10 concentration in Binh Chanh was also high in the evening from 2100 to 2200 hrs. Binh Chanh may have been impacted by emissions from heavy trucks, which are only allowed to operate after 2100 hrs.

In March 2005, the PM_{10} concentration at Binh Chanh was higher than at Thong Nhat due to the differences in traffic density. The construction activities in the Binh Chanh area

were also higher. The most frequent wind in March blowing pollutants towards west from the city centre to the Bingh Chanh area could cause increased PM_{10} levels.

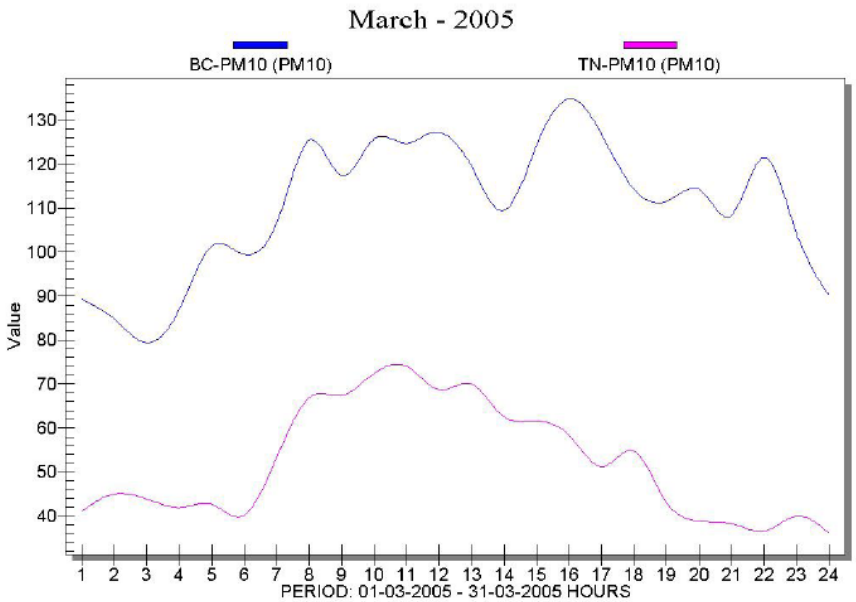


Figure 4-1. The average diurnal variation of hourly PM_{10} concentrations measured at Binh Chanh and Thong Nhat during March 2005

The Breuer diagramme for measurements of PM_{10} at Thong Nhat hospital is shown together with the wind rose in Figure 4-2.

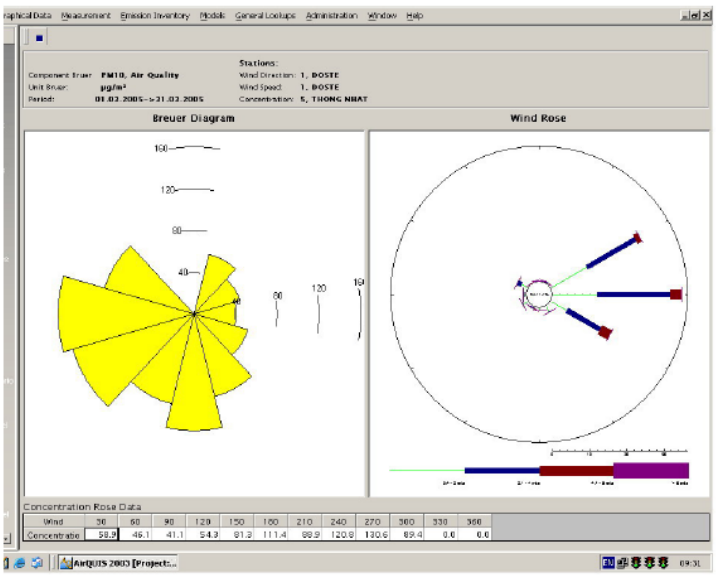


Figure 4-2. The average PM_{10} concentrations measured at Thong Nhat as a function of wind directions measured at DOSTE for March 2005.

Figure 4-2 shows that the highest concentrations of PM_{10} observed at the Thong Nhat station was measured during a few hours with winds from west and west-southwest. These are the directions when it was blowing from the street to the station. The average concentration of PM_{10} was 120 $\mu g/m^3$ in these cases. For winds from east, which was the most frequent wind direction, the average PM_{10} concentration was measured at 40 $\mu g/m^3$.

The cumulative frequency distribution of PM_{10} concentrations measured at Binh Chanh and Thong Nhat is presented in Figure 4-3.

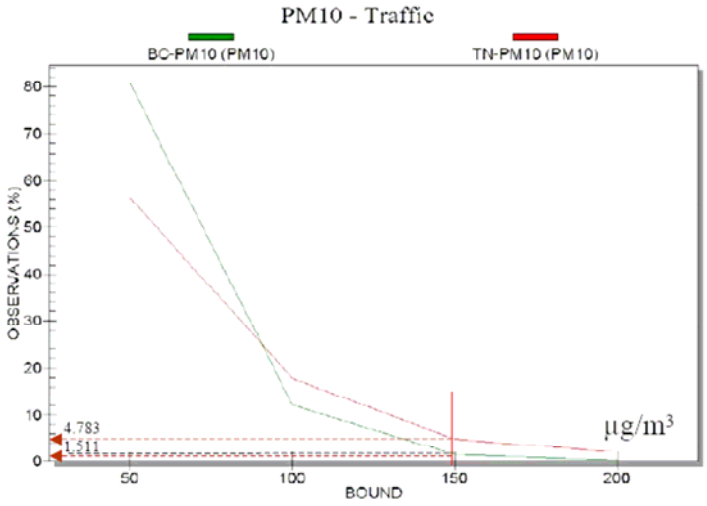


Figure 4-3. The frequency (in %) of 24 hour average PM_{10} concentrations above bounds, as measured at Binh Chanh and Thong Nhat during March 2005

The observed concentrations have been compared to the Vietnam Standard (TCVN 5937–2005; for PM_{10}, which is 150 $\mu g/m^3$ for a 24 hour average). The frequency of exceedances was 1.5 % at Binh Chanh and 4.8 % at Thong Nhat.

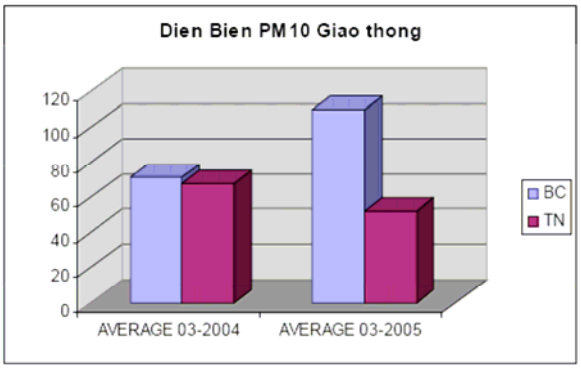


Figure 4-4; Monthly average concentrations of PM_{10} measured during March 2004 and March 2005.

A comparison with the monitoring results in March 2004 as presented in Figure 4-4 indicates that the concentrations at Binh Chanh increased while the CO levels at Thong Nhat had been reduced.

4.1.2 Carbon monoxide (CO)

The hourly average CO concentrations are presented as a function of time of day in Figure 4-5. The highest CO concentrations were observed during rush hours (0630 to 0900 hrs and between 1700 and 1900 hrs). This is probably a result of very high traffic density and and traffic jam with cars idling. The CO concentrations decreased at the very low level in the early morning hours between midnight and 0500 hrs.

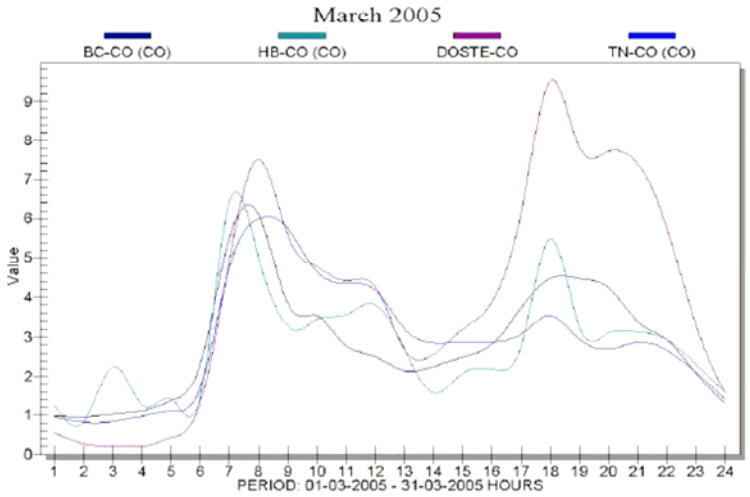


Figure 4-5. The average diurnal variation of hourly CO concentrations measured at 4 sites in HCMC during March 2005.

Comparison with the Vietnam Standard (TCVN 5937–2005), which gives a limit value for CO concentrations at 5 ug/m3 as a 24-hour average, is presented in Figure 4-6. At DOSTE the CO concentrations exceeded the standard during 62.5% of the time. The exceedance at Binh Chanh was 28.8%, at Hong Bang 14.85% and at Thong Nhat 9.6% of the time in March.

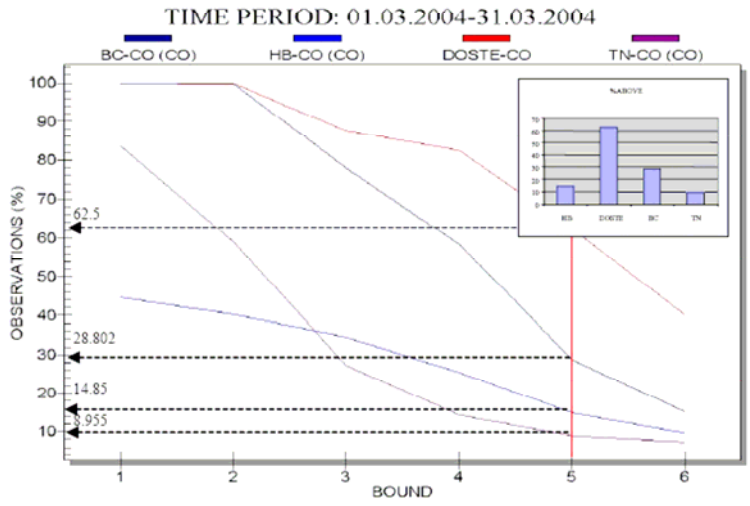


Figure 4-6: The cumulative frequency distributions of 24 hour average CO concentrations measured at four sites in HCMC in March 2005.

6

The highest hourly CO concentration during March 2005 ranged between 11 and 18 mg/m3 at the four stations in HCMC.

4.2 The urban background concentrations

4.2.1 PM_{10} concentrations

The monthly average PM_{10} concentrations at the urban background stations varied between 70 and 100 µg/m^3 in March 2005. Figure 4-7 shows the average diurnal variation of PM_{10} concentrations at the 3 urban background stations in HCMC.

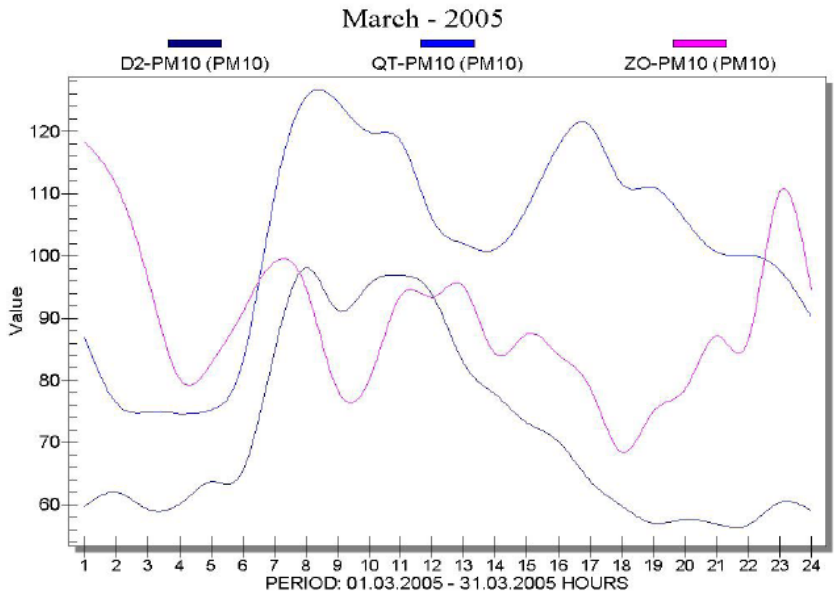


Figure 4-7: The average diurnal variation of PM_{10} concentrations (µg/m^3) measured at District 2, Quang Trung and Zoo during March 2005.

Figure 4-7 shows that hourly PM_{10} concentrations varied from hour to hour during the day. At Quang Trrung and District 2 the PM_{10} concentrations were clearly higher between 0700 hrs and 1100 hrs. At Quang Trung a secondary maximum occurred around 1700 hrs. The data from Xoo also shows a maximum around midnight, which was not measured at the other sites.

The frequency of PM_{10} concentrations exceeding three concentration limits is presented in Table 4-1. The Vietnam Standard (TCVN 5937–2005) for PM_{10} at 150 µg/m^3 as a 24-hour average is marked.

Table 4-1: Number of observations and percentage of exceeding the PM_{10} concentrations limits of 50, 100, 150 and 200 $\mu g/m^3$

Site	Concentration $\mu g/m^3$	Number of Obs. ABOVE	% ABOVE
District 2	50	354	66.3
	100	49	9.2
	150	3	0.6
	200	0	0
Zoo	50	478	74.5
	100	107	16.7
	150	24	3.7
	200	0	0

At Zoo 3.7% of the observations exceeded 150 $\mu g/m^3$ for PM_{10}. At District 2 the PM_{10} concentrations were exceeded only 0.6 % of the time in March 2005.

The monthly average PM_{10} concentrations are shown for March 2004 and March 2005 in Figure 4-8.

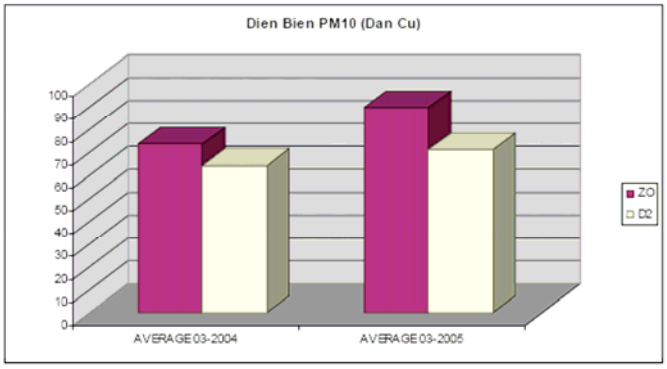


Figure 4-8. Monthly average PM10 concentrations measured at Zoo and District 2 in March 2004 and March 2005.

The PM_{10} concentrations increased slightly from March 2004 to 2005.

4.2.2 Ozone (O_3)

The average diurnal variation of hourly ozone concentrations measured in March 2005 is presented in Figure 4-9. The O_3 concentrations show a significant fluctuation over the day. The O_3 concentration measured during the warmest part of the day, between 1200 and 1600 hrs, was significantly higher than during the cooler part of the day after sunset. The regionally formed ozone is dependent upon sun radiation.

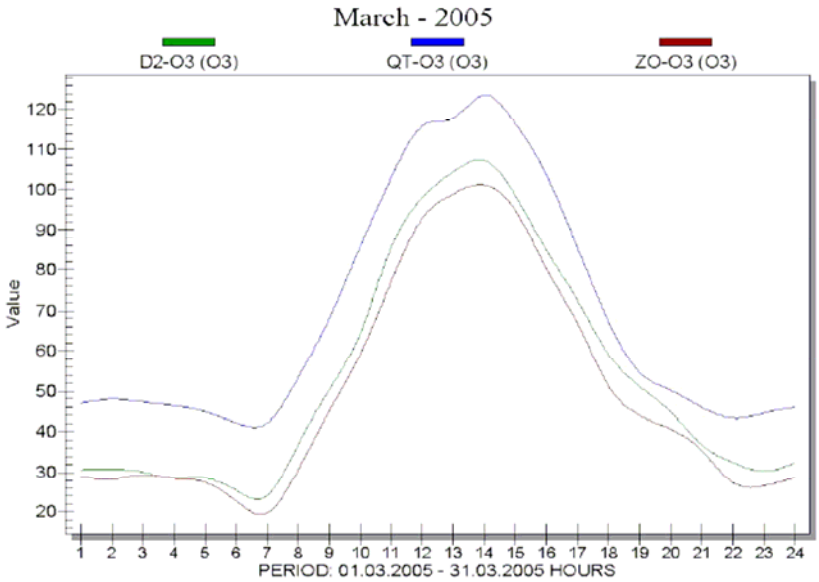


Figure 4-9. The average daily variation of ozone concentrations ($\mu g/m^3$) at 3 stations in HCMC during March 2005

The highest average concentrations of ozone were measured just after noon. The hourly concentrations varied between 96 and 122 $\mu g/m^3$ at this time of the day.

The new Vietnam Standard (TCVN 5937–2005) shows that the hourly ozone concentrations should not exceed 120 $\mu g/m^3$ and the 24-hour average should not exceed 80 $\mu g/m^3$. In Figure 4-9 we see that the ozone concentration limit values are exceeded at all four stations.

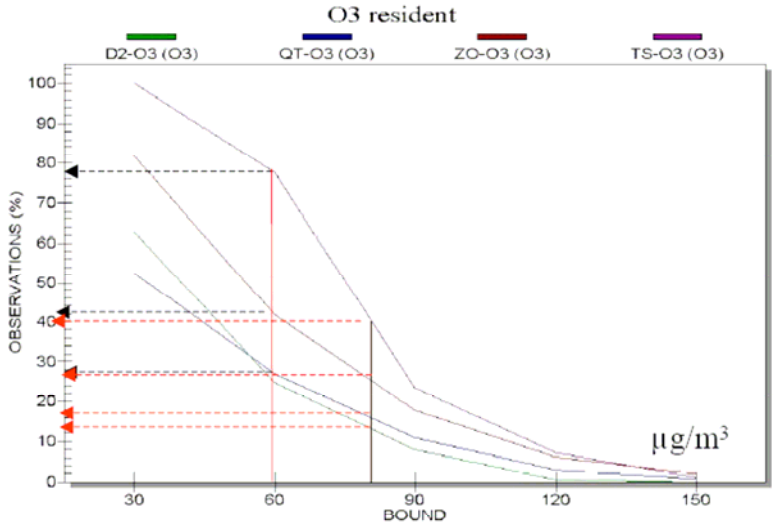


Figure 4-10: Cumulative frequency distribution of ozone based on data from four sites in HCMC, March 2005.

The percentage of data exceeding 80 $\mu g/m^3$ as a daily value was in March 2005 40 % at Tan Son Hoa, 27 % at Zoo, 16 % at Quang Trung and 12 % at District 2.

9

The monthly average concentrations of ozone were slightly higher in 2005 than on 2004 as shown in Figure 4-11.

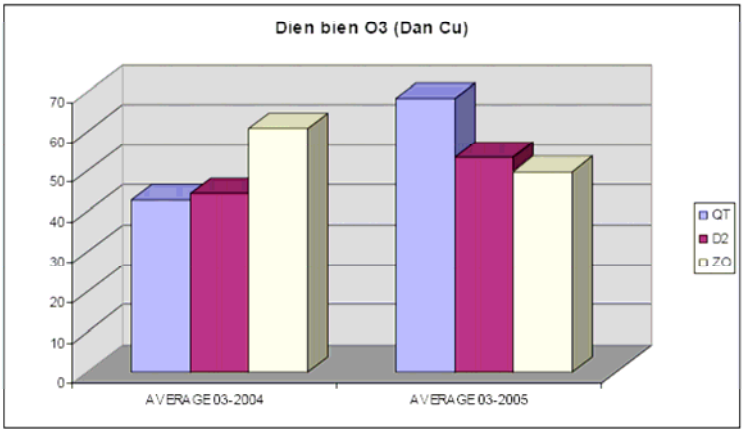


Figure 4-11:Monthly average ozone concentrations at three sites in HCMC, March 2004 and March 2005.

The highest monthly average ozone concentrations were found at Quang Trung, which is a kind of regional background station not heavily influenced by local traffic (NOx) emissions.

4.2.3 NO_2 concentrations

Monthly averages, 98-percetiles and maximum NO_2 concentrations measured at 3 sites in HCMC during March 2005 is presented in Figure 4-12.

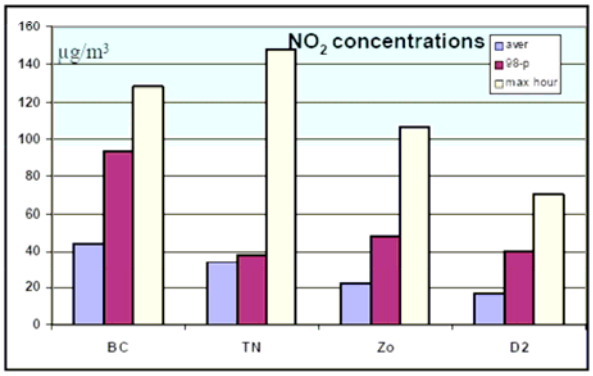


Figure 4-12: Monthly averages, 98-percetiles and maximum NO_2 concentrations measured at 3 sites in HCMC during March .

The monthly average concentrations varied between 17 and 44 µg/m^3. The highest hourly concentration, 148 µg/m^3, was measured at Thong Nhat hospital. The Vietnam air quality standards (TCVN 5937–2005) for NO_2 concentrations were only exceeded for the 24-hour average of 100 µg/m^3 at the Zoo station in March 2005. The frequency of exceedance was 0.27 % of the time.

Hourly NO_2 concentrations are plotted as a function of simultaneously observed ozone concentrations for measurements at District 2 in March 2005 in Figure 4-13.

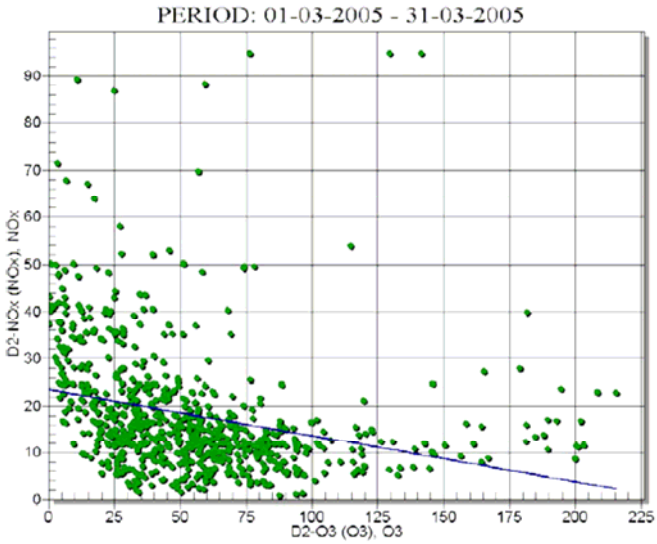


Figure 4-13. Simultaneous observations of ozone and NO_2 observed at District 2 for March 2005.

For ozone concentrations exceeding 150 µg/m^3 the NO_2 concentrations are less than 40 µg/m^3. There is a tendency that NO_2 and ozone are inverse proportional, which is a result of the fact that ozone is used to form NO_2 from the NOx emissions.

4.2.4 SO_2 concentrations

The diurnal variation of SO_2 presented in Figure 4-14 indicates that the SO_2 concentrations at Thong Nhat reach a maximum during rush hours.

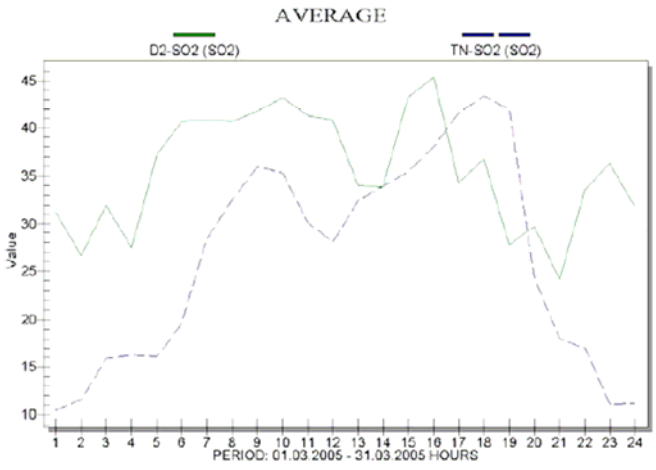


Figure 4-14. The average diurnal variation of hourly SO_2 concentrations (µg/m^3) at two stations in HCMC measured during March 2005.

Also at District 2 there is a tendency of higher SO_2 concentrations during day time hours. This station is from time to time impacted by SO_2 emissions from industrial sources and

power plants. The highest concentrations are thus related to specific wind directions bringing the SO_2 plumes across the monitoring site.

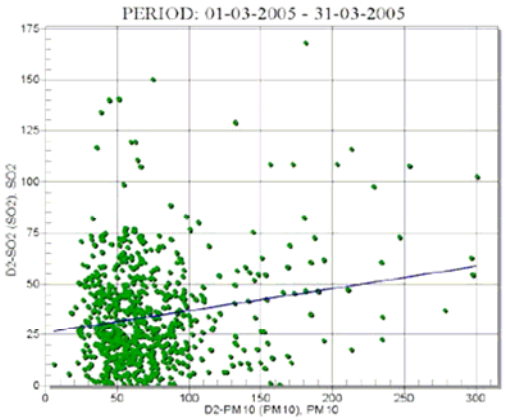


Figure 4-15. Simultaneous observations of hourly SO_2 and PM_{10} concentrations recorded at District 2. March 2005.

There is not a clear dependency between SO_2 and PM_{10}, even if the linear regression line indicates that there is an increase of SO_2 with increasing PM_{10}. If the correlation was better we could have concluded that we are observing the same source for the two pollutants.

The new Vietnam Standards (TCVN 5937–2005) for SO_2 was never exceeded during March 2005-06-22

Table 4-2. Number of observations and frequency of occurrence (%) of SO_2 concentrations higher than given bounds.

SO_2 – D2	BOUNDS	Num.Obs. ABOVE	% ABOVE
	30	276	42.137
	60	69	10.534
	90	16	2.443
	120	6	0.916
	300	0	0

SO_2 – TN	BOUNDS	Num.Obs. ABOVE	% ABOVE
	30	214	28.958
	60	60	8.119
	90	21	2.842
	120	7	0.947
	300	0	0

5 Assessment of air quality index (AQI) in March 2005

The air quality in HCMC is qualitatively classified by an air quality index (AQI). The AQI values are automatically calculated every day base on the measurements of PM_{10}, SO_2, NO_2, ozone and CO. The AQI values are divided into a road and traffic related AQI value and an urban background value.

The classification is presented in Table 5-1.

Table 5-1. Air quality index (AQI) values and classification

No.	AQI	Air quality
1	0 – 50	Good
2	50 – 100	Moderate
3	100 – 200	Poor
4	200 – 300	Bad
5	300 – 400	Hazardous

The AQI values estimated for each day during March 2005 is presented in Figure 5-1.

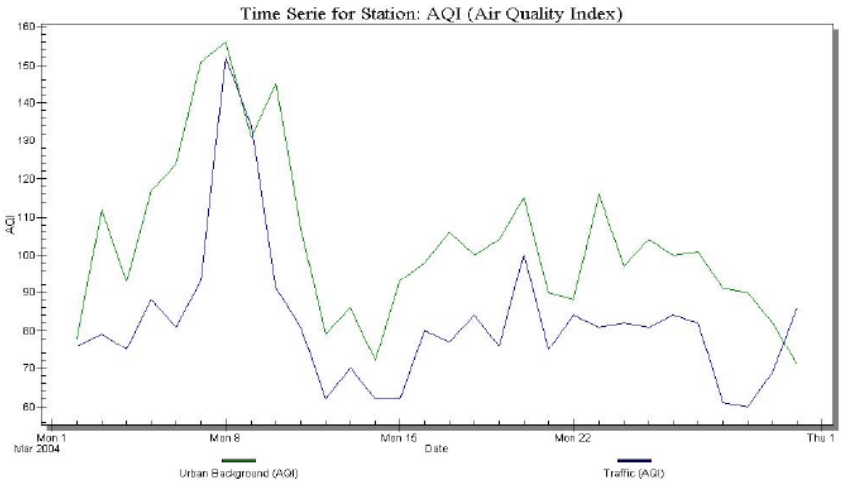


Figure 5-1: Daily values of the air quality index (AQI) estimated for HCMC, for traffic (blue) and urban background stations (green).

We see that poor air quality was observed during ten days in the beginning of March 2005. At the same time it is strange to observe that the urban background concentrations gave higher values of AQI than the traffic stations in March. This might be due to particularly high ozone concentrations in the background air. On the other hand we will have to re-examine the calibrations of instruments and the quality of individual instruments.

6 Conclusion

Generally the level of NO_2 and SO_2 is low to moderate The most critical air pollutants in HCMC during March 2005 were PM_{10}, CO and ozone. Especially during rush hours the concentrations of CO and PM_{10} increases and can exceed Vietnam air quality standards.

Ozone concentrations around noon and in the early afternoon are also very high.

Much of the air pollution situation in HCMC seems to be related to traffic emissions.

Appendix H

Minutes of meetings

Appendix H1

Ho Chi Minh City Environmental Improvement Project

Air Quality Monitoring Component, Reflab & training

HoChiMinhCity Ennvironmental Protection Agency
(HEPA/DONRE)
The Norwegian Institute for Air Research (NILU)

Minutes

Title:	**Project meeting no. 10**
Date	18 February 2005
Participants:	Bjarne Sivertsen (BS), Rolf Dreiem (RD), Mona Waagsbø (MoW), Gunnar Jordfald (GJ)
Prepared by:	B Sivertsen
Distribution:	Participants, The Nguyen Thanh, (TNT,) Leif Marsteen (LM), Rune Ødegaard (RuO), Paal Berg (PB), Le Van Khoa, Vo Thanh Dam

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1 Agenda

1. Project status just now, reports
2. The end of HEIA project- the start of HEIA2
3. Audits to stations in HCMC, when how?
4. Time schedule (preliminary) for HEIA 2
5. Procurement of instruments and equipment for Reflab.
6. Training needs assessment.
7. Air Pollution Poverty and Health (New project)
8. NILU/HEPA input to the Health project.
9 NILU possibilities in Hanoi (and National Vietnam?)
10. Time schedules and further work.
11. Other matters

2 Summary of meeting

2.1 Project status just now, reports

The HEIA project was finalised during Mission 5 in November-December 2004. The plans have been followed and performed according to the contract. A contract for a follow-up project on the development of a Reference Laboratory and additional training was signed during a ceremony at DONRE in HCMC on 16 November 2004.

The last two reports have been finalised (NILU OR 1/2005 and NILU OR 4/2005). The reports have been distributed to HEPA, DONRE and NORAD.

2.2 The end of HEIA project- start of HEIA 2

Information concerning the HEIA project was presented to DONRE during a meeting in HCMC on 2 February 2005. An overview of the economic situation concerning the NORAD financed HEIA projects was presented together with a time schedule for the next part of the HEIA project (HEIA 2) signed on 16 November 2004.

It was agreed also with NORAD in the meeting with L Landro on 28 January 2005 that the station audits that were not undertaken during the last Mission of the HEIA 1 project, due to

Rolf Dreiem's illness had to be carried out in 2005. The money, 312 000 NOK, was transferred to the HEIA 2 project.

An updated payment schedule for the total remaining budget of 2 012 463.- NOK was prepared and presented to DONRE (See Attachment 1).

2.3 Audits to stations in HCMC

The scheduled station audit to all the monitoring sites including maintenance, repair and some remaining training had to be postponed until the spring of 2005. This audit was originally planned for March 2005. However, because of the laboratory situation at HEPA (they had to move into new buildings in February), and the fact that spare parts had not arrived in HCMC from API/ USA in February, this audit was postponed again till after Easter holydays.

The station and instrument audit will thus be combined with training for the new Reference laboratory project and will probably be undertaken during May 2005 depending of the situation at HEPA.

2.4 Time schedule (preliminary) for HEIA 2

A preliminary time schedule was prepared for the HEIA 2 project. The final decisions concerning the performance, installations and further training will depend upon the situation concerning available personnel, offices and laboratories at HEPA. The time schedule discussed with DONRE on 2 February 2005 is presented in Attachment 1.

The situation in the beginning of 2005 was not easy, as HEPA with short notice had to move out of the preliminary office building and into another building. The moving and installations had not been finalised when this project meeting was arranged (18 February 2005).

2.5 Procurement of instruments and equipment for the Reference laboratory

The procurement phase has been finalized. Specifications of instruments, laboratory space and content as well as tools and benches was presented in November 2004.

These specifications have been used to request an offer from API. This offer has not arrived yet. After receipt of the offer, NILU will evaluate the content as well as prices and finally place an order at API.

The further plan is to have all equipment available in HCMC before August 2005 for installations in the Reference laboratory in September, when also testing will start.

2.6 Training needs assessment.

An assessment of further training will be materialized based on further discussions with HEPA personnel. We have already planned to perform on-the-job training in instrument calibrations, maintenance and repair. Additional workshop and seminars has been indicated as part of the establishment of the Reference laboratory including the QA/QC procedures.

One seminar will also be conducted to increase the understanding of the air pollution issues. The objectives are to improve the capacity building and to assure that the HEPA personnel will be able to conduct air quality assessment studies and air quality planning.

Training in the application of AirQUIS as a basis for performing abatement strategy planning will be continued, but the work itself will have to be undertaken locally. NILU may, if wanted, participate in the process as part of the on-the-job training programme.

2.7 Air Pollution Poverty and Health (New project)

Information was given concerning the new Air Pollution Poverty and Health (APPH) project initiated by the Asian Development Bank (ADB). HoChiMinh City (HCMC) has been selected for a health study of this kind. The implementing agency for the project in HCMC will be the Department of Environment and National Resources (DONRE). In addition, local research organizations will be utilized for data collection and analysis in order to maximize the capacity building effort of the project. The principal project co-ordinating institute will be the Health Effect Institute (HEI) from Boston USA. NILU will become subcontractor to HEI.

Investigations have shown that the air quality data collected by HEPA (HCMC Environmental Protection Agency) is of adequate quality for a health study of this kind. The ToR presented by ADB indicated that HEPA/NILU might have to support information about the air pollution related to:

- Ambient concentrations in a variety of microenvironments,
- Neighbourhood concentrations,
- Outdoor/indoor concentrations, and /or
- Personal (individual) exposures assessed by time and location

The air quality monitoring network and the air quality management system developed at HEPA for DONRE/HEPA has been delivered by NILU based on funds from NORAD. HEPA is presently operating nine monitoring stations. Danida provided the four first measurement sites. NILU is still co-operating closely with HEPA to improve and finalize the planning system including emission data and air pollution modelling.

2.8 NILU/HEPA input to the Health project.

To obtain the best possible input for evaluation of air pollution exposure in HCMC NILU has in a preliminary project proposal presented to ADB and HEI indicated that several steps will have to be taken:

1. Statistical treatment of the available air quality monitoring data directed to serve the Health study
2. Improvement of the emission inventory database using the available AirQUIS system already installed and operated by HEPA
3. Modification and improvement of the modelling capability to assimilate concentration fields based on both models and measurements
4. Additional simple and inexpensive measurements in selected receptor points/areas (micro environments)
5. Additional training of the HEPA personnel to meet the requirements of the Health study.

Detailed plans for these tasks will have to be developed when the Health study design has been finalised.

2.9 NILU possibilities in Hanoi (and National Vietnam?)

NILU has been asked by the World Bank to participate in a meeting on air quality monitoring and management in Hanoi. VEPA in Hanoi has expressed interest for a development of an air quality monitoring and management system in Hanoi similar to the existing network of monitoring stations already operated in Hanoi. A proposal has been presented to VEPA and included the main objectives and the actions and services needed to obtain a modern air quality monitoring and management system for Hanoi.

In the meeting in Hanoi NILU presented a typical AQMS platform. The NILU developed AirQUIS system and its possibilities was also presented.

To meet the objectives given for Hanoi NILU will offer to develop a GIS based Air Quality Management System based on the AirQUIS system which already is being operated by HEPA in HoChiMinh City.
The following elements will be included:

- Evaluation and improvement of existing measurements
- Improving the quality assurance and quality control (QA/QC) procedures
- Start collecting data for a Emission Inventory for point, line and area sources
- Perform Dispersion Modelling
- Improve reporting procedures
- Establish Air Quality information dissemination solution using internet

A major part of the development will include capacity building and training including:

- Understanding the air quality management concept
- How to operate monitoring network
- Data quality assurance, QA/QC procedures
- Statistics and reports
- Collection of data for the Emission Inventory
- Basic training in the use of dispersion and exposure modelling
- How to publish air quality information to the public using internet

2.10 Time schedules and further work.

Tasks and time schedules for the further work in HCMC was presented. Attachment 2 includes both the work needed to continue the HEIA 2 project as well as some preparations needed to meet the requirements of the APPH project.
Work indicated after December 2005 is mainly related to the ADB Health (APPH) project, where NILU/HEPA need to provide concentration estimates in specific areas or at specified receptor points. Experts from the IT and IMIS department at NILU will have to be involved in some of this development.

Deadlines for the different tasks are indicated in Attachment 2.

5

Attachment 1

Payment schedule for Reflab-training project of HEIA

An updated payment schedule for the continuation of the HEIA project beyond January 2005 is presented below, based on the tasks and time schedules presented in the technical descriptions of the Reference Laboratory project proposal.
The total budget for 2005 and beyond is composed of the remaining work from the first phase of the project, which had to be postponed due to hospitalisation of the instrument expert Mr R Dreiem, and the additional funds made available through the Reference lab project. The health problems of Mr Dreiem also caused a delay in some of the training component, which will have to be undertaken in the beginning of 2005. This total budget for the new Reference lab component is according to the new contract 1 732 000 NOK. The remaining budget from the first phase of the HEIA programme is 312 463 NOK (see table below).

The payment schedule for the total remaining budget of 2 012 463.- NOK is linked to some major milestones of the remaining HEIA project, including Mission Report (MR), such as:

Total budget and payments HEIA project

Invoice date	Number	Costs NOK
21.06.2002		2747130.83
06.02.2003		934226.24
12.06.2003		285221.77
28.11.2003		1101883.17
04.06.2004		478247.84
20.12.2004		514328.72
Credit		-127000
30.12.2004	24676	153498.15
Total payd		**6087536.72**
Budget		6400000
Remaining work Jan05		**312463.28**

1. The station and instrument audit programme including continued training as well as planning and preparations of the Reference laboratory (MR1)
2. Detailed planning and design of laboratory as well as further institutional building (MR2)
3. All equipment procured and tested (status report)
4. Mission to HCMC; installations and training started (MR3)
5. Workshops, seminar and on-the job training, reflab and modelling (MR 4)
6. Final visit, presentations and final report (MR 5)

The payment schedule below includes the milestones indicated above.
Individual payments are given in Norwegian Currency (NOK). Also accumulated payments are presented in the Table.

Payment schedule, cash flow estimate

Payment	Indicator, status	Report	Month . nr.	1000 NOK	1000 NOK accumul.
1	Audit and training	MR1	3	300	300
2	Planning and design	MR2	5	300	600
3	Equipment procured and tested	SR	9	800	1400
4	Installations and training	MR3	11	232	1632
5	Workshops, seminar inst. Building	MR4	13	200	1832
6	Final Mission, seminar, reporting	FR	15	180	2012
	Total budget			**2012**	

Terms of payment

Prices, total costs and a payment schedule are presented above. The payments for services will be made by NORAD directly to NILU in accordance with terms of the Contract upon receipt of invoices issued by NILU and certified by DONRE.
Particular conditions are described in the Service Contract "Particular Conditions".
.

Each invoice will be based on actual work and purchases performed. Time sheets and a documentation of reimbursable will be attached to the invoices. Travel, stay and per diem expenses shall be separately specified and invoiced according to the Norwegian Governmental rates unless otherwise is agreed upon. Travel time is additional cost and will be specified.

The invoices will be sent in original form to DONRE with a copy to NORAD and a notification by Fax or E-mail to DONRE. DONRE will send the approved original to NORAD after 10 calendar days. The payments are due forty five (45) days from the date of the invoice included 10 calendar days for the certification process at DONRE. Only disputed items may be withheld from the payments.

The prices for continual services shall not be changed during the Contract period. The price may be changed only upon renewal of the Contract. NILU may also claim price additions to cover documented increases in Norwegian customs or taxes, which are levied during the term of the Contract.

Currency fluctuations that influence costs, which are related to the NILU's Services, may be claimed upon by both parties as a ground for price adjustment upon written notice to the other party two (2) weeks in advance.

7

Attachment 2

Memo

Title	**Tasks for the continuation of the HEIA project**
Purpose	A specification of tasks that will have to be undertaken to check the database availability and quality and improvement of the modeling capacity.
Distribution	The Nguyen Thanh (TNT), Rolf Dreiem (RD), Leif Marsteen (LM), TB, PB, GJ, Mr. Khoa, Mr Dam,
Author	Bjarne Sivertsen
Date	4 February 2005
Reference No	O-101143

To continue the air quality monitoring and management programme in HCMC NILU will have to further support HEPA to perform the following tasks:

- Statistical treatment of monitoring data
- Data validations, availability and quality
- Insert Wards and population distributions in the AirQUIS GIS platform
- Continue emission inventorying
- Improvement of meteorological data input
- Modelling capability using the Haifa now-casting approach

Some of these tasks will have to start soon, other are intended for the new health related project financed by the Asian Development Bank.

The following list of tasks have to be discussed, designed and assigned to NILU experts:

Main task	Work content	Output	Resp	When
Air Quality data	Generate 24 h average data series of all parameters (included AQI), from all sites	Database in AirQUIS and on excel?	TNT/ Mona/ BS	Mar05
	Test verify, check quality and availability	Report	BS/IH	Mar05
Ward GIS	Insert the 300 Wards (shape and coordinates) in AirQUIS	Ward in AirQUIS	TNT	Feb05
Emission data	Area sources traffic, estimated in Wards + traffic data	Input Excel AirQUIS	BS	Feb05
	Emissions from small industries and enterprises, locations and activities	Area spec. and emission estimates	Dam	May05
	Identify more point sources from satellite photos ?	input to AirQUIS	BS	May05
	Correct existing point source positions	Input to AirQUIS	TNT/ Dam	Mar05

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Main task	Work content	Output	Resp	When
Meteorol. data	Check met tower DOSTE wind and temp data	Memo on corrections	BS/ Dam	contin
Met measurement	Improve AWS station HCMC, Vaisala	Install new AWS	RD/ LM	Sep05
Met data for modelling	Download met data from CSIRO CD for 2001-2005 , NILU database (AFV?)	Prepare wind data base	BDE/ TNT/ AFV	Aug05
Modelling	Test existing HCMC model AirQUIS versus measurements	Modelling report	SEW?/ BS	Sep05
	Develop new HCMC model based on Now-casting procedures	New model in AirQUIS?	BDE/ RuO	Dec05
	Test and verify model against data	Report	BDE ?	2006
Additional measurement	Design additional measurements (passive sampl and simple PM) in specific areas for health study	Additional input for model verific	BS	2006?

Tasks that have been indicated to be performed before Summer 2005 is linked to the existing programme and will have to be undertaken soon.

Work indicated after July 2005 is mainly related to the ADB Health project, where NILU/HEPA need to provide concentration estimates in specific areas or at specified receptor points.

NILU/IMIS will have to allocate experts to the project as indicated above. As part of the ADB Health project the Bank will pay for a visit of a modelling expert from HEPA to spend about one month at NILU. Details concerning this visit will have to be decided upon later.

Appendix H2

Ho Chi Minh City Environmental Improvement Project

Air Quality Monitoring Component, Reflab & training

HoChiMinhCity Ennvironmental Protection Agency
(HEPA/DONRE)
The Norwegian Institute for Air Research (NILU)

Minutes

Title:	**Project meeting no. 11**
Date	21 April 2005
Participants:	Bjarne Sivertsen (BS), The Nguyen Thanh, (TNT), Harald Willoch (HW), Leif Marsteen (LM)
Prepared by:	B Sivertsen
Distribution:	Participants, Mona Waagsbø (MoW), Rune Ødegaard (RuO), Gunnar Jordfald (GJ), Paal Berg (PB), Le Van Khoa (LVK), Vo Thanh Dam (VTD)

1 Agenda

1. Project status just now,
2. Instruments and spare parts; field instruments (HW/TNT)
3. Procurement of instruments and equipment for Reflab (LM/BS)
4. Audits to stations in HCMC, preparations (HW).
5. AirQUIS status, air quality data and input data (TNT)
6. Training needs assessment; prepare for seminars in October. (BS/LM)
7. NILU/HEPA input to the new ADB Health project (BS)
8. The status of the Hanoi air quality monitoring project (BS)
9. Time schedules and further work.
10. Other matters

2 Summary of meeting

2.1 Project status just now, reports

NILU has been working hard to correct air quality data and to obtain new emission data in AirQUIS. GIS update and import of Ward coordinates have also been on the agenda.

NILU has already spent 134 000 NOK on the project this year. We are still missing payment for the Internet page development. On 23 March Mr Khoa wrote that Dr Tuan has signed the contrast for HEPA's Website. "However, it has been lost. If you have not got it back, please give me a favour to send to us a new contrast. Sorry again for this mistake."

On 8 April we sent a letter to DONRE requesting the status concerning the establishment of the reference laboratory. (See Attachment 1)

2.2 Instruments and spare parts; field instruments (HW/TNT)

We have received lists of instrument status as well as a short list of spare parts available (See Attachment 2). We have several questions concerning the status of instruments and spare parts, and Mr Willoch will have to go through all this during his short stay in HCMC in May.

Willoch will also check with Mr Quoc the status on deliveries of spare parts, and prepare a list of missing spare parts related to the actual status of instruments.

2.3 Procurement of instruments and equipment for Reflab (LM/BS)

Instruments for the Reference laboratory at HEPA has been requested from Industriell Måleteknikk in Norway. They also delivered all the instruments for the NORAD financed part of the monitoring system in HCMC.

NILU has obtained a compatible price from the Norwegian company and the order will be placed at the end of April 2005.

2.4 Audits to stations in HCMC, preparations (HW).

Mr Willoch has prepared lists and plans for the audits to be undertaken in HCMC from Friday 6 May 2005. We will request the HEPA experts to start the audit programme already during the weekend to be sure that we will manage to finish before 11 May 2005.

Some of the time during that week will also have to be used for maintenance and repair training.

2.5 AirQUIS status, air quality data and input data (TNT)

The work concerning the use of AirQUIS for monitoring data as well as for modelling and air quality planning is a continuous process. To update NILU on the progress it has been proposed that Mr The will work with Mr Dam, who presently is in Singapore. They will work together for a few days and try to solve the following challenges, as Mr Dam wrote:

1. You will help me to reinstall the latest update and workable AirQUIS in my PC.
2. Import HCMC's Wards shape file into GIS of AirQUIS
3. Revise and input traffic counting data into AirQUIS
4. We will import correct locations of point sources, providing I receive the co-ordinates from my colleagues in HCMC

In addition to this work we will have to correct air quality data according to tests and corrections that have been undertaken at NILU.

Area sources (Wards), traffic sources (counting data) and point sources have to be updated, and we will have to run tests on concentration distributions.

Correct names and addresses for the contact persons working with AirQUIS at HEPA was updated:

- Mr. Nguyen Thanh Huy - thanhuy1210@yahoo.com - 090 848 9606 – Collection and quality assurance of measurement data
- Mr. Nguyen Bao Quoc - quocnguyen9718@yahoo.com - 090 847 9718 - Repair of the instruments/monitors (also with Mr. Nguyen Thanh Huy, Mr. Nguyen Toan Hung Dung, Mr. Le sanh Quoc Tuan)
- Miss Duong Thi Minh Hang - mhang_vn@yahoo.com - 095 877 1377 - Collection of emission data (line and point)and Modeling

2.6 Training needs assessment; prepare for seminars in October. (BS/LM)

During the Mission in May Mr Khoa together with Mr Bjarne will identify the specific needs for further training. NILU has indicated in the plans that the following topics will be covered:

1. Quality Assurance (QA) and Quality Control (QC) program, including updating existing standard operations procedures (SOP) and adding QA/QC as part of the Reference laboratory procedures (LM)

2. Air quality data control at the HEPA data centre, understanding concentration levels and correcting errors, prepare SOP for data control (BS),
3. Air Quality modelling and management, further on the application of the modelling tool (BS),
4. Training concerning maintenance and repair, mainly hands-on training (HW/LM)

2.7 NILU/HEPA input to the new ADB Health project (BS)

The Health Effect Institute (HEI) has prepared an updated project proposal. NILU has sent all comments and additions to the proposals but HEI reported on 7 April that they were still awaiting comments from the others. Then they will put a conference call together - likely sometime in the middle of April. As of 23 April no conference call has arrived.

Unfortunately, there is no more clarification on the dates of the next HCMC visit yet, but HEI has taken notes of NILU being in HCMC in the first two weeks of May.

2.8 The status of the Hanoi air quality monitoring project (BS)

There are two parallel activities going on in Hanoi.
Swisscontact issued a request for proposal on 17 March for a short expert mission (approx. one week) to:

1. Perform a detailed technical assessment of the five automatic fixed air quality monitoring stations and the one mobile unit available in Hanoi
2. Assess the training needs for station operators and design a customer-tailored training curriculum
3. Develop Standard Operation Procedures (SOPs) to be introduced and applied by all organizations involved in station O&M in Hanoi

NILU presented a detailed plan on 29 March 2005 concerning the:
"Air Quality Monitoring Implementation Plan, expert mission to Hanoi".
The plan itself was 10 pages as required plus annexes.
We have not heard from Swisscontact since, except for the following received also on 29 March:

```
Dear Bjarne, I confirm receipt of your proposal with many thanks.
You will hear from us in due time. Best regards Lukas Heer
```

The other activity concerning Hanoi is from the World Bank, who wants NILU to perform a study consisting of three specified tasks. The World Bank (Jitu Shah) has asked for about $140,000 for the tasks over a period of 15 months and would need NILU and CICERO (some time for Gunnar Eskeland) and appropriate time for local institutions.

The tasks identified are (short versions):

1. Infrastructure evaluation (CICERO/NILU)
2. Emission control strategy - analyse options (in close co-operation with local experts and Swisscontact?)
3. Institution analyses for sustainability (NILU +).

We have responded positively, but are waiting further details from WB.

2.9 Time schedules and further work.

Some of the tasks to be undertaken during the next visit to HCMC were mailed to HEPA on 6 April and contain the following topics:

1. Verify the quality of the collected data (GIS, measurement and emission) since our last visit in November 2004

2. Perform gap analysis of the existing data regarding improvement of the quality with focus on emission sources (line and point for now)
3. Prepare a report of the data together with the HEPA team and start preparing data for the Health project
4. Upgrade the existing AirQUIS version
5. Undertake complete audit of the measurement stations
6. Start the repair and maintenance training
7. Perform passive sampling of NO2 and SO2 based on the collected traffic data

We also asked status on pending activities:

1. Correction of location of the point sources in AirQUIS?
2. Ward shapes to be imported into AirQUIS?
3. Collection of the traffic data, have they been imported to AirQUIS?
4. The HEPA reference lab location

We will prepare a detailed time schedule for the visit and present and discuss this with Mr Khoa on the first meeting at HEPA on 3 May 2005.

Work to be performed during 2005 has been indicated in earlier meetings. An updated list is presented in Attachment 3.

2.10 Other matters

A new meteorological station to be placed at DOSTE has been requested from Vaisiala OY in Finland. The existing weather station at DOSTE, installed during the Danida project, has never been operated adequately as stated in several Mission reports. Good quality meteorological data are necessary for performing air pollution modelling. HEPA and NILU have thus agreed to use money from the budget to procure and install a new weather station at DOSTE. This station produced is now available at NILU and will be tested and prepared with the new NILU data logger and one additional temperature sensor for ground level measurements.

The instrument may be available for installation in HCMC during the installations of the Reference laboratory in September 2005.

5

Attachment 1

Letter to DONRE

Department of Natural Resources and Environment of Ho Chi Minh City
(DONRE)
53 Ly Tu Trong Strett
District 1
Ho Chi Minh City, Vietnam

Attention to: Deputy Director Mr Nguyen Van Chien.

Deres ref./*Your ref.*:	Vår ref./*Our ref.*:	Kjeller,
	BS/BKa/O – 101 143	8 April 2005

Concerning the Reference Laboratory for Air, NORAD project

We are referring to the Contract signed on 16 November 2004 between Department of Natural Resources and Environment (DONRE) and the Norwegian Institute for Air Research (NILU) concerning services performed by NILU as part of the Ho Chi Minh City Environmental Improvement Project: Air Quality Monitoring Component, Reference Laboratory and Training.

A room for the Reference laboratory will have to be identified at HEPA. The complete "Reference Laboratory" should then be equipped with gas monitors in addition to the multipoint calibration units, to enable calibrations of gas standards. NILU is presently preparing all the equipment and will install, test and start training at HEPA in HCMC from 1 September 2005. After preparations of the laboratory (room) expert personnel at HEPA will be trained to operate the monitors for calibration reasons.

The first Mission from NILU experts to HCMC will from 2 to 14 May 2005. To enable the project to progress adequately DONRE/HEPA will have to find an adequate room/laboratory according to specifications given before. The size of the room should be at least 30 m^2. Please inform us as soon as this room has been identified, and please give us informations about location, size and available furnitures. The rest of the benches, tables, chairs and aircondition etc. will be purchased as part of the NORAD financed project.

We are looking forward to hearing from you as soon as possible
Yours sincerely

Gunnar Jordfald
Director

Bjarne Sivertsen
Associate Research Director

HEIA\Project Meeting 11\BS April 2005

Attachment 2

Instruments and spare parts

Status instruments					
Instrumen	Error description	Error Date	Actions Done	Status	Station
API 100A	Sample Flow Warning; Shutter warning; conc= -38.8	11 Nov 03	Turn off	Not OK	Doste
API 400A	Orifice flow warning	07 Apr 05	No	OK	Doste
SM 200	Fatal error #4	08 Jan 03	Turn off	Not OK	Doste
API 100A	Shutter warning	28 Jun 04	Turn off	Not OK	TanSonHoa
API 300	Sample flow warning	29 Aug 04	Turn off	Not OK	TanSonHoa
SM 200	Fatal error #2	08 Mar 03	Turn off	Not OK	TanSonHoa
API 100A	Shutter warning; Sample flow warning(336)	28 Jul 04	Turn off	Not OK	ThuDuc
API 200A	Azero warning	16 Aug 04	Clean PMT cell.Turn off	Not OK	ThuDuc
SM 200	Fatal error #4	18 Nov 02	Turn off	Not OK	ThuDuc
API 200A	Azero warning	23 Fer 04	Turn off	Not OK	HongBang
API 300	Sample Flow Warning (443)	29 Mar 05	Clean lines	OK	HongBang
SM 200	Fatal error #9	08 Jan 03	Turn off	Not OK	HongBang
API 200A	Can not do Optic test (PMT: 951 mV)	06 Apr 05	Adjust PMT	Not OK	Zoo
API 400A	O3 Ref: 2898; O3 Meas: 2897	06 Apr 05	Adjust O3 Ref	Not OK	Zoo
API 100A	Can not do Calibration (PMT unstability)	04 Apr 05	Do Calibration but it can not be done	Not OK	QuangTrung
API 200A	Can not do Calibration (PMT unstability)	04 Apr 05	Do Calibration but it can not be done	Not OK	QuangTrung
API 400A	O3 Ref: 2941; O3 Meas: 2939	04 Apr 05	Adjust O3 Ref	Not OK	QuangTrung
API 200A	Can not do Optic test (PMT: 1712 mV)	04 Apr 05	Adjust PMT	Not OK	District 2
API 400A	O3 Ref: 2877; O3 Meas: 2976	04 Apr 05	Adjust O3 Ref	Not OK	District 2
API 100A	Optic test : 1586	21 Mar 05	No	OK	ThongNhat
API 200A	PMT unstability, Azero warning (5000)	15 Oct 04	Turn off	Not OK	ThongNhat
API 300	CO Ref: 3104.9; CO Meas: 3660.8; Electrical Test: 28.9	21 Mar 05	No	OK	ThongNhat
API 200A	Can not do Optic test (PMT: 2290 mV)	08 Apr 05	No	OK	BinhChanh
API 300	CO Ref: 2743; CO Meas: 3203; Electrical Test: 17.1	08 Apr 05	No	OK	BinhChanh

Spare parts as of April 2005 (ordered?)

Part No.	Part Name	No.	Delivery Date	Status
PU0000022	Pump Diaphragm Rebuilt Kit	11	19 Apr 2004	Ordered
5140300	V/F Card Assembly	1		
KIT000124	CPU card Assembly	1		
14080100	HVPS	2		
2620100	UV lamp	2		
KIT000093	214 nM UV Filter	1		
021070000	PMT Pream Card	1		
002680000	CD, PMT, SO2, Low noise	2		
002670000	CD, PMT, NOx, Low noise	1		

7

Attachment 3

Tasks to be undertaken (updated April 2005)

Main task	Work content	Output	Resp	When
Air Quality data	Generate 24 h average data series of all parameters (included AQI), from all sites	Database in AirQUIS and on excel?	MOW/ BS	March-May 05
	Test verify, check quality and availability	Report	BS	May05
Ward GIS	Insert the 300 Wards (shape and coordinates) in AirQUIS	Ward in AirQUIS	TNT	Feb05 May05
Emission data	Area sources traffic, estimated in Wards + traffic data	Input Excel AirQUIS	BS	Feb05 May05
	Emissions from small industries and enterprises, locations and activities	Area spec. and emission estimates	VTD	May05
	Identify more point sources from satellite photos ?	Input to AirQUIS	BS	May05
	Correct existing point source positions	Input to AirQUIS	TNT/ VTD	Mar05 May05

Main task	Work content	Output	Resp	When
Meteorol. data	Check met tower DOSTE wind and temp data	Memo on corrections	BS/ VTD	contin
Met measurement	Improve weather station at DOSTE in HCMC, Vaisala	Install new station	LM/ HW	Sep05
Met data for modelling	Download met data from NILU database (AFV)	Prepare wind data base	BS/RH AFV	April-Aug05
Modelling	Test existing HCMC model AirQUIS versus measurements	Modelling report	HEL/ BS	Sep05
	Develop new HCMC model based on Now-casting procedures	New model in AirQUIS?	BDE/ RuO	Dec05
	Test and verify model against data	Report	BDE	2006
Additional measurement	Design additional measurements (passive sampl and simple PM) in specific areas for health study	Additional input model verification	BS	2005 - 2006

NILU/IMIS will have to allocate experts to the project as indicated above. As part of the ADB Health project the Bank will pay for a visit of a modelling expert from HEPA to spend about one month at NILU. Details concerning this visit will have to be decided upon later.

HEIA\Project Meeting 11\BS April 2005

Appendix H3

Ho Chi Minh City Environmental Improvement Project

Air Quality Monitoring Component, Reflab & training

HoChiMinhCity Ennvironmental Protection Agency
(HEPA/DONRE)
The Norwegian Institute for Air Research (NILU)

Minutes

Title: **Meeting with Vice Director Nguyen Van Chien at DONRE**
Date 6 May 2005
Participants: Vice Director Nguyen Van Chien, Bjarne Sivertsen (BS), Le Van Khoa (LVK), Mme Nguyen Thi Tuyet Hoa
Prepared by: Bjarne Sivertsen
Distribution: Participants, Vo Thanh Dam (VTD), The Nguyen Thanh, (TNT),

---

1 Agenda

The meeting was called to discuss the infrastructures and personnel needed to fulfil the requirements of the NORAD financed HEIA Reference laboratory project.

2 Summary of meeting

To maintain the good reputation and quality of the HEPA air quality monitoring network in HCMC it is important that the facilities and the adequate manpower is being made available. The different options and possibilities were discussed as referred below.

2.1 Personnel needed

An analysis of the personnel required undertaking the tasks needed to keep up a good quality air pollution monitoring and management programme was presented.
The following tasks and experts have been identified:

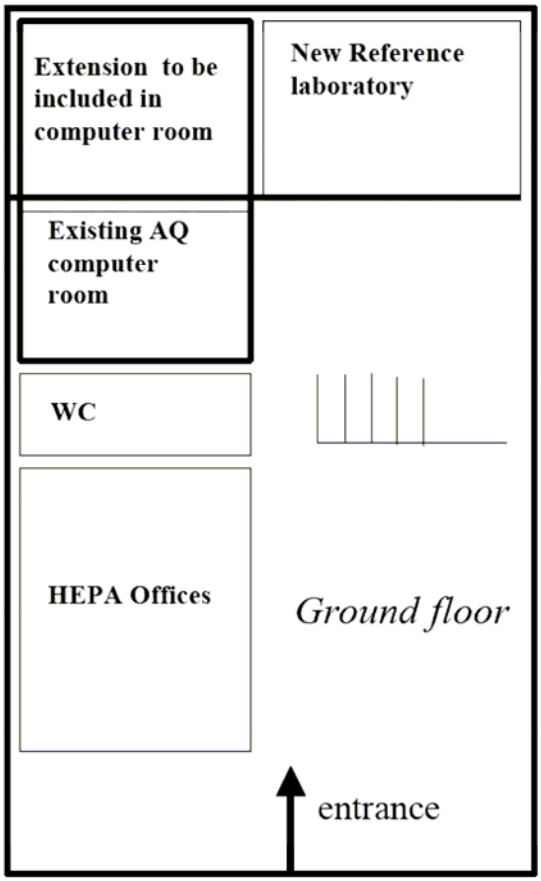
Expert person	N	Tasks	
Programme manager	1	To supervise and co-ordinate the different functions of the air quality monitoring and management programme and be the main responsible for quality in all parts of the programme, prepare summary reports	VTD
Air quality modellers and assessment experts	2	To prepare and undertake dispersion modelling, impact assessment and air quality management tasks, help preparing statistics for monthly reports	DTMH ?
Quality assurance officer	1	One expert to be responsible for the data quality assurance, according to SOP and procedures. Also to work as a data expert in the computer centre	NTH
Reference laboratory responsible	1	Responsible for multipoint calibrations, supervise maintenance and repair, knowledge of all instruments	NBQ
Field operator and instrument experts	3	Site visits, support field calibrations and daily, weekly and monthly data follow-up. Instrument instrument repair and maintenance	NTHD LSQT ?

According to the staff available today at HEPA there will be a need of at least two more experts. These experts will have to be available before September 2005.

2

Vice Director Chien approved the requirement and responded that this will be the responsibility of Mr. Khoa. It was understood that two new experts would be added to the staff in time before installations in September 2005. Vice Director Chien also pointed out that Mr Dam had already been appointed head of the Division of Environmental Quality, Monitoring and Assessment (EQMA) at HEPA.

2.2 Facilities for EQMA and Reference laboratory



According to the time schedule agreed between NORAD, DONRE and NILU the installations of the Reference Laboratory must be undertaken in September 2005. Instruments have already been ordered in Norway, and they will be ready for shipment in August.

The facilities available at HEPA to day are not adequate for the air quality monitoring and management programme. This was also agreed between Mr Khoa and Vice Director Chien.

Vice Director Chien also emphasized that HEPA would be located in 137 Nguyen Dinh Chinh Street for many years to come. HEPA has already applied to People Committee for proposal of 200 million Dong to undertake construction work necessary to facilitate the computer centre and the new Reference Laboratory. Mr Khoa will follow up on this matter and keep NILU informed about the status.

A sketch of the planned extension is shown to the left.

Personnel

Personnel available at HEPA as of May 2005 are shown in the following table.

Le Van Khoa (LVK),	Project Manager HEPA/DONRE
Vo Thanh Dam (VTD),	EDC, data retrieval, reporting, field
Nguyen Bao Quoc (NBQ),	Instrument expert, field operations
Nguyen Thanh Huy (NTH)	QA/QC, field operations, instruments
Nguyen Toan Hung Dung (NTHD)	Instruments and monitors, repair
Le Sanh Quoc Than (LSQT)	Instruments expert, field operations
Miss Duong Thi Minh Hang (DTMH)	Emission data, modelling

Appendix H4

Ho Chi Minh City Environmental Improvement Project:
Air Quality Monitoring Component; Reference lab

Department of Natural Resources an d Environment (DONRE
HCMC Environmental Protection Agency (HEPA
The Norwegian Institute for Air Research (NILU

Memo

Title	**Tasks undertaken 1 Jan-31 March 2005**
Purpose	A description of tasks performed during the first quarter 2005, related to invoice 25053, dated 29 April 2005.
Distribution	Mme Nguyen Thi Tuyet Hoa (NTTH), Mr. Khoa, Mr Dam, The Nguyen Thanh (TNT)
Author	Bjarne Sivertsen
Date	7 May 2005
Reference No	O-101143

The following tasks have been undertaken during the first quarter 2005, relating to the invoice dated 29 April 2005:

- Data quality assurance and training
- Daily concentrations
- Preparing audits
- Instrument status and spare parts
- Preparing the Reference Laboratory at HEPA
- Procurement of instruments
- New weather station for HEPA at DOST
- AirQUIS status and upgrades
- Modelling data input
- Internet pages
- Project meetings

1 Data quality assurance and training (HCMC)

A visit was paid to Hanoi and HCMC 28 January to 4 February 2005. In Hanoi we had meetings with NORAD to discuss the continuation of the HEIA programme and to report on the status of the project.

In HCMC we analysed air quality data, performed corrected actions and did some training on the data assessment at the computer centre. Procedures for data quality controls after imported to the database were also developed.

2 Daily concentrations

Work has been undertaken at NILU to transform hourly concentrations of air pollutants measured in HCMC since 2002 to daily average concentrations. These data have then been used to verify data availability and to quality assure the data available in the database. A draft report has been prepared based on this evaluation (NILU OR x/2005)

3 Preparing audits

Due to the health problems of Rolf Dreiem the audits to all stations in HCMC was postponed till May 2005. Mr Harald Willoch has taken over these duties and has prepared the audit documents to be brought to HCMC in May.

4 Instrument status and spare parts

Correspondence concerning available instruments, the status of instruments and available spare parts has been part of the preparations of the establishment of a reference laboratory at HEPA. Attachment 2 in the Minutes from the project meeting no. 11 at NILU shows the status as of 21 April 2005.

5 Preparing the Reference laboratory at HEPA

Specifications and discussions of the layout of the Reference Laboratory have been communicated between NILU and HEPA. A letter war prepared to DONRE on 8 April 2005 (see Attachment 1, Minutes from project meeting 11).

It was stated in this letter that a room for the Reference laboratory will have to be identified at HEPA before September 2005. The complete "Reference Laboratory" should then be equipped with gas monitors in addition to the multipoint calibration units, to enable calibrations of gas standards.

6 Procurement of instruments for the Reference laboratory

The procurement phase started in November 2004 and specifications of instruments, laboratory space and content as well as tools and benches was presented. These specifications have been used to request an offer from API. After receipt of the offer, NILU evaluate the content as well as prices and placed a new request at Industriell Måleteknikk in Norway. They also delivered all the instruments for the NORAD financed part of the monitoring system in HCMC.

NILU has obtained a compatible price from the Norwegian company and the order was placed at the end of April 2005.

The further plan is to have all equipment available in HCMC before the end of August 2005 for installations in the Reference laboratory in September, when also testing will start.

7 New weather station for HEPA at DOST

The automatic weather station located in the tower at DOST has never been working properly. Presently it seems like only the temperatures are correctly recorded. A new weather station, produced by Vaisala OY, arrived at NILU on 28 April 2005. This new type of automatic weather station will be tested and equipped with the new NILU data logger. The plan is to install the station at DOST in September 2005 as a "gift" from the NORAD/NILU project

8 AirQUIS status and upgrades

The work concerning the use of AirQUIS for monitoring data as well as for modelling and air quality planning is a continuous process. To update NILU on the progress it has been proposed that Mr The will work with Mr Dam, who presently is in Singapore. They will work together for a few days and try to solve the following challenges:

1. Reinstall the latest update and workable AirQUIS in Mr Dam's PC.
2. Import HCMC's Wards shape file into GIS of AirQUIS
3. Revise and input traffic counting data into AirQUIS
4. Import correct locations of point sources

Also air quality data will have to be corrected according to tests and corrections that have been undertaken at NILU.

Area sources (Wards), traffic sources (counting data) and point sources have to be updated, and test runs for concentration distributions will have to be prepared during the next Mission in May 2005.

9 Modelling data input

As indicated under the AirQUIS status above, NILU and HEPA have been working on preparing input to the dispersion models. The work has been somewhat delayed by the absence of Mr. Dam, who was trained at NILU to undertake these tasks.

New traffic counting data and the specification of wards has been prepared. Also the exact positions of the stack emission data have been corrected. Further work has been prepared to collect emission data from more of the industrial sources inside HCM City.

Meteorological data have been collected at NILU based on large-scale weather forecast data. Wind speeds and wind directions have been prepared for one year as a basis for creating a typical annual meteorological database. The meteorological data from the tower at DOST will also have to be corrected.

10 Internet pages

NILU supported HEPA with the establishment of the "AirOnline" part of the Internet pages created at HEPA. These pages are now being updated daily with information concerning the Air Quality Index for HCMC. This information is available on: www.hepa.gov.vn click AirOnline

11 Project meetings

Two project meetings have been held at NILU during the first quarter 2005. The minutes from these meetings are available in Mission 6 report. They have also been forwarded to HEAP and to NORAD.

Appendix H5

Ho Chi Minh City Environmental Improvement Project

Air Quality Monitoring Component, Reflab & training

HoChiMinhCity Environmental Protection Agenc
(HEPA/DONRE
The Norwegian Institute for Air Research (NILU

Minutes

Title: **Meeting with the HEPA staff at end of Mission 6**
Date 13 May 2005
Participants: The whole HEPA staff, Bjarne Sivertsen (BS) and The Nguyen Thanh, (TNT),
Prepared by: Bjarne Sivertsen
Distribution: Participants,

---

1 Agenda

The meeting was called to go through tasks and obligations to be undertaken during the next few weeks and months. B Sivertsen had prepared a list, and the HEPA staff added further points.

2 Summary of meeting

Brief summaries and comments concerning the 22 tasks discussed are presented in the following:

Task	Description	Responsible
1	Buy new calibration gases for the Danida stations, new gases available at DOST? –have to be used!	
2	Prepare the room for the reference laboratory before the end of August	Khoa
3	Change procedures for site visits? 3 persons – 3 sites each. Consider!	- all
4	Check log books and calibration sheets at the sites	Huy
5	Extra paper rolls for the PM_{10} monitors should be available at the sites at any time (5 rolls available at HEPA?)	Quoc
6	Check level of PM_{10} at monitors with calibration foil, at least every time you install new paper roll. Report in logbook	Quoc
7	Cut down trees when influencing air input. Do it at D2 and BT	Quoc
8	Clean the intakes! Need ultrasonic baths (will be checked by NILU)	Harald W
9	Make final list of spare parts available – what is further needed	Harald W
10	CO pumps are not working – must be changed soon	Quoc
11	Where are the records for calibrations undertaken by Smith Vietnam? There is no proof of calibrations since Sept. 2003. Find data!	Quoc/Dam
12	Calibration sheets for the Danida stations are not available. Prepare these sheets!	Dam
13	Emission input for Modelling, input all industrial sources, report to NILU	Hang

Task	Description	Responsible
14	Prepare monthly report and report to NILU, prepare annual report	Duc
15	Air Quality data will be checked by NILU if monthly data are sent to NILU, prepare print outs on Word sheets !	Huy
16	Remember to correct wind directions and lower temperatures	Huy
17	Check if visibility data are available from Weather Service	Khoa
18	Prepare air quality report separately from water report?	Duc
19	Merge all data available on emissions from roads, stacks into AirQUIS, communicate "problems" and report to NILU	Hang
20	Run model tests, send results of PM_{10} and NO_2 to NILU	Hang
21	Emissions in each Ward will be estimated. Import results into AirQUIS as area sources	NILU/Hang
22	Specify modelling grid, origo position and size: 40 x 34 km.	Dam/Hang/The

We also specified that the payments for the Internet development as well as for the spare parts have to be finalised as soon as possible. NILU will otherwise have to reconsider using project money for the new weather station.

HEIA\Meeting HEPA 13 May 2005

Norwegian Institute for Air Research (NILU)
P.O. Box 100, N-2027 Kjeller, Norway

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TITLE	PROJECT LEADER
Ho Chi Minh City Environmental Improvement Project Air Quality Monitoring and Reference Laboratory Mission 6, May 2005; Status report (MR1-2), Station audits, design reference laboratory and training	Bjarne Sivertsen NILU PROJECT NO. O-101143
AUTHOR(S) Bjarne Sivertsen, The N. Thanh and Harald Willoch	CLASSIFICATION * A CONTRACT REF.

REPORT PREPARED FOR
NORAD
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0030 OSLO, Norway

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244 Dien Bien Phu St., Distr.3
Ho Chi Minh City, Vietnam

ABSTRACT

Mission 6, as part of the NORAD financed HEIA project, was undertaken to HCMC from 1 May 2005 to 14 May 2005. The air quality monitoring and management system has now been established and is being operated by trained HEPA/DONRE experts. The Mission included a complete audit to all stations. We continued the planning for the establishment of a Reference Laboratory, updated the total system including the AirQUIS database. Some training were also given concerning reporting.

NORWEGIAN TITLE

KEYWORDS		
Air quality monitoring	Air quality assessment	Vietnam

ABSTRACT (in Norwegian)

** Classification*
A Unclassified (can be ordered from NILU)
B Restricted distribution
C Classified (not to be distributed)