Department of Science,
Technology and
Environment (DOSTE)
Ho Chi Minh City

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DEVELOPMENT COOPERATION

Ho Chi Minh City Environmental Improvement Project
Air Quality Monitoring Component

Mission 2, November 2002; Status report (QR3), Installations performed

NILU
Norwegian Institute for Air Research

HEIA
Ho Chi Minh City
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Air Quality Monitoring Component

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List of Abbreviations

ADACS	Automatic Data Acquisition System
CO	Carbon monoxide
CEN	European Committee for Standardisation
CLRTAP	Convention on Long Range Transport of Air Pollutants
DANIDA	Danish International Development Assistance
DOSTE	Department of Science, Technology and Environment.
EDC	Environmental Data Centre at DOSTE
HEIA	**H**o Chi Minh City **E**nvironmental **I**mprovement Project **A**ir Quality Monitoring component
HEIP	Ho Chi Minh City Environmental Improvement Project.
ISO	International Organization for Standardization
NILU	Norwegian Institute for Air Research
NO_2	Nitrogen dioxide
NORAD	Norwegian Agency for Development Cooperation
Pb	Lead
PM_{10}	Particulate matter with diameter Less than 10 micrometer
$PM_{2,5}$	Particulate matter with diameter Less than 2,5 micrometer
	Quality Assurance / Quality Assessment
	Quality Control
PIU	Project Implementing Unit (PIU)
PMU	
QA	Quality Assurance
QC	Quality Control
SO_2	Sulphur dioxide
SOP	Standard Operating Procedures
SVN	Schmidt Vietnam Co. Ltd.
UNOPS	United Nations Office for Project Services

1 Task 1. Review existing system

1.1 Introduction

The Norwegian Institute for Air Research, NILU, has been appointed to undertake the NORAD funded part of the air quality monitoring component of the Ho Chi Minh City Environmental Improvement Project (HEIP). The NORAD supported part of the project (phase 2) is based on a DANIDA funded (phase 1) project, and it is a component of the ADB funded Ho Chi Minh City Environmental Improvement Project. The UNDP through the "Environmental Management Ho Chi Minh City, Air Quality Monitoring Project" was responsible for phase 1 of the project,

The Executing Agency for the **H**o Chi Minh City **E**nvironmental **I**mprovement Project **A**ir Quality Monitoring component (HEIA) is the Department of Science, Technology and Environment (DOSTE). A Project Implementing Unit (PIU) has been established in DOSTE, and this will co-ordinate and manage all activities required for the daily implementation and management of the components, while reporting and maintaining continuous contact with the PMU. The PIU will be responsible for the administration and supervision of the implementation of the Air Quality Monitoring component.

NILU will build on the existing developments to further develop and improve the monitoring programme as well as establish tools to perform air quality planning. The evaluation and assessment of the Danida funded developments have formed the basis for identifying further stations, instrumentation and the development of a total air quality planning system.

The project is being undertaken in a number of tasks and subtasks. Mission 2 had as its main objective to:

- Install the new NORAD funded air quality monitoring stations
- Start training in operations, maintenance and repair
- Install and start training in multipoint calibration
- Purchase and install new computers at the computer centre
- Meet with NORAD in Vietnam

- Assess the training needs, update the training schedules and perform on-the-job training.

1.2 Administrative meetings

An introductory meeting was held at DOSTE on 11 November 2002. The status of the project was discussed. A detailed schedule for the Mission was discussed and agreed upon. This schedule is presented in Appendix A1.

Questions were raised concerning the shipments of instruments, gas bottles and data loggers. The amount of consumables and spare parts was also discussed, and confirmation concerning the future maintenance and repair to be undertaken by DOSTE is discussed in Chapter 8.4.

In an introductory meeting with the EDC staff we were informed about the new PC installed at the centre in September 2002. (See Ch. 4.1.)

During the preparations of the instruments before shipping to Vietnam, several meetings were also held at NILU. The Minutes from one such meeting at 15 August 2002 can be seen in Appendix A2

2 Task 2. Design and update

2.1 Monitoring sites, final selection

Five sites were identified during Mission 1. During the preparations of the platform one of the sites were changed completely, while two sites were slightly modified. The sites are described in details in Appendix B1.

District 1-Zoo (Urban background)
The original background site in District 9 has been moved to District 1 at the Zoo garden. The site is representative for a typical urban background station located outside the busy city but only about 20 m away from a busy street. The area around is typical city park area.

Quang Trung - software city,
(Residential/Urban background)
This site is one of the better suited for open area residential location. The site is located downwind from the urban area of HCMC and about 100 m from a busy road (Quoc Lo 1a). The site could also be classified as an urban background station.

District 2 - PC (Residential to urban background)
The site is to day a representative residential site. A small road is passing by the station. This road may be widened and experience increased traffic in the near future. There may also be large changes in the development of this area and the measurement here may in the future reflect these changes. The location of the shelter is on the roof of a 20 m high building. The site will thus be representative for a residential area and in the future maybe become an urban background station as the new city develops.

Thong Nhat Hospital (Roadside)
The location is well suited to reflect some of the most heavily traffic-loaded streets leading out of the city. The site will serve as a roadside station and will be representative for the exposure of pollution to people living and moving along the streets.

Binh Chanh - Educational Office, (Roadside)
The educational centre is located at Hung Vuong road. The site is next to one of the busiest streets in the western part of HCMC. The shelter is place 10 from highway 1, which is the main road out of the city towards southwest.

The NILU/NORAD sites in HCMC
A summary of selected sites is presented in the Table below. The site characteristics as well as the indicators to be measured at each site are presented in Table 1.

Table 1: The new proposed sites for air quality measurements in HCMC.

Site	NO_x	SO_2	O_3	CO	PM_{10}	VOC	Shelter	Site
District 1 - Zoo	1		1		1		1	Urban bg..
Quang Trung - softw	1	1	1		1		1	Res/urban bg.
District 2 PC	1	1	1		1		1	Residential.
Thong Nhat hospital	1	1		1	1	1	1	Road side
Binh Chanh - Educ.	1			1	1	1	1	Road side
Total instruments	5	3	3	2	5	2	5	

From the original plans we have moved the background station in District 9 to the Zoo station in District 1. This site will fall nicely in to represent the typical urban background air quality of the city. At the background sites there should occasionally be collected passive samplers in order to have a picture of the background air quality surrounding the city.

For further details see Appendix B1.

3 Task 3. Procure and install

3.1 Specifications

Specifications for new instruments and a complete list of instruments as well as instrument descriptions were presented in a special section of the Technical Project proposal "Equipment and Supplies". (Sivertsen, 2001). A complete list of deliveries to DOSTE in November 2002 is presented in Appendix C1.

3.2 Requests and supplier support

The procurement phase has been finalised, and all equipment is in place in Vietnam.

An additional question that has been raised is concerning the specifications from the supplier concerning support during the guarantee period. A summary of some points in the contract between NILU and the Norwegian supplier indicates that:

- If errors on the instruments delivered to DOSTE in Vietnam occur during the guarantee period, DOSTE should first of all try to identify the error without any extra costs. The supplier will support DOSTE and give advice and guidance free of charge.
- If DOSTE cannot identify the error, or if the error is major, the local supplier of API instruments, Schmidt Vietnam Co Ltd (SVN), will undertake error seeking, correct errors and if needed change parts which are defect. Equipment damaged during this process is not covered by the guarantee.
- Work performed by the local service supplier should be according to normal routines. These routines should be specified after this contract is signed and should contain specifications for maximum limits expenditures to be used for repair. The costs related to work performed by the local supplier (SVN) shall be covered by 50% from the supplier and 50 % by NILU/DOSTE.
- The supplier will establish a stock of the most common spare parts at DOSTE. Spare parts will be provided together with the instrument

delivery. The Supplier will cover additional spare parts transport costs. He will also cover transport costs for returning parts if this is being terminated.
- The storage area has to be securely organised environmentally and for safety reasons.

A meeting was held with Schmidt Vietnam on 28 November 2002. During this meeting a service agreement was negotiated between NILU and Schmidt Vietnam Co. ltd. This repair and service contract is presented in Appendix C2.

3.3 Prepare shelters at NILU

The monitoring stations have been assembled and tested completely by NILU in Norway before shipped to Vietnam.

3.4 Test instrument set-up

Following the installation at NILU, a complete test programme has been followed to see that the instruments were working perfectly. The data acquisition system, the OPSIS retrieval system, was also tested at NILU prior to shipping all equipment to Vietnam.
A report from this work can be seen in Appendix C3.

3.5 Transport to Vietnam

All instruments including spare parts for one year were prepared and shipped in containers from NILU on 1 October 2002. Lists of specifications were sent to DOSTE (see Appendix C1)

DOSTE was responsible for obtaining all necessary papers for custom clearance etc. The shipment arrived in HCMC on 5 November 2002 according to schedules presented by the transport company.
The equipment, which had arrived at the harbour in HCMC was inspected during a visit to the port area on 11 November 2002. Mr. Khoa, Mr. Hoa and Mr. Dam participated in this inspection. We took two shelters out of one container and opened one for inspection by one Custom Officer.

3.6 Field installations

Mr Rolf Dreiem from NILU was responsible for the installations of the new 5 sites in HCMC. Daily reports from the installations can be found in Appendix C4.

DOSTE personnel participated in the installations and followed the process from placing the shelters, installing intake structures, mounting the rack with monitors and starting the monitoring equipment. The installations also were operated as a hand-on training in installations and operations of the monitors. The DOSTE field instrument experts Mr. Nguyen Thi Tuyet Hoa, Mr. Nguyen Bao Quoc and Mr. Vo Thanh Dam were instructed in stations set up, instrument calibration and field-testing of the whole monitoring programme.

The transport of shelters and instruments to the prepared sites started on 12 November 2002. On 12 November three shelters, no 837, 838 and 839, where loaded to two trucks and taken to different sites. The last two shelters, no 840 and 841,were loaded to one truck and transported to their stations on 13 November 2002.

The first shelter was installed on 13 November 2002.

- District 1-Zoo, Shelter 839

Three sites were installed on 14 November 2002. The first part of the installation was pure technical (without power connections). The sites installed on 14 November were:

- Quang Trung -Software City, Shelter 838
- Thong Nhat Hospital, Shelter 840
- District 2-PC, Shelter 837

One site was installed on 15 Nov 2002:

- Binh Chanh – Educational Office, Shelter 841

Installation of electricity and start-up of monitors were undertaken on 19 November 2002. All sites were equipped with power and air condition after a few days. Only one site (District 2, People Committee Building) had a telephone line connected at the end of the Mission.

4 Task4. Assure system integration

4.1 Identify existing data collection system

The Enviman ComVisioner had been tested at NILU in August-September 2002. This was necessary to obtain one consistent monitoring system to be operated by DOSTE.

The data logger DL256 installed by the Danida project broke down due to hard disk failure in July 2002. The Nguyen Thanh from NILU has been corresponding with DOSTE experts to try to verify the error to enable the data to be retrieved again. A solution has been proposed to DOSTE from NILU. (See Appendix A2)

Mr Dam at DOSTE had installed a new computer at the EDC centre. Specifications for this computer are presented in Appendix D1.

4.2 Evaluate OPSIS system and add new licences

The existing OPSIS system was investigated during Mission 1 and a report from the NILU IT manager is presented. (Mission 1 Appendix D2.)

The old EDC-PC had a hardware failure and had been changed to a new PC before the beginning of Mission 2. Specifications for this PC are presented in Appendix D1. The EnviMan data retrieval system was updated to receive data from 5 more stations. A new version of the EnviMan ComVisioner was thus installed and the complete system will be used to retrieve data from all 9 sites (DANIDA + NORAD) in HCMC.

To reduce the possible down time whenever the system should break down, a routine for cloning of the PC was established. An operational Manual and a Cloning Log was presented to DOSTE. (See Appendix D2).

4.3 Prepare interface

As part of the preparation of the interface between the OPSIS system and AirQUIS NILU had to configure EnviMan to automatically produce daily measurement files in EN2-format for the AirQUIS import module.

Existing reporting routines in Excel Macro also had to be updated to include the new measurement stations. An overview of the current data collection, presentation and reporting system was presented and a summary is given in Appendix D3.

No major modifications were implemented to the existing reporting procedures, as it was agreed that the new reporting procedures using the new AirQUIS version would be more efficient. New reporting routines are indicated in Appendix D4.

While waiting for the implementation of AirQUIS, DOSTE needs to report the daily Air Quality Index (AQI) and AQI classifications. NILU proposed to look at the existing templates and extend these also to produce the daily AQI and AQI classifications for presenting on the electronic street panel at Ben Thanh Market

For the future operations of AirQUIS as well as reporting, modelling and planning purposes a new server with one client will be purchased and installed at the DOSTE EDC. (See specifications, Appendix D1b).

5 Task5. Quality Assurance (QA/QC)

5.1 Design QA/QC

The Quality Assurance system developed by the DANIDA project has been evaluated, and major parts of that will be used also in the future. Only slight modifications and updating has been performed by NILU. New instruments, such as the Eberline PM_{10} monitor have been described in details and operating procedures (SOP) for the quality assurance have been developed.

After discussions with DOSTE and Schmidt Vietnam during Mission 1 it was decided that more of the QA/QC procedures had to be transferred to DOSTE. It was concluded that Schmidt Vietnam could not be the reference laboratory as foreseen in the project plans. The Quality Assurance (QA/QC) systems must therefore have to be changed and upgraded during the NORAD supported project. See also Chapter 5.2, Chapter 8.5 and Appendix E1.

5.2 Prepare SOP

Based on the evaluation of the QA/QC system developed by the Danida project NILU started updating the procedures during the last week of August. Additional SOPs were prepared, and a final updated was performed during and after installations at Mission 2 in HCMC.

As part of the NILU routines we will assure that some typical SOPs are available. In field operations the following routines should be established:

- Station Manuals including Standard Operating Procedures (SOP) for instrument installations, maintenance, controls etc.,
- Zero span checks and calibration routines,
- Station history logbook available.

An example of one of the Standard Operating Procedures is presented in Appendix E2. This is the procedure for one of the instruments that was not delivered by the Danida project, the Eberline type PM_{10} monitor.

A complete collection of SOPs was handed over to DOSTE after the installations, both on paper and in electronic form.

At the "Monitoring Laboratory" at DOSTE data are controlled following quality assurance routines as described in the Mission 1 report. These routines will be followed up later in the project when all stations are in operation.

5.2.1 QC during operations

When inspecting the daily data quality controls at the Environment Data Centre (EDC) it was identified that many of the zero-span checks performed on a daily basis were inadequate, due to permeation tubes that already were more or less empty.

Permeation tubes should be among the consumables delivered during the Danida project. We did not identify any extras during our Mission. The station logbooks were also inadequate filled in. This was stated to the operators.

5.2.2 Dynamic calibration

As part of the maintenance and calibration procedures to be installed at DOSTE it would normally be necessary to establish a "reference laboratory" at DOSTE. This would require a complete set of monitors as well as a multipoint calibrator with zero-air generator and standard gases.

NILU was informed that a multipoint calibrator was already part of the Danida deliveries (see Appendix E1). This multipoint calibrator together with standard gases and a zero air generator would be used at DOSTE for dynamic calibrations, and hand-on training was being planned based on this equipment.

At the start of Mission 2, however, we found out that DOSTE never received an API700 multipoint calibrator from the Danida project. The API702 calibrator available in the laboratory can only be used as a two-point calibrator. We thus decided to perform the first training on this equipment.

On the other hand it was clear that equipment for high quality multipoint calibration will have to be purchased in the future if DOSTE wants to meet the final objectives of performing dynamic calibration and act as a "reference laboratory" for the air quality measurements in HCMC.

Before start-up of the monitoring programme in HCMC in November 2002 all monitors have been properly calibrated. An example of the certificate for a dynamic calibration of the NOx monitor is presented in Appendix E3.

The calibrations performed by NILU should normally assure that the instruments would perform adequately for about one year. The procedures set for routine service check and dynamic calibrations in the HEIA programme is every six-month (see Appendix E4).

5.3 QA presentation and training

The hand-on training performed during installations in HCMC as well as the training given to the calibration laboratory experts represents one part of the QA/QC training given by NILU. NILU will also follow up the quality assurance systems during the establishment of a calibration and maintenance laboratory at DOSTE.

The QA/QC officer appointed by DOSTE, Mr. Vo Thanh Dam, will receive special training when visiting NILU during the spring 2003. According to the updated training schedule, presented in Appendix K1, QA/QC will be covered during the visit to NILU.

6 Task6. Install AirQUIS

6.1 Prepare AirQUIS platform and GIS

Computers for the AirQUIS platform have been specified and will be installed before the next Mission 3 to HCMC. A server and a client will be installed as specified in Appendix D1b.

NILU will install the Oracle database and configure the AirQUIS database on the server. The PC client will be installed with one AirQUIS client licence. The PC server and the client PC will be connected on the existing network in the EDC.

During Mission 2 the AirQUIS Measurement module was discussed and some of the templates for importing emission data was presented. (See Appendix G1). The complete AirQUIS system including emission inventory systems and dispersion models will be installed during the next Mission to HCMC.

6.2 Establish final GIS

Digitised maps were brought to NILU from DOSTE during Mission 1. These maps will be prepared for AirQUIS during the first months of 2003.

To finalise the GIS database in AirQUIS we will have to define:

- Shape themes
- AirQUIS themes and
- Datasets

A short description of the use of regions selected for AirQUIS is presented in Appendix F. Shape Themes is not connected to data in the AirQUIS database. Examples of shape themes may be coastlines, lakes, parks, borders, or anything that will make the map look better and be easier to understand. The user decides which shape themes to include.

The basic GIS system to be used in the AirQUIS set-up for HCMC will be prepared at NILU prior to the installations at DOSTE in HCMC.

6.3 Develop and test interface

Mr The N Thanh prepared the interface between the OPSIS data retrieval system and AirQUIS. The existing reporting routine was updated in Excel Macro to include the new measurement stations.

EnviMan will be configured to automatically produce daily measurement files in EN2-format for the AirQUIS Import Module.

Air quality data from the four Danida monitoring sites for 2001 were collected by NILU during Mission 1 and tested for AirQUIS applications.

6.4 Hand-on-training

Hand-on training will be given to the DOSTE experts during the installation of the AirQUIS platform during the visit to NILU in March-April 2003, and after installations at DOSTE

During the visit to NILU a more detailed presentation included hands-on training through operations will be performed. Later during the operations at DOSTE training will be given as part of the application of the air quality management system. The actual work performed at DOSTE during the emission inventorying, data retrieval, transfer of data into the databases, data treatment and presentation as well as dispersion and exposure modelling will be part of this training.

7 Task7. Air Quality Modelling

7.1 Prepare input data

To operate the AirQUIS air quality management system different type of input data have to be prepared:

- Maps and GIS system
- Emission data and emission inventories,
- Air Quality data,
- Meteorological data,
- Population distribution data,
- Area use and topographical data.

7.2 Emission inventories

A brief survey of air pollution sources in HCMC was performed during Mission 1. The main exposure and human health impact seem to stem from millions of motorbikes filling the streets from early morning to late night.

Simple counting has indicated that several streets have more than hundred thousand motorbikes passing through the street every day. Many people are spending a considerable time of the day along the streets and roads. It will thus be important to map the pollution and the exposure along these roads.

Background information for emission inventories was prepared during Mission 2. A brief presentation of the emission templates to be used as input to the AirQUIS modelling module was given during Mission 2. Examples of such templates are presented in Appendix G1. All templates are given in Excel format.

7.2.1 Point sources

Source data for emission estimates related to single stacks and point sources will have to be collected. This work started during Mission 2 by presenting some of the templates used as input data to the AirQUIS emission inventory

model. The dataflow for collecting of point source data is shown in Appendix G2. Example templates for collecting emission data for point sources are presented in Appendix G1. All the templates for AirQUIS are available in Excel format, and the operating experts will be trained to use these templates directly. New templates will be prepared specifically for the HEIA project.

7.2.2 Population distribution, area sources

Data for the population distribution given for each of the Districts in HCMC was collected during Mission 1. A more detailed population distribution should be collected if possible.

7.2.3 Traffic density

Some preliminary data on traffic density and the development of traffic in HCMC was presented during Mission 1. Templates are available for collecting information on road links, vehicle classes, traffic densities etc.

The first templates for collecting traffic data were presented during Mission 2. Examples are shown in Appendix G3. However, these templates will have to be modified to meet the characteristics of the HCMC traffic fleet.

Before going into a complete data collection procedure we will have to find out whether there are any traffic models available for HCMC.

7.3 Dispersion modelling

The dispersion models, which will be delivered as one module of the AirQUIS system, include models for point sources, area sources and line sources.

Based upon spatially distributed and time dependent input data of emissions, wind and turbulence, the model gives time-dependent concentrations in any receptor point within the modelling area. (Walker, 1997)

DOSTE experts will be introduced to the modelling system, and will be trained to operate the model in the AirQUIS system. We were requested during Mission 1 to bring one additional expert to NILU to receive additional training in modelling. The reason being that these skills is not at all available in DOSTE today. When this was discussed during Mission 1 we hoped to have additional support from UNOPS. Presently we will have to find funds for this training inside the NORAD budget.

8 Task8. Field Operations

8.1 Start-up phase

Installations of monitors in shelters as well as testing of instruments have been carried out at NILU in Norway before the ready-made stations were shipped to Vietnam. The instruments will also be adapted to the existing logging and data retrieval system and tested. (See Appendix C2)

NILU instrument experts together with the DOSTE field operators undertook installations from 13 to 21 November 2002. (See also Chapter 3.6) As part of the start-up of monitor DOSTE field experts were trained to install and operate the monitors themselves.

8.1.1 Visits by OPSIS and Instrumatic

Mr Seved Grytting of OPSIS AB visited HCMC on 29-31 October 2002. The objective was to identify errors on the SM200 particle samplers and the meteorological sensors on the 25 m tower at DOSTE. (See Appendix H1)

Mr Grytting stated that the sensor installed on top of a 25-meter tower was not functioning due to a WS002 IOMan module not working. This made all following IOMan modules not working either. A new module has been sent for (free of charge from OPSIS). Schmidt Vietnam group staff has been instructed to install it and make the necessary change in the software.

Mr. Grytting recommended a 3-4 days training of DOSTE and Schmidt Vietnam staff in using the OPSIS software and hardware equipment delivered to DOSTE.

The sonic anemometer has probably not been working at all since it was installed, and Instrumatic AS will be contacted for repair.

Instrumatic AS has announced that they will be visiting DOSTE in December 2002 to repair the meteorological instruments.

8.1.2 Screening using passive samplers

To obtain an average picture of the general concentration distribution of NO_2 and SO_2 over HCMC a total of 40 passive samplers were located around the city from 14 to 24 November 2002.

Most of the samplers were located on and around the monitoring station to evaluate the representativeness of the monitoring sites. The locations of the samplers are presented in Appendix H2.

A special report from the sampling programme has been prepared. (Sivertsen, 2003)

8.2 Operational phase

The operations of nine -9- air quality monitoring stations in HCMC started after installations on 22 November 2002. DOSTE field operators received hand-on training in the operations during and after the installations. This training was in addition to the training and experience they have gained from operation API instruments delivered during the Danida project.

The NILU instrument expert specifically trained the DOSTE experts in operating the new PM_{10} monitor as well as prepared instructions for calibration of the instruments.

The operational procedures manuals were updated as well as the station logbooks and instrument logbooks. The routines for daily data retrieval and quality controls, established by the Danish project, will be followed up in the future. Daily and weekly data checks, and feedback to the operators were recommended.

A first hand-on training in instrument maintenance, field calibrations and some simple repairs started during Mission 2. This training will, however, have to be continued due to the lack of an adequate multipoint calibrator. (See Appendix E1). An API representative will also give training in maintenance and some simple repair in HCMC during December 2002.

Further information linked to the operation of instruments are to be found both concerning QA/QC routines in Chapter 5 and Maintenance and Service under Chapter 8.4.

8.3 Audits of the stations

Audits to the monitoring sites should be performed on a half-year basis. At similar national monitoring systems designed and installed by NILU, a national reference laboratory normally undertakes these audits.

During Mission 1 we identified that Schmidt Vietnam (SVN) did not have the experience and the laboratory facilities to undertake these functions in HCMC. During the warranty period, however, SVN will serve as the instrument supplier for API monitors, which they actually are.

After Mission 2 we have identified that several tasks will have to be undertaken to meet the requirements of a Reference Laboratory to be established at DOSTE. (Appendix E1). In the future we will recommend that an independent unit of this "Reference Laboratory" be given the task of auditing the stations every 6-month.

Audits to the monitoring stations from NILU experts have been scheduled to take place after one year of operations and after the second year of operations. This will assure that operations are following the prescribed operational procedures, and that the monitoring system is operated according to international standards while NILU is undertaking the 3-year NORAD funded project.

8.4 Maintenance and service

The maintenance and service of all monitoring stations have been discussed in details both during Mission 1 and Mission 2. The DOSTE field and instrument experts usually perform regular maintenance of the instruments at the station during routine service visits.

A specific service and repair contract was signed with Schmidt Vietnam for all API instruments and the OPSIS DL 256 related to the 5 new monitoring stations in HCMC. The contract is valid for one year and is presented in Appendix C2.

8.4.1 Weekly check routines

A weekly service procedure has been established by the Danida project. This will be followed up also for the 9 stations in operations from November 2002. A weekly service form has been developed and is presented in Appendix H3.

At the shelters a zero air generator and span gas cylinders has to be used for performing weekly manual Zero/Span checks. The zero check shall be based on a zero air generator. The span check is based on a gas cylinder with

"normal outdoor" concentration connected directly to the monitor without any dilution and without pressurising the monitor inlet. These two-point calibration procedures have been part of the delivery and installed in the NILU delivered shelters during Mission 2.

A scheme for undertaking two-point calibrations is presented in Appendix H4.

8.4.2 Bi-annual maintenance and calibrations

In addition to the regular maintenance presented above NILU normally recommends a yearly overhaul where the instrument is examined, cleaned and adjusted more thoroughly. The overhaul will typically take about two 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 a laboratory designed for this purpose. This laboratory was set up at DOSTE during Mission 2.

The Danida project recommended bi-annual maintenance and dynamical calibrations every 6-month. Following discussions with DOSTE we have decided to keep these procedures at the moment. The service checklist similar to the one presented in Appendix E4 will be followed.

Consumables and spare parts
The overhaul usually requires spare parts, consumables and tools that are easier accessible in the laboratory then at the station. Consumables and spare parts are pert of the deliveries and are being stored at the DOSTE laboratory. A list of these consumables and spare parts is presented in Appendix H5.

8.4.3 Service agreement

A service agreement for the warranty period has been discussed with the supplier both in Norway and locally in Vietnam. Schmidt Vietnam (SVN) had a contract with Instrumatic AS during the Danida Phase of the project. A simpler contract has been signed with NILU as presented in Appendix C2.

Based on discussions with DOSTE and SVN much of the maintenance and repair will in the future be transferred to DOSTE, as well as the bi-annual dynamic calibrations. The service agreement with the supplier has therefore been somewhat simpler than during the Danida phase of the project.

A summary of the procedures for service and repair during the warranty period is presented in Appendix H6.

8.5 Dynamic calibrations

The bi-annual (or annual as recommended by CEN and NILU) check and overhaul of instruments should be combined with a linearity check and performed at the same time in the laboratory. The linearity check requires a complete dilution/calibration unit.

During the first year of operation of the NILU delivered instruments the dynamic calibrations will be performed by Schmidt Vietnam.

8.5.1 A "Reference Laboratory" at DOSTE

As part of the maintenance and calibration procedures to be installed at DOSTE it would normally be necessary to establish a "reference laboratory" at DOSTE. This would require a complete set of monitors as well as a multipoint calibrator with zero-air generator and standard gases. For the establishment of a complete "Reference Laboratory" at DOSTE see Appendix E1.

NILU was informed that a multipoint calibrator was already part of the Danida deliveries, and this we planned to use this at the service centre at DOSTE for multipoint calibration. At the start of Mission 2 we found out that DOSTE never received a multipoint calibrator from the Danida project. The API702 calibrator can only be used as a two-point calibrator. We thus decided to perform the first training on this equipment. However, equipment for high quality multipoint calibration will have to be purchased in the future.

In the future a complete "Reference Laboratory" should be established at DOSTE. NILU has stressed before that this Reference Laboratory should be equipped with gas monitors to enable calibrations of gas standards. Expert personnel have to be trained to operate the monitors for calibration reasons. Personnel have to be prepared and trained to carry out systematic audits of the monitoring programmes.

As part of the development of a reference laboratory DOSTE has sent a letter to NORAD to request additional funds for the costs related to this development. A copy of this letter is presented in Appendix H7.

8.6 Sites re-visited

After the second year of operation NILU experts will again visit all the monitoring stations, to check the performance and to verify adequate operations. NILU may also support DOSTE in any maintenance operation or simple repairs.

9 Task 9. Data interpretations

9.1 Understanding AQ

Some of the data collected were evaluated and some comments were given to the levels and variability. However, there was no time during Mission 2 to go into details in training the DOSTE experts to understand in depth the values reported in the database.

During the AirQUIS installations and training a more comprehensive introduction to the data and to the understanding of air quality, sources and meteorology will be given.

Some data collected during the weeks of passive sampling in HCMC (11 to 25 November 2002) was collected and is presented in Appendix I1.

9.2 Use of Meteorological data

No meteorological data collected from the 30 m tower at DOSTE was available during Mission 2. The instruments installed by Instrumatic AS in June 2000 was supposed to provide 5 minute data of wind speed, wind direction, air pressure, relative humidity, total incoming radiation, relative humidity and air temperature.

Several errors were identified in the meteorological data during Mission 1. Mr Seved Grytting of OPSIS AB who visited HCMC on 29-31 October identified errors on the meteorological sensors. (See Appendix H1). Some of these errors were corrected during a visit by Instrumatic a/s in December 2002.

There is still a need for training of the DOSTE team on analysis and quality control as well as for interpretations and application of meteorological data.

9.3 Statistical evaluation

As stated during the meetings at DOSTE the AirQUIS system offers several options for statistical and graphical presentations. Time series data can be presented and updated e.g. every hour included one or several indicator. Presentations can be prepared for screen presentations, for printouts or for automatic web presentations. The preparations of index presentations and monthly reports will be generated by the AirQUIS system in the future.

9.4 Reporting Air Quality

Hourly air quality data as presented in Appendix I1 is the basis for statistics and presenting of daily and monthly reports.

An example of a monthly report produced by DOSTE based on input from the first phase of the project is presented in Appendix I2.

The monthly average concentrations for October 2002 are summarized in the following table (in $\mu g/m^3$):

Parameter	Stat.	DOSTE	Hong Bang	Tan Son Hoa	Thu Duc	VN Standard
NO ($\mu g/m^3$)	Average	**79.39**	**22.99**	**15.89**	**22.23**	
	98-percentile	251.4987	80.54	54.75	83.77	
	Max. hour	322.89	126.42	86.00	128.70	
	Max. day	154.2	50.1	27.6	39.9	
NO_2 ($\mu g/m^3$)	Average	**79.39**	**53.42**	**17.63**	**19.27**	100
	98-percentile	175.19	159.04	55.87	95.13	
	Max. hour	351.45	240.79	88.17	300.77	400
	Max. day	105.1	109	29.3	47	100
SO_2 ($\mu g/m^3$)	Average	**66.23**	**N/A**	**75.05**	**N/A**	300
	98-percentile	112.29	N/A	126.38	N/A	
	Max. hour	199.94	N/A	170.97	N/A	500
	Max. day	86	N/A	87.7	N/A	300
O3 ($\mu g/m^3$)	Average	**14.02**	**17.22**	**24.67**	**N/A**	60
	98-percentile	64.84	68.89	87.28	N/A	
	Max. hour	118.63	120.53	139.51	N/A	200
	Max. day	34.3	33	46.1	N/A	60
CO (mg/m^3)	Average	**6.83**	**N/A**	**N/A**	**N/A**	5
	98-percentile	19.62	N/A	N/A	N/A	
	Max. hour	33.73	N/A	N/A	N/A	40
	Max. day	10.3	N/A	N/A	N/A	5
PM_{10} ($\mu g/m^3$)	Average	**N/A**	**N/A**	**61.67**	**140.41**	160
	Max. day	N/A	N/A	96.30	238.90	160 *)

*) The value is derived by multiplying the standard for SPM with 0.8.
Values collected from the PM10 analysers for this period were not valid due to technical difficulties.

9.5 Internet presentations

NILU has been preparing web applications for air quality data presentations for several projects. During the visit of DOSTE experts to NILU in 2003 NILU will present web applications and discuss the possibilities with DOSTE.

NILU can deliver different web solutions depending on the needs and requirements of DOSTE. There are several ways of showing information on the Internet. There are also many ways of using the Internet both for presenting general information, projects and results, as well as dissemination of online environmental data retrieved directly from monitoring networks.

NILU is delivering Internet solutions for urban city and road authorities, linked to the AirQUIS monitoring and modelling platform utilising the automatic data retrieval system (ADACS).
See: www.nilu.no and
http://www.luftkvalitet.info/

10 Task10. Air Quality Assessment

10.1 Use of AirQUIS

The GIS based AirQUIS system will be the main platform for the Air Quality Assessment and Management system to be used for HCMC. AirQUIS consists of six components and makes use of an Oracle database. The system has integrated forms and maps; it was developed in Visual Basic and Map Object (GIS) and works well on an ordinary PC-server. A new version of the AirQUIS system will be available for DOSTE in March 2003.

DOSTE experts will be trained to use the system for air quality management. The first introduction and training will be held during a visit to NILU in March-April 2003. NILU will offer an intensive course. The basis for the air quality assessment and planning system is an integrated air quality monitoring system including both monitoring and modelling.

Also after the installation of Air QUIS in HCMC lectures and hand-on training in the application of AirQUIS will be offered to the DOSTE experts.

10.2 Emission inventories

During Mission 2 some of the templates for collecting of emission data were presented to DOSTE:
See Appendix G1, G2, G3.
Data already collected from the industries are stored in the computer at the EDC Centre at DOSTE should be extracted and imported through the templates into AirQUIS. This work will start after the training at NILU.

For modelling and planning purposes it will be important to achieve a complete emission inventory as possible.

10.3 Model exposure estimates

The dispersion models ("EPISODE") (Walker, 1997) available in AirQUIS will enable quantification of changes in exposure and population responses to changes in source composition and emissions, which in turn is necessary for an evaluation of impacts of e.g. road traffic system changes on urban scale.

References and descriptions of the models were presented in Mission1 report. The modelling system at NILU is constantly being revised and improved, and we believe that the version prepared for HCMC will be the best we can offer at the time being. The models will also be run and verified with observations. Crucial input parameters will be meteorological data, which we have not yet seen, and emission data that will be developed from 2003.

10.4 Abatement and planning

The use of AirQUIS for abatement strategy planning will be part of the capacity building and training programme. Emission reduction scenarios, a plan for action and measures to improve the air quality in HCMC has to be developed by local experts in co-operation with Norwegian experts.

The necessary input data for this purpose will be discussed as part of the training sessions, and the collection of necessary data has to start from 2003. For more details see Mission report 1 and Appendix J1.

11 Task11. Capacity building

The training needs assessment document has been updated since Mission 1 and can be seen in Appendix K1. In summary training needs have been identified both for operations and maintenance of instruments, for data retrieval and controls as well as for understanding air pollution and performing air quality assessment and planning.

11.1 Kick-off seminar

A kick-off seminar was prepared and held at DOST during Mission 1 and was reported in Mission 1 report and in a separate presentation of the seminar slides has been prepared as a NILU document (Sivertsen, 2002)

11.2 Instruments and monitors

The instrument supplier has already offered some training. However, the NILU instrument expert will give most of the training in operation of instruments and monitors as hand-on training.

A large part of the tasks undertaken by Rolf Dreiem during and after the installations was connected to the handling and operation of instruments.

An example taken from the daily reports in Appendix C4 reports that: "RD performed training on API 702. Calibrated zero air and gas cylinder flow. Explained in detail how to perform a GPT to check the NO_2 converter on API 200 NOX monitor. Calibrating gas concentration was calculated in an excel sheet. Calculated also converter efficiency. These two excel sheets were copied to computers at EDC and calibration laboratory. All consumables were put in shelves at the calibration laboratory".

11.3 Data retrieval and QA/QC

For the data retrieval system delivered by OPSIS we identified during Mission 1 a need for further training in the operation of the OPSIS retrieval system. Mr. Grytting from OPSIS, who visited DOSTE in October, also

recommended a 3-4 days training of DOSTE and Schmidt Vietnam staff in using the OPSIS software and hardware equipment delivered to DOSTE.

The QA/QC officer appointed by DOSTE, Mr. Vo Thanh Dam, will receive special training in the quality assurance operations when visiting NILU during the spring 2003. According to the updated training schedule, presented in Appendix K1, QA/QC will be covered during the visit to NILU

11.4 AirQUIS training

The AirQUIS platform will be installed first at NILU in March 2003. This will represent the basis for the training to be undertaken in application of AirQUIS as a planning system for HCMC.

A comprehensive workshop based and on-the-job training programme will be undertaken at NILU in April 2003 to train 3 selected DOSTE experts in using and taking over the system. This training will continue after the installations of AirQUIS at DOSTE in May 2003.

The system used for emission inventorying, data retrieval, databases, data treatment and presentation as well as dispersion and exposure modelling will be part of this training. The output will enable DOSTE experts to operate and use the planning tool in the future.

11.5 Use of models

Modelling and data interpretation skills will have to be evaluated. Air quality data statistics including the use of meteorological data in air quality interpretation and presentation will have to be prepared. Procedures for air quality impact assessments as well as preparation of abatement options and scenarios have to be presented. Cost-benefit analyses can be used to evaluate the best possible options to reduce the air pollution load seen from an economic point of view. The results of such analyses again may lead to the development of Action plans.

DOSTE experts will have to be directly involved in the collection of input data, they will have to evaluate the data and perform analyses and model estimates. They have already requested to have one expert specifically assigned for modelling to participate in the training at NILU.

11.6 Statistics and reporting

During the training to be performed at NILU and at DOSTE during 2003 (See Appendix K1) DOSTE experts will receive both hand-on training and

class-room training in the application of AirQUIS for statistics and reporting purposes.

11.7 AQ assessment and planning

The air quality assessment work, which will be performed at the end of the project, will start with training at NILU in March 2003. The input data for this assessment will be prepared together with NILU experts in HCMC. See training needs assessment in Appendix K1.

11.8 Abatement strategies

The abatement strategy planning will be a continuation of the assessment work. For optimal abatement strategies data on abatement costs as well as cost estimates for air quality impacts will have to be estimated. This is the last phase of the 3-year project.

Mr Steinar Larssen at NILU who developed the technology for the World Bank and has performed several studies in China (Guangzhou and Shanxi province) will be responsible for the introduction to optimal abatement strategy planning for HCMC.

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Appendix A

Task 1. Review existing system and preparations

Appendix A1: Daily schedules

Mission 2, November 2002

Day	Hr.	Task	Assignment	NILU	DOSTE	Done
6 Nov			▪ Rolf Dreiem arrives in HCMC	RD		
7 Nov			▪ Visit to new sites	RD		ok
8 Nov		3	▪ Install calibrator at new Calibration and repair room	RD		ok
10 Nov	2000		▪ BS Arrives HCMC TG686 from Bangkok	BS		
Mon. 11Nov	0800	1	▪ Arrival DOSTE Meeting Mr. Khoa Installations at office, presentations, plan installations ▪ Discuss status EDC, met.data?	BS RD BS	LVK, NTK, LVK, NKT,VNT, TrNT+,	
T. 12 Nov	0900	2a	▪ Plan passive sampling programme ▪ Get shelters, transport?	BS,TNT RD	NTD, VTD, NBQ	
W. 13 Nov	0830	3 11	▪ Instrument installation ▪ Reporting, training schedule update	RD BS	NTD,NBQ,NTH LVK	
Th. 14 Nov	0900	8.1	▪ Locate passive samplers (as soon as shelters are placed)	BS		
F. 15 Nov	1000 0815	 8.1	▪ More passive samplers out ▪ Collect data at EDC ▪ Instrument installation	BS RD	 NTD,NBQ,NTH	
M. 18 Nov	0830	3.6	▪ Instrument installation ▪ Prepare meeting with NORAD	RD BS	NTD,NBQ,NTH	
T. 19 Nov	0830	3.6 5	▪ Instrument installation ▪ Mission report, memos Reflab	RD BS	NTD,NBQ,NTH VTD	
W. 20 Nov	0815 0930 1100	3	▪ Instrument installation ▪ Meeting Khoa ▪ To Hanoi	RD BS BS	NTD,NBQ,NTH LVK	
Th. 21 Nov	1000	1.2	▪ Meeting NORAD in Hanoi ▪ Instrument installation and ▪ Hands-on training	BS RD	 NTD,NBQ,NTH VTD	
F. 22 Nov		 3	▪ Project work Hanoi ▪ Finalise installations, training	BS RD	 NTD,NBQ,NTH	
S 24 Nov			▪ HCMC, BS back from Hanoi	BS		
M. 25 Nov	0830	5.3	▪ Training calibration and maintenance, Calibrator ▪ SOP and manuals	RD BS	NTD,NBQ,NTH VTD	
T. 26 Nov	0745 1200 0900 2000	8.1 5.2 5	▪ Collect passive samplers HCMC ▪ Manuals, Prepare statistics ▪ Repair and maintenance PM10 ▪ The N Thanh arrives HCMC	BS BS RD TNT	NTD NBQ,NTH	

Day	Hr.	Task	Assignment	NILU	DOSTE	Done
W 27 Nov	0830	4.2 8.4	▪ Back up data, Enviman ▪ Training repair and maintenance ▪ Spare part lists ▪ Mission report, NORAD report	TNT RD RD BS	NTD NBQ,NTH	
Th 28 Nov	0800 1600 1830	 4.3 7.1 8.4	▪ Mission report ▪ Configure Enviman, retrieve data from new station ▪ Emission templates ▪ Training maintenance, CO monit ▪ Meeting Schmidt Vietnam, service contract ▪ Official dinner	BS TNT TNT,BS RD BS,TNT all	 VTD, NKT LVK	
F 29 Nov	0900 1400 2105	10 8	▪ Enviman/AirQUIS intro ▪ Emission templates ▪ Final reporting, meeting ▪ Return to Norway, TG 687	TNT,BS BS,TNT BS		
M 2 Dec	0815	10	▪ AirQUIS ▪ Data centre update, prepare purchase of Server	TNT	NTD ++	
M 3 Dec	0815	4	▪ Data retrieval	TNT		
T 4 Dec		6.1	▪ Establish backup, disaster recovery	TNT		
W 5 Dec		4 10	▪ Data retrieval ▪ More on templates	TNT		
Th 6 Dec			▪ Summary EDC ▪ Server and client working?	TNT		
F 7 Dec	1150		▪ Leave HCMC and Mission 2	TNT		

The staff:

DOSTE	
Doan Thi Toi (DTT),	Head of Environmental Management Division
Nguyen Thi Tuyet Hoa (NTTH),	PIU Secretary
Le Van Khoa (LVK),	Project Manager DOSTE
Ngo Thanh Duc (NTD),	Instruments and field expert
Vo Thanh Dam (VTD),	EDC, data retrieval, reporting, field
Tran Ngoc Thanh (TrNT),	EDC, computers, index reporting
Nguyen Bao Quoc (NBQ),	Instrument expert, field operations
Nguyen Thanh Huy (NTH)	Instrument expert, field operations
NILU	
Bjarne Sivertsen (BS)	Project Manager
The Nguyen Thanh (TNT)	IT Manager, Computer expert,
Rolf Dreiem	Instrument expert

Appendix A2: Minutes from project meeting at NILU

Department of Science,
Technology and Environment (DOSTE)
The Norwegian Institute for Air Research (NILU)

Minutes of Meeting

Title	Project meeting no. 4
Date	15 August 2002
Place	NILU
Participants	Bjarne Sivertsen (BS), Leif Marsteen (LM), The Nguyen Thanh (TNT), Rolf Dreiem (RD), Mona Waagsbø (MOW), Finn Bjørklid (FIB)
Prepared by	Bjarne Sivertsen
Distribution	BS, LM, TNT, RD, Steinar Larssen (STL), Herdis Laupsa (HEL), Le Van Khoa, DOSTE, Tor Færden, SFT

1. Draft Agenda

1. Information from evaluation by SFT
2. Status instruments and installations
3. UNOPS training assessment, status
4. Status AirQUIS, platform, GIS, maps
5. Data retrieval and AirQUIS interfaces.
6. AQ and met data from HCMC, results of AirQUIS evaluations
7. Status site infrastructures
8. QA/QC and SOP preparations
9. Other matters

2. Summary and conclusions

1. Information from evaluation by SFT
Two representatives from Norwegian Pollution Control Authorities (SFT) evaluated the HEIA project on 13 August 2002.
The main topics during the evaluation were:

- The project status, delays, changes etc
- What has been obtained compared to plans?
- How does the project organization work?

The reference material represented by the Inception report (NILU OR 28/2002) and the Mission 1 report (NILU OR 23/2002) was presented to the

SFT representatives. The status of preparations and work until 13 August was presented and related to the different tasks and time schedules.

The work so far has been completely according to plans. Some uncertainties were indicated, such as:

- The OPSIS data retrieval system has broken down and NILU has been requested to support DOSTE,
- The station infrastructure and permissions in HCMC is still under preparations,
- More training has been requested and NILU will follow up even if some of this is in addition to the project descriptions,
- The UNOPS additional training linked to the Danida part of the project has not been approved yet, and NILU will be part of this training also.

Some changes compared to the original plans were also indicated:

- DOSTE will receive training in calibrations and maintenance, as Schmidt Vietnam did not have the adequate background for this (See Appendix E1b, page 81 of the Mission report),
- More training has been requested concerning the new PM_{10} monitors. This will be taken care of by NILU.
- As part of the Air Quality Management system to be applied in the future DOSTE requested one more expert for training at NILU in 2003. This will have to be paid by the project.

The project organization was presented. The HEIA Project manager Counterpart Dr. Khoa has been working closely with NILU, both during Mission 1 and during the progress of the project. Also the team appointed at the Environmental Data Center seems to be well suited for the tasks, and they have been actively taken part in the development.

The SFT representatives expressed their satisfaction with the project progress and status. They will visit HCMC during the first week of September, and NILU will receive feedback from the discussions there.

2. Status instruments and installations

All instruments, shelters, UPS and Air conditioners are in storage at NILU. Instrument racks and instruments are ready for installations in the shelters. To check the "instrument-database-data retrieval – AirQUIS interface" one monitor with data logger and telephone line has been set up for this specific testing. RD/LM will be responsible for starting this test on 19 August.

Enviman light (OPSIS data retrieval) will be installed with the new version of the AirQUIS database system. TNT will be responsible for initiating this testing from 1 September.

Transport of all equipment to Vietnam on 1 October will be verified with the transport company. LM will verify prices and time schedules.

The standard gases (calibrations gases) have been reported delayed from Industriell Måleteknikk as. However, we do not believe that this will delay our shipment from Norway. The last information indicates arrival of gases at NILU on 15 September.

3. UNOPS training assessment, status
Several mails have been sent back and forth between NILU and Instrumatic in Denmark, who is the lead institute for the additional training for DOSTE. These funds have been assigned from UNOPS to the Danish company, who again will use NILU as a subcontractor.

The last Memo from NILU is attached this report (Attachment 1).

4. Status AirQUIS, platform, GIS, maps
The digital maps, which were brought from DOSTE during mission 1 have been viewed and tested. An example of these maps is presented in Attachment 2. The maps are still not part of the AirQUIS platform.

The new functionalities in AirQUIS will be finalized before FIB and HEL start working on the GIS data. This work will be started in September 2002 and has a deadline in January 2003..

5. Data retrieval and AirQUIS interfaces.
The data logger DL256 installed by the Danida project broke down due to hard disk failure in July 2002. The Nguyen Thanh from NILU has been corresponding with DOSTE experts to try to verify the error to enable the data to be retrieved again. A solution has been proposed to DOSTE from NILU. (See Attachment 4)

This work will be an important part of the UNOPS financed Mission for repair and training. If UNOPS funds will not be available during August, NILU may have to prepare an additional Mission to HCMC in September. This will be finally decided during the first week of September.

The development of interfaces between the Danida installed systems and the new AirQUIS will be finalized on 10 September. (Responsible TNT with RH and HKR as development team).

6. AQ and met data from HCMC, results of AirQUIS evaluations
Data received from the measurement network on HCMC have been imported to AirQUIS. Some of these data have been evaluated and some statistics have been presented.

The result of this work confirms the errors on the meteorological data that were identified during Mission 1. (See some analyses in Attachment 3). The analyses will have to be investigated again. The question concerning the parameter itself and the sequence of parameters in the database will have to be looked into again. (HEL, MOW).

7. Status site infrastructures
Mr Khoa has reported status on preparations of the site infrastructures in HCMC and he informed us that DOSTE have almost received agreements from owners of five pretended AQM sites. There are little changes in our planning:

1) Binh Chanh Educational Office is okay,
2) Thong Nhat hospital site is okay;
3) IT Park site is moved from planned position about 80m, nearer to the main gate;
4) District 2 PC office site will be moved up on the right upstairs of this building (I feel that the new location is better than old one due to no surrounding obstacles);
5) The fifth site we look forward to setting up in District 1, will be located in the Zoo area, near its subordinate gate, about 80 m from Nguyen thi Minh Khai street.

This set-up seems adequate and is well within the planned locations. DOSTE will prepare the concrete base of shelters and contact with the Electric Company and the Telephone Company for establishing mains power and installing the telephone lines. This work will have to reported back to NILU to assure that all infrastructure is in place before 1 November 2002.

8. QA/QC and SOP preparations
The QA/QC system developed by the Danida project will be evaluated and necessary support material will be prepared. LM will start this work during the last week of August. Copies of the preliminary SOP manuals will be given to BS and RD. Additional SOP may be prepared, and finally updated during and after installations in HCMC (RD).

Spare part storage procedures and maintenance and repair procedures will be discussed and prepared at NILU before 10 September 2002. These

procedures will be presented to DOSTE during installations in November-December 2002. (LM/RD).

9. Other matters

The future application of AirQUIS and Air Quality Management training will depend on new versions of AirQUIS being presently developed at NILU. The measurement module is finished and will be tested on HCMC data. The modelling and management modules will be finalised at the end of 2002, well before this kind of training will take place at NILU for the DOSTE experts during the Spring of 2003.

The UNOPS supported training module has not been approved yet. However, it seems presently necessary to undertake an additional mission to HCMC before November 2002. Also the OPSIS data retrieval system will be tested against AirQUIS at NILU. If this process fails we have discussed the possibility of using the NILU data loggers and data retrieval system for the new sites. A final decision concerning these matters will have to be taken before 1 October 2002. This change in plans will also involve extra costs to the project.

Attachment 1

UNOPS

INT/99/R11 Fund for Danish Consultancy Services, Equipment and Supplies

98 VIE 1196 - Air Quality Monitoring Training, HCMC

NILU participation

The following tasks will have to be undertaken as part of the supplementary training for DOSTE in HCMC:

- Check and correct meteorological tower. (10 days)
- Train DOSTE staff in the use of meteorological data. (5 days)
- Train DOSTE staff in the OPSIS Enviman System. (2 days)
- Check and verify data interpretation and interface to AirQUIS, and OPSIS/AirQUIS interface training of DOSTE staff, including installation of Enviman on the new PC system. (2 days)

Task 1 Check and correct meteorological tower. (10 days)
This task will have to be undertaken by Instrumatic experts.

Task 2: Train DOSTE staff in the use of meteorological data. (5 days)
The training will be a joint effort between NILU and OPSIS. NILU will spend 4 days of the training to support DOSTE. The training will contain:

- Data control and quality checks. These controls of the data quality will be performed in co-operation between DOSTE and NILU experts, while instrument experts from Instrumatic are still available in HCMC. (2 days)
- Understanding the data, performing the necessary statistics and using the data. (1 day)
- Hand-on training will be given to see that the data are understood and that there will be a feeling for the basic understanding of the different parameters collected from the meteorological tower.(1 day)

Task 3: Train DOSTE staff in the OPSIS Enviman System. (2 days)
This task will be undertaken by OPSIS experts.

Task 4: Check and verify data interpretation and interface to AirQUIS, and OPSIS/AirQUIS interface training (3 days)
This will be a joint effort between OPSIS and NILU. The NILU input will be undertaken by Mr The from NILU and will include:

- Data transfer control and performance tests, (1 day)

- Verify the interfaces between Enviman and AirQUIS. (1 day)
- Training in the use of the systems will be started, and will be continued as part of the NORAD financed project. (1 day +++)

Financial proposal NILU:

The **cost estimate for NILU** participation in the up grading of the HCMC air quality monitoring system is based on co-ordinated efforts with the NORAD financed project. The original cost estimate was 9300 USD (June 2002) equivalent to 9900 EURO. The following table shows a budget break down:

	Name	Man-days	EURO
Fees	The Nguyen Thanh	6 *	4500
	Bjarne Sivertsen	2 **	1500
Travels	2 air tickets		3260
Accomodation	8 days in HCMC	8	640
Total			**9900**

**) included travel days*
***) another 4 man-days are taken from NORAD project*

NILU experts

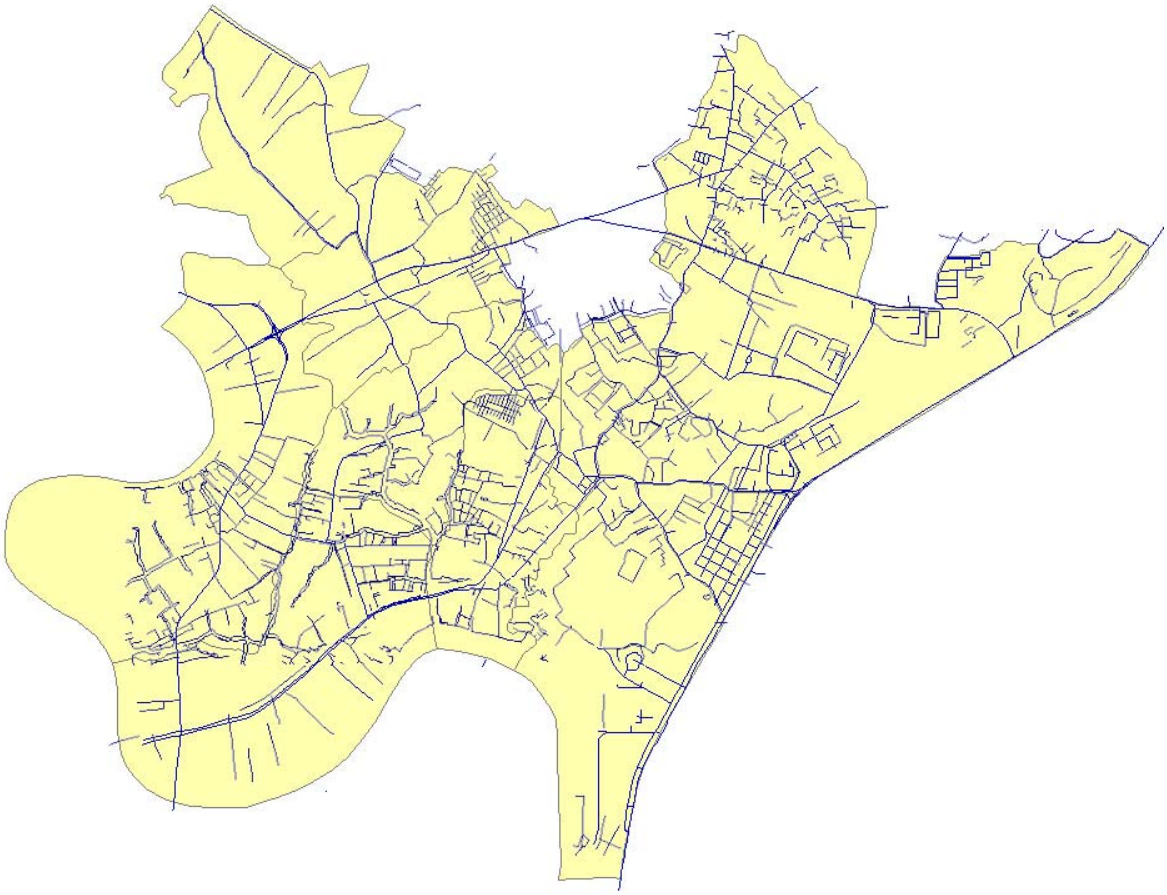
Two experts have been appointed from NILU to undertake the work. Mr B Sivertsen is the Project Manager of the NORAD funded project and will be in HCMC mainly on funds from NORAD.

Mr Bjarne Sivertsen (BS) is the Project Manager of the NORAD financed project. He is responsible for co-ordinating the Norwegian and international team of experts, and assure the project progress and results. Ha developed and performed training courses, he prepared the report for UNOPS and will assure integration with the Danida financed project. He is an air pollution meteorologist with 30 year of experience in the field. He also identified errors in the meteorological data and have since corresponded with DOSTE on various matters concerning the data quality and data applications.

Mr. The Nguyen Thanh (TNT) is the IT manager of the NORAD project. He is responsible for IT technologies and system integrations in the project. He has extensive experienced in computer technology, database development, network and communication. He is also part of the AirQUIS design team. He is presently head of the IT department at NILU and has participated in solving some of the problems that have been present in the DOSTE air quality network.

The total NILU participation in the UNOPS project will be 9900 EURO.

Attachment 2

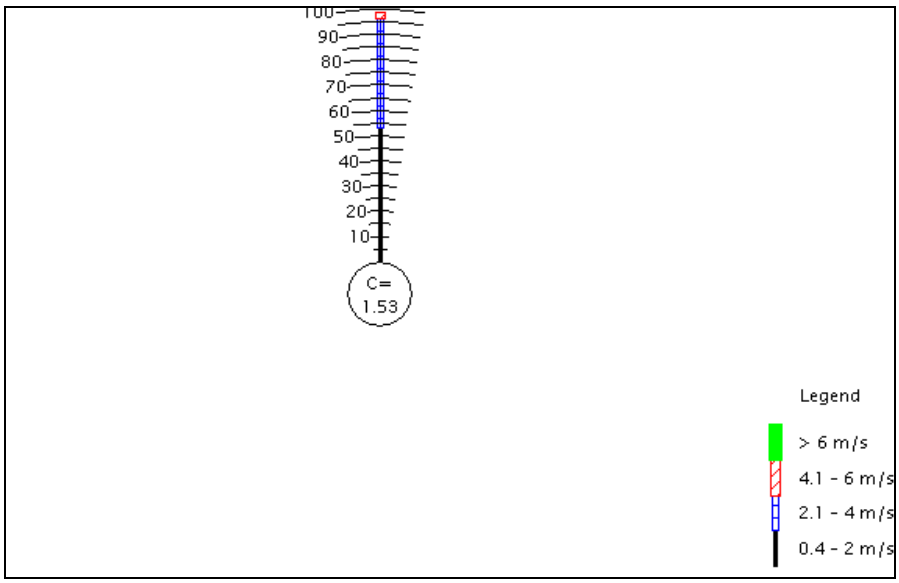


One District of HCMC (Tu Duc) as seen from the digitised maps, which are to be imported to the AirQUIS platform.

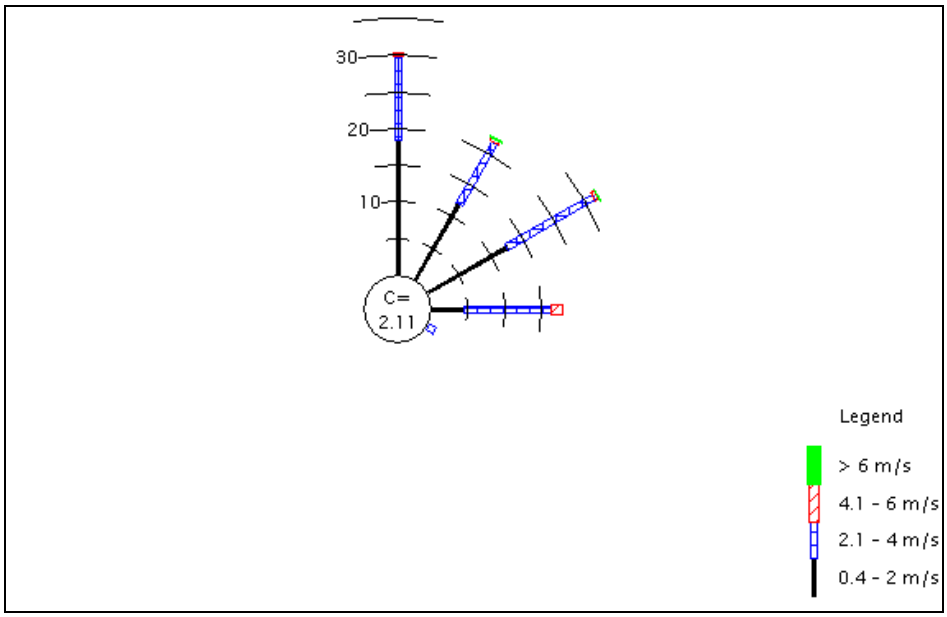
Attachment 3

Wind roses and wind direction raw data indicate major errors in these parameters.

WIND ROSE - HCMC - 01.01.2001-31.01.2001

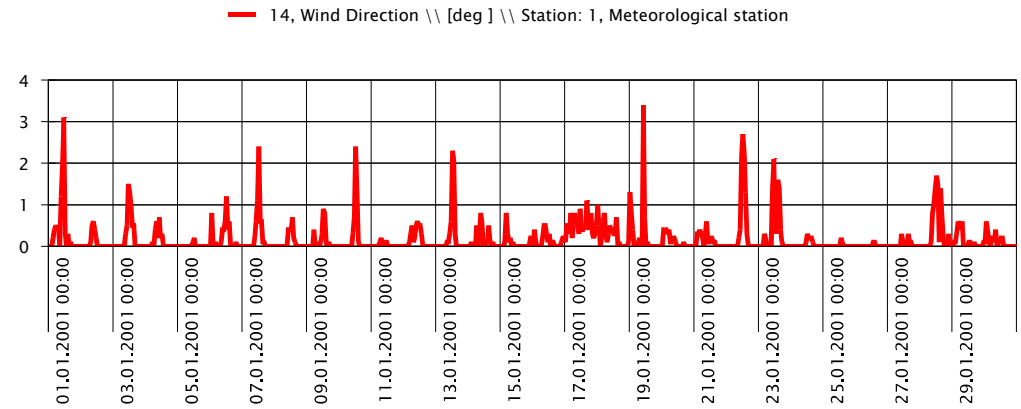


WIND ROSE HCMC - 01.12.01-31.12.01

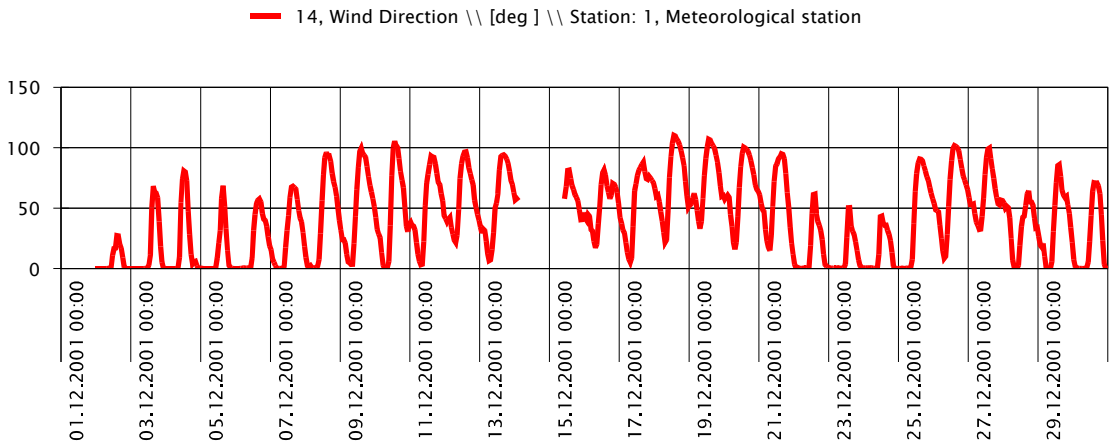


Wind direction record for January and December 2001.

WDD for HCMC - 01.01.2001-31.01.2001



WDD for HCMC - 01.12.2001-31.12.2001



Attachment 4

Data logger 256 problem

Reply from The Nguyen Thanh, 6 August 2002:

This problem seems very serious. I have contacted OPSIS about this matter.

Here is the suggestion from the OPSIS technical person:

DL256 is not compatible with DOS 7.0. You must install MS DOS 6.22 or lower, but not lower than MS DOS 5.0. MS DOS 6.22 supports also large HDs. I recommend that you should go for MS DOS 6.22.

If the above-mentioned solution does not work, then I propose that you use F-disk and downsize the 20GB hard disk to e.g. 4GB if the CMOS cannot handle larger HD than 4GB. It's worth a try....

For your information, the new DL256 comes with MS DOS 6.22.

I hope that this suggestion will solve your problem.

Appendix B

Task 2. Design and update

Appendix B1 New sites

New sites

Location of NILU/NORAD sites in HCMC

The 5 shelters were moved to the sites on 12 and 13 November 2002. A new list of sites with shelter number specifications is presented below.

The final sites for air quality measurements prepared by NILU in HCMC.

Site	NO_x	SO_2	O_3	CO	PM_{10}	VOC	Shelter no	Site
5. District 1- Zoo	1		1		1		839	Urban background.
6. Quang Trung-Software City	1	1	1		1		838	Residential urban background
7. District 2 PC	1	1	1		1		837	Residential .
8. Thong Nhat hospital	1	1		1	1	1	840	Road side
9. Binh Chanh Educat. Centre	1			1	1	1	841	Road side
Total instruments	5	3	3	2	5	2		

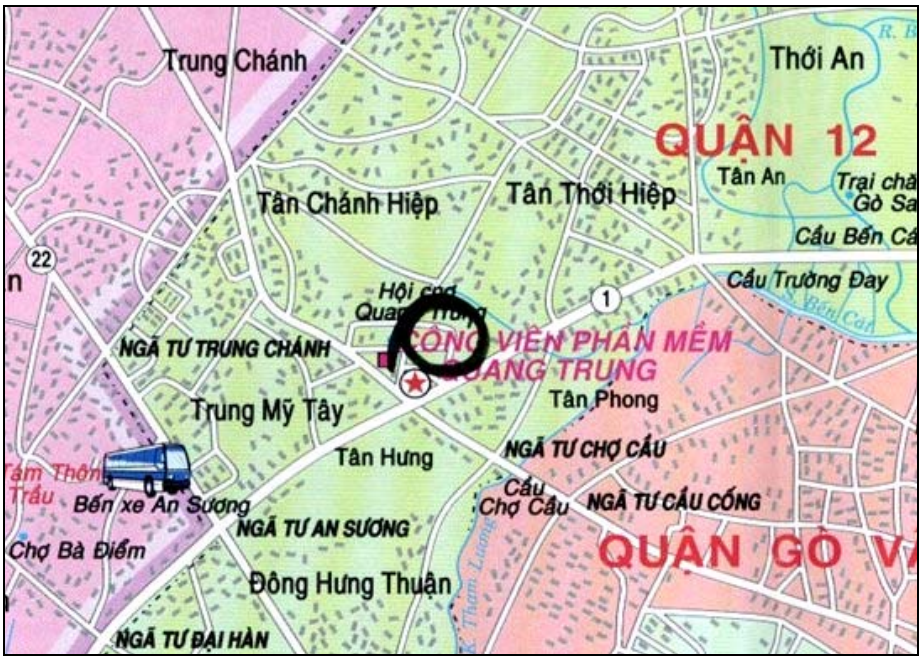
The sites are presented in photos below:

Site	**District 1-Zoo**
Shelter no:	**839**
Site type	Urban background station
Area/Location	The site is inside the park of the HCMC Zoo in the north eastern part of District 1. It is surrounded by park areas and is located about 20 m from a large main road leading out of the city towards north east. (Duong Nguyen Thi Minh Khai)

Zoo site, District 1

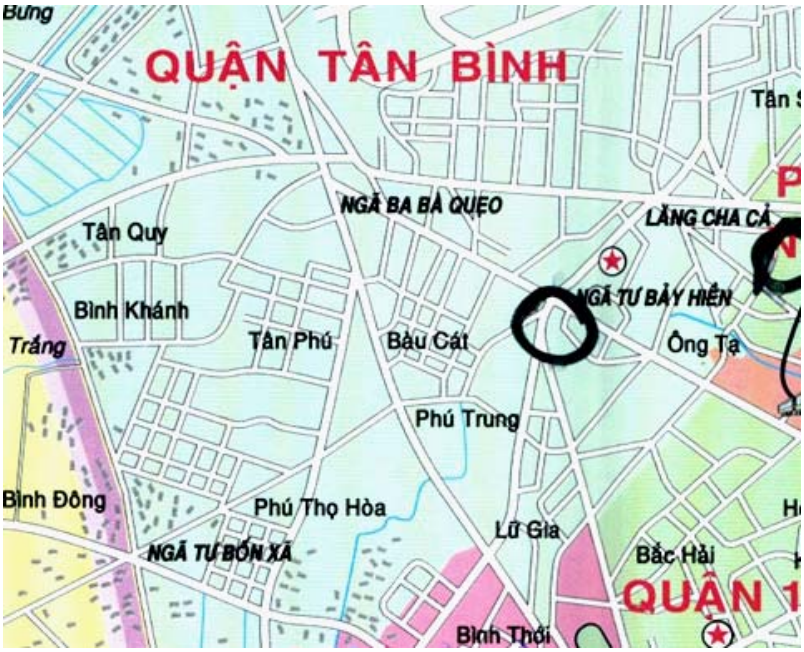
District 1- zoo

Site	**Quang Trung - Software City**
Shelter	**838**
Site type	Residential/urban background
Area/Location	The site is inside a large technology park with open areas. It is located in District 12. The area is located about 12 km north-north-west of the city centre of HCMC, about 5 km north of the international airport. The site is located about 100 m from road 1.



Software city, District 12

Site	**Thong Nhat Hospital**
Shelter:	**840**
Coordinates	N: 10 deg 47,550 min, E 106 deg 39,215 min
Site type	Road side station
Area/Location	Hospital in the Tan Binh District. The area is located in the north-western part of the city centre of HCMC, about 2 km south of the airport. The shelter is located at the road, 5 m from the road side.



Thong Nhat Hospital

Site	**Binh Chanh Educational Office**
Shelter:	**841**
	N: 10 deg 43,711 min, E 106 deg 36,442 min
Site type	Road side station
Area/Location	The area is located about 15 km south-west of the city centre of HCMC, on 462 Hung Vuong road leading out of the city to My Tho. The shelter is located at the fence next to the main road no. 1.

Binh Chanh Educational Centre

Site **District 2 – PC, People Committee Building**
Shelter: **837**
Site type Residential
Location: At the roof of the People Committee building of District 2. The site is located about 6 km east of the city centre of HCMC. The area is under development. Open areas surround the site. The main road to Hanoi passes less than 2 km north of the site and small industries are located about 3 km to the south and to the north-east. A future railroad station is planned only 500 m south from the site.

District 2, People Committee building

Appendix C

Task 3. Procure and install

Appendix C1

Deliveries

The following equipment has been delivered to DOSTE in November 2002:

No. of items	Item description
5	Shelter
5	Air conditioner
5	APC Smart-UPS 3000
5	Instrument rack
5	Drawer
5	Chair
5	Glass manifold with air intake and blower
3	Opsis DL 256 PRO data logger PC
5	API M701 Zero air generator
5	ESM Andersen F-H 62-1 dust monitor with air intake, heater and pump
2	API M300, Gas filter correlation CO monitor
3	API M400A, UV absorption O3 monitor
3	API M100A, UV fluorescence SO2 monitor
5	API M200A, chemiluminescence NO-NO2-NOx monitor with pump
13	Gas cylinder regulator
5	Ladder
1	Box with consumables, see attached list
1	PM_{10} flow and mass calibrator kit
2	Opsis DL 256 PRO datalogger PCs
3	AGA, 50 l bottle, 1 ppm SO2 in synthetic air
2	AGA, 50 l bottle, 1 ppm NO + 50 ppm CO in N2
3	AGA, 50 l bottle, 1 ppm NO in N2
1	AGA, 10 l bottle,1 ppm SO2 in synthetic air
1	AGA, 10 l bottle, 1 ppm NO in N2
1	AGA, 10 l bottle, 50 ppm CO in N2
5	Comvisioner licence
2	VOC sampler
5	Inlet manifolds
5	Comvisioner licence
1	Consumables for 3 years

Specifications

More detailed specifications of all equipment were presented in the technical project plan.

Accessory and spare parts

The delivery includes accessory and spare parts kit for 3 years' operation, according to supplier's experience. It was also specified in the requirements

to the suppler that the supplier must have spare parts in stock for at least five years after delivery of the instrumentation.

Packing and delivery
All equipment was delivered to NILU, Norway. The supplier should prepare the equipment for packing, including insurance.

Warranty
Warranty of a minimum of 1 year for overall equipment has been required. An agreement with the local supplier of API equipment, Schmidt Vietnam Co. Ltd. was signed during Mission 1.

Appendix C2: Service and repair contract

REPAIR AND SERVICE CONTRACT

No:
Date: …….

This Contract is made between :

PARTY A: **NILU (Norwegian Institute for Air Research)**
Instiuttvn. 18
PO Box 100
N-2027 Kjeller
NORWAY
Tel: + 47 63 898000
Fax: + 47 63 898050
Represented by: Mr. The Nguyen Thanh – Director of Information and Communication Technology
Hereinafter referred to as "NILU"

and

PARTY B: **SCHMIDT VIETNAM CO.LTD**. (Local Supplier)
Address: 13/Fl., Saigon center Building, 65 Le Loi Str., Dist. 1, HCMC.
Tel: + 84 8 8228228.
Fax: + 84 8 8230239
Tax code: 0100113085-001-1
Represented by: Mr. PREBEN HJORTLUND - General Director
Hereinafter referred to as "SCHMIDT"

The two Parties mutually agreed to enter this contract which the terms and conditions hereunder stipulated:

ARTICLE 1: SUBJECT OF SERVICE

SCHMIDT agrees to render maintenance service for the equipment supplied under the Contract HEIA.

For a period of **1 (one) year** from the date of signature.

ARTICLE 2: SCHMIDT RESPONSIBILITY

The services to be provided by SCHMIDT during its normal business hours shall include:

a) Repair of the equipments described in Appendix 1, when defect is reported by DOSTE. The response time to such a notification is within 8 (eight) hours. SCHMIDT shall produce a repair report and send to DOSTE within 2 (two) Working Day after each repair.
b) The period for correction of defects is maximum 2 (two) weeks after notification from DOSTE. If the defects cannot be repaired by SCHMIDT, then SCHMIDT shall inform DOSTE immediately for transportation of the defected equipments to the SUPLIER. SCHMIDT shall produce and send a status report of the defected equipment to the SUPPLIER and DOSTE within the period for correction, before the equipment can be sent to the SUPLIER.
c) Replace spare parts provided by DOSTE when necessary and return the damaged parts to DOSTE
d) Calibrate the equipment mentioned in this contract on every 6 (six) months and in addition to major repairs. SCHMIDT shall produce and send a 6-months Periodical Calibration Service Report to DOSTE within 4 (four) Working Days after the services have been performed.
e) SCHMIDT shall insure and keep insured its own employees against all claim for which it may responsible.
f) All repairs and calibration services must based on standard manuals provided by the Distributor and if necessary with guidance from Distributor and Supplier.

ARTICLE 3: SUPPLIER AND DOSTE LIABLITY

a) DOSTE shall carry out the daily maintenance, including consumable part replacement. All activities will be logged by DOSTE.
b) DOSTE shall keep the equipment clean in according to Operational Manuals provided by the Distributor in order to minimize the risk of SCHMIDT's maintenance personnel being exposed or health hazards.
c) DOSTE shall make the equipment available for repair/calibration, a representative of DOSTE shall be presented at all times. DOSTE should also provide the necessary suppliers such as power supply.

d) The Supplier shall, if possible, support SCHMIDT in communication with the Distributor on technical consult.

ARTICLE 4: CONTRACT VALUE

Total value for services rendered under this contract shall be calculated at 3% (three percents) of the total equipment value in Appendix 1 plus the regulated VAT.

3% of USD:	USD 7,300.00
VAT 5%:	USD 365.00
Total:	**USD 7,665.00**

ARTICLE 5: PAYMENT

a) The first payment of 50% (fifty percents) contract value will be effected by the Supplier by cash transfer upon contract signed to SCHMIDT through the following Bank account:

Beneficiary: SCHMIDT VIET NAM CO., LTD.
A/C No.: USD 4321113701599
Banker: VID PUBLIC BANK (02 Ngo Quyen, Ha Noi, Vietnam)
Swiftcode: VIDPVNV5

b) The remaining 50% contract value will be effected by NILU by cash transfer to SCHMIDT through the above mentioned account not later than 07 days upon receipt of an unconditional and irrevocable performance bond issued by SCHMIDT in favor of NILU equivalent to 50% of the contract value. The bond is to expire upon the completion of this contract validity based on the contractual obligation as agreed upon.

ARTICLE 6: EXCLUSION

This service does not include the following:

- Electrical or environmental work external to equipment.
- Relocation and re-installation of the equipment.
- Supply of consumable items required for the operation of the equipment.
- Supply of the other parts not stipulated in the contract.
- Service caused by damage to destruction of equipment resulting from:
  - ❖ Unauthorized relocation and re-installation of the equipment.
  - ❖ Unauthorized repair, modification or connection of foreign equipment.
  - ❖ Fire or explosion of any origin, riot civil commotion, war, or any Act of God including but not limited to lightening, storm, flood, earthquake, etc.

- Operator routine maintenance as specified in the equipment operation manual (s).
- Interpretation of data

ARTICLE 7: GENERAL CONDITIONS

a) This contract will be governed and constructed in accordance with the laws of Vietnam.
b) All above mention terms and conditions shall be effected seriously by both parties. Either party cannot alter the contract without the other's party consents.
c) Any dispute or discrepancies which may arise out of this agreement shall be settle smoothly, amicably basing on mutual understanding. Any amendment or supplement of this agreement will be valid only if they are made in writing and signed by both party.
d) This contract shall come into effect on the date of signing and valid for 1 (one) year. The contract is written in English in 4 (four) copies with two (2) copies for each.
e) Definition of DOSTE (Customer), SCHMIDT (Local Supplier), Industriell Maaleteknikk (Supplier) and API (Distributor) is described in the Form of Confirmation.
f) The term "Working Day" means Monday through Friday, except Vietnamese holidays and official celebration days.
g) The term "Working Hours" means the hours between 08.00 and 17.00 Vietnamese local time, on Working Days.

ARTICLE 8: BREACH OF CONTRACT BY SCHMIDT

a) What is to be deemed as breach of contract
The SCHMIDT is in breach of contract in the event that the Services described in Article 2 are not being fulfilled.

b) SCHMIDT's duty to remedy breach of contract
Work to remedy breach of contract shall commence and be fulfilled as soon as possible upon the SCHMIDT's receipt of notification of the problem by DOSTE and not later than the agreed deadlines described Article 2.

c) SCHMIDT's duty to notify
In the event that service cannot be performed as agreed upon, SCHMIDT shall as soon as possible in writing notify DOSTE in this respect. The notification shall inform about the reason for the delay and if possible state when performance can be expected. The same also applies for any further delays. All delays must be accepted in writing by DOSTE.

d) Penalty by the Working Hours
In the event that an agreed deadline is not kept in Article 2 a), a penalty shall automatically accrue by the Working Hours. The daily penalty shall be 0.5 % (zero-point-zero percent) of the total yearly price excluding value added taxes for each commenced Working Hour as long as the delay endures. This penalty shall only accrue on Working Hours and up to a maximum of 50 (fifty) Working Hours.

NILU is not entitled to terminate the Service and Repair Contract while the daily penalty accrues.

e) Penalty by the Working Day
In the event that an agreed deadline is not kept Article 2 b), a penalty shall automatically accrue by the Working Day. The daily penalty shall be 0.5 % (zero-point-zero percent) of the total yearly price excluding value added taxes for each commenced Working Day as long as the delay endures. This penalty shall only accrue on Working Days and up to a maximum of 50 (fifty) Working Days.

NILU is not entitled to terminate the Service and Repair Contract while the daily penalty accrues.

f) Remedies due to SCHMIDT's breach of contract
In the event of breach of contract, NILU will issue a Letter of Penalty from 0% (zero percent) to 100% (one hundred percents) of the remaining of 50% (fifty percents) the contract value in Article 5 b) based on Article 8 d) and e).

g) Termination for cause
In the event that a breach of Service and Repair Contract substantially affects DOSTE and cannot be remedied without substantial costs or inconvenience to DOSTE, NILU is, subsequent to having notified SCHMIDT in writing and having given him a reasonable deadline to remedy the breach, entitled to terminate the Service and Repair Contract with immediate effect.

NILU may, subsequent to the expiry of the daily penalty period, terminate the Service and Repair Contract with immediate effect.

FOR PARTY A **FOR PARTY B**

Mr. PREBEN HJORTLUND

Appendic C3 Test instrument setup at NILU

The following was reported in the project meeting 15 August 2002
All instruments, shelters, UPS and Air conditioners have been tested at NILU. Instrument racks and instruments were completely installed in the shelters. To check the "instrument-database-data retrieval – AirQUIS interface" one monitor with data logger and telephone line was set up for this specific testing. RD/LM was responsible for starting this test on 19 August.

Enviman light (OPSIS data retrieval) will be installed with the new version of the AirQUIS database system. TNThe will be responsible for initiating this testing from 1 September.

After testing all shelters and monitors transport of all equipment was prepared. The loading into containers was finalized before 1 October 2002, and the shipment left Norway on 4 October 2002.

All documents needed for releasing the equipment from harbour in HCMC was provided by our shipper Danzas. The documents were sent from Norway on 18 October (except Certificate of Origin) to the agent for Danzas AI in HCMC. The contact person is Thi My Phung Nguyen, with telephone number 88 226 087 and fax 88 226 018.

DOSTE shelters tested at NILU August 2002

Appendix C4 Installations in field

Work notes from Rolf Dreiem

4-5 Nov 2002 Travel to HCMC. Arrived HCMC in the afternoon on 5 Nov 2002 at 1900.

6 Nov 2002 Went to DOSTE at 0845 and met Doan Thi Toi, Le Van Khoa and Nguyen Thi Tuyet Hoa. Was introduced to the rest of the staff. Inspected the DOSTE Station and went to EDC and was introduced to the staff and looked at the data from all 4 stations.

7 Nov 2002 Visited all five new sites to inspect the locations.

1. Zoo Station, District 1
The Station looks good. About 30 meters from the street. Fuses on pole need cover for protection from visitors in the park.

2. People Commity, District 2.
The Station looks good. It is put on top of the building approx. 9 meter above street level.

3. Quang Trung Software City, District 12
The Station looks good. Close (10-30 meter) to the station they are burning leaves from the surrounding trees. These will influent on the measurements. I was told that DOSTE will move the station in near future.

4. Thong Nhat Hospital
Some branches have to be cut. PM10 air intake will come to close to the branches.

5. Education and Training Bureau, District Binh Chanh
The station looks good.

8 Nov 2002 Unpacked the calibrator. This is **API 702 calibrator,** which is a single point calibrator and can not be used as a multipoint calibrator as API 700. The gas cylinders have too low concentrations; similar to outdoor air and can not be used on the calibrator.
The zero air generator **API 701** is not at DOSTE at all. We borrowed one from SCHMITH, Vietnam.
The manual on API 702 was missing. DOSTE asked API,

USA if they would send one by mail?
In the afternoon we made a copy of Excel Calibration Sheet and installed this on the PC in the calibration lab.
I trained EDC (4-5 persons) how to use the Excel Calibration Sheet.

11 Nov 2002 New office on ground floor. BS arrived HCMC. Manual on API 702 Calibrator on mail from API, USA. Made a quick overwev of the whole manual.
Made a list of stations and where to put different shelters.

People Committee, District 2.
Shelter 837
Quang Trung Software City, District 12.
Shelter 838
Zoo Station, District 1
Shelter 839
Thong Nhat Hospital
Shelter 840
Education and Training Bureau, District Binh Chanh
Shelter 841

Customs: Went to harbour with Mr. Khoa, Mr. Hoa and Mr. Dam.
Took two shelters out of one container and opened one for inspection by one Custom Officer.
The shelters where put back in the container and looked.
The other container was opened and the customs officer opened all boxes (5) and had a quick look inside.
The boxes was taped and container was locked.

12 Nov 2002 Three shelters where loaded to two trucks and taken to different sites.
The shelter No is 837, 838 and 839 were moved first.
All boxes from the container where placed in one shelter to avoid any problem on our way out of the custom area. The boxes where taken to the office at DOSTE. Mr Quoc and Mr Huy participated and supported this task.

13 Nov 2002 Two shelters where loaded to one truck and transported to their stations. These were shelter No is 840 and 841.

Installed: **Zoo Station, District 1, Shelter 839**

14 Nov 2002 Installed 3 stations.
Software City, District 12. Shelter 838
Thong Nhat Hospital, Shelter 840

People Commity, District 2, Shelter 837

15 Nov 2002 Installed 1 station.
Education and Training Bureau, District Binh Chanh Shelter 841
All glass tube manifolds were inside this shelter. The remaining 4 manifolds was placed in the car and taken to the other stations as we do the final installations and start-up of the monitors.

18 Nov 2002 Started all instruments at District 1-Zoo. All instruments are working well.

19 Nov 2002 Finalised start-up at District 1-Zoo site.
Started District 2-PC monitoring site. Telephone line is connected. PM10 monitor does not have a set point of 50-degree C. This will have to be corrected soon.

20 Nov 2002 Installed the station at Quang Trung-software city.
Installed Thong Nhat Hospital. All monitors on both sites are performing well.

21 Nov 2002 Check NO gas cylinder at DOSTE. Rebuilt gas regulator to fit on cylinder.
Started Binh Chanh-Educational Office. Monitors are working well.
Light inside does not work.
Data logger needs new set up menu.
NO gas cylinder and regulator was brought to District 1-Zoo.
The Teflon tubing's and fittings to make a zero and span check was connected.
A zero/span was performed.

22 Nov 2002 Office work. Made one complete SOP for DOSTE. DOSTE will copy from this SOP to make 5 other, one for every site.
Made a work plan with Mr Dam for next week.
1. Monday: Two-point calibration at DOSTE.
2. Tuesday: Foil calibration PM10 at Zoo station.
3. Wednesday: Maintenance and service at DOSTE.
4. Thursday: Maintenance and service at DOSTE.

25 Nov 2002 Performed training on API 702. Calibrated zero air and gas cylinder flow. Explained in detail how to perform a GPT to check the NO_2 converter on API 200 NOX monitor.
Calibrating gas concentration was calculated in an excel sheet. Calculated also converter efficiency. This 2 excel sheet

is copied to computers at EDC and calibration laboratory. All consumable was put in shelves at calibration laboratory.

26 Nov 2002 Made foil calibration of PM10 dust monitor at District 1-Zoo. This calibration includes how to change filter reel witch has to be performed once a year. Rotary vanes has to be replaced one a year and I explained in details how to do it according to instruction manual.
Visited District 2-PC station. Changed air inlet temperature to 50 degree C to avoid condensation inside the tube.

27 Nov 2002 Prepared spare part and consumable list at calibration laboratory. Performed maintenance as training on two monitors that did not work properly.
CO monitor have some problems in electronics and one board has to be replaced.
SO2 monitor has a leek in the kicker. Has to be replaced.

28 Nov 2002 Training in maintenance and repair at DOSTE station.
Went to District 2-PC. Had to reset PM10 monitor.
A power failure occurred at the same time as the instrument was doing a filter change. This made the instrument stop and not start again.
Had a quick look at the CO monitor. This monitor has to be brought to a the laboratory for a complete maintenance and new calibration. (By Schmidt Vietnam).
The gas cylinders at DOSTE today is:

1. 1 ppm NO 40 litre.
2. 1 ppm SO2 40 litre.
3. 1 ppm NO 10 litre.
4. 1 ppm SO2 10 litre.

1 and 2 is span gases.
3 and 4 is travelling standard gases.

Appendix D

Task4. Assure system integration

Appendix D1: Specifications of the data retrieval PC at EDC

Specification of the data retrieval PC

Brand	NOVA (Local Brand)
CPU	Intel Pentium 4, 1.5 GHz
Hard disk	IDE 20 GB
RAM	256 MB
Graphical Adapter	Supports 1280 x 1024 or higher resolution, 32-bit true colour quality
Network	TP - 100 Mbit (disabled)
Monitor	15" supports 1280 x 1024 or higher resolution and 32-bit true colour quality
Case	Desktop
Other	1.44 FD, CD-ROM, keyboard, scroll mouse, com port, parallel port and USB ports
	Windows 2000 English with SP 3
Warranty	1 – 3 years

This PC was purchased and installed in September 2002.

Specification of the new Enviman Comvisioner

EnviMan Comvisioner version is 2.0.44 (30.09.02 19.07.06).

Appendix D1b: Specifications of the PC-equipments for AirQUIS

Client-PC

Brand	Local
CPU	Intel Pentium 4, 2GHz or faster
Hard disk	IDE 20 GB or larger
RAM	512 MB
Graphical Adapter	Supports 1280 x 1024 or higher resolution, 32-bit true colour quality
Network	TP - 100 Mbit
Monitor	19” supports 1280 x 1024 or higher resolution and 32-bit true colour quality
Floppy disk	1.44 MB
CD	CD-RW (52/24/52) or faster
Case	Desktop or Tower
Other	Keyboard, scroll mouse, com port, parallel port and USB ports
Operative system	Certified for MS Windows XP English with SP 1 or newer
Warranty	Minimum 1 year

Server-PC

Brand	Compaq MT 530 or newer
CPU	Intel Pentium III Xeon – 512 Kb, 1 GHz or newer/faster
Hard disk	4 x 36 GB SCSI hot-swap
RAID Adapter	Supports RAID 0 and RAID 5
RAM	1 GB
Graphical Adapter	Supports 1280 x 1024 or higher resolution, 32-bit true colour quality
Network	TP - 100 Mbit
Monitor	19” supports 1280 x 1024 or higher resolution and 32-bit true colour quality
Case	Rack or Tower. A rack model is preferred because DOSTE has a standard rack containing a 3COM HUB and a patch panel.
Other	Keyboard, scroll mouse, com port, parallel port and USB ports
Operative system	MS Windows 2000 Server English with SP 3 or newer
Warranty	Minimum 1 year

Service agreement	Option for yearly service agreement after the warranty period

NILU will purchase 1 client-PC and 1 Server-PC for this project. These PCs will be installed at the EDC. The equipments above should be purchased 2 weeks before installation of AirQUIS due to the fast development and the price fall.

DOSTE and NILU will need at least 1 week to prepare and install the operative system and connect the equipments to the existing network.

DOSTE does not have a dedicated and automatic system for backup. DOSTE uses CD-RW solution for backup.

Appendix D2 Disaster Recovery

Disaster Recovery

Operational Manual

December 2002
Author: The Nguyen Thanh
User Group: The EDC Team

Content

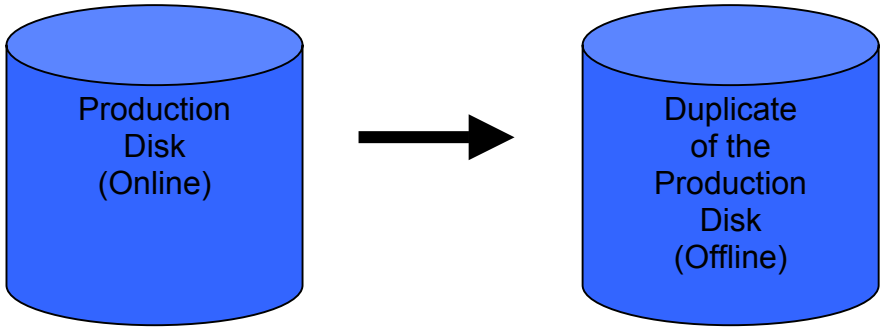
Page

1. Introduction

This document describes how reconstruct your production system in a fast and efficient way, if a system crash should appear. You will never need to reinstall all the software and tuning all the parameters when reconstructing after system crash.

2. Disk Cloning

Disk cloning is a method of creating an exactly copy of a complete disk.



1. Configure the clone disk as slave
2. Turn off the PC
3. Open the top cover of the PC
4. Attach the available IDE bus cable using for the production disk.
5. Attach available power cable to the clone disk
6. Insert the floppy disk labeled Ghost Boot Disk
7. Turn on the PC
8. The system will restart with PC DOS
9. The About Norton Ghost Windows appears. Select OK
10. Select Local
11. Select Disk
12. Select To Disk
13. Select number 1 (the first line for the master disk) from the Drive column in “Select local source drive by clicking on the drive number”-window. This is your Production Disk. The selected line will turn to dark blue.
14. Select OK
15. Select number 2 (the second line for the slave disk) from the Drive column in “Select destination source drive by clicking on the drive number”-window. This disk will be a clone of your Production Disk.
16. Select OK
17. The Destination Drive Details appears
18. Select OK

19. The Question: (1831) appears. Please always verify in this window that **Source** is Local drive [1], ……MB and the **Destination** is Local drive [2], …… MB.
20. Select Yes and the cloning will start
21. The Clone Complete (1912) window appears with the message Clone Completed Successfully.
22. Remove the floppy disk labeled Ghost Boot Disk
23. Turn off the PC
24. Detach the IDE data transfer cable from the clone disk
25. Detach the power cable to the clone disk
26. Verify the clone disk by configure the clone disk as master disk
27. Turn on the PC and restart if necessary to verify that the clone disk is in order
28. If everything is in order then turn of the PC
29. Close the top cover of the PC
30. Turn on the PC
31. Log the clone date in the history log for the clone disk
32. Keep the clone disk in safe condition
33. Now you have an exactly copy of the production disk

3. Disaster Recovery

Use this procedure only when you have a total system crash meaning that the system cannot start or start as expected.

1. Turn off the PC
2. Open the top cover of the PC
3. Detach the data transfer cable and the power cable from the defected production disk.
4. Remove the production disk
5. Install the clone disk at the same place as the defected production disk
6. Turn on the PC
7. Verify that the system is working as expected. If not, please notify the error message and use the procedure for reporting errors.
8. Close the top cover of the PC. The new installed disk will be the new production disk
9. Get a new disk and make a clone disk of the production Disk. Please see Section no. 2.

4. Problem reporting procedure

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.

Appendix D3 Identify existing data collection, presentation and reporting system

The current data collection system

DOSTE is currently running the Enviman comvisioner for collecting measurement data from the OPSIS DL 256 Pro at the stations.

The data are being downloaded at least once a day.

The current data presentation

Enviman Comvisioner is used for presenting the measurement data.

The current reporting system

For reporting purposes, DOSTE is using the reporting tools developed by dk TEKNIK for calculation and presentation of the daily AQI and the AQI classifications. The daily AQI and the AQI classifications are also presented on the electronic street panel at Ben Thanh Market. These tools can be described in the following steps:

1. Select data from the Enviman Reporter.
2. Copy data manually to predefined templates in Excel.
3. Run the Excel macro in the templates. The Excel Macro produces the ASCII-file station.ann as input for Enviman Reporter.
4. Run Enviman Reporter to quality assure the content of the station.ann before running the AQI_cal.exe.
5. Run Pascal program AQI_cal.exe to produce AQI and AQI classifications in HTML-format and the ASCII-file aqi.ann. The AQI and AQI classification will be sent to the electronic street panel at Ben Thanh Market. See the Section Figures for more details.
6. Run Enviman Reporter to visualize the historical AQI data. See the Section Figures for more details.
7. The ASCII-files *.ann are for Enviman Reporter use only.

For more details see the Sections Calculation of the daily AQI , Final quality control of monitordata Suggestion for Air Quality Index (AQI) for the HCMC AQ network below written by dk TEKNIK.

Specification of the ASCII-files

ASCII-file	yymmdi_cor.ann
Example	0211TS_cor.ann
Explanations	yy = year
	mm = month
	di = Datalogger ID

01/11/02 00:00	15.88	15.79	77.53	2.46	-999.00	50.20
01/11/02 01:00	12.50	15.23	73.27	4.92	-999.00	50.20
01/11/02 02:00	14.13	21.62	81.51	2.20	-999.00	50.20
01/11/02 03:00	11.25	6.58	77.82	8.55	-999.00	50.20
01/11/02 04:00	15.13	15.04	88.61	3.11	-999.00	50.20
01/11/02 05:00	16.50	15.42	87.47	3.76	-999.00	50.20
01/11/02 06:00	21.00	25.00	81.51	7.64	-999.00	50.20
01/11/02 07:00	14.13	17.48	87.47	23.84	-999.00	50.20
01/11/02 08:00	17.13	21.81	101.67	28.11	-999.00	50.20
01/11/02 09:00	14.25	9.96	82.93	27.72	-999.00	50.20
01/11/02 10:00	13.13	1.88	63.62	25.91	-999.00	50.20
01/11/02 11:00	11.63	-3.38	59.92	25.26	-999.00	50.20
01/11/02 12:00	11.75	-3.38	60.49	28.76	-999.00	50.20
01/11/02 13:00	11.63	-4.14	63.62	28.63	-999.00	53.50
01/11/02 14:00	11.50	-5.26	63.62	26.43	-999.00	56.30
01/11/02 15:00	12.25	-0.94	63.05	26.68	-999.00	56.30
01/11/02 16:00	11.75	3.57	61.91	25.78	-999.00	56.30
01/11/02 17:00	11.38	8.65	61.63	16.71	-999.00	56.30
01/11/02 18:00	13.25	18.99	63.90	7.77	-999.00	56.30
01/11/02 19:00	16.38	18.99	67.02	4.66	-999.00	56.30
01/11/02 20:00	13.50	14.66	73.84	5.96	-999.00	56.30
01/11/02 21:00	14.25	16.36	69.01	4.92	-999.00	56.30
01/11/02 22:00	19.13	15.42	67.31	4.02	-999.00	56.30
01/11/02 23:00	39.50	17.30	79.80	1.68	-999.00	56.30
02/11/02 00:00	62.63	17.48	88.32	1.81	-999.00	56.30
02/11/02 01:00	38.38	17.30	90.88	2.72	-999.00	56.30
02/11/02 02:00	63.00	16.54	130.92	1.69	-999.00	56.30
02/11/02 03:00	29.00	8.46	130.92	1.43	-999.00	56.20
02/11/02 04:00	18.63	5.26	79.80	1.04	-999.00	56.30
02/11/02 05:00	25.50	4.70	68.73	1.04	-999.00	56.30
02/11/02 06:00	31.38	8.08	76.68	2.59	-999.00	56.30
02/11/02 07:00	17.38	8.65	70.15	11.15	-999.00	56.30
02/11/02 08:00	14.75	4.51	69.86	17.77	-999.00	56.30
02/11/02 09:00	13.00	0.75	66.17	24.64	-999.00	56.30
02/11/02 10:00	15.63	4.51	64.18	31.65	-999.00	56.30
02/11/02 11:00	12.13	-0.19	61.63	35.15	-999.00	56.30
02/11/02 12:00	12.75	1.50	61.06	33.20	-999.00	56.30
02/11/02 13:00	13.00	-0.75	60.78	29.18	-999.00	52.50

02/11/02 14:00	12.13	-3.95	60.21	30.61	-999.00	49.30
02/11/02 15:00	12.25	-0.94	60.78	29.57	-999.00	49.30
02/11/02 16:00	12.25	5.64	62.20	29.70	-999.00	49.30
02/11/02 17:00	12.38	19.36	63.33	21.14	-999.00	49.30
02/11/02 18:00	13.38	27.07	65.89	14.66	-999.00	49.30
02/11/02 19:00	11.50	18.24	64.75	30.48	-999.00	49.30
02/11/02 20:00	11.13	16.54	69.30	27.11	-999.00	49.30
02/11/02 21:00	11.25	6.77	65.04	21.27	-999.00	49.30
02/11/02 22:00	10.88	8.46	72.70	16.47	-999.00	49.30
02/11/02 23:00	11.50	25.19	114.45	6.87	-999.00	49.30
03/11/02 00:00	21.88	31.02	150.80	1.82	-999.00	49.30
03/11/02 01:00	16.13	26.70	114.45	1.95	-999.00	49.30
03/11/02 02:00	15.00	23.88	135.18	1.55	-999.00	49.30
03/11/02 03:00	13.38	14.10	110.19	4.78	-999.00	49.30
03/11/02 04:00	12.25	11.47	75.26	5.82	-999.00	49.30
03/11/02 05:00	13.38	12.22	67.31	5.30	-999.00	49.30
03/11/02 06:00	15.13	12.03	68.73	6.98	-999.00	49.30
03/11/02 07:00	15.75	18.80	77.82	15.25	-999.00	49.30
03/11/02 08:00	16.63	24.06	87.47	23.66	-999.00	49.30
03/11/02 09:00	13.25	9.59	80.37	39.04	-999.00	49.30
03/11/02 10:00	11.63	6.39	71.57	69.03	-999.00	49.30
03/11/02 11:00	11.13	5.83	73.84	77.82	-999.00	49.30
03/11/02 12:00	11.88	5.08	69.58	57.14	-999.00	49.30
03/11/02 13:00	12.63	0.38	67.02	39.81	-999.00	54.30
03/11/02 14:00	13.13	0.75	67.88	33.35	-999.00	58.70
03/11/02 15:00	12.75	2.82	68.16	36.07	-999.00	58.70
03/11/02 16:00	12.50	5.26	69.58	33.09	-999.00	58.70
03/11/02 17:00	12.00	12.22	65.32	26.50	-999.00	58.70
03/11/02 18:00	11.75	17.48	63.62	22.49	-999.00	58.70
03/11/02 19:00	11.88	17.86	64.18	20.04	-999.00	58.70
03/11/02 20:00	11.88	18.80	68.16	17.32	-999.00	58.70
03/11/02 21:00	13.38	26.13	66.74	12.67	-999.00	58.70
03/11/02 22:00	12.75	19.55	62.48	14.35	-999.00	58.70
03/11/02 23:00	12.50					

ASCII-file	yymmAQI.ann
Example	0211AQI.ann
Explanations	yy = year
	mm = month

The content of the filename:

01/11/02 00:00	150	67	22
02/11/02 00:00	110	74	23
03/11/02 00:00	135	86	19
04/11/02 00:00	169	64	23
05/11/02 00:00	189	67	25
06/11/02 00:00	133	63	31
07/11/02 00:00	95	69	22
08/11/02 00:00	145	72	21
09/11/02 00:00	169	76	21
10/11/02 00:00	152	66	21
11/11/02 00:00	181	76	19
12/11/02 00:00	172	73	20
13/11/02 00:00	153	79	23
14/11/02 00:00	169	67	21
15/11/02 00:00	173	84	23
16/11/02 00:00	145	86	17
17/11/02 00:00	133	65	17
18/11/02 00:00	169	67	21
19/11/02 00:00	201	74	25
20/11/02 00:00	192	69	20
21/11/02 00:00	172	76	19
22/11/02 00:00	165	87	23
23/11/02 00:00	131	75	16
24/11/02 00:00	145	73	18
25/11/02 00:00	178	91	22
26/11/02 00:00	209	89	24
27/11/02 00:00	183	97	-999
28/11/02 00:00	175	96	-999
29/11/02 00:00	205	75	-999
30/11/02 00:00	188	70	-999

Column 2 = Road
Column 3 = Resident
Column 4 = Industry

Calculation of the daily AQI

The nessecary data are collected from Enviman Sitebuilder through the command files aqi_NO2, aqi_SO2, aqi_O3, aqi_CO and aqi_PM10. Sitebuilder produces tables in HTML format, which are stored in the folder c:\opsis\enviman\tmp\export\.

The program c:\opsis\enviman\bin\sitebuilder\AQI.EXE reads theese data and calculates the AQI's according to definition of the AQI. It also reads the template file ...sitebuilder\templates\aqi_temp.htm and produces a new files .\tmp\export\AQImmdd.htm, which includes the AQI from "yesterday" and the four preceeding days. At the same time the AQI's for the same five days are stored in the Enviman database AQI. The Pascal source file aqi.pas is found in the folder ...sitebuilder/.

The batch program ...\sitebuilder\aqi_cal.exe (AQI on the desktop) starts sitebuilder and afterwards the program for calculation. When the calulation is finished the new values can be shown in WORD.

The program should be run every day. Missing data from previous periods can be calculated by setting the PC's date to the day after the day you want to calculate.

The names of the AQI classification (Good, Moderate, ...) are stored in the file ..sitebuilder/templates/aqifiles.dat. They can be changed with Notepad.

The Date Configuration in the REGIONAL OPTIONS on the computer must be:

DATE: MM/dd/yyyy (for both the short and long date)
TIME: h:mm:ss tt with AM & PM

Final quality control of monitordata

The control should be performed in the beginning of each month for the previous month results.

Data are treated for one station at a time.

All files are stored in c:\opsis\enviman\data\timeseries\final).

Open the EXCEL book for the station. (DO_temp.xls, HB_temp.xls, TS_temp.xls and TD_temp.xls.

For each of the compounds NO, NO_x, SO_2, O_3 and CO the procedure is:

In Reporter:

- Choose average, zero and span in the mentioned order (for NO the span for NO_x should be used) in Parameter Selection.
- Select exactly one month and 60 minutes averaging time in Calendar
- Select all three parameters in Time Series
- Show the results as a table
- Select all and copy to clipboard

In EXCEL:

- Select the sheet for the compound in the EXCEL book and select cell A1. Paste from clipboard.
- Identify apparently wrong data on the graphs. Delete (clear contents) the corresponding results from columns C, D and E. (It is not necessary to remove the asterisks for missing data.)
- Fill in the spangas concentration as measured at latest calibration with reference gas bottles prior to the month in cell F5. If calibration was performed during the month the new value is written in column F in the cell corresponding to the day and time for the calibration.
- Press ctrl-Z
- Look once more at the graphs. If new corrections are made press ctrl-Z again.

PM_{10}

- the parameters conc and volume are selected in Reporter.
- the results are Copy/Pasted to the sheet PM10.
- the apparently wrong results are deleted (clear contents). Results with volumes above 18 and below 25 are automatically removed (do not pres ctrl-Z).

When all compounds from a station have been checked press ctrl-S. This will save the EXCEL book under the name yymmSS_cor.xls (SS=DO, HB, TS or TD) and it will produce an ASCII file yymmSS_cor.ann, which can be accessed from databases SS_com in Reporter.

Comments:

The concentrations are corrected for zero and span drift using the formula:

$$C_{cor} = (C_{avg} - Z_{cal})*SC_{cal}/(S_{cal} - Z_{cal})*CF,$$

where Z_{cal} is the zero calibration, S_{cal} the span calibration, SC_{cal} the span calibration at the last calibration with reference gas and CF the conversion factor between ppb and $\mu g/m^3$ (or ppm and mg/m^3) at 25^0C and 1013 mb.

CF= 1.88, 2.84, 2.0, 1.14 for respectively NO_2, SO_2, O_3 and CO.

Suggestion for

Air Quality Index (AQI) for the HCMC AQ network

The AQI shall be based on the existing VN air quality standards.

The health effects should be taken into account considering a classification of the different AQI intervals, presuming that the standards represent the lower level for any provable effect.

In establishing the definitions of similar indices from other countries, i.a. USA, Malaysia and UK, are taken into account.

Daily index

Based on the present network, with four stations in operation, the index could be divided in two categories Traffic represented by the DOSTE and Hong Bang stations and Residential represented by the Tan San Hoa station. However the small number of stations may give some uncertainties on the single AQI's due to the use of only one or two stations to represent a whole area. The fourth station (Thu Duc) is placed in an industrial area, where more stations and more parameters would be needed to give a representive assessment of the air quality.

The calculation method is the same for both categories.

The measured results for the potential harmful species NO_2, CO, SO_2, O_3 and PM_{10} are included for determination of the AQI. (All parameters may not be measured at a given station. In this case only the measured parameters are included.) Further both hourly and daily averages are included to take into account that the health deterioration may be initiated both of short time exposure to high concentrations and long time exposure to lower levels. This fact is also reflected in the Air Quality Standards.

The hourly subindex, I^h_j, for a given day at the station j is calculated as:

$$I^h_j = Max_{day}(Max_i(C^h_{i,j}/S^h_i)) * 100$$

where $C^h_{i,j}$ is the hourly average concentration for the specie i at the station j and S^h_i is the hourly Air Quality Standard for the specie i. (PM_{10} is not included in the calculation of I^h_j as PM_{10} only is measured as daily averages.)

The corresponding daily index, I^d_j, is calculated as:

$$I^d_j = Max_i(C^d_{i,j}/S^d_i) * 100$$

where $C^d_{i,j}$ is the daily average concentration for the specie i at the station j and S^d_i is the daily Air Quality Standard for the specie i.

For PM_{10} is $0.8*S^d_{SPM}$ used as standard in order to take the difference between SMP and PM_{10} into account. The β measurements shall, for practical reasons, be used in the calculations.

Based on these results the indices for the three categories are defined as:

$$AQI_{traffic} = (AQI_{DO} + AQI_{HB})/2$$

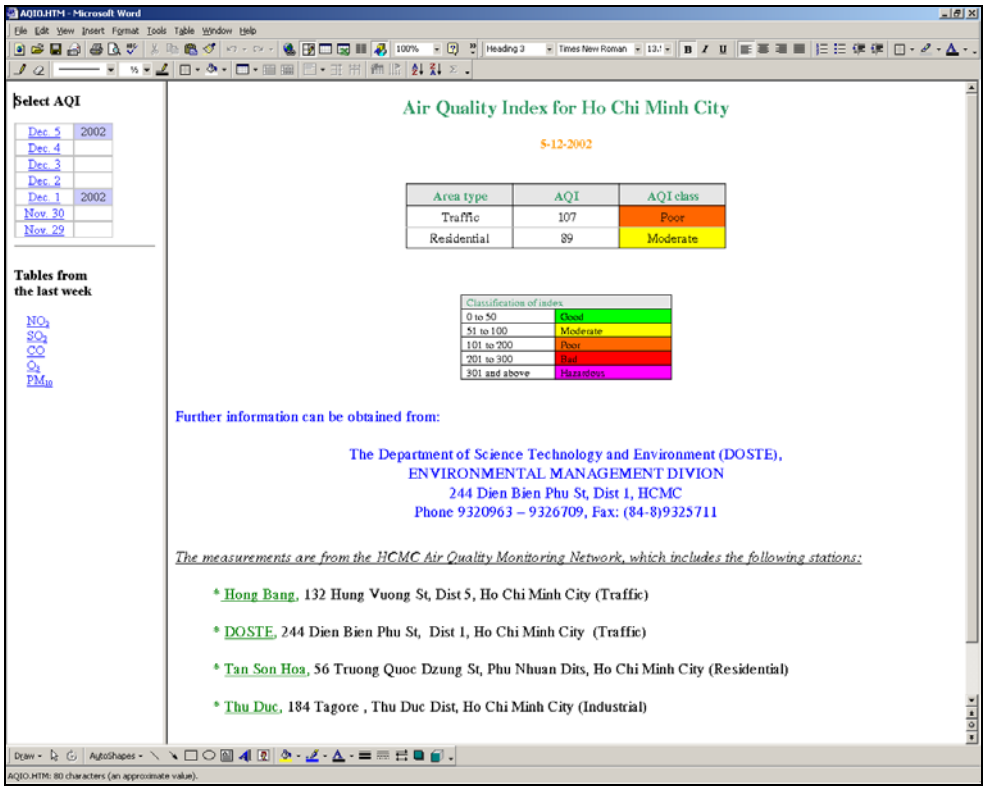
$$AQI_{residential} = AQI_{TS}$$

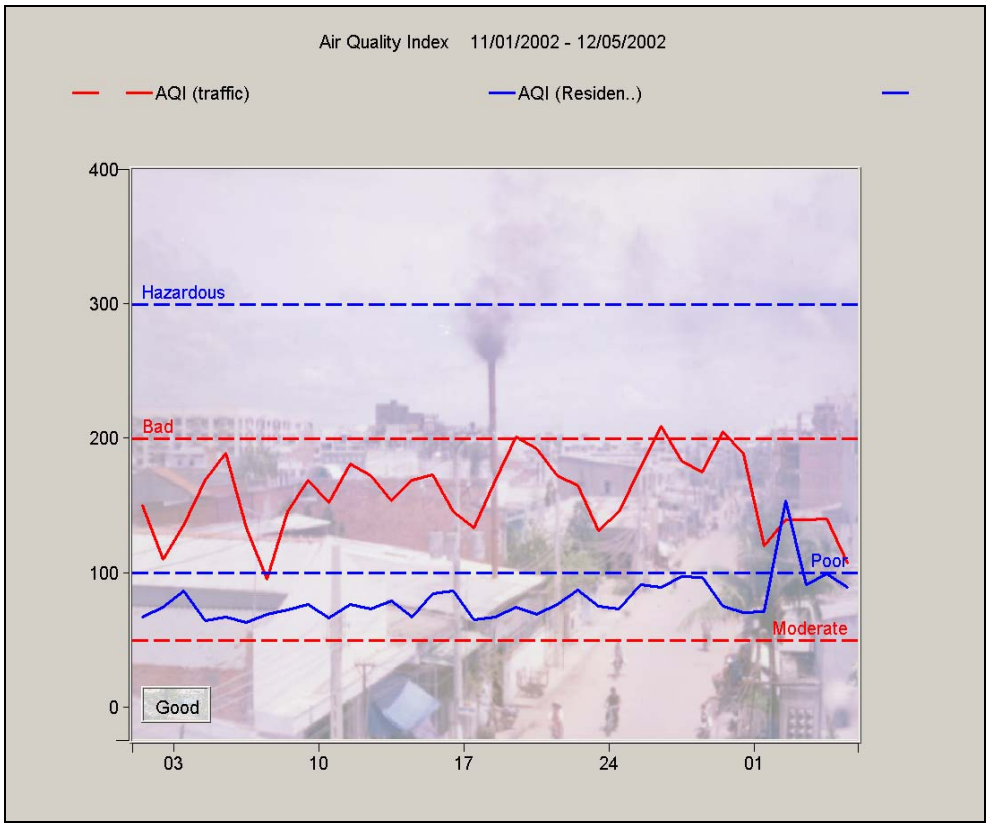
where DO, HB and TS are respectively the stations at DOSTE, Hong Bang and Tan Son Hoa.

The air quality is categorized in five classes, based on the guidelines given in the US Federal Register Part III, Environmental Protection Agency, 40 CFR Part 58, according to the following table:

Classification of index	
0 to 50	Good
51 to 100	Moderate
101 to 200	Poor
201 to 300	Unhealthy
301 and above	Hazardous

Figures


Select AQI
Dec. 5 2002
Dec. 4
Dec. 3
Dec. 2
Dec. 1 2002
Nov. 30
Nov. 29
Tables from the last week
NO2
SO2
CO
O3
PM10
Air Quality Index for Ho Chi Minh City
5-12-2002
Area type | AQI | AQI class
Traffic | 107 | Poor
Residential | 89 | Moderate
Classification of index
0 to 50 Good
51 to 100 Moderate
101 to 200 Poor
201 to 300 Bad
301 and above Hazardous
Further information can be obtained from:
The Department of Science Technology and Environment (DOSTE),
ENVIRONMENTAL MANAGEMENT DIVION
244 Dien Bien Phu St, Dist 1, HCMC
Phone 9320963 – 9326709, Fax: (84-8)9325711
The measurements are from the HCMC Air Quality Monitoring Network, which includes the following stations:
* Hong Bang, 132 Hung Vuong St, Dist 5, Ho Chi Minh City (Traffic)
* DOSTE, 244 Dien Bien Phu St, Dist 1, Ho Chi Minh City (Traffic)
* Tan Son Hoa, 56 Truong Quoc Dzung St, Phu Nhuan Dits, Ho Chi Minh City (Residential)
* Thu Duc, 184 Tagore , Thu Duc Dist, Ho Chi Minh City (Industrial)


Air Quality Index 11/01/2002 - 12/05/2002
AQI (traffic)
AQI (Residen..)
400
300
200
100
0
Hazardous
Bad
Poor
Moderate
Good
03
10
17
24
01

Appendix D4 New reporting routine using AirQUIS

The new reporting routine

The DOSTE team by VTD and NILU by TNT has discussed how AirQUIS can make current reporting system more efficient. The were agreed upon the following new reporting routine with AirQUIS:

- EnviMan Comvisioner will create automatic export of measurement data to ASCII-files based on the EN2-format. The export routine will run at least once every day. DOSTE prefers to export 1 file containing all the components for each station.
- AirQUIS Automatic Import will be scheduled to read the ASCII-files produced by EnviMan Comvisioner.
- AirQUIS will calculate the daily AQI and AQI classification. It should be possible to select different type of AQI-calculations.
- AirQUIS will propose a layout for the presentation of the daily AQI and AQI classification. The AQIs must be stored in AirQUIS.
- AirQUIS will visualize the AQIs as historical data.
- The possibility to export the presentations to images such as jpeg-format.

While waiting for the implementation of AirQUIS, DOSTE needs to report the daily AQI and AQI classifications.

NILU proposed to look at the existing templates and extend these also to produce the daily AQI and AQI classifications for presenting on the electronic street panel at Ben Thanh Market.

Appendix E

Task5. Quality Assurance (QA/QC)

Appendix E1 Calibrations and maintenance laboratory at DOSTE

Department of Science,
Technology and Environment (DOSTE)
The Norwegian Institute for Air Research (NILU)

Memo

Title	Calibrations and maintenance laboratory at DOSTE
Distribution	Mr Khoa, NILU staff for Mission 2 report App. H
Author	Bjarne Sivertsen
Date	12 November 2002
Reference No	O-101143

Calibration and Maintenance

Introduction

In the contract negotiations as well as during Mission 1 of the HEIA project, meetings and discussions concluded that a "reference laboratory" would have to be established at DOSTE to take care of multipoint calibrations of the monitors used in the field measurements.

NILU instrument experts will perform the necessary training. Together with the DOSTE field operators NILU will also follow up calibration procedures and maintenance. Hand-on training in instrument maintenance, field calibrations and some simple repairs will be undertaken by NILU experts during the three year of operation in the project period.

Multi point calibrator

As part of the maintenance and calibration procedures to be installed at DOSTE it would normally be necessary to establish a "reference laboratory" at DOSTE. This would require a complete set of monitors as well as a multipoint calibrator with zero-air generator and standard gases.

NILU was informed that a multipoint calibrator was already part of the Danida deliveries (see Attachment). This multipoint calibrator together with standard gases and a zero air generator would be used at DOSTE for dynamic calibrations, and hand-on training was being planned based on this equipment.

At the start of Mission 2, however, we found out that DOSTE never received an API700 multipoint calibrator from the Danida project. The API702 calibrator available in the laboratory can only be used as a two-point calibrator. We thus decided to perform the first training on this equipment. To meet the final objectives of moving the dynamic calibration to DOSTE equipment for high quality multipoint calibration will have to be purchased in the future.

Reference laboratory at DOSTE

In the future a complete "Reference Laboratory" should be established at DOSTE. NILU has stressed before that this Reference Laboratory should be equipped with gas monitors in addition to the multipoint calibration units, to enable calibrations of gas standards. Expert personnel have to be trained to operate the monitors for calibration reasons. Some experts will also have to be prepared and trained to carry out systematic audits of the monitoring programmes.

The monitors should be placed in a rack in the reference laboratory. The complete set-up includes the following instruments:

NO_x mon.	Equipment:	NO_x monitor, API 200
SO_2 mon.	Equipment:	SO_2 monitor, API 100
O_3 mon.	Equipment:	O_3 monitor, API 400
CO mon.	Equipment:	CO monitor, API 300
Data acq.	Equipment:	Datalogger and PC
Zero air	Equipment:	Two point calibration unit, API 701
Calibrator	Equipment	Multipoint calibrator, API 700
Accessories	Equipment:	Accesssories

Multipoint calibrations and audits to the stations should be undertaken on an annual basis. After discussions with DOSTE it has been agreed that NILU will establish the necessary expertise to operate the whole system at DOSTE. If necessary NILU could be contracted to perform Audits once a year in the future.

The Quality Assurance/Quality Control (QA/QC) systems may have to be upgraded as part of the NORAD development. Once every year the monitors should undergo a dynamic calibration and overhaul at the DOSTE Laboratory.

The situation as of November will require that a complete set of mew instruments for this reference laboratory will have to be purchased and installed. The equipment presently available will not meet the requirements of a reference laboratory.

Checks and calibrations

At the shelters a zero air generator and span gas cylinders will be used for performing weekly manual Zero/Span checks. The zero check shall be based on a zero air generator. The span check shall be based on a gas cylinder with "normal outdoor" concentration connected directly to the monitor without any dilution and without pressurising the monitor inlet. These two-point calibration procedures have been part of the delivery and installed in the shelters.

There is an ongoing work in several working groups within the European standardisation organisation CEN that aims at standardising measurement methods. Working group 12 of Technical committee 264 is preparing standards for the measurement of NO_2, CO, SO_2 and O_3 respectively. The table below is an extract from the draft standard EN 14212, ambient air quality - Measurement method for the determination of the concentration of sulphur dioxide by ultraviolet fluorescence. Similar recommendations exist for the other measurement methods as well.

Recommended frequency of checks and calibrations

Checks and calibrations	Frequency	Action criteria
Regular maintenance of components of the analyser	As required by manufacturer	As required
Linearity	At least every year and after repair of the instrument	As required and when linearity ≥ 1 % of the measured value
Calibration and adjustment of the monitor	At least every 3 months	Zero : ≥ 5 ppb span : ± 3 % of span value

As can be seen from the table CEN recommends a calibration and adjustment of the monitor every three months and linearity check once a year. Calibration and adjustment includes only a two-point calibration where the monitor is adjusted at zero level and at a fixed span level. This is most easily done using a zero air generator and a span gas cylinder with "outdoor" concentration. The zero and span gas is fed directly to the monitor at ambient pressure.

To determine the linearity of the monitor's response gas concentrations at multiple levels including the zero level are required (a dynamic calibration). This is achieved by mixing zero air from a zero air generator with high concentration gas from a gas cylinder to the required level. These gas cylinders should be certified and traceable. A calibrator/dilution unit

controls the mixing ratio. This task will be undertaken at the reference laboratory!

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.

A complete Reference Laboratory costs

The equipment needed to establish a complete reference laboratory at DOSTE has been indicated above. A complete inventory list with cost estimates is presented in the following table:

Inventory List

Reference laboratory

Items	Model (Example)	Cost 1000 NOK	Comments
SO_2 monitor	API100	100	0
NO_x monitor	API200	100	0
O_3 monitor	API400	90	Travelling standard
CO monitor	API300	80	0
Zero air generator	API701	30	
Zero air gen. compressor	1hae-11t-m104x		Cost incl. in Zero air generator
PC with monitor	GW P5-133	10	
PC Software	MS Office 95	5	0
PC printer	HP 682C DJ	2	0
Rack for monitors (2 pcs)	EDR20086	10	0
Lab. env., Rel. Hum.+Temp.	Va HMP 231	80	0

Items	Model (Example)	Cost 1000 NOK	Comments
Lab. env., Air Pressure	Va PTB 201AD		Incl. in Lab. env., Rel Hum.+Temp.
Lab. env., CO detector	SA 3000 SI		Incl. in Lab. env., Rel Hum.+Temp.
Multigas mulitpoint calibrator	API700	130	0
O3 calibrator	API	110	0
SO2 cal. gas, 100 ppm, ref std.	NIST	14	Incl. regulator
NO cal. gas, 100 ppm, ref std.	NIST	14	Incl. regulator
CO cal. gas, 5000 ppm, ref std.	NIST	14	Incl. regulator
Flow calibrator	BIOS DryCal	25	0
Repair tools	BACO	4	
Laboratory items	Fittings, filters e.t.c.	5	
	Total	**823**	

Attachment to H
Mail 8 October 2002

To: BS@nilu.no
From VTDam

Dear Mr. Bjarne Sivertsen,

The room for calibration and maintenence is Mr. Duc's room:
a) the size of the room: 3.2m x 6m
b) We've already had 1 set of the multipoint calibrator API Dynamic Dilution Calibrator Model 700, We put it in Mr. Duc room now.
c) Calibration gases are available and we have the certificate of those gases. It is stored in DOSTE station.
d) We have some big tools, so we need special tools for API instrument.

Have a good day.

Best regards
VTDam

Appendix E2: Prepare SOP

STANDARD OPERATING PROCEDURES

SECTION 11

OPERATION OF ESM EBERLINE PM10 MONITOR **Version/date:** 20102002

DOSTE AIR QUALITY MONITORING PROGRAMME **Responsible:** Le Van Khoa

Ho Chi Minh City **Approved/date:**

11.1 SCOPE

The purpose of this document is to describe the operating and general maintenance procedures to be performed by DOSTE staff for the PM10 monitors used for air quality monitoring in *HCMC Air Quality Monitoring Project*. These procedures are valid for monitors of type ESM Eberline.

The organisation of the network is described in section 2 of this manual. DOSTE is responsible for the operation of the monitors. The service and maintenance will be conducted by DOSTE calibration laboratory and are not addressed in these procedures.

The contents of these procedures are:

11.2 Maintenance and Operation Schedule.

The schedule for maintenance and operation is shown in table 11-1.

Table 11-1. Schedule for maintenance and operation.

Frequency	Daily	Weekly	2 Months	6 Months	Annual	Annual
Activity	QC measuring data and status signals at EDC	Check of instrument performance during site visit and at EDC, check the critical QC parameters in table 10-2 in this section.	Clean PM10 inlet, Check filter tape	Calibration	Check air flow, change pump carbon vanes,	Internal audit of standard operation procedures
Performed by	DOSTE EDC data expert	DOSTE Environmental Monitoring Technician, Data Expert	DOSTE	DOSTE	DOSTE cal.lab	DOSTE Project Manager
This manual, Reference	Section 4	This section (11.4)	This section (11.5)	Section 2, Appendix 2.1		This section (11.6)

The ESM analyser is logged analogues (not via RS232). No QC parameters are transfered to EDC. The main part of QC must be performed during the weekly site visit.

11.3 Instrument logbooks.

Every ESM analyser has its own logbook. The logbook title is “ESM Eberline”. On the frontside cover the DOSTE identification number is marked (ESM-x) together with the instrument’s serial number. In this way, the logbook can always be tracked back to the right instrument. This is particularly important when instruments are returned from repair and/or when they are moved from one station to another.

The logbooks are very important tools in the operation of the instrument. Every check, maintenance, calibration, service or audit must be recorded in the instrument’s logbook.

WEEKLY CHECK OF INSTRUMENT OPERATION

The ESM Eberline has a continues filter reel which last for about one year under normal operation.

The following procedures must be recorded in the weekly checklist:

	yes/no
ESM status LED warnings?	*RED - Error, YELLOW - Warning or Limit or Operation status, GREEN - Ok*
Status?	*0000 - Normal, 0001 - Filter spot change, 0002 - Zero adjustment (see table 10-3)*
Error	*00 - Normal, Other - Error(s) record text messages*
Filter reel changed?	*yes/no*
PM10 sampling head cleaned?	*yes/no*
Instrument surfaces cleaned?	*yes/no*

If the status LEDs are other then green, this must be recorded in the weekly checklist under “Comments”. At the same time, the status code and/or error code and text messages must be recorded (see section 6.5). The status and any corrective action must also be recorded in the logbook.

11.4.2 Checking instrument parameters.

If the error code differs from 00 it may be usefull to check the instrument parameters.

- From the Value display menu (main menu) choose DISP to enter the DISPLAY menu. The current concentration, total mass and air flow is displayed. The air flow should be close to 1000 l/h.
- Choose NEXT two times to skip the AIR FLOW and MEAN VALUES menus. The ERROR STATUS menu is displayed. The error code is expanded to four 4 digit error codes, see section 6.5.
- Choose NEXT to display the errors in english text. Choose NEXT again if there are more then two errors reported. Enter the text messages in the Comment field.
- Choose BACK until you are back at the Value display.

11.4.3 Changing the filter reel.

The filter reel normally lasts for about one year. Refer to section 4.4 for changing the reel. The same procedure may also be used if the filter tape breaks.

11.4.4 Checklist storage.

Immediately after return from station, the checklist must be stored at EDC in the folder ”WEEKLY CHECK”. A folder for each station is kept at EDC. The form “OPSIS SM200 buffer readings check” must be kept in the same folder as the weekly checklist.

11.5 Other maintenance

11.5.1 Maintenance of the suction pump

The suction pump carbon vanes last for about one year under normal operation. To change the vanes refer to section 7.11.

11.5.2 Dismantling of the measuring head and cleaning

If during automatic zero adjustments the zero point is not reached repeatedly the measuring head must be cleaned.

Refer to section 7.7 for dismantling of the measuring head and cleaning.

This procedure invloves the removal of the radioactive krypton source. It should only be performed by experienced personnel using the proper tools or by returning the instrument to the supplier.

11.6 Calibration of the ESM analyser

11.6.1 Check of calibration using the calibration foil

Refer to section 7.10.2 to check and if necessary adjust the mass measurement device.

11.6.2 Check the air flow rate and flow measuring module

Refer to section 7.11.3 to check and if necessary adjust the air flow rate measurement and control device.

11.7 Non-routine site visits.

A non-routine visit is required when the EDC Data Expert reports an incident of QC parameters being out of the acceptable range, or if measured values seem to be not valid, and when the incident suggests that troubleshooting should be performed at the station.

11.7.1 Troubleshooting.

During QC of the ESM performance, or whenever troubleshooting is required, special attention must be payed to the parameters shown in table 11-2.

Table 11-2. Critical parameters used for QC of ESM Eberline.

Buffer parameter	Unit	Acceptable range/remarks
Air flow	l/h	1000 +- 50
Heater temperature	°C	50

The acceptable ranges are shown in the table.

Generally, there is very little DOSTE operators should do in case of malfunction of the ESM instrument. However, before contacting the supplier check at the station that mains power is connected.

11.8 SITE AUDITS

Internal audits must be performed every 12 months by a DOSTE official to control that the procedures are followed. The DOSTE official appointed to perform the audit could be the the project manager or a technical expert from another department of DOSTE.

During the site audit, the DOSTE official must go through the operating procedures as they are described in this manual, and the site operating expert must explain how the procedures are performed in the field. It is recommended that an audit form is used to document that all procedures are followed, and if not, explain the reason why. In the latter case, suggestions for corrective action or suggestions for revised procedures should be given by the project manager.

Appendix E3 Dynamic calibarion

Dynamic Calibration - NOx Monitor

Guest

Owner: Mon. Alx.
Monitor: TEI 42C
Ser. no: 57601-314
Date: ########

	NO	NOx	NO2	
Range:	1000.0	1000	1000	ppb
Bkg:	1.6	2.6		ppb
Coef:	0.955	934	0.998	

Reference

Cal. lab: Ref.lab.
Calibrator: TEI 146
Ser. no: 57545-317

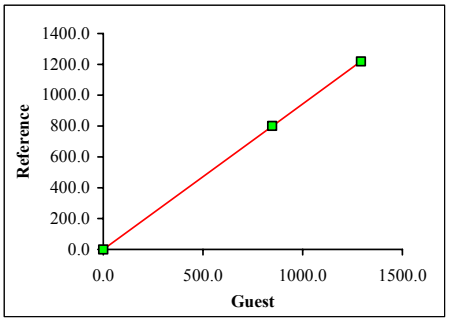
Gas std: Scott, NO, 1%
Ser. no: ALM046351
NO: 99.24 ppm
NOx: 99.24 ppm

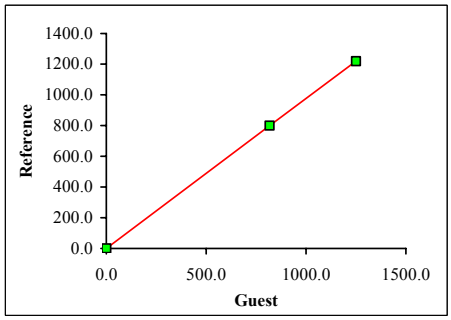
Parameter NO

Zero air [LPM]	Gas [SCCM]	Ref. [ppb]	Guest [ppb]	G - R [ppb]	Statistics, y=ax+b	a	b
8.00	0.0	0.0	0.0	0.0	Scale f:	0.943	0.000
8.01	65.1	800.1	847.0	46.9	Regression		
8.00	99.5	1219.1	1293.0	73.9	Scale f:	0.943	0.321
					St. error:	0.001	1.113
					St. error y estimate:		1.159
					r2:	1.00000	

Parameter NOx

Ref. [ppb]	Guest [ppb]	G - R [ppb]	Statistics, y=ax+b	a	b
0.0	0.0	0.0	Scale f:	0.975	0.000
800.1	818.0	17.9	Regr.		
1219.1	1251.0	31.9	Scale f:	0.975	0.647
			St. error:	0.003	2.232
			St. error y estimate:		2.324
			r2:	0.99999	





Init: _____

Zero/ Span check unit

	Ser. No.		Zero air	[ppb]	Span	[ppb]
Z/S TEI 145:		NO:				
NO2 Perm. tube:		NOx:				
NO Gas cylinder:		NO2:		NOx-NO		

Converter check

	Without O3	[ppb]	With O3	[ppb]
NO:				
NOx:				
NO2:			NOx-NO	
			Eff. (%):	

Laboratory environment

Temp: _____ °C
Press: _____ mm Hg
Rel. h: _____ %

Appendix E4 Service check list

ROUTINE SERVICE CHECK LIST

ALL BELOW MENTIONED MAINTENANCE WORK HAS TO BE PERFORMED STRICTLY ACCORDING TO THE INSTRUCTION MANUAL

MAINTENANCE SCHEDULE FOR GAS ANALYZER'S M100A

DATE INSTRUMENT RECEIVED: ……

	Jan.	*Feb.*	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Maitenance interval*
Check zero with N2 or synthetic air grade 5, and span drift with transfer standard gas cylinder. Write true and measured zero/span values into z/s scheme.						3RD WEEK						3RD WEEK	perform every 6 months
validate internal zero and span source						3RD WEEK						3RD WEEK	perform every 6 months
Zero air canister refill						3RD WEEK						3RD WEEK	perform every 6 months
zero air dfu filter						3RD WEEK 2001/2							change every 12 months
measurement cell cleaning						3RD WEEK 2001/2							clean every 12 months if necessary (stray light indication)
sample flow						3RD WEEK						3RD WEEK	check every 6 months with calibrated flow meter (soap bubble flowmeter).
pneumatic lines						3RD WEEK 2001/2							examine every 12 months and clean if necessary
leak check						3RD WEEK 2001/2							check every 12 months
pump diaphragm						3RD WEEK 2001/2							change every 12 months
Check permation purge flow						3RD WEEK 2001/2						3RD WEEK 2001/2	with calibrated flow meter
Adjust zero to the true value with zero air from gas cylinder with n2 or synthetic air grade 5						3RD WEEK						3RD WEEK	perform every 6 months
Adjust span to the true value with SO2 gas from transfer standard gas cylinder						3RD WEEK						3RD WEEK	perform every 6 months
perform linearity test						3RD WEEK						3RD WEEK	perform every 6 months
check zero and span source						3RD WEEK						3RD WEEK	perform after start up following every calibration

Appendix F

Task 6. Install AirQUIS

Appendix F1 GIS for HCMS

Establish GIS for HCMC

NILU is preparing the GIS map database for AirQUIS. We have received some maps from DOSTE, but have found that the co-ordinate systems are inconsistent. It seems like there have been different systems used for different shapes and districts. Each of the "catalogue" seem to have a different co-ordinate system, some of them are in UTM48 co-ordinates.

WE have requested DOSTE to identify and specify the different systems. Even better would be to use the same, preferably the UTM co-ordinate system, for ALL parts of the HCMC maps!!

Import of Map data - AirQUIS Themes

There are several geographical elements, which can be defined as separate themes within AIRQUIS, and these will build up the geographical infrastructure of the system, such as administrative regions, model grids, roads and building points.

Areas and the borders between the areas can be defined in several different ways in AIRQUIS. A common way for both air and water related issues is to divide areas into smaller units with use of administrative regions like countries, counties, municipalities and/or neighbourhood.

There are four region types within AirQUIS:

1. Administrative regions, which consists of any regions with administrative borders, such as counties and municipalities.
2. Catchments in which catchments borders can be stored. (Not often used in air pollution studies)
3. Treatment Area, which is used in the Treatment Area, forms under Pollution Sources
4. User-defined areas, which can include any region.

Regions in AirQUIS are used for several purposes. One main function is their use as a search criterion. When many items are defined in AirQUIS, such as measurement stations, industries, and lakes, it is useful to be able to search for the ones you are interested in by narrowing the geographical area. Selecting the appropriate region to search within can do this.

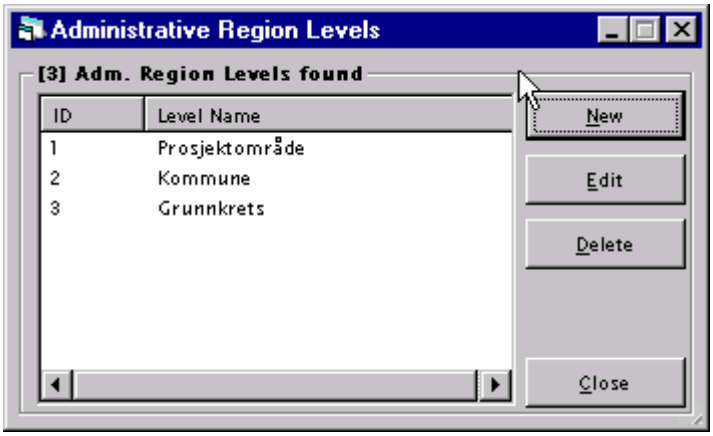
Another purpose of region is to link data to it as data set. Used in the data set menu, the geographical regions will be available via "Data set" - "Region". The user can then assign one value of all kinds of parameters/variables (population, rainfall intensity, concentrations, etc) to each of the regions and hence obtain a spatial overview of the parameters/variables in question.

When using region as a search criterion and to link data to it, it is important to have a hierarchy of regions defined.

It is most convenient (and necessary if import) to define the largest region you are interested in first, and then define smaller and smaller regions within this mother region until you have defined the smallest regions that you will need. Not only does this help use the regions for the uses described above, but it is then easier to locate the region you are interested in, because they are found in a tree-view.

Administrative Region Level

Area distributed data are often given as data sets distributed in small or larger regions, based on an administrative boundary division. This regional division may be done on several levels. Before defining the regions themselves, the different levels of regions must be defined. This is done by selecting "Geographic Areas" on the toolbar and then to choose "Administration Region Level under "Region". The example shown is built up of three levels, where the most upper one is called project area, the middle is municipality (kommune), while the lower one is neighbour hood (Grunnkrets).

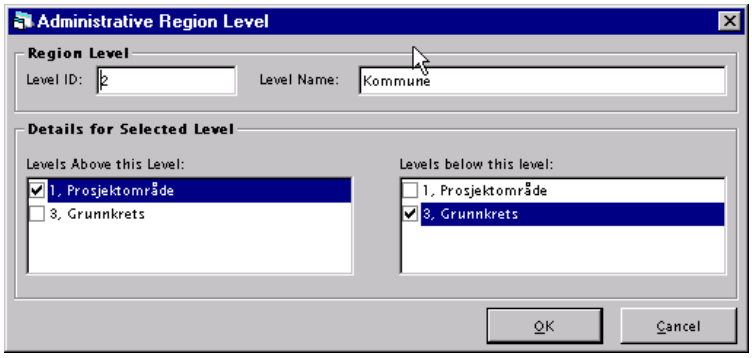


Screen for defining the administrative region levels.

This form lists the defined administrative levels in the present project. The administrative levels can typically be country, county, municipality and neighbourhood, but can freely be organised configured to the users` own needs.

<New>: Define a new administrative level.
<Edit>: Edit the existing, highlighted administrative level.
<Delete>: Delete current administrative level.
<Close>: Close the opened form.

Administrative Region Level <New> and <Edit>



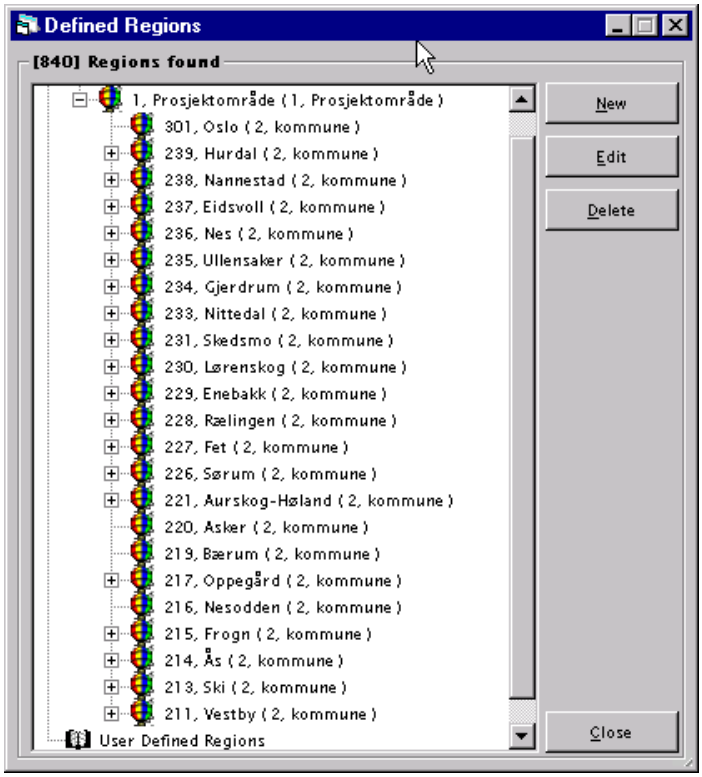
Screen for defining administrative region level details

The form Administrative Region Levels is a tool for defining the region levels, and looks like this

Each level is defined by the name of the level and by which levels who are above and below in the hierarchical structure.

When connected data are entered on a region, it will no longer be possible to edit or delete the definition before the connected data is deleted.

Administrative and user-defined area



Screen showing the regions found in the database.

Administrative and user-defined regions are defined manually by the “Defined regions” form found under "Geographic area" - "Region" - "Administrative Regions and User Defined Area". These regions are used as search criteria and data sets can be linked to it. Administrative regions are typically imported into AIRQUIS from shape files.

Defined regions - manually: Select an administrative or user-defined region by selecting from the tree view. Only the geographical definition of the region, which means the co-ordinates of its boundaries, and the names are created, edited and deleted via this menu.

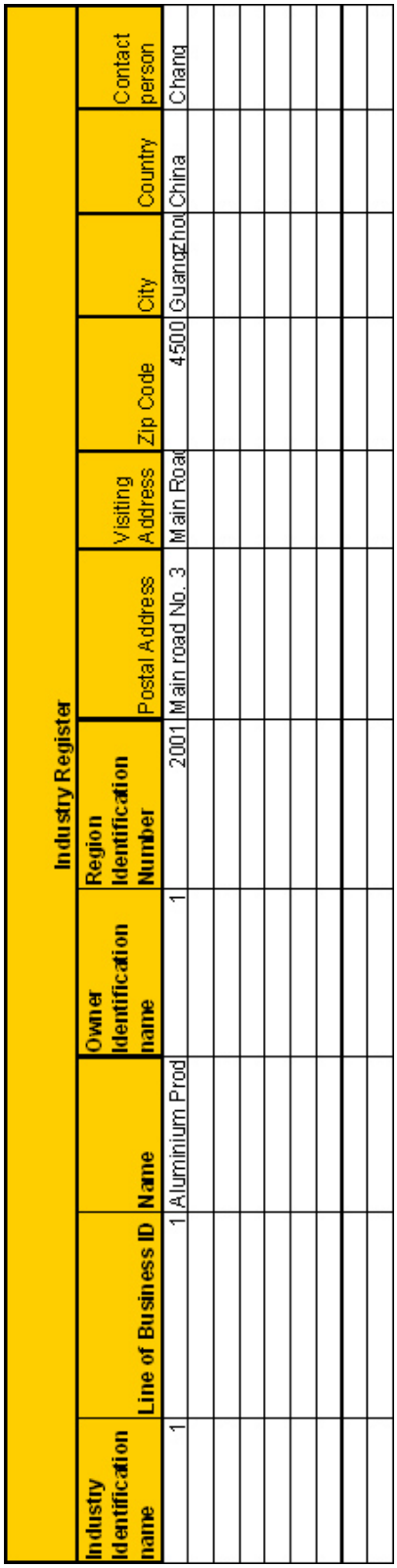
Appendix G

Task7. Air Quality Modelling

Appendix G1 Templates for collecting data from point sources

Building Points								
Building Point Identification Number	Other ID #1	Other ID #2	Building Number and Letter	Number of People	Address	X-Co-ordinate	Y-Co-ordinate
1	117	141	7802943	6	BROTTET 32	562801.59	6625635.75
2	117	612	158595419	2	KRISTIAN 138	563208.5	6625550
3	117	330	158559420	3	KRISTIAN 141	563046.66	6625530.5
4	117	329	158560712	2	3. BERA T 30 E	563891.16	6625495.25
5	117	787	7799918	3	ROLIGHETE 11	563598.63	6625526.75
6	117	786	7799578	5	ROLIGHETE 13	563617.59	6625522
7	117	582	7799551	4	ROLIGHETE 15	563641.41	6625519.5
8	117	784	7800282	5	ROLIGHETE 17	563667.03	6625509.25
9	117	783	7801319	4	ROLIGHETE 19	563692.41	6625506.5
10	115	815	158560879	3	UNDERLIA 265	566235.25	6625497.5
11	117	780	7800630	3	ROLIGHETE 10	563588.94	6625495.25
12	117	779	7800150	5	ROLIGHETE 12	563620.78	6625490.5
13	117	782	7800843	6	ROLIGHETE 21	563716.16	6625486.25

Owner Register								
Owner identification Number	**Name**	**Region Identification Number**	Postal Address	Visiting Address	Zip Code	City	Country	Contact person
1	Metal International	2001	West road No. 3	North Road No. 5	4500	Guangzhou	China	



Industry Register											
Industry Identification name	Line of Business ID	Name	Owner Identification name	Region Identification Number	Postal Address	Visiting Address	Zip Code	City	Country	Contact person
1	1	Aluminium Prod	1	2001	Main road No. 3	Main Road	4500	Guangzhou	China	Chang

Stack Data													
Industry Identification Number	Stack Identification Number	Stack name	Alternative Identification Number	Time of Inventory	Validity Period	X Co-ordinate	Y Co-ordinate	Height above Sea Level (m)	Stack height (m)	Stack Diameter (m)	Gas Temperature (C)	Gas Velocity (m/s)	Gas Flow Rate (m^3/s)
602001	60200101	Pipe 602001-1		29.06.1998	1995	569110	6621355	0	10	0.3	200		0.05833
602001	60200102	Pipe 602001-2		29.06.1998	1995	569110	6621355	0	10	0.315	230		0.16667
602001	60200103	Pipe 602001-3		29.06.1998	1995	569110	6621355	0	11	0.55	220		0.30556
602002	60200201	Pipe 602002-1		29.06.1998	1995	569371	6623322	0	17	1	220		2.94444
602002	60200202	Pipe 602002-2		29.06.1998	1995	569509	6623416	0	20	0.6	220		1.47222
602011	60201101	Pipe 602011-1		29.06.1998	1995	568934	6620650	0	68	0.45	220	15	0
602012	60201201	Pipe 602012-1		29.06.1998	1995	568019	6623245	0	25	0.7	235	15	0
602013	60201301	Pipe 602013-1		29.06.1998	1995	569176	6623410	0	10	1	200	15	0
602014	60201401	Pipe 602014-1		29.06.1998	1995	566052	6623407	0	16	0.4	237		0.05556
602014	60201402	Pipe 602014-2		29.06.1998	1995	566052	6623407	0	16	0.4	237		0.08306
602015	60201501	Pipe 602015-1		29.06.1998	1995	569000	6623000	0	10	1	200	15	0
602016	60201601	Pipe 602016-1		29.06.1998	1995	567495	6624047	0	16	0.5	200	15	0
602018	60201801	Pipe 602018-1		29.06.1998	1995	569009	6622794	0	16	0.7	240		0.12278
625001	62500101	Pipe 625001-1		26.11.1998	1995	560000	6627000	0	20	1.8	200	15	0
626001	62600101	Pipe 626001-1		26.11.1998	1995	567000	6628000	0	17.7	1.23	120	0	16.6667
626002	62600201	Pipe 626002-1		26.11.1998	1995	565445	6632875	0	48	0	200	0	1.11111
626003	62600301	Pipe 626003-1		26.11.1998	1995	567000	6628000	0	26	0.35	200	15	0
626004	62600401	Pipe 626004-1		26.11.1998	1995	563806	6634553	0	36	0.7	200	15	0
626004	62600402	Pipe 626004-2		26.11.1998	1995	563806	6634553	0	24	0.6	200	15	0
626006	62600601	Pipe 626006-1		26.11.1998	1995	565099	6635126	0	14	1	220	15	0
626007	62600701	Pipe 626007-1		26.11.1998	1995	567000	6628000	0	10	0.68	230	10	0
626008	62600801	Pipe 626008-1		26.11.1998	1995	567000	6628000	0	8	1	145	0	0.03958
626009	62600901	Pipe 626009-1		26.11.1998	1995	567000	6628000	0	6	0.3	320	0	0.10417
626010	62601001	Pipe 626010-1		26.11.1998	1995	567000	6628000	0	8	0.25	200	15	0

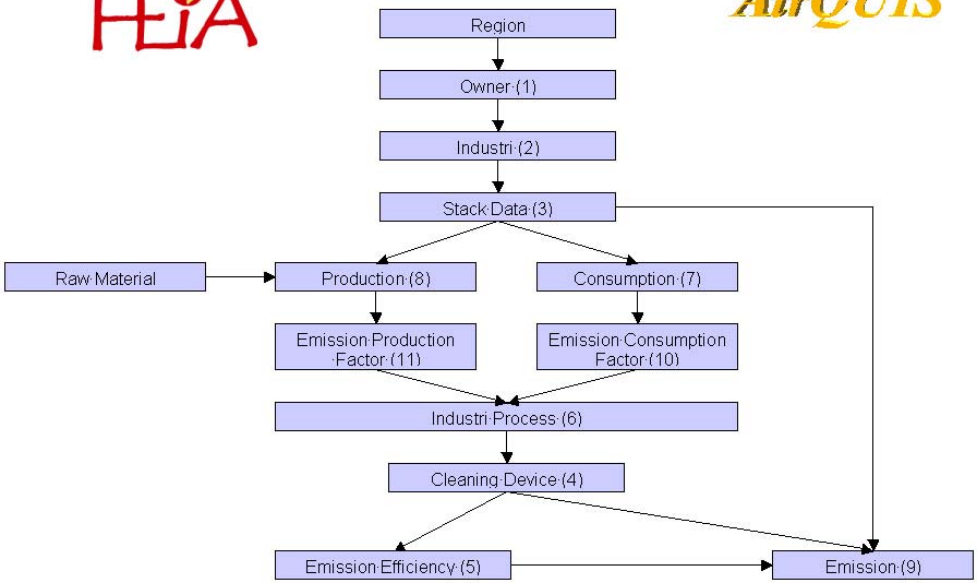
Process Emission Data											
Process Identification Number	Alternative Identification Number	Component ID	Emission Value	Emission Unit	Concentration	Concentration Unit	Gas Flow Rate	Gas Flow Rate Unit	Time Variation ID	Validity Period	Time of Inventory
1	0	1	5000	ug/s	2000	ug/m^3	10	m^3/s		1998	
1	0	5	10000	ug/s	4000	ug/m^3	10	m^3/s		1998	

Stack Data

Industry Identification Number	Stack name	Time of Inventory	Validity Period	X Co-ordinate	Y Co-ordinate	Height above Sea Level (m)	Stack height (m)	Stack Diameter (m)	Gas Temperature (C)	Gas Velocity (m/s)	Gas Flow Rate (m^3/s)	Building Height	Building Width	Emission rates (kg/h)
602001	Pipe 602001-1	29.06.1998	1995	569110	6621355	0	10	0.3	200		0.05833			
602001	Pipe 602001-2	29.06.1998	1995	569110	6621355	0	10	0.315	230		0.16667			
602001	Pipe 602001-3	29.06.1998	1995	569110	6621355	0	100	1.8	180		6.9	20	30	67
602002	Pipe 602002-1	29.06.1998	1995	569371	6623322	0	17	1	220		2.94444			

Appendix G2: Prepare input data – Point sources

Emission Point Source Dataflow



Appendix G3 Example templates for collecting Traffic data for emission inventories

Road and traffic data

Road Link Definition														
Road Link ID	Road Link Name	Alternative ID	Start Node ID	End Node ID	Direction (1 = Start to End Node, 2 = End to Start Node , 3 = both ways)	Length	Length Unit	Road Grandient	Road Class ID	Buildning Façade Type ID	Traffic Area Type ID	Administrative Road Link Code	Road Link Shape
1	ROSENKR.GT		101	103	1	200	m	2	1	1	1		
2	E-76		101	400	1	271	m	1	1	1	1		
3	GML RIKSV SOLB.E.		101	401	1	150	m	3	1	1	1		
4	CHR.HORNSRUDSV		103	104	1	165	m	4	1	1	2		
5	ROSENKR.GT		103	105	1	184	m	3	1	1	2		
6	BUSKERUDVN		104	110	1	195	m	2	1	2	2		
7	BETZY KJELDSB.V/E76		105	106	1	487	m	2	1	2	3		
8	ROSENKRANTZGT.		105	107	1	165	m	0	1	2	3		
9	BETZY KJELSB.V/E76		106	116	1	785	m	0	1	2	3		
10	INGENIØR RYBERGSGT		107	108	1	235	m	1	2	3	1		
11	ROSENKRANTZGT.		107	113	1	256	m	1	2	3	2		
12	INGENIØR RYBERGSGT		108	109	1	156	m	1	2	2	1		
13	INGENIØR RYBERGSGT		109	111	1	741	m	2	2	2	1		

Dynamic traffic data

Dynamic Traffic Data													
Road Link ID	Alternative ID	Data Valid from	Data Valid to	Direction (1 = Start to End Node, 2 = End to Start Node	Annual Daily Traffic	Lane Width	Lane Capacity	Cold Start Fraction	Cold Start Fraction Time Variation Name	Free Flow Speed	Speed Unit	Volume Delay Function Name
1		19950101 00	19960101 00	1	13420	8.5	14762		7	80	km/h	
2		19950101 00	19960101 00	1	8286	5	9114.6		7	80	km/h	
3		19950101 00	19960101 00	1	3289	3.5	3617.9		5	50	km/h	
4		19950101 00	19960101 00	1	289	3.5	317.9		7	30	km/h	
5		19950101 00	19960101 00	1	13132	8.5	14445.2		8	80	km/h	
6		19950101 00	19960101 00	1	289	3.5	317.9		5	50	km/h	
7		19950101 00	19960101 00	1	2387	6	2625.7		5	20	km/h	
8		19950101 00	19960101 00	1	13088	8.5	14396.8		5	60	km/h	
9		19950101 00	19960101 00	1	2231	5	2454.1		5	40	km/h	
10		19950101 00	19960101 00	1	2839	6	3122.9		6	22	km/h	
11		19950101 00	19960101 00	1	12709	8.5	13979.9		7	80	km/h	
12		19950101 00	19960101 00	1	0	4	1000		8	40	km/h	
13		19950101 00	19960101 00	1	0	4	1500		5	30	km/h	

Road Node Definition				
Road Node ID	Road Node Name	X Co-ordinate	Y Co-ordinate	Height above see level
1000		598662	645587	
1001		598661	645586	
1002		599039	646441	
1003		599484	645498	
1004		599420	644876	
1005		599548	645720	
1014		603623	640824	
1024		596050	643312	

Road Classes		
ID	Name	Alternative ID
1	Major road / transit road	
2	City centre street	
3	Residential area street	
4	Industrial area street	
5	Local road	

Road Link Vehicle Distribution					
Road Link ID	Link Direction	Alternative ID	Vehicle Class ID	Vehicle Class Fraction %	Vehicle Class Time Variation ID
1	1		1	30	
1	1		2	40	
1	1		3	20	
1	1		4	10	
2	1		1	20	
2	1		2	50	
2	1		3	10	
2	1		4	20	
3	1		1	40	
3	1		2	60	
4	1		1	70	
4	1		2	10	
4	1		3	20	

Appendix H

Task8. Field Operations

Appendix H1 DOSTE visit report

OPSIS®

Dear Mr. Khoa,

A report from my visit to Doste, Ho Chi Minh City.

The visit was made 2002-10-29 to 2002-10-31.

The target was to find out the status of two defective SM200 and to check the installation at DOSTE office.
Only DOSTE station was visited. I was informed that there were no problems at any other stations.
All instruments (except perhaps the indoor temp sensor) mentioned below have been sold and delivered from Opsis to Instrumatic A/S in Denmark.

SM200.
Two defective SM200 analysers were transported to DOSTE office.
To make at least one analyser working, the carousel parts in one analyser have been swapped with the other. Staff from Smith group in HCMC did it.

SM200 #259.
The analyser became very hot and the temperature test showed that at least one temp sensor was broken. Tried to exchange the heater module (including one temp sensor) but the result was without success. By changing temp sensor position I tried to find out the reason to the high temperature but the analyser was still very hot, which indicate a possible problem on the main board.
The leak test became OK at several occasions but failed later on.

The analyser could not be repaired at site and I recommend contacting Instrumatic for further repair arrangements.

SM200 #268.
The analyser is giving fatal error 4, 'carousel not moving', and that was also correct. The carousel motor wasn't working at all which indicated a motor or motor card error.

The analyser could not be repaired at site and I recommend contacting Instrumatic for further repair arrangements.

WS510.
The sensor is installed on top of a 25-meter pole. I found that the WS002 IOMan module was not working which made all following IOMan modules not working either. The WM002 module was bypassed and the rest of the modules are now working fine.

A new module is sent for (free of charge from Opsis) and I have instructed the Smith group staff how to install it and also how to make the necessary change in the software.

WS520. (3-axis ultrasonic anemometer).
The sensor is installed on the same pole as above and is attached to the DL256 (s/n 098). A further investigation using the data-logger inbuilt terminal program (IO256 software) showed that some communication was working. It was possible to go into WS520 configuration setup and to download the sensor setup (D3 command). However, it was not possible to make a correct manual data poll of the sensor. The last 10% of the data string coming from the sensor was cut off (it was cut off in the middle of status value). It means that no ETX or checksum were received by IO256 software and therefore could not be accepted.
The sensor was connected to another COM port (working perfect with API analysers) but showed the same bad result.
A later version of IO256 software was installed in DL256. However, no improvement of the communication was made and the original software was reinstalled.
Investigations of historical data showed that the sensor may haven't been working at all since the installation.

The sensor function could not be fixed at site and I recommend contacting Instrumatic for further repair arrangements.

API CO analyser.
Four API analysers (SO2, O3, CO and NO/NO2/Nox) are multi-drop connected to DL256. The communication with CO analyser sometime fails. Couldn't find out the reason. Communication with SO2, O3 and 3 NO/NO2/Nox analysers was 100% OK.

I recommend testing communication with the analysers one by one to find out if the problem remains. If problem remains, then contact Instrumatic for further repair arrangements.

Other sensors.
The indoor temp was not working. After changing the IM032 card (to an old one found at site) it works fine.
Humidity sensor is definitely showing too low value. A calibration is needed.

More.
All DL256 data loggers are working fine and so are EnviMan ComVisioner and Reporter software.

DOSTE staffs were shown how to use EnviMan ComVisioner for automatic calculations of for instance air pollution index.

IOMan, DL256 and IO256 manuals (PDF format) were given to DOSTE staff.

I strongly recommend a 3-4 days training of DOSTE and Schmidt staff (max 6 persons).

Appropriate contents should be:

- DL256 software/hardware
- IO256 software
- SM200 software/hardware
- IoMan hardware
- Sensors
- EnviMan ComVisioner and Reporter software

Seved Grytting
Opsis AB

Appendix H2a
Calibration and maintenance

See Memo

SAMPLING INSTRUCTIONS FOR A DIFFUSIVE SAMPLER

1. Sampling equipment

The sampler is a little round plastic container with the dimensions 1.2 cm * 2.5 cm (height, diameter). It consists of a steel net placed in front (opening) of the sampler, a Teflon filter and an impregnated filter to absorb gases, in addition to the container. Together with the steel net, the teflon filter will prevent turbulent transport to the active filter.

2. Sampling

2.1 Reception of the samplers

- The samplers must be stored in their transport boxes in a cool spot (ex. in a refrigerator) until exposure takes place.
- If any of the different items are loose at reception, this should be noted on the drift form that follows the samplers.

2.3 Outdoor sampling

- The samplers should be located about 2 meters above the ground, ex. Under the tip of a roof, under a fence or under a shelter roof etc.
- The samplers schould be attached up side down underneath the horizontal plane with a two-sided adhesive tape, with the filter side (the opening) turned down.
- I is of extreme importance to mount the samplers in such way they are not getting wet!

2.4 Ending the exposure

- After exposure, the samplers schould **immediately** be placed in its transport box in which they were received.
- The samplers schould again be stored in a cool spot until they are sent back to NILU.
- The samplers schould be sent back to NILU as soon as possible after exposure.

3. Marking the diffusive samplers

- Mark the transport box, not the sampler, because of the size of the samplers.
- A little label is attached to the transport box. This label contains the name of the station, sample type (code for SO_2, NO_2 etc the number of the sampler, and a vacant field where the station holder shall write for how long the sampler are exposed (date from - to).

4. Filling out the drift forms

- The drift form shall always be filled with a ball pen.
- When error in writing, cross out the error and write the correction beside.
- The drift form shall always be returned to NILU together with the samplers the drift form refers to.
- The station holder must write readably on the drift form, preferably with block letters.
- The following fields shall always be filled out:

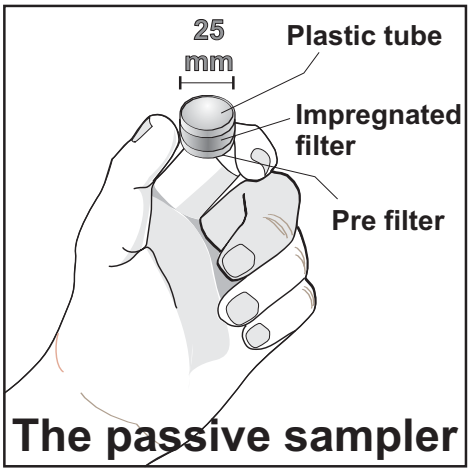
Observer:	Name of the person that has carried out the fieldwork.
Date:	Date that the sample is exposed from start and to collection day (write while in the field)
Station name:	Name of the station
Position:	When there are more than one sampler that are placed at the same spot, the samplers have to be numbered.
Sampler identification:	The number on the sampler must be noted on the drift form, (red samplers are for SO_2 , blue samplers are for NO_2)
Sample type:	Diffusive samplers can be used to sample different types of gases. One must therefore note on the form which type of sample the form refers to (NH3, SO2, etc.). The code is noted on the transport box.
Comments:	Comments may contain weather, errors, dust etc..

5. Fieldblanks

- The field blanks are marked whit a red Lable !! or with a note on the transport box, marked “FBL”.
- The filed blank is not to be taken out of the transport box.
- The field blank is stored in a measure stall (for outdoor measurements) or near the measure place (for indoor measurements).
  The field blanks are packed whit the exposed samples after ended sampling period, and the whole thing is returned to NILU.

About the passive sampler

A simple sampler for surveillance of time integrated SO_2 and NO_2 concentration distributions has been developed. The sampler is inexpensive in use, simple to handle and have a good overall precision and accuracy. This method has been used in industrial areas, in urban areas and for studies of indoor/outdoor exposures

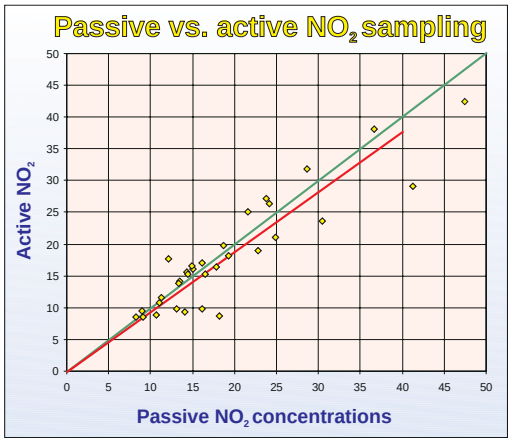


A sensitive diffusion sampler for sulphur dioxide (SO_2) and nitrogen dioxide (NO_2) in ambient air has been used in several investigations to undertake a screening of the spatial concentration distribution.

The sampler was developed by the Swedish Environmental Research Institute (IVL) and has been used in several cases by NILU. The sampler includes an impregnated filter inside a small plastic tube. To avoid turbulent diffusion inside the sampler, the inlet is covered by a thin porous membrane filter. Gases are transported and collected by molecular diffusion. The uptake rate is only dependant upon the diffusion rate of the gas.

The collection rate is 31 l/24h for SO_2 and 36 l/24h for NO2. Also NH3 can be collected at a rate of 59 l/24h.

Comparison with monitors



The integrated passive sampling of SO_2 and NO_2 is well correlated with available active sampling methods.

For SO_2 the measuring ranges are approximately 0,1-80 ppb for a sampling period of one month. The corresponding range for NO_2 is 0,02-40 ppb.The passive samplers are assembled and made ready for use at NILU .After exposure the samplers are usually returned to NILU where concentrations of SO_2 are determined as sulphate by ion chromatography. NO_2 and NH3 is determined by spectrophotometry.

Appendix H2b Passive air pollution sampling

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

Field observations: November 2002 **Observer:** Bjarne Sivertsen

Sampling period				Site name	Coord.		Coord		Sampler identification		
From:		To:		(position)					SO_2	NO_2	Comments
date	hr.	date	hr.		North		East		(red)	(blue)	
14Nov	0925	26 Nov	0820	Zoo, Quan 1					9	20	at shelter, taken down and transport in trafic 4 hours
14 Nov	0930	26 Nov	0825	zoo at fence					5	19	NO_2 lost
14 Nov	0945	26 Nov	1205	Tan San Hoa					7	16	at Danida shelter
14 Nov	0955	26 Nov	1210	Nguyen van Troi str					10	17	DOCSOF company gate
14 Nov	1030	26 Nov	0915	Tu Duc					6	18	Shelter
14 Nov	1120	26 Nov	0845	Quan 2 PC build					4	15	at roof shelter
14 Nov	1125	26 Nov	0845	Quan 2 at gate	10deg.	47.492	106 d	44.956	2	13	at fence 25 m from buildin
14 Nov	1200	26 Nov	1150	ThongNat Hospital					8	14	on NILU shelter – lost !!
14 Nov	1400	26 Nov	1015	Software city	10 deg	51.154	106	37.748	1	11	shelter Quan 12
14 Nov	1405	26 Nov	1015	Software city gate					3	12	at gate 90 m from shelter
14 Nov	1420	26 Nov	1050	Road 14					17	8	Daons Lag Ban Bich rd.
14 Nov	1500	26 Nov	1110	Binh Chanh educ.					13	10	at shelter, main road
14 Nov	1530	26 Nov	1125	Hong Bang					14	9	At Danida shelter

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

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

Field observations: **November 2002** **Observer:** **Bjarne Sivertsen**

Sampling period				Site name	UTM coord.		Location		Sampler identification		
From:		To:		(position)					SO_2	NO_2	Comments
date	hr.	date	hr.		X	Y	east	west	(red)	(blue)	
14 Nov	1645	26 Nov	1400	DOSTE shelter					16	5	
14 Nov	1650	26 Nov	1400	DOSTE fence					19	6	
14 Nov	1650	26 Nov	1350	DOSTE office					18	7	
14 Nov	1900	25 Nov	1800	Liberty 1 4.floor					20	4	
14 Nov	1900	23 Nov	???	Liberty1 entrance					12	2	Taken into office, open till 25 Nov , then in box
15.nov	0945	26 Nov	1150	Tran Hung Dao str.					15	3	At sign
15.nov	1000	26 Nov	1225	Nguyen Tat Thahn					11	1	Quan 4

Appendix H3 Weekly station check

STATION name:	Date of visit to station:	Time of visit:	Person conducting check:

Station exterior	Checked?	**Air intake manifold**	Inspected?
	Damage found?		Cleaned?
Station interior	Checked?	**API zero air generator**	Pressure?
	Cleaned?		Air inlet particle filter inspected?
Air conditioner	Inspected?		Air inlet particle filter replaced?
	Cleaned?	**Air intake teflon lines for API analysers**	Inspected?
			Cleaned/replaced?

Instrument	**SM200 PM10**	**API100 SO_2**	**API200 NO_x**	**API300 CO**	**API400 O_3**	**ESM PM10**
RED fault light flashing?						
Warning message? (must also be recorded in logbook)						
Observed test value for warning parameter?						
Warning message cleared?						
Manual zero check for CO: API300 zero reading after stable signal (minimum 20 minutes)?						
Manual span check for CO: API300 zero reading after stable signal (minimum 20 minutes)?						
CO gas cylinder closed?						
Analyser sample flow before filter change? (ml/min)						
Analyser particle filters changed?						
Analyser sample flow after filter change? (ml/min)						
Box temperature? (°C)						
SM200 status LED warnings?						
Observed test value for status in buffer?						
Exposed PM10 filters removed for analysis?						
New PM10 filters inserted in clean filter container?						
PM10 sampling head cleaned?						
Instrument surfaces cleaned?						
ESM Status LED warning?						
Status code						
Error code (messages in Comments box)						

Comments-

Appendix H4 Two Point Calibration – SO_2 Monitor

Two Point Calibration - SO2 Monitor

Guest				Reference			
Owner:	Mon. Alx.		SO2	Cal. lab:	Mon.lab.	Ref. gas:	SO2 in N2, Scott
Monitor:	TEI 43C	Range:	1000 ppb	Calibrator:		Ser. no:	BLM004271
Ser. no:	57681.316	Cal. bkg:	8.5 ppb	Ser. no:		SO2:	1.102 ppm
Date:	########	Cal. Cof:	1.003	At station:	Tabbin		
				Comment:	Before cal.		

Parameter SO2

	Zero air		
	Ref. [ppb]	Guest [ppb]	G - R [ppb]
	0.0	0.5	0.5
Average:	0.00	0.50	
St. Dev:			

	Span gas				
Zero air [LPM]	Gas [SCCM]	Ref. [ppb]	Guest [ppb]	G - R [ppb]	
		1102.0	960.0	-142.0	
Average:		1102.00	960.00		
St. Dev:					

Calibration factors

	y=ax+b	
	a	b
SO2:	1.149	-0.574
St. Dev:		

Laboratory environment

Temp: _____ °C
Press: _____ mm Hg
Rel. h: _____ %

Init: LM

Appendix H5 Spareparts and Consumables

a) Consumables delivered November 2002 to DOSTE

Consumables			
Part number	**Item**	**Qty**	**Supplier**
005960000	activated charcoal	10	API
005970000	purafil	10	API
016920000	mol sieve	5	API
	ptfe – filter	700	API
006900000	clean air filter (s)	20	API
006900100	clean air filter (l)	20	API
fl0000003	dust filter	5	API
or0000059	o-ring	20	API
or0000035	o-ring	20	API
or0000001	o-ring	36	API
fl0000001	sintered filter	18	API
hw000002	spring	18	API
002270100	gasket window	60	API
pu0000022	pump valves	8	API
	y-connector (l)	12	NILU

Consumables will be supplied to DOSTE on a yearly basis for year 1 through 3. The delivery above is considered relevant for year 1.
The total budget available for consumables AND spare parts is 225 000 NOK, with a priority on consumables. Additional costs beyond 225 000 NOK will be covered by DOSTE.

List of consumables available in Excel.

for identification and control

Spare part and consumables list
DOSTE/SVN

		Part number	005960000	005970000	016920000		006900000	006900100	fl0000003
		Item	activated charcoal	purafil	mol seive	ptfe - filter	clean air filter (s)	clean air filter (l)	dust filter
		Supplier	api	api	api	api	api	api	api
Trans.		**Total Net**		**10**	**10**	**5**	**700**	**20**	**20**	**5**
1	In	Date	02.11.27						
		Number In		10	10	5	700	20	20	5
		Net		10	10	5	700	20	20	5
2	Out	Date								
		Number Out								
3	In	Date								
		Number In								
4	Out	Date								
		Number Out								
5	In	Date								
		Number In								
6	Out	Date								
		Number Out								
7	In	Date								
		Number In								
8	Out	Date								
		Number Out								
9	In	Date								
		Number In								
10	Out	Date								
		Number Out								
11	In	Date								

Spare part and consumables list
DOSTE/SVN

		Part number	or0000059	or0000035	or0000001	fl0000001	hw000002	002270100	pu0000022
		Item	o-ring	o-ring	o-ring	sintered filter	spring	gasket window	pump valves
		Supplier	api	api	api	api	api	api	api
Trans.		**Total Net**		**20**	**20**	**36**	**18**	**18**	**60**	**8**
1	In	Date								
		Number In		20	20	36	18	18	60	8
		Net		20	20	36	18	18	60	8
2	Out	Date								
		Number Out								
3	In	Date								
		Number In								
4	Out	Date								
		Number Out								
5	In	Date								
		Number In								
6	Out	Date								
		Number Out								
7	In	Date								
		Number In								
8	Out	Date								
		Number Out								
9	In	Date								
		Number In								
10	Out	Date								
		Number Out								
11	In	Date								

Consumables and Spare part list to be filled in

Spare part and consumables list DOSTE/SVN									
		Part number							
		Item							
		Supplier							
Trans.		**Total Net**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1	In	Date							
		Number In							
		Net							
2	Out	Date							
		Number Out							
3	In	Date							
		Number In							
4	Out	Date							
		Number Out							
5	In	Date							
		Number In							
6	Out	Date							
		Number Out							
7	In	Date							
		Number In							
8	Out	Date							
		Number Out							
9	In	Date							
		Number In							
10	Out	Date							
		Number Out							
11	In	Date							
		Number In							
12	Out	Date							
		Number Out							
13	In	Date							
		Number In							
14	Out	Date							
		Number Out							
15	In	Date							
		Number In							
16	Out	Date							
		Number Out							
17	In	Date							

Spare part list

Presented by Supplier on 27 Nov. 2002

Part no.	Description	Qty
	API MODEL 100A SPARE PARTS	
002620100	UV Lamp Assembly	1
003290000	Thermistor Assembly (885-071600)	2
004020300	Sensor Board	1
012360000	Fan, Power Supply Module	1
013140100	Fan, PMT Cooler	1
014610000	Cooler Assembly	1
KIT000093	CD, UV Filter 214 NM	1
PS0000010	15V Switching Power Supply	1
RL0000008	Solid State Relay, 12 Vdc	2
	API MODEL 200A SPARE PARTS	
004020200	Flow/Pressure Sensor Board	1
011310000	Drier Assembly Complete with Flow Control	1
012360000	Fan, Power Supply Module	1
013140000	Fan, PMT Cooler	1
014610000	Cooler Assembly	1
CB0000001	FUSE O3, 1A	2
HE0000017	Heater, Reaction Cell, 12W	1
PS0000010	15V Switching Power Supply	1
	API MODEL 300 SPARE PARTS	
006110100	Assembly, Band Heater M300	1
007930000	Assembly, Fan, PSM (FA0000004 ASSY)	1
009530000	Pre-amplifier/Detector Assembly	1
015810000	Source Assembly (with Adapter)	1
016910000	AKIT, Exp. Kit, CO Catalyst	1
CH0000024	Catalyst, CO/CO2 Converter (1 OZ)	1
HE0000017	Heater, Reaction Cell, 12W	1
VA0000002	Solenoid, Stainless Steel, 24V	1
KIT000109	Replacement, Opto Sensor M300	1

Spare part list (continued)

Part no.	Description	Qty
	API MODEL 400A SPARE PARTS	1
024190000	Assy, Heater, Thermistor, UV Lamp, (M400A/M450)	1
KIT000076	M400A Absorption Tube Replacement	1
VA0000028	"IZS, Zero/Span Valve, 3-Way, 1/8"" tube"	1
000941000	Orifice, 13 mil 1000 cc, Rx Cell	1
005260200	UV Lamp Assembly, Source	1
006120200	Assembly, Ozone Generator Lamp w/ Pigtail	1
FL0000012	Filter, M400A Reference Scrubber	2
024190000	Assy, Heater, Thermistor, UV Lamp, (M400A/M450)	1
022550000	Assy, Heater, Thermistor (IZS) M400A	1
	API MODEL 701 SPARE PARTS	
014340000	Valve, Shuttle, Drier	1
FA0000006	Fan, 115Vac	1
VA0000011	Valve, 4-Way, Drier	1
VA0000014	Pressure Regulator	1
VA0000016	Valve, CHECK	1
VA0000017	Valve, 2-Way (Water Drain)	1
	ESM Andersen FH 62-1 Spares	
4254511	Pump	1
DPM100100PP	Baffle plates for inlet	5

Appendix H6 Procedure for service and repair during warranty period

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

Department of Science,
Technology and Environment (DOSTE)
The Norwegian Institute for Air Research
(NILU)

Procedure for service and repair during warranty period

Schmidt Vietnam Co Ltd (SVN) signed an agreement with the DOSTE, on 15 April 2002 for a one-year service of API instruments free of charge. The agreement is valid from the date of delivery to the Customer. A detailed description of the services was included in the Repair and Service Contract signed after Mission 2. (Appendix C2 of Mission 2 report). This contract is covered by NILU and the Norwegian supplier (Industriell Maaleteknikk) by 50 % each.

Step no.	Action	Costs
1	DOSTE should first try to identify and correct error	No cost
2	If DOSTE can not find or correct the error, local supplier, SVN, undertake error seeking	Covered by the Repair and Service contract
3	SVN correct errors and change parts	Labour covered by the Repair and Service contract, parts taken from stock (see step 8) at DOSTE.
4	Damaged parts MUST be returned to Supplier in Norway	Transport paid by supplier (guarantee parts)
5	If instrument is damaged and can not be repaired in Vietnam, return instrument for repair to Supplier	Transport paid by DOSTE
6	Supplier repair instrument	Labour and parts paid by Supplier
7	After repair the instrument will be returned to DOSTE	Transport paid by Supplier
8	Supplier establishes stock of spare parts at DOSTE	Paid by the Supplier
9	Dynamic calibration of API monitors performed by SVN	Covered by the contract with NILU
10	After the warranty period the remaining spare parts in stock at DOSTE must be returned to Supplier	Paid by Supplier

Appendix H7 Letter to NORAD

Department of Science, Technology and Environment (DOSTE)
244 Dien Bien Phu Street, District 3
Hochiminh City, Vietnam
Phone: 84 8 9326709
Fax.: 84 8 9325711
Email: pqlmt@hcm.vnn.vn

NORAD
Royal Norwegian Embassy
Metropole Centre
Suite 701/702
56 Ly Thai To Street
Hanoi, Vietnam

att: Ragna Fidjestøl

Hochiminh City, November 25, 2002

Ho Chi Minh City, Air Quality Monitoring Component
A Reference Laboratory at DOSTE

After the first year of the NORAD funded project "Air Quality Monitoring Component under Ho Chi Minh City Environmental Improvement Project" we confirm that the project has proceeded according to plans and that the co-operation with NILU has been very good.

However, one specific task has been identified, which will improve the quality of the project and will also ascertain sustainability in the air quality monitoring programme. The need for moving calibration and maintenance from Schmidt Vietnam Co Ltd. to DOSTE was first mentioned prior to the project negotiations in Norway in December 2001. It was also discussed during the signing of the contract in Norway.

During Mission 1 from NILU in April 2002, NILU experts had discussions with DOSTE as well as meetings with Schmidt Vietnam, which revealed that the problem of calibration and maintenance was a real one. It was suggested in Chapter 5 of the Inception report as well as in Chapter 8 of the Mission 1 report, that the calibrations had to be moved to DOSTE.

It was further stated that a multipoint calibrator as well as necessary equipment and facilities for calibration was available. During Mission 2 from NILU in November 2002 it was, however, clear that in spite of facilities end personnel the equipment available would not be adequate for the establishment of a "Reference Laboratory" at DOSTE.

A memo was prepared identifying the needs for additional funding to set up a complete Reference Laboratory at DOSTE. This memo is attached.

DOSTE will thus ask NORAD to consider these extra costs related to the new situation as presented in the attached Memo. We have discussed the matter with NILU experts, who are willing to use some of the contingency in the project for installation and training. However, it is also evident from the work so far that training has been highly underestimated in the project.

We are looking forward to a positive respons from NORAD.

Yours sincerely

Prf. Dr. Dao van Luong,
Director of DOSTE

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

Department of Science,
Technology and Environment (DOSTE)
The Norwegian Institute for Air Research
(NILU)

Memo

Title	**Calibrations and maintenance laboratory at DOSTE**
Distribution	Mr Khoa, NILU staff for Mission 2 report App. H
Author	Bjarne Sivertsen
Date	12 November 2002
Reference No	O-101143

Calibration and Maintenance

Introduction

In the contract negotiations as well as during Mission 1 of the HEIA project, meetings and discussions concluded that a "reference laboratory" would have to be established at DOSTE to take care of multipoint calibrations of the monitors used in the field measurements.

NILU instrument experts will perform the necessary training. Together with the DOSTE field operators NILU will also follow up calibration procedures and maintenance. Hand-on training in instrument maintenance, field calibrations and some simple repairs will be undertaken by NILU experts during the three year of operation in the project period.

Multi point calibrator

As part of the maintenance and calibration procedures to be installed at DOSTE it would normally be necessary to establish a "reference laboratory" at DOSTE. This would require a complete set of monitors as well as a multipoint calibrator with zero-air generator and standard gases.

NILU was informed that a multipoint calibrator was already part of the Danida deliveries (see Attachment). This multipoint calibrator together with standard gases and a zero air generator would be used at DOSTE for dynamic calibrations, and hand-on training was being planned based on this equipment.

At the start of Mission 2, however, we found out that DOSTE never received an API700 multipoint calibrator from the Danida project. The API702 calibrator available in the laboratory can only be used as a two-point calibrator. We thus decided to perform the first training on this equipment. To meet the final objectives of moving the dynamic calibration to DOSTE equipment for high quality multipoint calibration will have to be purchased in the future.

Reference laboratory at DOSTE

In the future a complete "Reference Laboratory" should be established at DOSTE. NILU has stressed before that this Reference Laboratory should be equipped with gas monitors in addition to the multipoint calibration units, to enable calibrations of gas standards. Expert personnel have to be trained to operate the monitors for calibration reasons. Some experts will also have to be prepared and trained to carry out systematic audits of the monitoring programmes.

The monitors should be placed in a rack in the reference laboratory. The complete set-up includes the following instruments:

NO_x mon.	Equipment:	NO_x monitor, API 200
SO_2 mon.	Equipment:	SO_2 monitor, API 100
O_3 mon.	Equipment:	O_3 monitor, API 400
CO mon.	Equipment:	CO monitor, API 300
Data acq.	Equipment:	Datalogger and PC
Zero air	Equipment:	Two point calibration unit, API 701
Calibrator	Equipment	Multipoint calibrator, API 700
Accessories	Equipment:	Accesssories

Multipoint calibrations and audits to the stations should be undertaken on an annual basis. After discussions with DOSTE it has been agreed that NILU will establish the necessary expertise to operate the whole system at DOSTE. If necessary NILU could be contracted to perform Audits once a year in the future.

The Quality Assurance/Quality Control (QA/QC) systems may have to be upgraded as part of the NORAD development. Once every year the monitors should undergo a dynamic calibration and overhaul at the DOSTE Laboratory.

The situation as of November will require that a complete set of mew instruments for this reference laboratory will have to be purchased and installed. The equipment presently available will not meet the requirements of a reference laboratory.

Checks and calibrations

At the shelters a zero air generator and span gas cylinders will be used for performing weekly manual Zero/Span checks. The zero check shall be based on a zero air generator. The span check shall be based on a gas cylinder with "normal outdoor" concentration connected directly to the monitor without any dilution and without pressurising the monitor inlet. These two-point calibration procedures have been part of the delivery and installed in the shelters.

There is an ongoing work in several working groups within the European standardisation organisation CEN that aims at standardising measurement methods. Working group 12 of Technical committee 264 is preparing standards for the measurement of NO_2, CO, SO_2 and O_3 respectively. The table below is an extract from the draft standard EN 14212, ambient air quality - Measurement method for the determination of the concentration of sulphur dioxide by ultraviolet fluorescence. Similar recommendations exist for the other measurement methods as well.

Recommended frequency of checks and calibrations

Checks and calibrations	**Frequency**	**Action criteria**
Regular maintenance of components of the analyser	As required by manufacturer	As required
Linearity	At least every year and after repair of the instrument	As required and when linearity ≥ 1 % of the measured value
Calibration and adjustment of the monitor	At least every 3 months	Zero : ≥ 5 ppb span : ± 3 % of span value

As can be seen from the table CEN recommends a calibration and adjustment of the monitor every three months and linearity check once a year. Calibration and adjustment includes only a two-point calibration where the monitor is adjusted at zero level and at a fixed span level. This is most easily done using a zero air generator and a span gas cylinder with "outdoor" concentration. The zero and span gas is fed directly to the monitor at ambient pressure.

To determine the linearity of the monitor's response gas concentrations at multiple levels including the zero level are required (a dynamic calibration). This is achieved by mixing zero air from a zero air generator with high concentration gas from a gas cylinder to the required level. These gas cylinders should be certified and traceable. A calibrator/dilution unit controls the mixing ratio. This task will be undertaken at the reference laboratory!

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.

A complete Reference Laboratory costs

The equipment needed to establish a complete reference laboratory at DOSTA has been indicated above. A complete inventory list with cost estimates is presented in the following table:

Inventory List
Reference laboratory

Items	Model (Example)	Cost 1000 NOK	Comments
SO_2 monitor	API100	100	0
NO_x monitor	API200	100	0
O_3 monitor	API400	90	Travelling standard
CO monitor	API300	80	0
Zero air generator	API701	30	
Zero air gen. compressor	1hae-11t-m104x		Cost incl. in Zero air generator
PC with monitor	GW P5-133	10	
PC Software	MS Office 95	5	0
PC printer	HP 682C DJ	2	0
Rack for monitors (2 pcs)	EDR20086	10	0
Lab. env., Rel. Hum.+Temp.	Va HMP 231	80	0
Lab. env., Air Pressure	Va PTB 201AD		Incl. in Lab. env., Rel Hum.+Temp.
Lab. env., CO detector	SA 3000 SI		Incl. in Lab. env., Rel Hum.+Temp.
Multigas mulitpoint calibrator	API700	130	0
O_3 calibrator	API	110	0
SO_2 cal. gas, 100 ppm, ref std.	NIST	14	Incl. regulator
NO cal. gas, 100 ppm, ref std.	NIST	14	Incl. regulator
CO cal. gas, 5000 ppm, ref std.	NIST	14	Incl. regulator
Flow calibrator	BIOS DryCal	25	0
Repair tools	BACO	4	
Laboratory items	Fittings, filters e.t.c.	5	
	Total	**823**	

Mail 8 October 2002

To: BS@nilu.no
From VTDam

Dear Mr. Bjarne Sivertsen,

The room for calibration and maintenence is Mr. Duc's room:
a) the size of the room: 3.2m x 6m
b) We've already had 1 set of the multipoint calibrator API Dynamic Dilution Calibrator Model 700, We put it in Mr. Duc room now.
c) Calibration gases are available and we have the certificate of those gases. It is stored in DOSTE station.
d) We have some big tools, so we need special tools for API instrument.

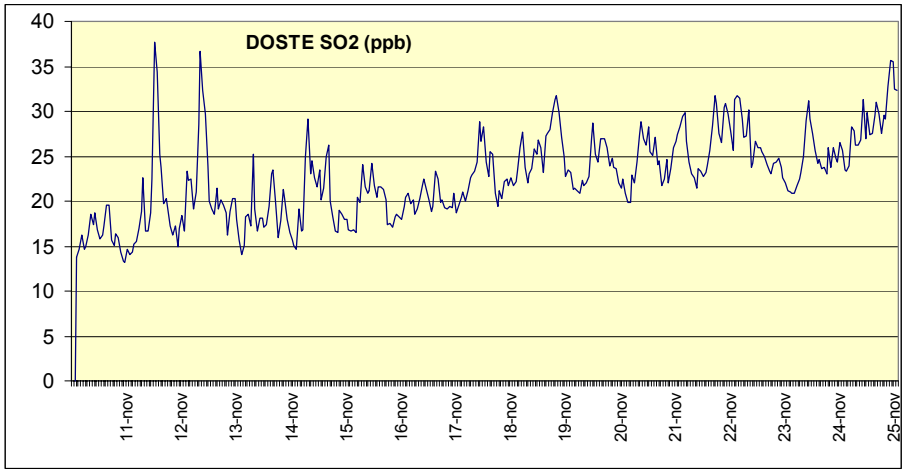
Have a good day.

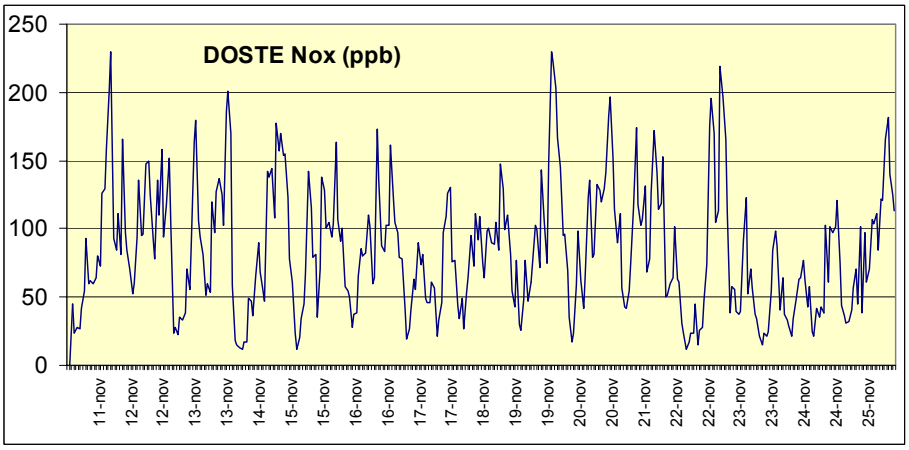
Best regards
VTDam

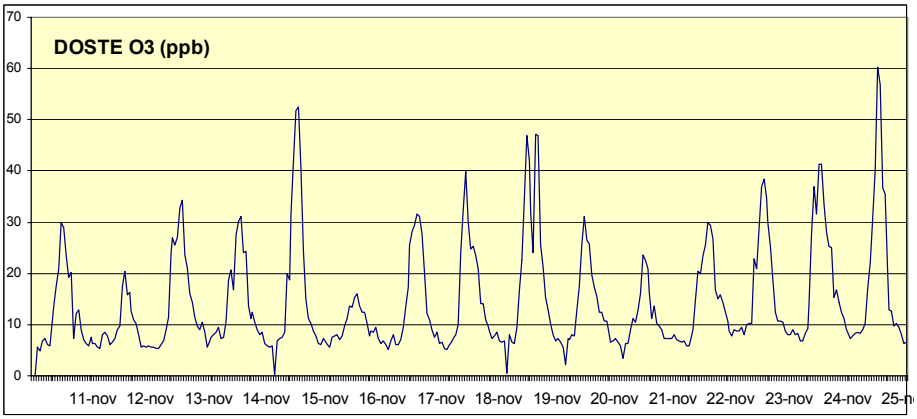
Appendix I

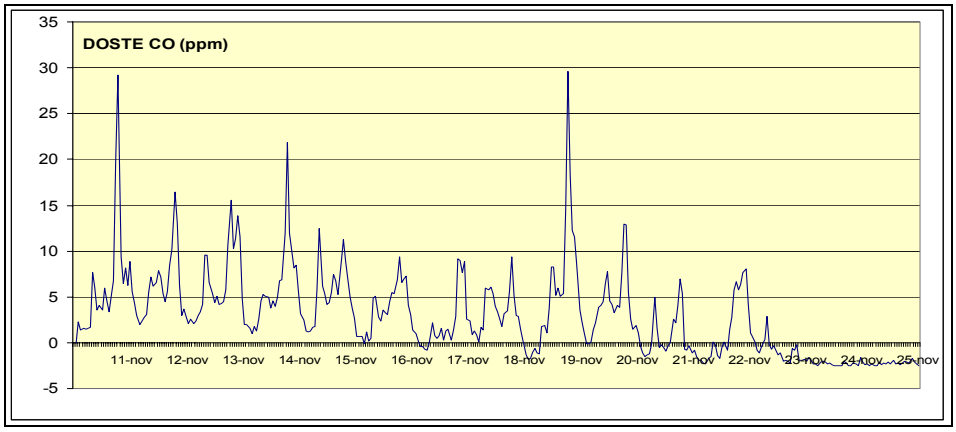
Task9. Data interpretations

Appendix I1 Air Quality data from DOSTE station 11 – 25 November 2002

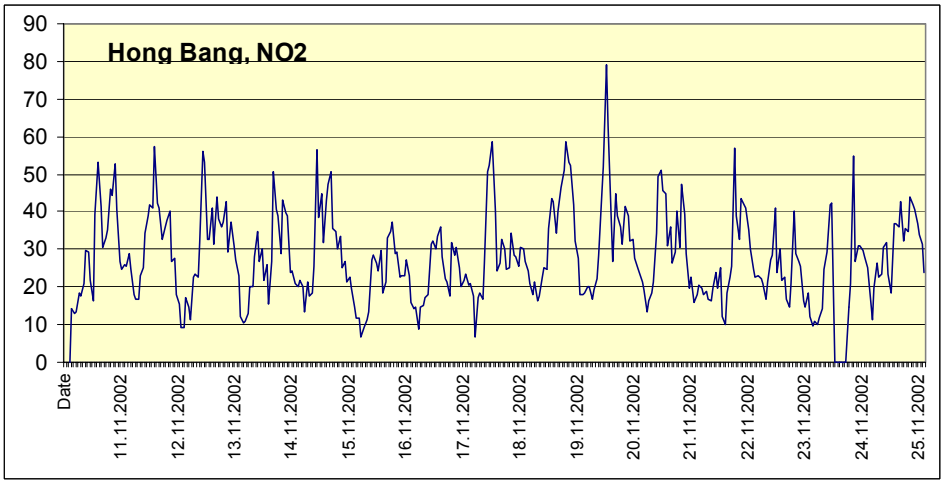


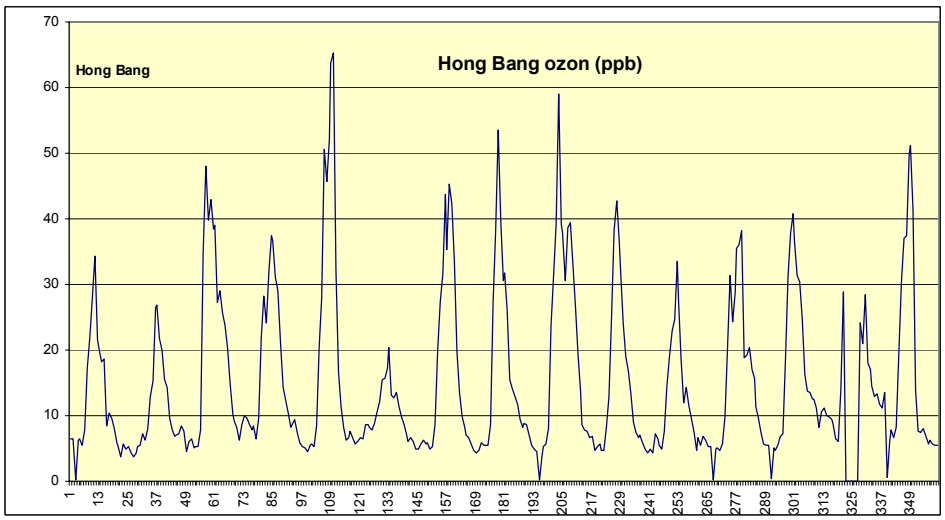




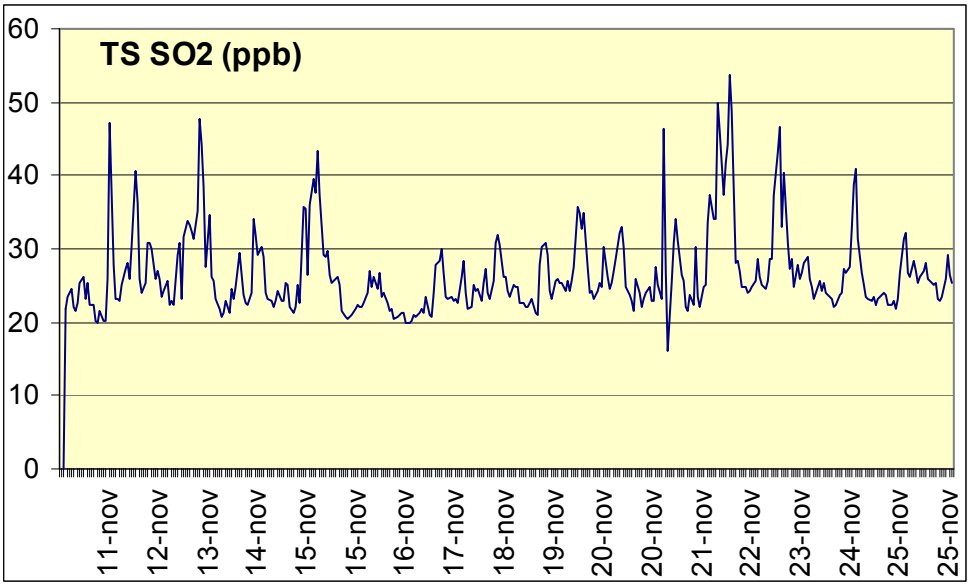


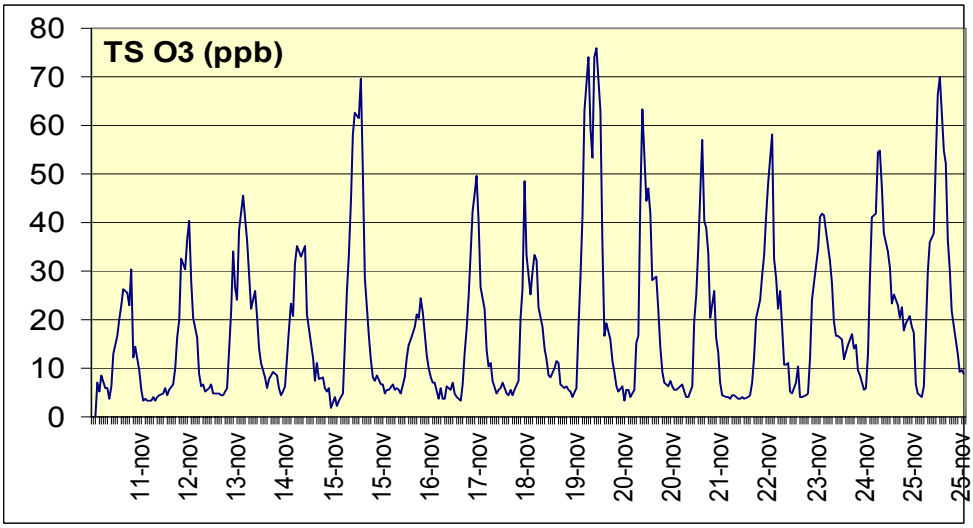
Air Quality data from HONG BANG station 11 – 25 November 2002



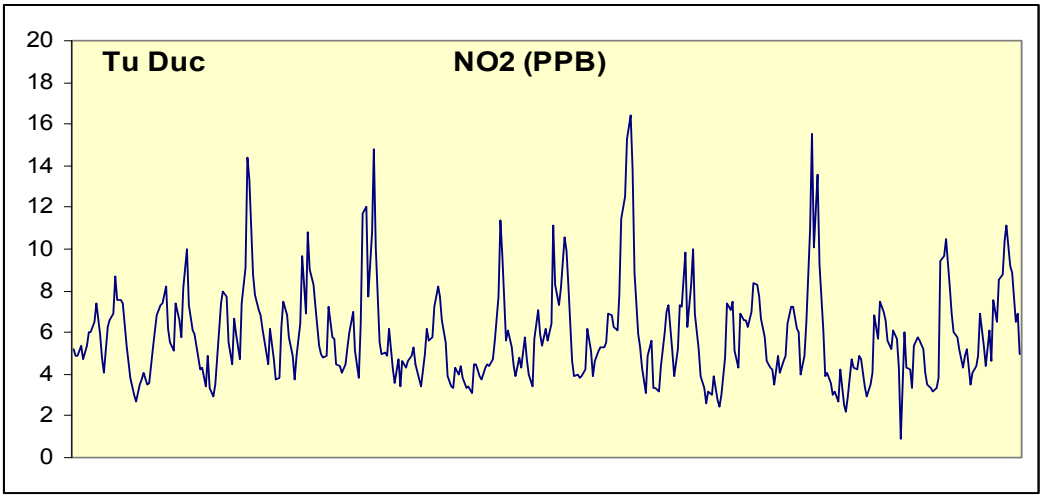


Air Quality data from TON Son Hoa station 11 – 25 November 2002



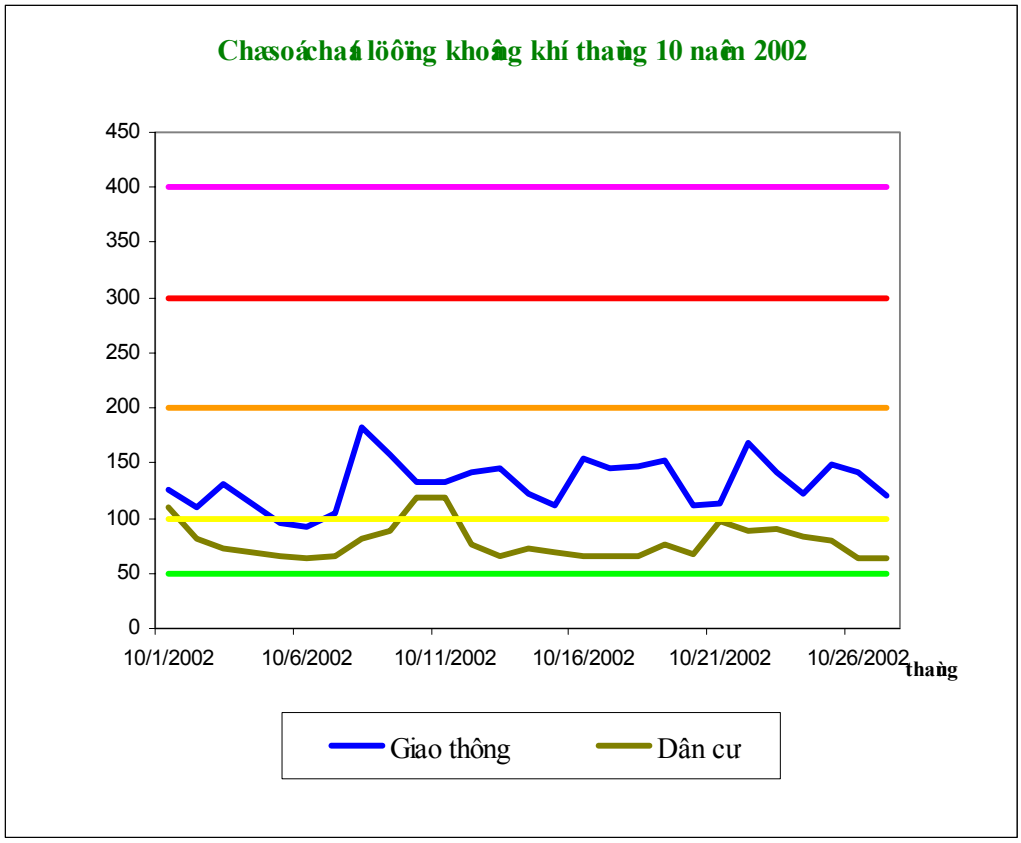


Air Quality data from Tu duc station 11 – 25 November 2002



Appendix I2 Air Quality Information Available on Internett

Air Quality Index presented for the month of October 2002-11-12



Blue: Street station Grey. Urban backgroun

AQ Index:

Chæ soá chaát löôïng khoâng khí ñöôïc qui öôùc:	
0 to 50	Toát
51 to 100	Trung bình
101 to 200	Keùm
201 to 300	Xaáu
301 and above	Nguy haïi

Appendix I2 contunued: Reporting AQ

Air Quality
Ambient Air Quality Standards

A summary of the Vietnam standard TCVN 5937 – 1995 is presented below:

Table 1 – Ambient air quality standards (all values are mg/m^3)

No	Parameter	1 hr average	8 hr average	24 hr average
1	CO	40	10	5
2	NO_2	0.4	-	0.1
3	SO_2	0.5	-	0.3
4	Lead (particulate)	-	-	0.005
5	O_3	0.2	-	0.06
6	Suspended particulate matter	0.3	-	0.2

Note:
Standard methods of analysis of ambient air quality parameters are specified in available current TCVNs

The network consists of four measuring stations.

Station	Address	Type	Parameters	Remarks
DOSTE	244 Dien Bien Phu, District 3	Traffic	NO, NO_2, SO_2, CO, O_3, PM_{10}	
Hong Bang	132 ,Hung Vuong, District 5	Traffic	NO, NO_2, CO, O_3, PM_{10}	
Tan Son Hoa	56 Truong Quoc Dung, Phu Nhuan	Residential	NO, NO_2, SO_2, CO, O_3, PM_{10}	
Thu Duc	184 Tagore, Lang Dai Hoc, Thu Duc	Industrial	NO, NO_2, SO_2, PM_{10}	

Monthly report from the AQ network in HCMC

October 2002

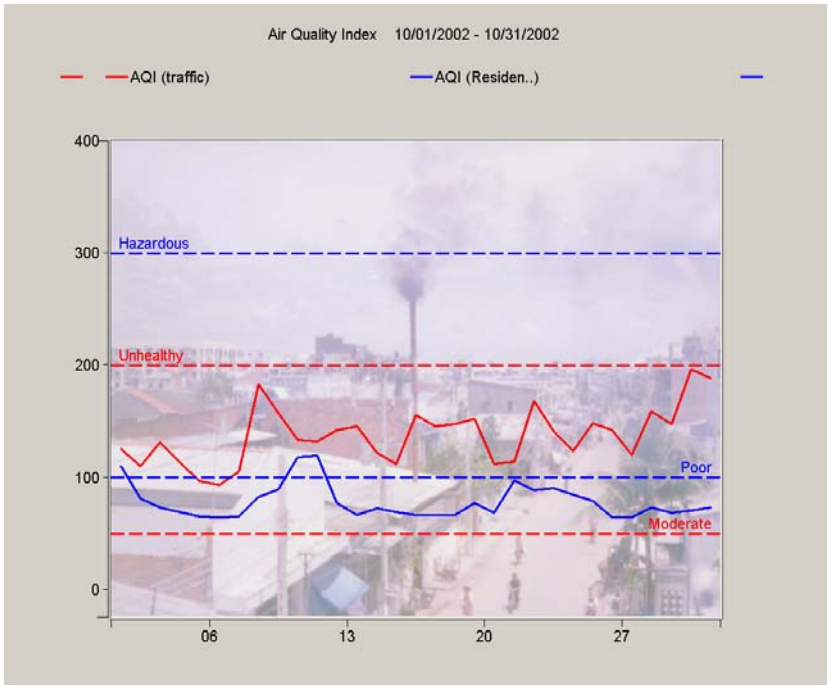
Statistical parameters compared to VN standards.

Parameter	Stat.	DOSTE	Hong Bang	Tan Son Hoa	Thu Duc	VN Standard
NO ($\mu g/m^3$)	Average	**79.39**	**22.99**	**15.89**	**22.23**	
	98-percentile	251.4987	80.54	54.75	83.77	
	Max. hour	322.89	126.42	86.00	128.70	
	Max. day	154.2	50.1	27.6	39.9	
NO_2 ($\mu g/m^3$)	Average	**79.39**	**53.42**	**17.63**	**19.27**	100
	98-percentile	175.19	159.04	55.87	95.13	
	Max. hour	351.45	240.79	88.17	300.77	400
	Max. day	105.1	109	29.3	47	100
SO_2 ($\mu g/m^3$)	Average	**66.23**	**N/A**	**75.05**	**N/A**	300
	98-percentile	112.29	N/A	126.38	N/A	
	Max. hour	199.94	N/A	170.97	N/A	500
	Max. day	86	N/A	87.7	N/A	300
O3 ($\mu g/m^3$)	Average	**14.02**	**17.22**	**24.67**	**N/A**	60
	98-percentile	64.84	68.89	87.28	N/A	
	Max. hour	118.63	120.53	139.51	N/A	200
	Max. day	34.3	33	46.1	N/A	60
CO (mg/m^3)	Average	**6.83**	**N/A**	**N/A**	**N/A**	5
	98-percentile	19.62	N/A	N/A	N/A	
	Max. hour	33.73	N/A	N/A	N/A	40
	Max. day	10.3	N/A	N/A	N/A	5
PM_{10} ($\mu g/m^3$)	Average	**N/A**	**N/A**	**61.67**	**140.41**	160
	Max. day	N/A	N/A	96.30	238.90	160 *)

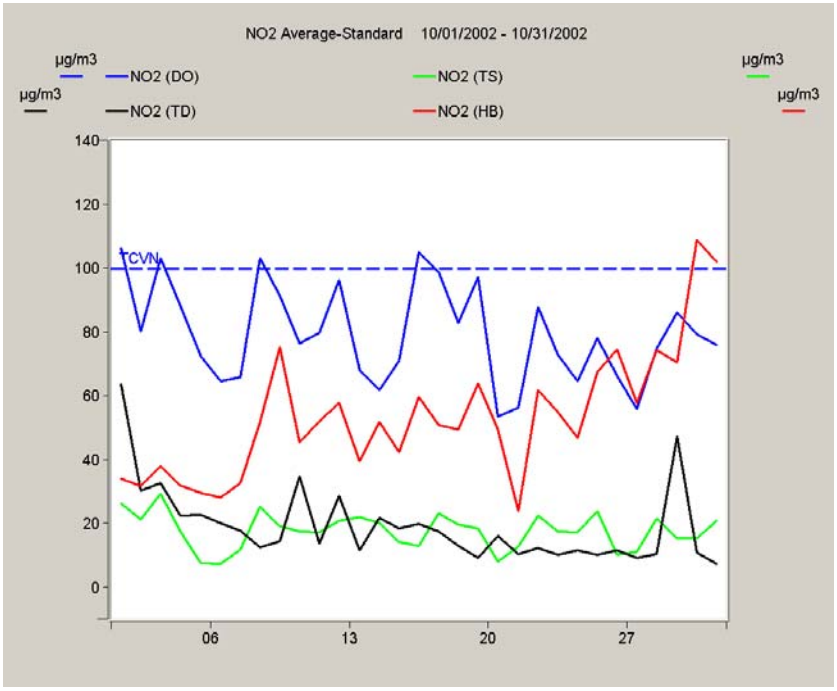
*) The value is derived by multiplying the standard for SPM with 0.8.
Values collected from the PM10 analysers for this period were not valid due to technical difficulties.

Graphs

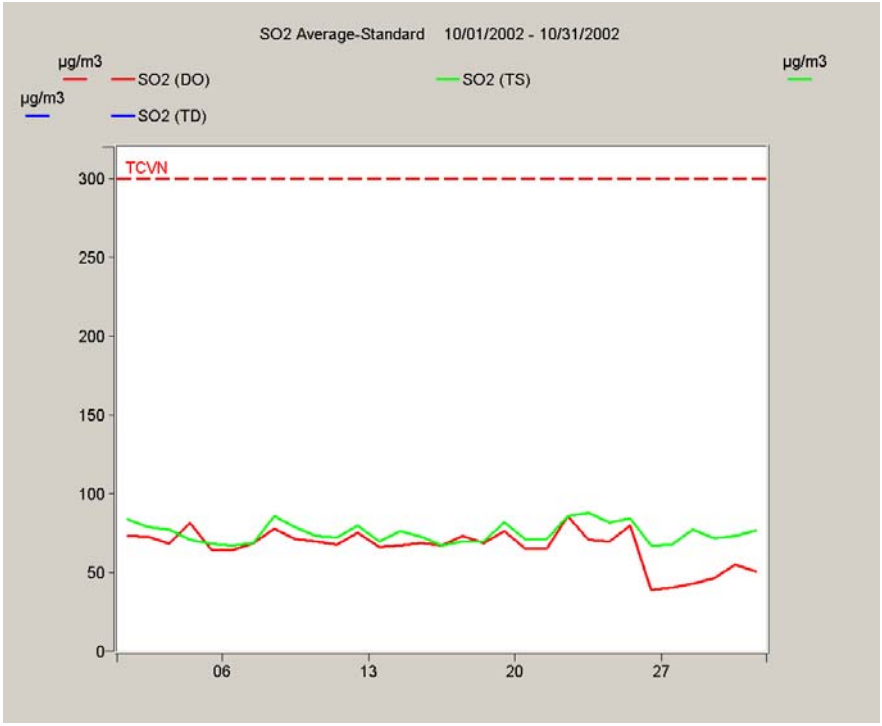
1. Daily AQI for October 2002



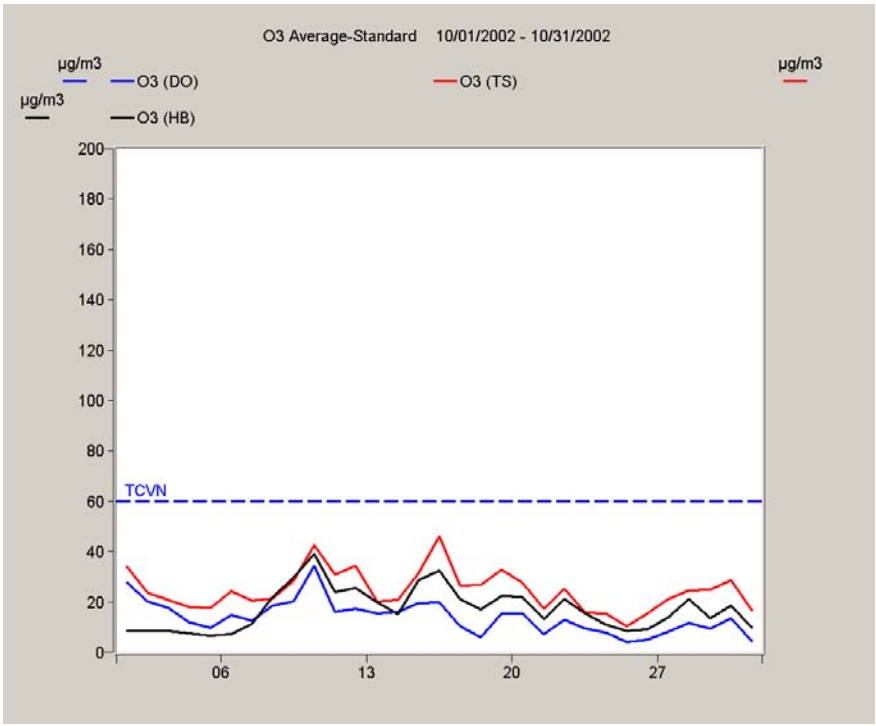
2. NO2 Average / Standards for October 2002



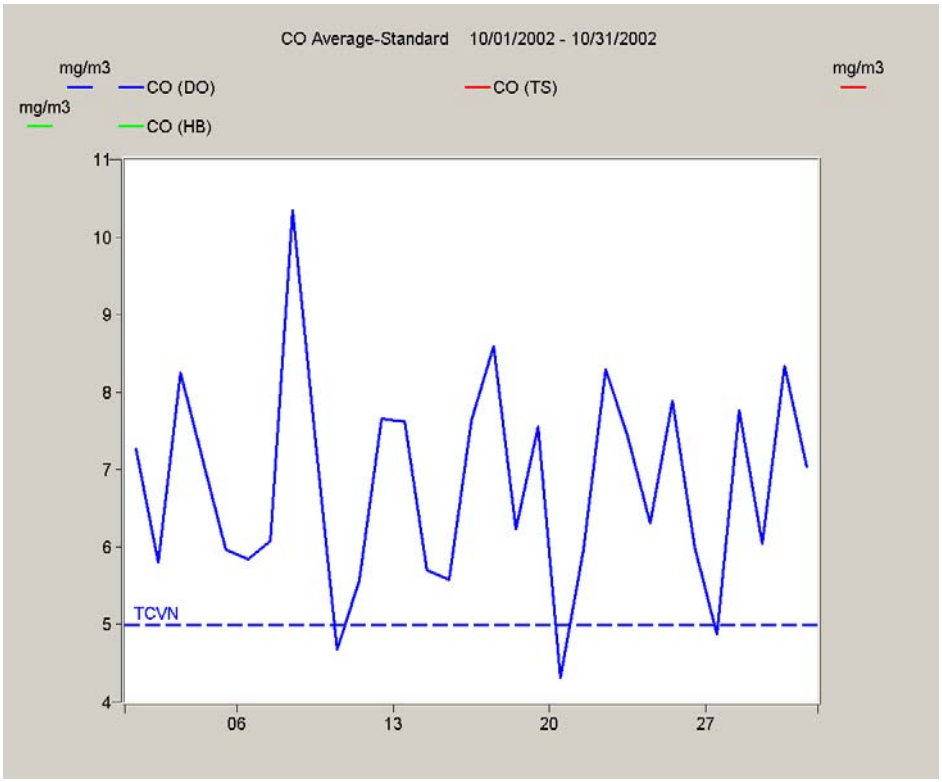
3. SO2 Average/ Standards for October 2002



4. O3 Average/ Standards for October 2002



5. CO Average/ Standards for October 2002

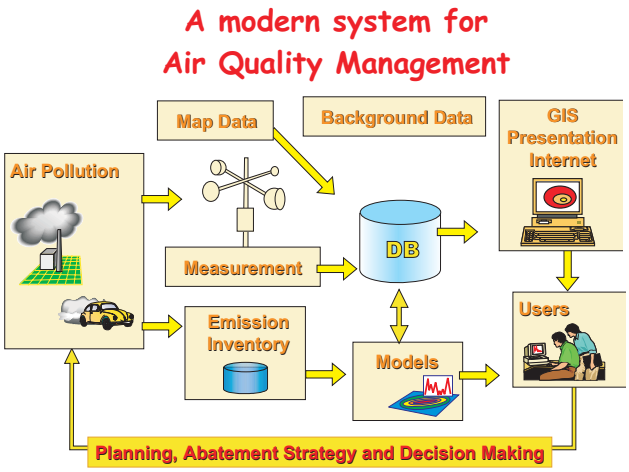


Appendix J

Task10. Air Quality Assessment

Appendix J1 Air Quality Management System

The AirQUIS AQM system is one of several urban air quality management systems available today. AirQUIS has been designed to enable efficient calculation and visualisation of urban air pollution concentrations and its spatial and temporal resolution.



- It is a truly integrated system (operational integration of modules).
- It supports visualisation of monitoring data, also shown on-line via the internet.
- It contains modules for emissions, meteorological wind field and dispersion models, and a population exposure model, integrated in a GIS system, which enables calculation and visualisation of concentration and exposure fields, including source-specific contributions, at various time resolutions.
- It enables the calculation of future air pollution changes based upon development scenarios, and gives basis for cost-effectiveness or cost-benefit calculations.

AirQUIS has an operational windows-based, user-friendly interface with the system, and runs on a state-of-the-art workstation.

Population exposure calculations

The spatial resolution possible in the model calculations is rather high. The built-in dispersion model system is typically run on a 1 km-size grid system. However, the sub grid models incorporated in the system, calculation of dispersion from point sources and streets, allow for calculation of

concentrations in freely specified "receptor points", allowing a resolution of 10 meters or better. Thus, concentrations can be, and typically are, calculated e.g. at individual houses/residences. The accuracy of the calculated concentration values is subject to the accuracy of a number of parameters: emission data, wind field and dispersion parameters, model inaccuracies, etc., as is typical for all such model calculations. The time resolution is typically 1 hour.

Such calculation abilities opens the possibility to make estimates of population exposure to air pollutants. As of now, an indoor pollution module is not incorporated in AirQUIS, although that should be entirely possible. This would entail an additional demand on input data: data necessary for estimating the indoor pollution (e.g. indoor/outdoor ratio and indoor sources), for individual houses.

A shortcoming of the kind of population exposure, which is possible to calculate with such a system, is that it is not possible to "follow" each person in his daily movements. Thus, the population exposure calculated is a "potential" exposure, related to the place in the city where each individual spends most of his time. A possibility to develop this towards better exposure estimates is to define population groups of individuals with similar patterns of daily movements.

AirQUIS has been used extensively to calculate potential population exposure distributions in Oslo. Calculations have been carried out for NO_2, PM10 and benzene. The model is run on an hourly basis for entire years, and statistics then calculated to give, for example, the number of people potentially exposed to exceedance of AQ limit values at their home address.

Strength and weaknesses of AQM systems in population exposure calculations

In the context of the topic of this paper, the use of AQM systems has main strengths and weaknesses as follows:

Strengths:
- Provides spatial and temporal resolution of outdoor concentrations.
- Indoor/outdoor modules possible.
- Source contributions can be calculated.
- Individual compounds, and combination of compounds.
- Gives potential or quasi-potential exposure distributions.

Main weakness:

- Does not give individual, integrated exposure values, but based on inclusion of micro-environment modules and time-activity patterns of population groups, (related e.g. to residence areas and work locations), estimates of "population group exposure" can be calculated.

Issues related to the use of AQM systems for population exposure assessments

- *Air Quality limit values are based upon epidemiological studies*
  In epi-studies health effects are studied in broad population groups related to home addresses (subgroups can be defined according to for instance sub-regions in the cities). The observed health effects are related to measured air pollution concentrations, usually from a few fixed monitoring stations. Such measurements represent a kind of "potential exposure". The actual pollution exposure is estimated in some epi-studies using personal monitors on a small subset of the population.

  In this context the approach to population exposure distribution estimation used by typical AQM systems (outdoor concentrations) could provide a sufficient basis for giving a first estimate of changes in health risks as a result of changes in emissions and resulting outdoor concentration changes.

- *AQM systems enhanced with indoor/outdoor modules and time-activity patterns for population groups come closer to the reality of population exposure.*
  As described in an earlier section of this paper, research is going on to improve the exposure calculation methodology, including microenvironment description and time-activity patterns for population groups.

  Even this will not result in the assessment of actual individual exposures, but should bring us closer to be able to evaluate which abatement measures would be more effective in reducing health risks, whether they relate to reduction of indoor or outdoor/hot-spot exposure.

Appendix K

Task11. Capacity building

Memo

Training needs assessment updated

Introduction

One of the aims for the HEIA project is to improve the institutional capacity of Ho Chi Minh City based agencies to manage the impacts of urban growth, and to gather, store and analyse air quality data for management purposes by establishment of the air quality monitoring system.

General institutional strengthening through air quality lectures and seminars has been designed specifically for the needs for DOSTE. It is vital for the project that the information and data collected from the monitoring stations is ultimately used to improve the air quality in HCMC. The program will give valuable information on the air quality in HCMC and assessment on how the situation is compared with air quality standards. This should be used to make a plan of action for measures to reduce emissions. The information from the project will be a good basis for making decisions on air pollution reduction measures.

Additional training funded by UNOPS ?

NILU was requested by UNOPS as part of Mission 1 to HCMC to evaluate and assess the training needs by the institutions involved in air pollution monitoring and air quality management. A report was prepared for UNOPS (See Appendix K of Mission 1 report). This report briefly answers to the questions raised in the Terms of Reference given by UNOPS.

Later in the process a programme was developed for a combined input from Instrumatic AS, Denmark, OPSIS AB, Sweden and NILU, Norway to meet the needs and requirements stated by the DOSTE staff. In October 2002 Instrumatic a/s withdrew from this project, and UNOPS funds were made available for Instrumatic a/s only.

Updated training assessment

We feel that an updated training assessment is needed after the discussions and experience gained during Mission 1 and during the start of Mission 2. There are a few changes compared to the original plans stated in the NORAD funded project proposal. It has since the project negotiations in Norway in December 2001 been pointed out by the consultant and by the DOSTE experts that too little funds for training has been made available for this project. Later the additional training linked to the Danida funded installations identified during Mission 1 by NILU has been reduced.

The following table represents an update of the training needs supplied by NILU within the present funds provided by NORAD. Compared to the input actually needed to fully perform air quality management we feel that the time set aside for training is very limited. This especially applies to the assessment and planning phase.

A summary of capacity building and training activities.

Task	Topic	Skills to be obtained	Forum	Trainees	Length	When
11a	Introduction to the total planning system	• The total air quality monitoring and management system • Understand air pollution	Kick-off seminar DOSTE	Experts, users, stakeholders	3 days	Apr 02
11b	Instruments and monitors	• Monitors functioning, installations and practical skills in using API monitors • The PM_{10} monitor, functions and operations • Field operations • Meteorological sensors? –not available?	Hands-on-training HCMC	Monitor experts	12 days 2 days	Nov 02 Nov 02 Apr 03 Nov 02 ?
11i	Calibration and maintenance	• Calibration lab set-up • Calibrations (Dynamic calibrations?) • Maintenance of monitors • Repair and update Ref.lab.	Hands-on-training DOSTE DOSTE	DOSTE Monitor experts	5 days 2 days 2 days	Nov 02 ? Nov 02 Oct 03
11c	Data retrieval and QA/QC	• Data retrieval at EDC • Update QA/QC procedures in field, SOP • QA/QC principles Meteorological data, training	Hands-on Hands-on Classroom at NILU DOSTE	EDC expert Field experts DOSTE experts	1 day 1 day 1 day ?	Nov 02 Nov 02 Apr03 May03
11d	AirQUIS platform	• Introduction to AirQUIS • Installation and training NILU Models and AQMS training at NILU Installation and training HCMC • • AirQUIS applications • Using AirQUIS	Hands-on HCMC Classroom NILU NILU Hands-on DOSTE DOSTE DOSTE	Experts EDC Experts 3 experts Selected exp. . EDC experts EDC experts EDC experts	1 day 5 days 5 days 5 days 5 days 5 days	Apr02 Nov 02 Apr 03 Apr 03 May 03 May03 May03
11e	Dispersion models	• Establish complete emission inventories for HCMC (use of templates) • The use of models in air quality planning and abatement strategies • Model application for HCMC	Hands-on HCMC Classroom NILU Hands-on HCMC	EDC Experts Selected experts EDC Experts	1 day 2 days 3 days	Nov 02 Apr 03 May 03 Oct 03
11f	Data treatment and reporting,	• Air Quality Data statistics Statistics from AirQUIS Understanding Air Quality Air Quality evaluation, use meteorological data	Intro in Seminar 1 Hands on NILU Class room NILU Work shop DOSTE	Experts and users Selected experts Selected experts DOSTE experts	1 day 1 day 1 day 1 day	May 02 Apr 03 Apr 03 Oct 03
11g	AQ Assessment and planning	• The basic contents of AQMS Air Quality assessment and planning with AirQUIS, models Data needed, use of templates and systems Collection and use of data	Workshop HCMC Workshop and hands-on at NILU Hands on DOSTE	DOSTE experts Selected experts EDC experts	1 day 3 days 3 days	May 03 Apr 03 Oct 03

Task	Topic	Skills to be obtained	Forum	Trainees	Length	When
11h	Abatement strategies	• Environment and health damage assessment; • Abatement options assessment; • Cost-benefit analysis or cost-effectiveness analysis; • Abatement measures selection (action plan); • Design optimum control strategy	Workshop NILU Hands--on DOSTE DOSTE DOSTE	selected experts Experts and stakeholders Local experts Local experts	2 days 3 days ? days	Apr 03 + later? Oct 03 Apr 04
9e	Data dissemination, use of Internet	• Presentation of the NILU on-line air quality presentations by Internet	NILU classroom	Selected DOSTE experts	1 day	Apr 03

Kick off seminar

The capacity building started with a kick-off seminar at DOSTE held in April 2002. The seminar introduced the staff and participants to the total monitoring and planning system and explained the various elements of such a system.

Monitoring and field operations

The development of platforms, monitors, models and assessment tools will be performed through on the job training and discussions between expatriate experts and local experts as the work proceeds. Special training will be undertaken for the new PM10 monitor, both in HCMC and at NILU.

Calibrations and maintenance

Moving the responsibilities for maintenance and calibrations of monitors from Schmidt Vietnam to DOSTE (as decided during Mission 1, see Ch. 8.4-8.5, Mission 1 report) will require additional training. This part of the training was not originally assigned to the NORAD funded part of the project.

AirQUIS

The AirQUIS platform will be installed as a basis for the air quality management and planning system to be used in HCMC. A comprehensive workshop based and on-the-job training programme will thus have to be undertaken to train local experts in using and taking over the system. This first training will take place at NILU after installation of AirQUIS at NILU and after installations at DOSTE in May 2003?.

Selected experts (2) will also be invited to NILU for an introductory training session. The system used for emission inventorying, data retrieval,

databases, data treatment and presentation as well as dispersion and exposure modelling will be part of this training.

Modelling and data interpretation

Modelling skills is essential for air quality planning and impact assessments. At least one local expert should be trained in using and interpreting air quality dispersion models. Air quality data statistics including the use of meteorological data in air quality interpretation and presentation will have to be prepared.

Air quality planning

Procedures for air quality impact assessments as well as preparation of abatement options and scenarios will be presented. Cost-benefit analyses can be used to evaluate the best possible options to reduce the air pollution load seen from an economic point of view. The results of such analyses again may lead to the development of Action plans.

Within the limited NORAD budget NILU can together with the client define the strategic objectives of an Air Quality Management and planning System (AQMS), and support the selection of tools, modules and components to be used in a specific situation and for a defined area of interest. Training in the application of AirQUIS as a basis for performing abatement strategy planning will be prepared, 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.

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ABSTRACT
Abstract

The Ho Chi Minh City Environmental Improvement Project, Air Quality Monitoring component (HEIA) is being supported by NORAD and is being undertaken by NILU. The second Mission to Ho Chi Minh City had several objectives. The main task was to install the new NORAD funded air quality monitoring stations and start training in operations, maintenance and repair.The lack of instruments for a new maintenance and repair laboratory was identified. Updating of the data retrieval and data back up procedures for new computers at the computer centre was undertaken. Meeting with NORAD in Hanoi was held to report on the status and indicate future needs Vietnam.

NORWEGIAN TITLE

KEYWORDS		
Air quality monitoring	Air quality assessment	Vietnam

ABSTRACT (in Norwegian)

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