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Ho Chi Minh City



NORAD

DIREKTORAT FOR
UTVIKLINGSSAMARBEID

NORWEGIAN AGENCY FOR
DEVELOPMENT COOPERATION

Ho Chi Minh City Environmental Improvement Project
Air Quality Monitoring Component

The air quality monitoring programme for Ho Chi Minh City



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The air quality monitoring programme for Ho Chi Minh City

Introduction

This report is based on a presentation prepared for the Seminar: “HCMC Air Quality Monitoring and Management Programme” This was a final seminar held at the end of the Ho Chi Minh City Improvement Project, Air Quality, Monitoring Component, Second part: Reference laboratory and Training. The project has been supported by Norwegian Agency for Development Cooperation (NORAD). The seminar was arranged by DONRE in Ho Chi Minh City (HCMC) on 23 November 2005.

The seminar presented a summary of the air quality monitoring and management programme, which has been developed, based on DANIDA and NORAD funds in Ho Chi Minh City. The presentations were mainly based on the development and training performed by NILU and will include background, monitoring system, calibration laboratory and air quality results.

The basic platform established for the air quality databases, emission inventories as well as the air pollution modelling has been based on the Norwegian developed AirQUIS system. This system may also be used for air quality assessment and planning. To ensure the best possible quality in the programme NORAD added support for the development of a reference and calibration laboratory. Results and status concerning the air pollution situation in HCMC will be presented in the seminar.

The monitoring programme

A total of 9 measurement sites using automatic monitors have been established in Ho Chi Minh City (HCMC). Four of the sites were supported by Danida and installed in 2000, while the remaining five sites have been supported by NORAD and were installed with the support from Norwegian Institute for Air Research (NILU) in 2002. The stations, site characteristics and locations are given in the Table below.

Table1: Air pollution measurement sites in HCMC, site characteristics and positions.

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

Hourly air quality data are being collected through the automatic monitoring and telemetric network every day. The data are quality controlled and transferred for storage in the integrated relational databases. Statistical programmes for control of quality and representativeness are used to check the validity of the data. Results can be then presented using user-friendly graphical tools.

The key features of the system is the integrated approach that enables the user to not only access measured data quickly, but also use the data directly in the assessment and in the planning of actions. The demand of the integrated system to enable monitoring, forecasting and warning of pollution situations has been and will be increasing in the future. At present Air Quality Index (AQI) values are generated automatically and presented on an information board in the city centre of HCMC as well as on an Internet page developed for DONRE/HEPA.

Air pollution dispersion models have also been added to the system in HCMC to enable concentration estimates, evaluation of different source's relative importance to the total exposure, impact assessment and to perform optimal abatement planning. For this purpose the HEPA experts are in the process of completing an emission inventory for HCMC.

During the last few months NILU has, with the financial support from NORAD, established a reference and calibration laboratory at HEPA. This will assure that calibrations and controls of the data will give quality assured air pollution information for HCMC.

Objectives

The establishment of the monitoring system in HCMC has been based on a number of different objectives:

1. Background concentrations measurements,
2. Air quality determination to
 - check current levels
 - compare with air quality standards,
 - detect individual sources
 - collect data for land use planning purposes,
3. Observe trends (related to emissions),
4. Develop abatement strategies
5. Assess effects of air pollution on health, vegetation or building materials
6. Information to the public
7. Develop warning systems for prevention of undesired air pollution episodes,
8. Develop and test atmospheric dispersion models.

Indicators and limit values

Not all compounds in the atmosphere can be measured at all time. We have therefore selected a number of indicators to represent the air quality of HCMC.

To enable a balanced interpretation of the measured data, the results are being compared to international and national Air Quality Limit values, Standards or guidelines. The guidelines as given by World Health Organization include a selection of a few priority pollutants. The indicators selected by the monitoring programme for HCMC were:

- Sulphur dioxide (SO₂)
- Nitrogen dioxide (NO₂) and/or NO_x (Nitrogen oxides),
- Suspended particles with diameter less than 10 micrometer (PM₁₀)
- Ozone (O₃)
- Carbon monoxide (CO)

The measured concentrations have been compared to the limit values or air quality standards given for Vietnam (**TCVN 5937 – 2005**). These standards are presented in Table 2 below, together with the World Health Organisations proposed guideline values.

Table 2: WHO guideline values and the Vietnam air quality standards as proposed in the TCVN 5937-2005.

Pollutant	Averaging time	Guideline and Limit Value	
		WHO	Vietnam
Sulphur dioxide (SO ₂)	1 hour	500 (10 min)	-
	24 hours	125	125
	Year	50	50
Nitrogen dioxide (NO ₂)	1 hour	200	200
	24 hours	-	-
	Year	40	40
Ozone (O ₃)	1 hour	200	120
	8 hours	120	-
	24 hours	-	80
Carbon monoxide (CO)	1 hour	30 000	30 000
	8 hours	10 000	10 000
Particles <10 µm (PM ₁₀)	24 hours	-	150
	Year	20	50
Lead (Pb)	Year	0.5	5 (hourly)

Air Quality Index (AQI) generated daily

The **daily reporting** of air quality in HCMC is done through the generating of an air quality index (AQI). The AQI procedures were re-evaluated and some slight changes and improvements were included in November 2005. The AQI procedures were then programmed into the AirQUIS system for automatic generation every day.

The measured results for the potential harmful species PM₁₀, NO₂, CO, SO₂, and O₃ 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 Air Quality Index (AQI) has been established in AirQUIS based on the present and proposed air quality standards for Vietnam (TCVN 5937 – 1995 and TCVN 5937 – 2005). The selected values used for generating the AQI values have also been compared with the World Health Organisation's new proposed guideline values for air quality.

References

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- WHO (2000) Air quality guidelines for Europe, second edition. Copenhagen, WHO, Regional Office for Europe (WHO Regional Publications, European Series, No. 91).
<http://www.euro.who.int/document/e71922.pdf>

Appendix

Presentation of the air quality monitoring programme for Ho Chi Minh City



Norwegian Institute for Air Research

Independent foundation
Established 1969
Annual turnover 20 mill USS
145 employees: 70 scientists; 42 with PhD

Some topics covered by NILU:

- Industrial pollution
- Urban air pollution
- Regional, transboundary
- Tropospheric ozone
- Ozone layer and UV
- Climate change,
- Coastal zone management
- Hazardous pollutants

NILU projects worldwide.




AirQUIS
installed in more than 30 locations



AirQUIS: The NILU developed air quality monitoring and management system

www.NILU.no

AQ Monitoring programme for HCMC, Background




Bjarne Sivertsen, NILU

Presented at
DONRE, HCMC
November 2005

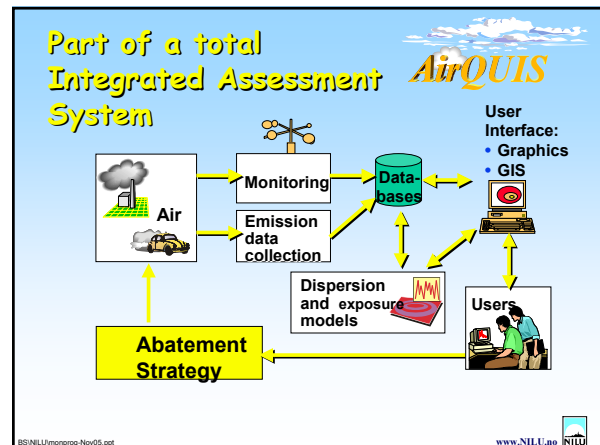
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A complete Air Quality Management Systems **AirQUIS**

- Monitoring
- Data retrieval
- QA/QC
- A GIS database
- Models
- Input data
- EIAssessments
- Forecasts



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Objectives

- Background concentrations measurements,
- Air quality determination to check,
 - current levels
 - and compare with air quality standards,
 - to detect individual sources
 - to collect data for land use planning purposes,
- Observe trends (related to emissions),
- Develop abatement strategies
- Assess effects of air pollution on health, vegetation or building materials
- Information to the public
- Develop warning systems for prevention of undesired air pollution episodes,
- Develop and test atm. dispersion models.

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Not all compound in the atmosphere can be measured !

Air Pollution Indicators

Priority pollutants:

- SO₂ (Sulphur dioxide)
- NO₂ (Nitrogen dioxide)
- PM₁₀ (Particles with aerodynamic diameter < 10 micrometer)
- O₃ (Ozone)

Other indicators:

- CO (carbon monoxide)
- PM_{2.5}
- Benzene (BTEX)
- Pb (lead)

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Indicators

Identified to:

- provide a general picture,
- be easy to interpret,
- respond to changes,
- provide international comparisons,
- be able to show trends over time.

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Guidelines ↔ Standards

Guidelines:

- Provide basis for protecting public health
- Background information (WHO)
- Not intended to be standards

Standards:

- Level of AQ adopted by regulatory authorities (Vietnam, TCVN-2005)
- Enforceable

Compound + Concentration + Averaging time

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Health based Guidelines

Classical pollutants:

SO₂ -NO₂- CO - O₃ -PM

- Guidelines for Air Quality (WHO 2000)
- New updated Guidelines, 2005 (World)

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AQ Guidelines and standards

Pollutant	Averaging Time	WHO (µg/m ³)	TCVN-2005 (µg/m ³)
SO ₂	Annual Avg.	50	50
	24 Hours	125	125
	1 Hour	500 (10min)	-
CO	8 Hours	10 000	10 000
	1 Hour	30 000	30 000
NO ₂	Annual Avg.	40	40
	24 Hours	-	-
	1 Hour	200	200
O ₃	8 Hours	120	80 (24 h)
	1 Hour	-	120
PM ₁₀	Annual Avg.	20	50
	24 Hours	50	150
Pb	Annual	0.5	-

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AQ Monitoring Sites

ID Code	Name	Character	PM10	NO2	SO2	O3	CO	X coordin (m)	Y coordin (m)
1 DO	DOSTE	Traffic	X	X	X	X	X	684,430	1,192,220
2 HB	Hong Bang	Traffic	X	X	X	X	X	681,620	1,189,460
3 TD	Thuc Duc	Res/Ind	X	X	X	X	X	683,640	1,199,790
4 TS	Tan Son Hiep	Lib Bldg	X	X	X	X	X	682,630	1,193,930
5 TN	Thong Nhat	Traffic	X	X	X	X	X	680,680	1,193,630
6 BC	Binh Chanh	Traffic	X	X	X	X	X	674,500	1,183,000
7 ZO	Zoo	Lib Bldg	X	X	X	X	X	686,420	1,193,370
8 DC	District 2	Res/Ind	X	X	X	X	X	691,160	1,193,510
9 DT	Duong Trung	Lib Bldg	X	X	X	X	X	677,940	1,200,080

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Different site types

Station class	Radius of area
Traffic stations	<10-15 m
Industrial stations	10-1000 m
Background stations:	
- Urban background	0,1-1 km
- Near-city backgr.	1 - 10 km
- Regional stations	25-150 km
- Remote stations	200-500 km

HCMC:

4 Road side- traffic stations: Doste, Hong Bang, Thong Nhat, Binh Chanh

3 Urban background: Zoo, Dist. 1, Ton Son Hoa, Quan Trung

2 Residential/industrial: District 2, Tu Duc

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The monitoring station at Zoo

Typical Urban background site

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Instruments

Many kinds:

- Simple passive samplers
- API Automatic Gas Monitors
- Eberline Betagauge PM10 monitors
- Automatic weather stations

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Monitors

SO ₂	fluorescent signal exiting SO ₂ with UV
O ₃	UV absorption analyser
CO	non-dispersive infrared photometer
HC	NMHC, flame ionizator detector (FID)
PM ₁₀	Beta gauge mass concentration of PM10 on filter

Reference instruments !

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Passive samplers for screening studies

The passive sampler

Passive vs. active NO₂ sampling

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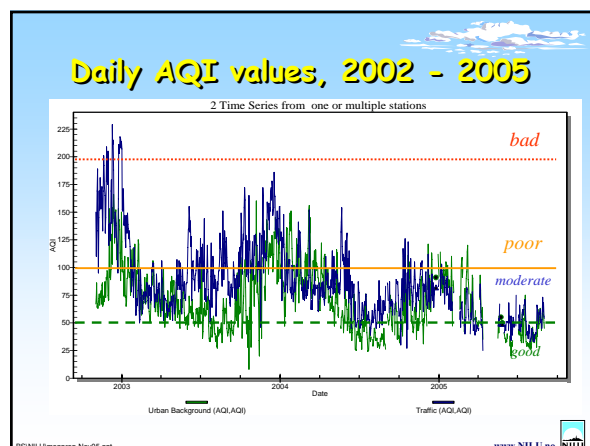
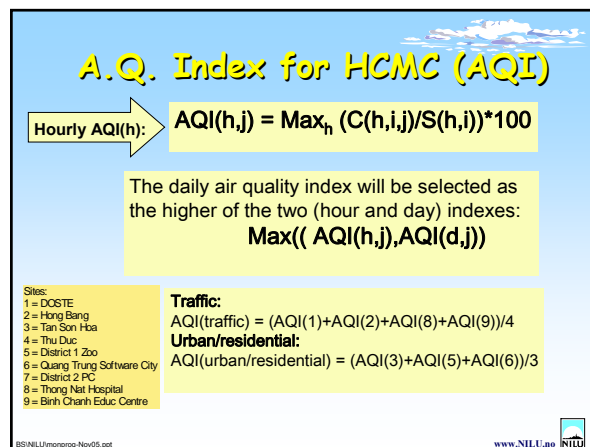
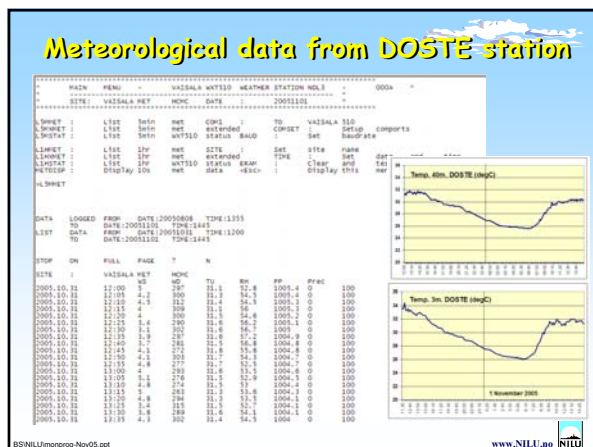
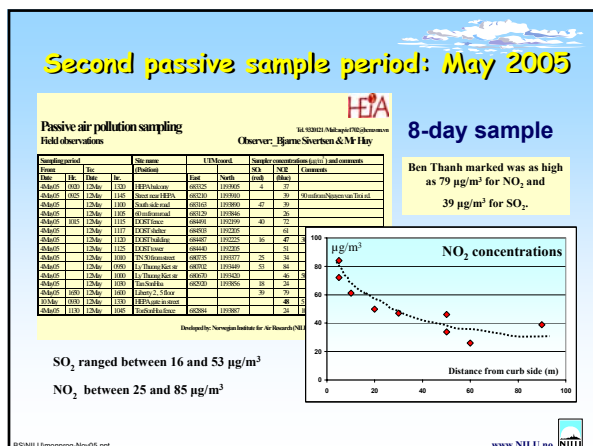
Passive sampling

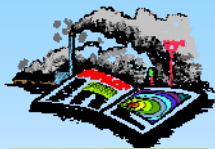
In HCMC
14-25 Nov 2002

The passive sampler

Measurement site	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)
Zoo, Quan 1	21	28
Zoo at fence	30	-
Tan San Hoa	32	36
Nguyen van Troi str	35	81
Tu Duc	39	30
Quan 2 PC build	72	18
Quan 2 at gate	23	24
ThongNhat Hospital	-	-
Software city	26	25
Software city gate	-	31
Road 14	72	91
Binh Chanh educ.	25	58
Hong Bang	50	63
DOSTE fence	67	86
DOSTE shelter	48	72
DOSTE office	14	49
Liberty 1 hotel, 4 floor	51	79
Liberty1 hotel, entrance	40	54
Tran Hung Dao str. City centre	62	44
Nguyen Tai Thahn, Quan1	67	89


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Reports

- ✓ Weekly (printouts)
- ✓ Monthly (data summary results)
- ✓ (6-months summary?)
- ✓ Annual report (status, assessment)



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Air Quality

↓

Data quality

↓

Quality assessment

↓

The right decisions



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Norwegian Institute for Air Research

www.nilu.no

NILU
POBox 100
No-2027 Kjeller
Norway
Fax: +4763898050
E-mail: nilu@nilu.no



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