Sida Evaluation 06/14

Impacts, Outputs and Effects from Sida-funded Air Quality Management Projects in Thailand and the Philippines

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This is a joint publication of two separate evaluations called "Impacts, Outputs and Effects from Sida-funded Air Quality Management Projects" in Thailand and the Philippines respectively. The former was carried out and written by Jon Bower and Bjarne Sivertsen, and the latter by Jon Bower and Steinar Larssen.

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Impacts, Outputs and Effects from Sida-funded Air Quality Management Projects in Thailand

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Figure 1 Part of the problem – one of Bangkok's legendary traffic jams

Executive Summary

Sweden has for many years supported a range of co-operative projects designed to support Air Quality Management activities in Southeast Asia. Under the assistance programme to Thailand, undertaken from 1990 to 1999, Sida contractors and consultants provided 72.5 manmonths of effort and financial inputs of 16.3 million Swedish Kroner. This was matched by Thai Government inputs of over 500 million Baht and many man-years of effort from the main programme beneficiary, Pollution Control Department. The main objective of this large-scale programme was the development of a state-of-the-art air quality monitoring and management system within Thailand.

In this report, we provide an independent evaluation of the Swedish assistance programme. In particular, we focus on its appropriateness to local needs, value-for-money, cost-effectiveness and long-term sustainability. We also make a number of recommendations designed to provide a sound basis for future Sida assistance in Thailand. Our report is based primarily on findings and direct interviews with programme beneficiaries and stakeholders, undertaken during a one-week visit to Thailand in June 2004.

Any programme of this scope, complexity and aspirations will inevitably have its successes and failures; this programme is no exception. Positive features of the programme include:

- The engagement, commitment and enthusiastic support provided throughout from the Thai authorities;
- The development of an advanced and effective national air monitoring network;
- The installation of a partially successful Airviro Air Quality Management System;
- Appropriate targeting of assistance at PCD;
- PCD feels it 'got what it wanted' from the co-operation;
- The systems provided have been utilised successfully, albeit in a limited capacity, for policy support and planning purposes.

Negative aspects include:

- Lack of cost-effectiveness; several key Airviro features are now unusable or have been bypassed.
- Insufficient emphasis on the use of simple monitoring technologies and tools;
- Airviro system has proved inflexible and difficult to adapt to changing policy and technical needs;
- Lack of long-term sustainability – continued Swedish support is required to maintain system operability;
- Attempts to introduce IT systems to Regional Offices outside Bangkok have proved unsuccessful;
- Insufficient emphasis was placed in training on fundamental aspects of Air Quality Management.

Since the assistance programme ended, political initiatives have begun in Thailand to progressively devolve some responsibilities for environmental management to the regions. However, PCD will retain a pivotal role in national monitoring, regulation and policy support.

Against this background, our main recommendations are that:

- PCD should remain the primary recipient for future Sida assistance;

- Its Airviro hardware and software must be upgraded, whilst efforts to diversify its range of alternative AQM tools should also be supported;
- A wide-ranging review of current air quality monitoring and management systems is needed over the coming years; its main focus should be the changes necessary to meet the challenges and needs of an increasingly devolved/regionalised air quality management structure within Thailand.
- Greater emphasis should in future be placed on the use of simple and cost-effective monitoring techniques and management tools. In particular, the use of passive samplers should be encouraged through training, the initiation of pilot/demonstration studies and the development of necessary support laboratory and QA/QC infrastructure.
- A training course should be provided to PCD and key Regional Offices on fundamental aspects of Air Quality Management tools and techniques. This knowledge should then be actively disseminated to Regional and Provincial Offices throughout Thailand.

1. Programme Context

1.1 Introduction

Sweden has for many years supported a range of projects designed to combat the emerging air pollution problems in Southeast Asia. In particular, Thailand and Philippines have been the main recipients of bilateral aid support, focussing on serious air pollution caused by traffic, construction and industrial emissions in megacities such as Bangkok and Metro Manila.

Sida now wishes to evaluate two sets of projects directed at supporting the relevant authorities in these cities. These projects were targeted at improving their overall capacity for sustainable and effective air quality management.

An independent review of the success – or otherwise – of these projects is therefore sought by Sida. Its main objective is to learn from the activities performed and to inform the implementation by Sida of future projects designed to improve air quality in the region. Specifically, the evaluation will also contribute towards a decision on how to proceed with current proposals for three new projects in the area.

This report deals with the assistance provided to Thailand. A companion report will cover the work undertaken in Philippines.

In Section 1, we review the background to the study and main features of the overall Sida assistance programme in Thailand. Our evaluation methodology is outlined in Section 2, following which we summarise our findings in detail in Section 3. Our main conclusions and recommendations are presented in Sections 4 and 5 respectively. Finally, some brief generic lessons are outlined in Section 6.

1.2 Background

1.2.1 Air Quality in Thailand

Air pollution poses a significant threat to human health, welfare and the environment throughout the world. The impacts have proved to be particularly severe in rapidly developing Asian megacities such as Bangkok; in this city, as well as in other parts of Thailand, increasing levels of environmental stress over the last decade have resulted from:

- High levels of urbanisation and population density
- Rapid social, economic, industrial and infrastructural development
- Massive increases in traffic density – roughly 15% per annum over the last two decades

Air pollution in Bangkok not only has immediate localised impacts on human health and social amenity, but also contributes to Asian transboundary problems (the 'Asian haze'), as well as global pollution. It poses severe economic implications due to increased mortality and illness, damage to ecosystems, property and infrastructure. Traffic congestion and the air pollution it produces not only makes Bangkok an unpleasant environment for its citizens, it also discourages tourism, business and inward investment.

In 1996, the World Bank estimated that a 20 per cent reduction of key pollutants in Bangkok would provide health benefits of approximately US $400 million to $1.6 billion for SPM (Suspended Particulate Matter) and between US $300 million and $1.5 billion for Lead.

Ambient air quality in Bangkok deteriorated significantly during the early 1990s, during a period of unprecedented economic growth. At the time, ambient concentrations of PM10 particulate matter, lead and carbon monoxide substantially exceeded Thai national standards (Table 1) and WHO Guidelines. The major causes were increasing vehicle emissions, combined with a high level of construction activity.

Awareness and concern about air pollution grew rapidly in the media, Government and general public. Government action to tackle the problems focussed initially on the introduction of a range of legislation, including the wide-ranging Enhancement and Conservation of National Environmental Quality Act of 1992. A high level National Environment Board, chaired by the Prime Minister, was established to co-ordinate and progress Government-wide environmental action.

Since the early 1990s, the Thai Government has initiated a wide-ranging set of measures to tackle air pollution, including:

- Introducing Flue Gas Desulphurisation to control emissions from major power plant (1992)
- Phasing out lead in gasoline (1996)
- Requiring catalytic converter for new gasoline vehicles
- Over 80% of motorcycles now utilise 4-stroke engines
- New diesel buses must meet Euro 2 emission standards
- Building up public transport through the introduction of major new infrastructure such as the Bangkok Transit System (BTS) in 2000 and the projected Metro system (2006)
- The creation on 2002 of a new Ministry of Natural Resources and Environment (MONRE) to oversee environmental management, including air quality (see Technical Annex 1)

Although the overall approach to tackling air pollution in Thailand can be regarded as an excellent model for the SE Asia Region, there is still much to do. Bangkok's air quality lags behind such cities as Singapore, Hong Kong, Taipei and Tokyo. Recent health studies suggest that the direct costs of pollution from fine particulates alone are equivalent to 1-1.6% of Thailand's GDP. Meanwhile, a public survey has shown that over 70% of respondents consider air pollution to remain the most critical environmental challenge facing the country. Moreover, PCD's own figures show air pollution to be by far the largest source of public complaints.

The Sida AQM co-operation projects commenced in the early 1990s. These were designed to assist in the development of an effective Air Quality Management System (AQMS) within Pollution Control Department (PCD) of the Thai Government. In the next section, we outline the major components and importance of such a system.

1.2.2 Air Quality Management Systems

Bangkok's AQMS is fundamentally concerned with the achievement of societal, economic, awareness and regulatory objectives. In scope, it therefore needs to cover the entire process of assessing and tackling air quality problems, from quantification of poor air quality through to formulation and execution of an effective remediation strategy. Initial assessment of the problems is one of the main tasks of ambient monitoring; this includes the identification of significant sources of air pollution – such as traffic, industry, domestic, commercial or agricultural – together with 'hotspots' or areas of elevated pollutant concentrations.

Once priority targets are identified, an AQMS must facilitate the systematic evaluation of the options available for controlling emissions and improving air quality to an acceptable level – this process is often referred to as 'scenario evaluation'. This acceptable level is defined in terms of national or international air quality standards, usually designed to protect population health. Thailand's current Air Quality Standards are summarised in Table 1 overleaf.

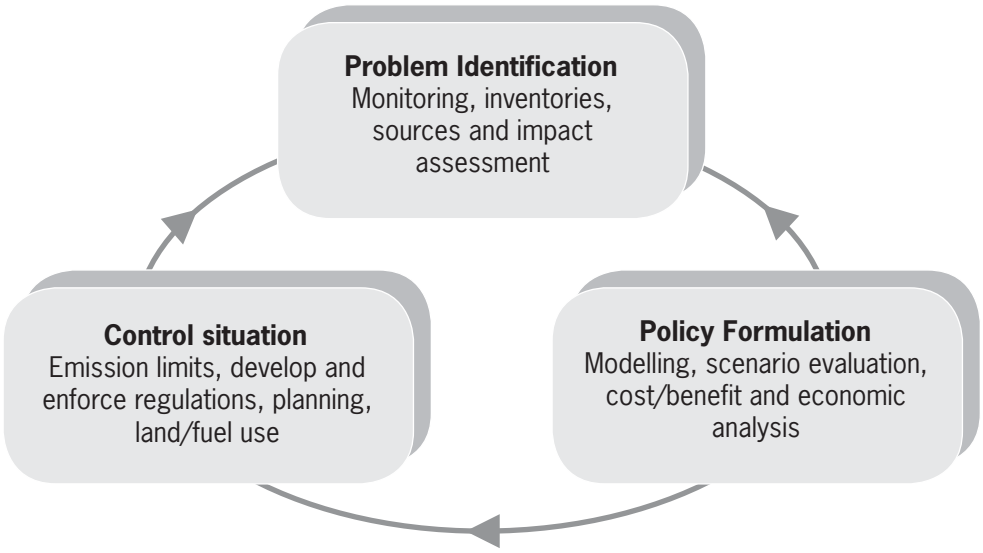

Figure 2 – The Air Quality Management process in Thailand: a conceptual outline

Figure 2 above shows the main processes and tasks involved in air quality management, outlined in a simple, conceptual way. From the perspective of planners and regulators, effective air quality management offers decision support to enable least-cost compliance with current and emerging legislation. For the population at large, however, AQM serves to protect health, amenity and quality of life in a rapidly changing world.

Table 1 Current Thai Air Quality Standards

Pollutant	Averaging time	Standard
TSP	Daily	330 μg/m^3
	Annual (Geom. mean)	100 μg/m^3
PM10	Daily	120 μg/m^3
	Annual (Geom. mean)	50 μg/m^3
Pb	Month	1.5 μg/m^3
O_3	Hour	200 μg/m^3
SO_2	Daily	300 μg/m^3
	Annual	100 μg/m^3
NO_2	Hour	320 μg/m^3
CO	Hour	34.2 mg/m^3
	8-hour	10.3 mg/m^3

The development of an effective Air Quality Management System (AQMS) within Thailand requires the following technical components:

- Reliable information on ambient air quality (a monitoring network)
- A complete and accurate emission inventory
- Adequate meteorological and topographic data
- An appropriate, validated dispersion modelling capability
- Effective means to disseminate data and information to public, policy, planning and other end-users
- The ability to quantify the costs of air pollution impacts on population health, ecosystems and the built environment, together with the costs of alternative remedial/control strategies
- Economic models developed for the local situation

The turnkey Airviro System installed and developed under the Swedish/Thai co-operation programme was designed to provide the basic tools and functionalities needed to enable PCD to discharge its policy and regulatory Air Quality Management responsibilities in a responsible, effective and informed manner. An outline of the Airviro system in provided in Technical Annex 2.

1.3 Project History and Scale

Support was provided over an extended period from 1990 to 1999; the main mechanism was through contract financing of technical co-operation with responsible organisations in Thailand. A series of six phased projects was undertaken.

Swedish assistance focussed on providing advice, training and consultancy, matched primarily to the functionalities and use of the turnkey Airviro AQMS. This assistance was matched by considerable investment in manpower and expenditure from within PCD; Thai funds also purchased the large-scale air quality monitoring network designed and specified under project THA 3.

The projects involved, for the most part, the same Swedish partners and local beneficiary/partner, as listed below:

Organisation	Project Role
County administration of Västra Götaland	Contractual partner, project management
Pollution Control Department	Contractual partner
Air Quality and Noise Division, PCD	Accomplishing division within PCD
Connexor Sensus AB	Project management, training
SMHI, Sweden	Airviro software support and training in inventories and modelling
Manrax AB	Training in system application, service and maintenance
IVL	Training in laboratory techniques

The timing, rationale, manpower inputs and project costs (to Sida only) of the six projects are summarised here:

Project	Rationale	Manpower, Duration	Cost, SEK
THA 1	Review of AQM in BMA, including the need for monitoring	6 months 1990	655k
THA 2	Assistance to DPC in the development of a) an emission inventory for Bangkok Metropolitan Region and b) a forecasting system for BMR	18 months, 1992–1993	3700k
THA 3	Design and specification of a national automatic online air monitoring network for Thailand	4 months, 1993	618k
THA 4	Training course for PCB on computerised Air Quality Management System (Airviro) for Thailand	2.5 months, 1993	273k
THA 5	Enhancement of AQMS for BMR	18 months 1994–1997	6170k
THA 6	Enhancement of Air quality Management Project to four regional nodes; continued support to PCD; support for establishment of Air Quality Laboratory at PCD	2 years, 1997–1999	4917k

As can be seen from this table, the full programme of assistance necessitated total Swedish manpower inputs of 72.5 man months and total financial inputs of SEK 16.33 million. Correspondingly large inputs of time and investment were forthcoming from the Thai partners; we were informed by the main Thai partner, Pollution Control Department, that Baht 500 million and many man-years of effort had been committed by PCD over the course of the project thus far.

So, the cumulative scale of the six AQM projects evaluated here been large; it has also been ambitious in terms of its scope, complexity and overall aspirations. It is therefore important that its success, and the achievement of its overall objectives, is fairly and impartially established. This is the main task of our evaluation, and its findings are summarised in this report.

2. Evaluation Methodology

2.1 Scope of Evaluation

The scope of the current evaluation is clearly defined in its Terms of Reference:

- Evaluation of results, effects and impacts of six projects undertaken in Thailand and aimed at establishing an Air Quality Management System in Bangkok.
- Initial assessment of the relevance, feasibility and appropriateness of two new project proposals:
  - Development with PCD of laboratory competence for air quality sampling and analysis
  - Development of strategy for management of air pollution problems caused by VOCs, NOx and PAH in the Bangkok Metropolitan Region.
- Form an opinion on further activities that may now be needed and how these should best be designed to meet local needs and conditions.

As requested, the full Terms of Reference for the evaluation are detailed in Appendix 1.

The evaluation team has also been asked to address the following key issues:

- What has been the impact of the projects?
- How did they relate to other activities in the field of air pollution control in Bangkok?

- What are the current ongoing activities, priorities and current plans for Air Quality Management?

The evaluation team recognises that its findings will be used for Sida's appraisal of current proposals for further support in Thailand, and that they will be widely disseminated to project participants and stakeholders, as well as external organisations such as the Asian Development Bank.

2.2 General Approach

The evaluation team for the Thailand projects comprised two independent international consultants, both having extensive practical experience of air quality monitoring, assessment and management projects in the SE Asia Region and world-wide:

- Jon Bower, Chief Air Quality Consultant and Project Director – AEA Technology, UK
- Bjarne Sivertsen, Associate Research Director – NILU, Norway

Our overall assessment of the Thai/Sida AQM projects was undertaken through:

1. A thorough review of the various background project papers, correspondence and reports provided in advance by Sida. It may be noted at the outset that the initial literature review proved to be of limited utility for the purposes of our evaluation. This issue is addressed in greater detail in the next section.

2. A one-week visit to Bangkok and environs, undertaken from 7 to 12 June 2004. Its main purposes were to:

   a. Meet a comprehensive range of project participants, beneficiaries and data end-users, both within and external to PCD. In addition to a number of meetings with PCD, we also met personnel from:
      – Swedish Embassy
      – Sida
      – Chonburi Regional Office (one of the four selected pilot areas under project THA 6)
      – Bangkok Metropolitan Administration

   A full list of our contacts is provided in Appendix 2.

   b. Discuss the AQM systems, tools and technologies introduced under the projects with working level as well as senior/management personnel

   c. Obtain frank and open feedback from as wide a spectrum of project stakeholders as possible

   d. Obtain written documentation on the project and deliverables (not available to us in advance), together with background information on air quality and AQM in Bangkok

   e. Assess project technologies, hardware and software, focussing on Airviro and its various functionalities

   f. Review as far as possible PCD's Air Quality Management systems in routine operation

   g. Assess current priority AQM needs in Thailand, together with specific requirements of PCD.

The six technical co-operation projects were closely integrated and inter-connected in terms of their overall rationale and global aspiration; this was to enhance PCD's overall AQM systems and capabilities in a way that was:

- Appropriate to local needs and conditions
- Cost-effective
- Sustainable in the long term

We have not focussed, therefore, on the detailed inputs, objectives and deliverables of the six separate projects. Rather, we have sought in this evaluation to consider the effectiveness of the entire programme. To this end, we formulated prior to our Bangkok visit a list of the primary questions and issues to be addressed within the evaluation. These are summarised in Box 1.

This issue list was emailed to our main contacts in PCD and Swedish Embassy well in advance of the evaluator's visit. It formed the basis of many of our discussions and now provides the focal point for this project evaluation report.

This approach has proved highly successful, and it will therefore form the basis of our forthcoming assessment of Sida assistance projects undertaken in Metro Manila, Philippines.

Box 1. Main Issues and Questions addressed in Evaluation – I

- Do you think the overall Air Quality Management approach adopted during the projects was appropriate to the local situation?
- Similarly, were the information technologies and systems adopted (specifically Airviro) suitable for local circumstances and needs?
- In general, were the technologies and approaches to AQM cost-effective? Or do you think that simpler approaches might have been as effective?
- Was sufficient practical and theoretical training provided in the new approaches and technologies?
- Was sufficient training provided in basic AQM tools such as monitoring, emission inventories, models, scenario evaluation etc?
- Were local stakeholders and end-users consulted sufficiently before the various phases of assistance were provided?
- Do you feel you were adequately involved in setting the targets and objectives of the various project components?
- Phasing and rationale of the projects- do you feel that there was sufficient time given for assimilation of results of one project before proceeding to the next one?
- Was the overall AQM capability of your organisation enhanced through the assistance? What about other organisations?
- Institutional and demarcation issues- were all necessary local organisations involved in the work? Or should some other relevant organisations also have been included?
- Did any institutional or staffing issues in beneficiary organisations hinder the project as a whole?
- How would you rate the projects overall in terms of their usefulness and value for money?
- Was the scope of assistance appropriate or too ambitious? Similarly, was its geographical coverage appropriate?
- Did you get what you wanted out of the projects? If so, what was this? If not, what was missing?
- We are particularly keen to explore the long-term sustainability of the project. So, are the systems, technologies and approaches introduced still in use?
- Do you feel you have received sufficient support, follow-up and services from the Swedish consultants in the course of the projects?
- Do you feel you have received adequate support after project completion?
- Was the balance between local and Swedish inputs to the work correct?
- Do you feel that the assistance provided has enabled you to more effectively tackle air quality problems in the BMR?
- Has their been a positive or measurable impact on local air quality; if so, do you think that this has resulted from the project?
- If Sida or another similar organisation offered you assistance now, would you do anything different this time round?
- What are your current AQM priorities?
- In what areas would you most like to see future assistance from Sida?

2.3 Limitations of the Study

As noted previously, our initial literature review proved to be of limited utility. This was because the documentation provided proved to be substantially incomplete. Specifically, most of the final reports (covering projects 1, 4, 5 and the overall programme) were not available, not produced or missing. We find this surprising for a project of this scale, duration and expenditure level. Important correspondence related to project justifications, workplans and deliverables was, likewise, not available to us.

We therefore *recommend* that a more thorough level of project documentation, monitoring and reporting would be appropriate for future projects of this type.

In the final analysis, however, much of the necessary information required was subsequently supplied by the Thai contacts, particularly within PCD, that we met and consulted during our one-week visit to Bangkok. Their openness, frankness and enthusiasm made it possible for our evaluation to proceed with the necessary rigour and completeness.

Although we cannot say that we were able to meet all system end-users, stakeholders, managers and interested parties during our visit, we were able to form a clear perception of the overall project, its successes, failures and ultimate deliverables.

3 Findings

In this section of the report, we summarise our assessment of the viability, cost-effectiveness, fitness-for-purpose and overall sustainability of the assistance provided by Sida to PCD from 1990 to 1999. As noted previously, our assessment is based on, and organised around, the list of questions and discussion issues that was pre-circulated to AQMS stakeholders and project participants.

For each question posed, we try where possible to provide a succinct summary answer. We also provide supplementary information and explanation, as necessary. Throughout, we have been careful to make a clear distinction between:

- Feedback and opinion of
  - Working personnel and managers at PCD
  - Personnel at the Chonburi Regional Office
  - Officials at the Bangkok Metropolitan Administration (BMA)
- Judgement and perception of the independent evaluators

Responses to these questions are provided in Sections 3.1 to 3.19. Summaries of our findings and a list of recommendations are provided in Sections 4 and 5.

3.1 Overall Air Quality Management Approach

Do you think the overall Air Quality Management approach adopted during the projects was appropriate to the local situation?

PCD – Yes, we think the overall approach was appropriate. However, some problems have appeared during the course of the project.

Evaluators – We agree. Some of the problems have been internal to PCD – for example, loss of staff and budget; some have related to the use of the turnkey Airviro system. These are explored further in this section.

3.2 Suitability of IT Technologies

Were the IT technologies adopted suitable for local circumstances and conditions?

PCD – Yes, we believe that the IT technologies adopted were initially suitable, but these proved increasingly problematical during the latter phases of the projects. Major issues included:

1) The computer hardware installed to host Airviro (v2.21) – a HP UNIX workstation with 64 MB RAM – has now encountered severe capacity problems. As a result, it cannot multi-task or handle multiple users, a key feature of its UNIX operating system.

Run times for modelling are, likewise, unacceptably long. This computer is clearly outdated and should be replaced. The Swedish experts have been informed, but the system has not been replaced due to lack of necessary funding from the Thai side.

We understand that the purchase of new hardware, in itself, would not be sufficient; a Swedish Airviro expert is needed to undertake 'license reinstallation'.

2) In 1997, it was planned to extend the system to the four pilot Regional Nodes: North, Northeast, East and South. For a number of reasons, however, the regional offices cannot access the data on their own stations through Airviro. Other approaches – primarily using the Internet – have had to be utilised.

3) The Airviro system does not at the present time seem to be compatible to other systems operated by PCD. Air pollution forecasts, which were a main objective, are being performed using the ENVIMAN system subsequently provided by OPSIS AB (Sweden). As noted previously, we cannot easily perform core AQM tasks such as modelling or scenario evaluation.

4) We have generalised problems adapting the system to meet our changing technical and policy needs.

Regional Office – Our systems have proved unusable after an initial period of operation.

Evaluators – There are clearly important problems here. In our opinion, the overall IT systems and approach provided under the assistance projects has been:

- Inflexible
- Overly complex
- Based on proprietary systems and therefore difficult to modify/optimise
- It has made PCD overly dependent on continued Swedish support, therefore compromising sustainability
- It has not fully met objectives set under THA 2 and has not met the aspirations of THA 6 at all.

Within PCD, we noted that many Airviro functionalities have now been bypassed, duplicated or not fully used:

- Airviro models are not used at all because of time/hardware limitations.
- Within regional offices, the IT systems have not proved viable or usable and offices cannot access their own data through Airviro. This is a particularly serious issue in view of the Thai national policy to decentralise and devolve responsibility for Air Quality Management to Thailand's regions (see Section 3.19 and Technical Annexe 1).
- Daily pollution forecasts are not based on the Airviro system. Purely statistical routines have been established, based on air quality measurement. The Swedish ENVIMAN system from OPSIS has been applied for this purpose.

- It appears that backup or alternative systems are widely used for monitoring data acquisition, front-end data screening and quality control reports.
- A further example of compatibility difficulties is posed by PCDs current development of a CEM (Continuous Emission Monitoring System). PCD has had to hire an external IT specialist interface real-time CEM data with Airviro.
- Emission inventories are currently being developed outside the scope of Airviro (Section 3.15).

PCD has shown considerable flexibility and initiative in the process in circumventing some of the problems and finding alternative solutions. However, it is undeniable that the original Airviro system and hardware is now out-of-date. Although state-of-the-art in the early 1990's, PCD has encountered increasing difficulty in using some of its functionalities, as well as in adapting it to keep abreast of changing technical needs and policy imperatives over time.

The evident need for 'license reinstallation' in the event of hardware update provides a good example of the lack of long-term sustainability of the overall AQMS concept, discussed further in Section 3.12.

3.3 Cost-effectiveness of the Approach and Technologies

Were the technologies and approaches to AQM cost-effective? Or do you think that simpler approaches might have been as effective?

PCD – We are aware that Asian Development Bank (ADB) has stated – in meetings undertaken within the Clean Air Asia Initiative – that the Thai/Bangkok AQMS is one of the best presently operational in the SE Asia region. ADB also considers it to be cost-effective.

However, from the PCD perspective, we are not so sure about its cost-effectiveness. It should be noted that Thai Government has invested 500 million Baht to achieve what is available to day. When corresponding Swedish effort is recognised, considerable time and money has been invested by both partners.

We are definitely interested in making greater use in future of simple monitoring technologies such as passive samplers.

Regional Office – We are also extremely interested in both simpler air monitoring and information technologies, mainly because we feel these will be easier to use and more consistent with our budget and skill-base constraints.

Evaluators – Airviro has not proved to be particularly cost-effective; as noted previously, many of its capabilities are not used, not possible to use or have been circumvented. PCD could actually operate successfully with much cheaper and open-ended technologies, and is actively moving in this direction. We believe this approach to diversification and simplification of IT systems to be sensible.

We also strongly endorse PCD and RO comments concerning the need for greater use of simple, cost-effective monitoring technologies. These will:

- Usefully supplement existing automatic measurements
- Enhance cost-effectiveness
- Maximise sustainability of effort in the long-term
- Be far more appropriate for use by Regional Offices

Figure 3 – Air Pollution display board at PCD Headquarters

3.4 Adequacy of Training

Was sufficient practical and theoretical training provided in new approaches and technologies?

Was sufficient training provided in basic AQM tools such as monitoring, emission inventories, models and scenario evaluation?

PCD – Most of the practical and theoretical training provided was devoted to operation of the Airviro system. Basic training on raising our understanding of air pollution was not adequate.

Another problem was that four out of five of the people originally trained in Airviro operation have now left PCD for better-paid jobs in the private sector. This has affected the sustainability of the project (see also 3.15).

Regional Office – Personnel here again made a strong and unsolicited statement about the need for greater basic training on fundamental AQM issues such as network design, monitoring equipment, QA/QC and principles of inventories.

Evaluators – We note a particularly strong consensus that more fundamental training was needed under the cooperation projects, rather than training that focussed purely on system hardware/software operation. We strongly concur with the perception of the Thai beneficiaries, noting that the balance of training was too centred on Airviro and how to use it.

It seems self-evident to us that a basic appreciation of Air Quality problems and AQM tools is essential for the successful operation of any Air Quality Management System. Such generic training must come first, therefore, followed by more system-oriented capability enhancement. This approach has not been adopted here, however.

3.5 Consultation with End-users

Were local stakeholders and end-users consulted sufficiently before the various phases of assistance were provided?

Do you feel you were adequately involved in setting the targets and objectives of the various project components?

PCD – Yes, we originally wanted an Air Quality Management System. We now have one. When selecting the Swedish Airviro system, we examined a number of turnkey systems but ended up selecting Airviro because we considered that co-operation with Sweden would be easier than with other countries such as the USA.

Regional Office – No, we were not consulted and our opinions were not sought on THA 4 (network design); as result of this, we believe that monitoring stations in our area are not sited correctly. Nor were we consulted on our selection as one of the four pilot regional hubs developed under THA 6.

Evaluators – The answer to this question depends on whom you ask. PCD seems happy with the level of consultation, Regional Offices less so. It appears to us that the lack of consultation with Regional Office has made it difficult for them to 'buy into' the overall project aspirations and objectives. But please also see additional comments on the status and roles of ROs in Section 3.11.

3.6 Phasing and Rationale of Projects

Do you feel there was sufficient time for assimilation of results of one project before proceeding to the next one?

PCD – Yes, we were fully involved in all aspects of the project developments, as well as in its evolution from one phase to the next. We also participated actively in the selection of monitoring and IT systems. We do not think the pace was 'pushed' in any way.

Evaluators – PCD feels it was fully and adequately involved in setting the pace for project timing and inception.

3.7 Building Air Quality Management Capacity

Was the overall AQM capability of your organisation enhanced through the assistance?
What about other organisations?

PCD – Yes, our overall AQM capability has improved dramatically throughout the period of the Swedish assistance. Other organisations also gain benefit from the data we collect and disseminate free of charge.

Evaluators – We concur that PCD's overall AQM capability has been significantly enhanced over the last 10 years. But it appears to us that this was primarily as a result of its own efforts, rather than directly due to the Swedish assistance.

This assistance has certainly provided some enabling tools and facilitated overall progress. However, the Thai authorities seem to have progressed because of their own commitment and enthusiasm. Without this, their capability would not have developed at all. They appear, also, to have been unusually effective in learning 'on the job' and working their way around some of the limitations of Airviro.

This good news, however, must be qualified by our assessment the improvement in overall AQM capacity has clearly not cascaded to Regional Offices as yet. PCD, the office themselves and the evaluators believe this may take some time. This point has importance implications for future assistance and use of appropriate technologies, discussed later in this section.

3.8 Institutional and Demarcation Aspects

Were the right beneficiaries involved?
Do you feel that all relevant local organisations were sufficiently included in the process?

PCD – Other relevant local organisations were not included in the process, but they must answer this question for themselves. It should be noted that PCD will in future have an important role in training the other local and regional offices in Thailand.

Evaluators – PCD is the recognised and authoritative government body for national environmental management and regulation in Thailand – as such, its current remit is clearly stated and summarised in Technical Annexe 1. It is therefore the most appropriate primary beneficiary for assistance.

As noted, however, efforts to disseminate capability to Regional Offices under THA 6 have not proved successful.

3.9 Value for Money

How would you rate the projects overall in terms of their usefulness and value-for-money?

PCD and others felt they could not easily comment on this question. However, PCD personnel were anxious to point out the substantial investment made by the Thai Government to developing its Air Quality Management System and monitoring network.

Evaluators – It is our role here to comment specifically on the value for money offered *by the Swedish technical co-operation inputs.* Primarily on the basis of previous comments relating to overall cost-effectiveness (Section 3.3), we would not rate these highly in terms of VFM.

As noted previously, several of the main components/functionalities of the core Airviro system are not functional, difficult to use effectively or no longer used. Moreover, all the Thai authorities consulted felt that there was an important role for alternative simpler monitoring and information systems that were easy to use and sufficiently flexible to adapt to their changing needs in future.

In Section 3.4, we noted concern that the training was too focussed on Airviro and therefore neglected basic Air Quality Management issues and tools. Since training and capacity building has been an important aspiration of the co-operation programme, this widespread perception amongst the Thai authorities must also negatively affect our assessment of its overall value for money.

3.10 Scope of Assistance

Was the scope of assistance and project geographical coverage appropriate or too ambitious?

PCD – Apart from local industrial 'hotspots', our main air pollution problem has been and is likely to remain in the Bangkok area. The selection of this city as the primary geographical focus for the early phases of the programme was therefore appropriate. The later selection of Regional Pilot areas was based on their potential for future air pollution problems.

Evaluators – We concur. With the benefit of hindsight, however, it is clear that the capability, funding and resource-base in Regional Offices made it difficult or impossible for them to benefit from the assistance. In this sense, the extension of the AQMS to the regions may be regarded as having been too ambitious.

Figure 4 – Exterior and interior of PCD Automatic Air Quality Monitoring Station at Chonburi

3.11 Beneficiary Satisfaction

Did you get what you wanted out of the projects? If so, what was this? If not, what was missing?

PCD – Yes, we believe we got what we wanted out of the projects. We were seeking to develop an AQMS and national monitoring network. We now have both.

Dr. Supat (Director of PCD) felt quite happy overall with the support from Sida. He commented that PCD would not have requested something that was not wanted or needed. He also felt that the projects did not force any system upon PCD. In the first phase, the Swedish consultants carefully assessed our needs and we believe we received what we requested. However, the system today is somewhat outdated.

Regional Office – No, our systems just don't work now. PCD's feedback on this is that the ROs did not exist in their present form during the period of the assistance; rather, they were working in municipalities and transferred to the Regional Offices when they were formed in 2002; to an extent, therefore, they inherited the systems and technologies. It was also stated that regional-level interest in air quality management only started to emerge during a period of industrial growth in the mid to late-1990s, at about the same time as project THA 6 was initiated.

Bangkok Metropolitan Administration – We can only receive data on Bangkok's air quality via the web and monthly from PCD. We don't receive it through Airviro and really need online access.

Evaluators – There is a clear and understandable divergence of opinion between PCD, Regional Offices and BMA. It appears that the opinion of the Regional Office we consulted must be considered in the context of changing regional administrative responsibilities and organisational structures.

It's not altogether clear to us why BMA is seeking online data access. Although we understand that it requires information on local air quality in the city, it's not clear why the organisation's stated responsi-

bilities – (assessing effects of policy/management action, public awareness, complaint response) really necessitate this.

We think this reflects a general uncertainty about the future responsibilities of Regional Offices. We will have more to say about this later (Section 3.19).

3.12 Long-term Sustainability

Are the systems and technologies provided under these projects still in use?

PCD – Expressed a strong opinion that, to achieve long-term operation and the continued effectiveness of Airviro, PCD would depend on additional support and upgrading. Some of the systems and technologies are still in use, but many components are getting old-fashioned, unnecessary, inappropriate or outdated.

Another problem noted that by PCD is only one of the five experts who were originally trained in to operate the Airviro system are still available for this purpose; one has left PCD to establish his own private company, one has died and two were transferred. This loss of skilled staff has reduced the sustainability of the programme considerably.

PCD concluded that overall system sustainability was therefore dependent upon continued hardware and software upgrading, additional training from Swedish experts and the retention by PCD of its trained experts. In the long run, much will depend upon the sufficiency of budget support from the Thai Government.

Evaluators – We agree strongly with PCDs opinions. It is clear that the Swedish support has NOT provided a sustainable AQM capability. In fact, this is probably one of the weakest features of the entire programme. It appears that the use of proprietary 'closed' IT systems and UNIX platforms has 'locked' PCD into a situation of continued dependency on Swedish experts. They recognise this, and are already 'building around' Airviro in a number of areas. We believe this approach towards diversification of AQM tools to be both sensible and appropriate.

We would note, however, that the loss of trained staff (particularly those with an IT background) to the private sector is a global rather than local issue.

3.13 Overall Support and Follow-up

Do you feel you have received sufficient support, follow-up and services from the Swedish consultants i n the course of the projects?

Do you feel you have received adequate support after project completion?

PCD – During the project (until 1999) we feel we have received sufficient support. However, today the support is no longer reliable or consistent. A number of problems have emerged after the last project terminated. For instance, we have new air pollution monitors with new protocols that cannot be supported by the old Airviro, and we cannot modify the system to include these.

A number of experts at PCD have received training during the Sida-funded AQMS projects. PCD still has some support from Swedish experts. However, service contracts and maintenance support now seem to be inadequate or not available at all.

Limited personal contacts continue with SMHI's sub-contractors, but this is on a purely informal basis. There is therefore no commercial or formalised basis for the present maintenance support. Any future Airviro upgrading or re-licensing must be undertaken on a commercial basis.

Evaluators – It is clear that post-project support has not been sufficient to meet PCD needs; the present arrangement is not sustainable and needs to be reviewed and formalised.

3.14 Balance of Project Inputs from Sweden and Thailand

Was the balance between Swedish and Thai project inputs correct, or do you feel a different emphasis might have been appropriate?

PCD – The Swedish support, in itself, was not sufficient. Every part of the projects also needed substantial Thai project support and inputs.

Evaluators – But this was always to be expected. We believe the balance was about right for a project of this scale and complexity.

3.15 Tackling Air Quality Problems

Do you feel that the assistance provided has enabled you to more effectively tackle air quality problems in the BMR?

PCD – Yes, in general we can now more effectively tackle air quality problems in the BMR.

From our further discussions it was, however, not completely clear whether the Airviro system has been fully used for planning and abatement evaluation. PCD has certainly tried to evaluate different scenarios and options to improve the air quality. Most successfully, the Airviro system was used to analyse specific air pollution episodes, including Asian haze events. Data were, in these cases, disseminate to the public.

A further example of Air Quality Management was the use of the Airviro system to estimate the impact of the reduction of sulphur in diesel and fuel oil in Thailand. However hardware restrictions made the necessary modelling extremely difficult due to excessive run times.

It was also stated that a variety of other (non-Airviro) methods and models have been applied in the assessment of air quality improvement measures.

PCD commented that GIS (Geographical Information System) experts are separately developing large-scale emission inventories outside Airviro. Emission factor inputs are being derived from a number of different sources, including JICA-funded projects presently undertaken in Bangkok. PCD is requesting national funds to upgrade and complete the inventories. It is intended that the inventory will be routinely updated.

PCD also intends to include VOC emission data. It needs to be able to model and predict photochemical ozone and fine particle levels in Bangkok (See Section 3. It is anticipated that Airviro, if suitably updated, may be utilised for inputting emission data into the overall inventory.

Evaluators – As noted previously, PCD has achieved much through continued development of its overall AQM capability. But this we believe to substantially through its own efforts rather than because of the external support. Airviro has proved problematical for use in routine air quality management tasks, so other approaches have been actively sought, with considerable success.

3.16 Impact on Local Air Quality

Has there been a positive or measurable impact on local air quality?
If so, do you think this has resulted from the project?

PCD – Whether the measurable improvement of, for example, fine particle concentrations during the last six years are due to the project is difficult to say. We probably cannot relate these changes directly to the Sida support in isolation. Decision makers have certainly used the available air quality data to evaluate the impact of actions, such as the SO2 reductions due to the installation of FGD (Flue Gas Desulphurisation) in Northern power plants.

On the other hand, PCD will need to do more area-based planning in the future. For this reason, we will need operational scenario evaluation models that are faster and easier to use than at present. Presently, we feel we don't have sufficiently detailed knowledge inside PCD to perform the adequate abatement strategy modelling.

Evaluators – We see evidence of the effective use of scenario analysis for decision and policy support, though this has been hindered by current Airviro system modelling/hardware deficiencies. However, the desire and capability is clearly present within PCD to use Air Quality Management Systems to manage Bangkok's air quality problems – the use of data and systems for tackling traffic emissions in Bangkok offering a good example of this.

We note PCDs statement on its capacity for abatement strategy modelling. This could usefully be included as an important topic area under general AQM training.

3.17 Some Lessons Learnt

If someone offered you similar assistance now, would you do anything differently second time round?

PCD – More basic fundamental training would be requested! In general the core focus on Airviro was not ideal. PCD in the future will not rely solely on this system. We are already using a range of approaches for AQM tasks, and also intend to use alternative models for impact assessment and prediction studies.

Evaluators – We note a strong opinion within both PCD and RO in favour of fundamental AQM training rather than system/hardware-oriented training. This is paralleled by a high level of interest in simple monitoring methods, an area not served in THA 4 or, indeed, throughout the project as a whole.

We also note PCD's efforts to diversify its AQM systems and tools, for instance through use of:

- Different models
- Other forecasting systems
- Different data collection and review systems
- Use of alternate EIS/GIS databases

We strongly support these opinions and actions. They provide a sound basis for the future development of an effective and genuinely sustainable AQM capacity within PCD.

3.18 Air Quality Priorities

What are your current Air Quality priorities?

PCD – We see the current major problems as being:

- PM10 particles from vehicles and construction;
- Photochemical ozone as emerging secondary problem;
- Increasing public co-operation and involvement in tackling air quality problems

- How to adequately disseminate expertise to the regions

RO Concerns are:

- Local air quality problems, including industrial impacts
- Lack of capacity, funding and expertise

BMA Our concerns are:

- PM10 from vehicles and construction;
- Photochemical ozone;
- Raising public awareness, participation and involvement;
- Lack of capacity, funding and expertise

Evaluators – These priorities seem sensible, given our current understanding of the respective organisations' capabilities and overall responsibilities.

All the organisations are, to an extent, starting to grapple with implications of the current Thai national policy to devolve and decentralise environmental management responsibilities to the regions. This issue is further explored in the next section.

3.19 Future Needs

In what areas would you most like to see future assistance from Sida?

PCD – Our priorities are as follows:

1) A new version of Arviro (v3.0) should be installed and run on an upgraded LINUX server. At the same time, we wish to continue to extend our range of available AQM tools in order ultimately to obtain a more flexible and open system than Airviro. It should also be possible for a number of users to log in and access data/information via Internet.

2) We need a new design of the national monitoring system, based on the current approach but which reflects the future needs of both the central as well as the local and regional authorities.

As a result of policy initiatives since 1999, accelerated by the formation of MONRE (Ministry of National Resources and Environment) in 2002, these organisations should be responsible for their own air monitoring and management.

The new network design concept needs ultimately to be based on:

- The integration of 16 regional/provincial and 85 local bodies into the system;
- A minimum requirement for 16 operational nodes, all of which having the capability to access data and operate some form of AQMS.

3) We are interested in reducing the number of automatic on-line monitoring stations in the future, and making greater use of simple, cost-effective samplers. We have already informed Sida of this intention.

At local level, we expect passive sampling to be used widely. Approved laboratories, in some cases linked to the universities, will perform chemical analyses. This again will need training programmes, which will also be requested from Sida. The data will still have to be imported (manually) into the new Airviro database system. Web forms or other Internet-based technologies may be used for this purpose.

The objective is for local and regional governments to be able to undertake simple air quality sampling. In some cases, it will be necessary also to perform on-line ambient air quality monitoring, quality assurance, evaluation of the data and reporting. The local offices will not have the capability to do this. In such cases, they will need to request support from the appropriate regional authorities or PCD. Again, we expect that this initiative will pose major training and capacity-building implications.

4) In summary, PCD is considering two major requests to Sida for future support:

   1. To support a radical re-design of the monitoring and AQM systems, taking into account the policy changes since 1999 and resulting new needs of the regional authorities.
   2. To support the development of a programme for simple sampling of air quality, together with the necessary laboratory-based analytical support.

BMA – We confirm that in future we expect to develop a standalone air monitoring and management capability. Merely accessing PCD data for Bangkok will not adequately meet our ultimate needs.

Evaluators

The rules of the game have changed dramatically since 1999. We are no longer dealing with just PCD and its AQM needs, but also those of a large number of regional and local units; however, none of these appear at present to have sufficient understanding of – or capacity for – effective air quality monitoring/management.

Environmental management in Thailand is clearly in a transition state, with some responsibilities fluid and national/local demarcations yet to be fully resolved. The future needs of both PCD and regional authorities need to be carefully considered in the light of these important changes.

However, it is clear that PCDs responsibilities (see Technical Annexe 1) remain clearcut. It has overall responsibility, enshrined in statute, for national air quality monitoring and assessment by law. This over-arching requirement is most unlikely to change in future.

We therefore endorse PCDs suggestions for:

- Network review in the light of recent national policy developments
- Supporting the development of a field and laboratory-based capability for use of simpler monitoring technologies
- Upgrading Airviro hardware and licenses to ensure basic modelling and data management functions can be performed more effectively, whilst continuing to diversify AQM tools through the use (where appropriate, necessary, or more efficient) of non – Airviro systems.
- Training for PCD in basic AQM techniques, objectives and tools. This knowledge can then be cascaded and disseminated as necessary to appropriate regional authorities (i.e.' training the trainers')

The situation is less clearcut when it comes to the involvement of local and regional bodies in the context of future Sida support. Their responsibilities:

1. Are not so clearcut as those of PCD
2. Tend to be more generic
3. Appear to overlap in some areas with those of PCD
4. May be more volatile over time, likely to change according to the priorities of different ministers and policy initiatives

Reflecting this general uncertainty in the future responsibilities of regional authorities, it appears that even PCD is not yet totally clear on the intended future demarcation of effort.

On the evidence presented to us, we doubt that BMA or the Regional Authorities presently have a clear understanding of the resources, skill-base, time, training and other implications of developing standalone air monitoring and Air Quality Management systems. It would certainly take many years to develop this capacity, together with considerable training and investment.

In view of the present level of policy indeterminacy, we think it appropriate for Sida support to continue to focus on the needs of PCD in the near-term. More focussed support to Regional Authorities should be contingent on a definitive clarification of their ultimate needs and responsibilities.

These important issues are addressed further in Sections 4 and 5.

4 Conclusions

In this section, we summarise the evaluator's main conclusions. Our emphasis is on conciseness. We base these conclusions primarily on our on-the-spot assessment undertaken in Bangkok and Chonburi from 7 to 12 June 2004. Its main findings have been presented in full in Section 3.

The full programme of Sida assistance has involved total Swedish manpower inputs of 72.5 man months and total financial inputs of SEK 16.33 million. Correspondingly large inputs of time and investment were forthcoming from the Thai partners; the Thai Government has spent over Baht 500 million and many man-years of effort over the last 10 ten years in developing modern air quality management and monitoring systems within PCD.

As this was a co-operative project, it has sometimes been difficult to de-couple issues and outcomes of the Thai and Swedish components of the resulting collaborative effort. Our remit here, however, is to examine as far as possible the overall effectiveness, value for money, long-term sustainability and outcomes from *the Swedish assistance.*

Any programme of this ambitious scope, complexity and wide-ranging aspirations will inevitably have its successes and failures. We will now attempt to summarise these.

Box 2. Main *successful* features of the Swedish Assistance

- The overall approach and methodologies have been endorsed and fully supported by PCD
- Several technical functionalities of the Airviro system are still in routine daily use by PCD
- There was full and effective consultation with PCD end-users during all phases of the programme
- PCDs' overall Air Quality Management and monitoring capabilities have developed substantially over the 8 years of assistance
- Sida and contractors have provided key technical tools contributing to this process
- Support was appropriately targeted at PCD, which remains the main authoritative and responsible body for Air Quality Management in Thailand
- PCD indicates 'it got what it wanted' from the assistance
- Good support was provided by Swedish consultants and contractors throughout
- Some Airviro tools have been used for policy support, although resulting impacts on overall air quality are difficult to assess

Box 2. Main *unsuccessful* features of the Assistance

- IT systems supplied are now clearly out of date and of limited utility
- Many Airviro functionalities have progressively been bypassed, discontinued or not fully utilised
- Overall cost-effectiveness and value-for-money of the assistance must therefore be regarded as limited
- IT systems are not fully compatible with other emerging PCD approaches
- IT systems are inflexible and therefore difficult to adapt to PCD's changing needs without continuing Swedish assistance
- Core technologies transferred to PCD are therefore not fully sustainable in the long term
- Technologies have proved unsuccessful in Regional Offices
- Programme did not provide sufficient emphasis on simple, cost-effective IT and monitoring techniques; these are now regarded as of key importance in Thailand
- Training focussed too much on Airviro use and did not adequately cover fundamental aspects of Air Quality Management
- Capabilities of Regional Offices have not been developed as a result of the assistance
- Insufficient support has been made available following the end of the current phase of projects

The evaluators have worked on a wide range of bilateral and grant-aid assistance projects, both in Asia and world-wide. We would comment here that this balance of positive and negative features is fairly typical for work of this nature!

We conclude this section by trying to assess the overall effectiveness of the assistance, having regard to both the successes and failures listed in Boxes 2 and 3. In our introduction, we noted that our primary intention has been to assess the Sida assistance in terms of its:

- Appropriateness to local needs and conditions
- Cost-effectiveness and value for money
- Sustainability in the long term
- Benefits and outcomes

Appropriateness

It would be fair to say that the assistance was appropriate and necessary when first provided. However, the core Airviro system and technologies provided have not been sufficiently flexible to adapt to PCD's changing technical and policy needs over time.

We would also comment that a complex, high-technology Air Quality Management System such as Airviro does not necessarily represent the most appropriate approach for rapidly developing countries; the use of simpler AQM tools and technologies, at least initially, is one we would recommend in most circumstances.

Cost-effectiveness and Value for Money

The project's overall cost-effectiveness has proved limited, primarily because so many of the core Airviro functionalities (modelling, forecasting, inventories) have been bypassed or discarded over time. PCD has been highly successful in adopting other approaches and systems, but the fact that it has had to move in this direction serves to demonstrate the basic 'closed' architecture and lack of flexibility of the Airviro turnkey concept.

Much of the training effort, moreover, has been directed towards day-to-day system operation, to the detriment of more important capability development in basic air quality management tools and principles.

THA 6, which attempted to cascade technologies and capabilities to 4 pilot Regional Offices, has proved to be unsuccessful.

We would also comment that overall value-for-money of the assistance would have been enhanced through greater emphasis on the use of simple approaches and technologies for air quality management, information management and front-end monitoring.

Long-term Sustainability

The assistance has not proved sustainable in the long term. The core technologies provided and approaches adopted remain highly dependent on continued Swedish support. In particular, the proprietary nature of the IT hardware architecture and software means that it cannot readily be adapted or upgraded without such support.

We note that overall sustainability of effort has also been compromised by staff loss, wastage and transfer within PCD – circumstances all outside the control of Sida, its consultants and contractors, of course.

Benefits and Outcomes

It is undeniable that PCD's overall capability for air quality monitoring, management, policy support and public information dissemination has developed substantially over the period of the assistance programme. Its capabilities and systems are now clearly amongst the best in the SE Asia Region.

However, we would comment that much of this progress has been due to the substantial efforts and financial inputs from the Thai Government, combined with the excellence of many of its staff. Ultimately, the Swedish assistance has provided some of the enabling tools, but PCD has used these most effectively to get the job done!

5. Recommendations

5.1 Background – the Future Role of PCD and Regional Offices

Before our recommendations concerning future Sida support to Thailand can be presented, it should be recognised that the environmental responsibilities of many of the different institutions, government bodies and levels of administration in the country are presently in a state of transition. Naturally, our recommendations must have regard to this situation, and the resulting level of uncertainty in the organisations we consulted concerning their future tasks and remit.

Our current understanding of the responsibilities of PCD and local offices is summarised in Technical Annexe 1.

Following on from political initiatives directed at progressively devolving power and responsibilities for environmental management to Thailand's regions, it may well take several years to establish a workable and coherent system. We were informed by two of the regional offices that they were not still prepared or able to take over full responsibilities according to recommendations given.

We understand that three levels of environmental responsibility will ultimately apply in Thailand:

- National level, which will cover all pollutants, advanced management and planning systems as well as national reporting and reference controls.
- Regional level will include the monitoring and databases addressing problems in each region, including assessment and regional planning.

- Local level, where simple sampling, short term field studies and impact evaluation will be undertaken to identify local problems and issues.

It must be emphasised that Pollution Control Department, the prime recipient of Swedish assistance over the past 10 years, will retain overall responsibility to regulate, supervise, direct, coordinate, monitor and evaluate the state of the environmental quality in Thailand.

It is clear, therefore, that PCD must continue to maintain and develop its advanced tools and technologies for air quality monitoring, management, modelling, planning, policy support and data dissemination. Our recommendations reflect this continuing need. PCD will benefit from support that is designed to ensure that its overall capabilities remain equal to the task of national air quality management in changing times and amidst a changing administrative framework.

Our assessment, and the opinion of some of the bodies themselves, is that many Regional Offices presently lack a clear understanding of their future remit; they also lack the necessary capability and skill-base for the operation of advanced air quality monitoring and assessment technologies. Their immediate needs are more basic, and centre on:

1) The need to use simple tools and approaches to recognise local problems, together with
2) Acquiring a basic understanding of the fundamental principles and tools of air quality management.

Note, however, that it is not only the Regional Offices that envisage simple monitoring technologies playing an important role in their future activities; PCD also intends to make greater use of these in future for spatial analysis, mapping, model validation/support, hot-spot identification and 'filling the gaps' between automatic monitoring network stations.

Against this background, we present our core recommendations in the next Section.

5.2 Our Recommendations

Our recommendations for future support from Sida to the Thai authorities are summarised in Box 3. Further clarification and supplementary information is then provided.

Box 3. Summary of Recommendations

- Upgrade Airviro computer hardware and software system within PCD; maximise compatibility with current or projected future IT systems
- Support PCD in a thorough review of the current air monitoring network and data management systems; this to be undertaken in the light of changing needs and the increased trend towards regionalisation of environmental responsibilities within Thailand
- Maximise data availability to Regional and Local Offices through web-based systems
- Continue to collect input data to a complete emission inventory for Bangkok and other areas and provide an operational dispersion model
- Support the development of a sustainable capability for passive sampling within PCD and Regions, together with necessary laboratory and QA/QC infrastructure
- Develop and undertake basic and fundamental training for PCD in Air Quality Science and Management; This knowledge can then be cascaded and disseminated to appropriate regional authorities.

1) A priority is replacing the current obsolete Airviro hardware in PCD, as well as updating its Airviro software license to the current version. This will enable PCD to continue to implement its core AQM tasks over the coming years. At the same time, there is a need to support PCD's continuing efforts to diversify its range of AQM tools and thereby reduce its dependence on what is, fundamentally, a system that lacks long-term sustainability.

2) Although highly successful, the current air monitoring network structure reflects the needs of a political and administrative structure that no longer exists. It, together with its supporting data handling systems, needs to be actively and carefully reviewed and changed over time to reflect:
   - The future needs and responsibilities of PCD, regional and provincial bodies
   - An increasing emphasis on the use of simple air monitoring technologies
   - The requirement of both central government and regional bodies, as well as the general public, for accessing ambient air quality data
   - Deficiencies of current data handling systems and their failure to operate successfully in a regional context
   - The need to streamline both monitoring and data handling systems and improve overall cost-effectiveness
   - The need to maximise local involvement, where possible and appropriate, in national monitoring systems

3) Fundamental training on Air Quality Management principles, tools and technologies is required at all levels, both within PCD and Regional Offices. This should focus on, inter alia:
   - Air Pollutants and their health/economic impacts
   - Fundamentals of Air Quality Management
   - Basic air monitoring technologies – including simple approaches
   - Principles of network design and quality assurance
   - Analysis and use of air quality data
   - Emission monitoring and assessment
   - Different approaches to air pollution modelling
   - Emission inventories and GIS fundamentals
   - Abatement scenario analysis
   - Economic and cost-benefit analysis

It would be impractical for this training to include PCD and all Regional, Provincial Offices. We recommend that it therefore concentrate initially on PCD and key local bodies. Using consistent core documentation, presentations and training systems, capability may be then be cascaded to local level through a 'training the trainers' model.

4) We have been asked by Sida to comment on current proposals for the development within PCD of laboratory competence for air quality sampling and analysis. We support this, although it should be seen as part of a broader effort to support and develop PCD's overall capability for the use of passive air quality samplers. Ultimately, PCD needs to develop a sustainable and standalone capability to design and operate networks based on this technology; these can then be used in baseline, source-oriented and Environmental Impact Assessment studies. This technique will also need to be used widely at local level, supported where necessary by PCD.

5) We have also been asked by Sida to comment on proposals for supporting PCD in the development of a strategy for the management of air pollution problems caused by VOCs, NOx and PAH in the Bangkok Metropolitan Region. This was not perceived as a priority by PCD and, given the wide-ranging and fundamental nature of the previous recommendations, we would not support its implementation at the present time.

6. Lessons

We would like to keep these short and to the point:

1) All multidisciplinary environmental assistance programmes end up being partly successful, at best. The most successful programmes tend to be those with a tight focus, clear objectives and based on a realistic assessment of what is practical and possible in the beneficiary country.

2) Keep technologies and approaches simple. Simple approaches:
   - Are often the most appropriate to local needs, resource constraints and skill-base
   - Maximise user uptake
   - Are easier to maintain, support and adapt over time.
   - Enhance cost-effectiveness and value-for-money
   - Will always prove most sustainable in the long-term

3) It is best for projects to start simple; more complex approaches and advanced technologies can then be introduced in a phased manner, when appropriate and when local capabilities permit.

4) High technologies are not always the solution to Air Quality Management. Sometimes they become the problem!

5) The centrepiece of this entire set of projects was the Airviro system. The main objectives, deliverables and activities of the programme as a whole all depended on its successful operation. This is a high-risk approach, and one we would not recommend for future projects.

6) A 'one-size-fits-all' approach to Air Quality Management is not possible. Techniques and technologies that work in developed countries such as Sweden may not always be appropriate or readily transferable to rapidly developing countries in Asia. Approaches and AQM tools therefore need to be carefully targeted and optimised to meet specific local needs, capabilities and resources.

7) The emphasis in assistance programmes needs to be on people rather than technologies. Tools are just a means to an end; the people using those tools are the key beneficiaries. Training and capability development are therefore core components of any successful assistance programme.

8) Training should not focus exclusively on the use of proprietary technologies or systems; rather, it should seek first to raise awareness of general principles and fundamental issues before dealing with such tool-oriented matters.

9) The success-or otherwise – of technical cooperation projects cannot always be assessed fully from their written outputs and report deliverables. However, the ready availability of such documents certainly helps!

10) Large-scale projects of this nature benefit from authoritative and independent technical review of deliverables and outcomes. The Thailand projects should have been thus reviewed after completion, and before the initiation of the companion Philippine projects.

Appendix 1 Terms of Reference

For the Evaluation of Results (impact, outputs and effects) from the Air Quality Management projects in Thailand and the Philippines supported by BITS and Sida.

1 Background

Sweden has supported the work to combat air pollution problems in Southeast Asia during the last decade. Thailand and The Philippines have been the main counterpart countries, especially focussing on the deteriorating air quality in mega-cities like Bangkok and Metro Manila. The support has been given through contract financing of technical co-operation, a financial instrument open to middle-income countries. This type of support is based on the assumption that the country has a responsible organisation, officially designated to handle the question at issue, and that the organisation can specify their needs and priorities sufficiently for forming the basis of a contract between them and the consultant. Sida then finances the technical assistance part of the contract, while the local part should finance the local costs. Sida can take a more hands-off role in these projects, as long as they are projects based on principles like "demand-driven", "cost-sharing", "competent partners" and "limited assistance with a clear exit".

Two sets of projects, both directed at support to environmental authorities for improving the air quality, should be evaluated. Both sets of projects involve the same main Swedish partner, and share more or less the same project objective: to establish a modern Air Quality Management (AQM) system. The first set of projects (six) was directed to support the authorities in Thailand (Bangkok), the second project (two phases) to support similar efforts in Metro Manila.

An overview of the projects to be evaluated, covering project objectives, duration, main activities and results, project owners and other important stakeholders, implementing organisations and project costs is provided as Annex A to this document. Please note the preliminary comments to be considered by the evaluator for each project. All the projects have now been finalised and final reports have been provided to Sida. New proposals have been submitted during the project periods, and three are still pending awaiting a decision on how to continue the Swedish support through contract financing of technical co-operation in the field of air pollution in South East Asia (see Annex C). The timing of the evaluation is chosen to be either the start of a new phase of support, or resuming that the support requested or needed does not fit with Sida's current possibilities. Thai projects were assessed by an independent consultant in conjunction with an evaluation of all support to environmental activities in Thailand in 1995[1]. Besides this no evaluation has been undertaken until now.

2 The Purpose and Scope of the Evaluation

The main purpose of the evaluation is to learn from the activities performed, and to achieve informed advice on efficient ways for Sida to support the improvement of air quality in South East Asia Mega cities, especially in Thailand and the Philippines. Both local and regional air pollution problems should be addressed.

[1] The report has not been found in Sida's archive.

Key issues are:

1. What has been the impact of the Sida (BITS) financed projects and what was their relation to other changes in the field of air pollution control in respectively Bangkok (Thailand) and Metro Manila (The Philippines)?

2. How is the present situation regarding air pollution control and management in respectively Bangkok (Thailand) and Metro Manila (The Philippines)? Describe ongoing activities, existing priorities and current plans.

The evaluation should put the projects financed by Sweden in the context of the, respectively, Thai and Philippine work to combat air pollution.

The scope of the evaluation is:

1. Five consequential projects in Thailand, aimed at establishing and supporting the development of an air quality management system in Bangkok. Evaluation of results effects and impact.

2. One project in The Philippines, divided into two phases, aimed at establishing an air quality management system in Metro Manila. Evaluation of results effects, and impact.

3. Initial assessment of the relevance, feasibility and appropriateness of three new project proposals/ideas:
   a. Thailand. Development of laboratory competence for air quality sampling and analysis. Counterpart: PCD (Pollution Control Department) in Bangkok[2]
   b. Thailand. Developing a strategy for handling air pollution problems caused by VOC, NOx and PAH in the Bangkok Metropolitan region. Counterpart: ERTC (Environmental Training and Research Centre) at DEQP (Department of Environmental Quality Promotion)[3]
   c. The Philippines. Initial request for continued Technical assistance, (TA3) support in developing an Air quality Management system for Metro Manila.
   Counterpart: EMB (Environmental Management Bureau) at DENR (Department of Environment and Natural Resources)

4. The own view[4] of the evaluation team on activities immediately needed and how they best should be designed to be best suited to combat air pollution in Bangkok (Thailand) and Metro Manila (The Philippines). This point is independent from earlier activities and existing proposals, and should reflect the view of an independent and highly competent consultant in the field of AQM.

The finding and recommendations will be used for Sida´s appraisal of further support. They will also be provided to all actors involved in the projects as guidance for future action to be taken. The evaluation report will be publicly available through the archive of Sida Evaluations. Amongst the interested parties, the environmental authorities at local, regional and national level in Thailand and The Philippines are to be found, as well as The Asian Development Bank.

3 The Assignment (issues to be covered in the evaluation)

Relevance of the projects performed is the main issue. It should be noted that the overall objective for the projects to be evaluated has been an improved air quality. The evaluation should discuss the appropriateness of the methods chosen to reach this objective, their timing, balance between providing

[2] Possibly there is a change regarding the coming duties of the PCD laboratory. This may make this project less relevant or require changes in the project design.
[3] It is uncertain if there is still an interest in Thailand to involve a Swedish consultant in the project.
[4] After consultation with relevant professionals

equipment and technical assistance, ownership issues and division of roles and responsibilities between consultants and counterparts, in theory as well as in practice.

Achievement of project objectives should be assessed with an emphasis on effects and impact. The immediate results have been reported (see List of Background documents, Annex B) as part of each project. This results should be validated when possible and within the scope of the key questions for the evaluation.

Effects on target groups shall be assessed and validated when possible. A major obstacle will be the changes in staff at the organisations involved in the project and subject to training as part of the projects. The evaluating team should focus on effects and impact, in this case if persons trained can be found in other capacities where their improved skills have been of use for the purpose of the projects. See further the project descriptions in Annex A for definition of target groups. Gender aspects should be considered when relevant and interesting.

Focus is mainly on the sustainability of the interventions. The report should include a cause and effect analysis, and discussion of deviations from what was anticipated, or initially overlooked, in the project design. The long-term impact of the projects should be described as well as what led up to them. A general assessment of the cost-effectiveness of the different projects/main activities in the projects shall be made and presented, followed by an analysis of major causes. A brief assessment of the legitimacy and capacity of the major institutions involved.

The report shall include any relevant links to enhancing sustainable development and improvement of living conditions for the poor. Of special interest is the validation of such effects from the project interventions and from the development of the AQM in general.

4 The Methodology, Evaluation Team and Time Schedule

The scope of the evaluation should be held within 40 days of work. The evaluation team should consist of two persons, of which at least one should have a specific and broad technical competence in the field of air quality monitoring. At least one should have a genuine knowledge and experience from the existing situation and the development during the last ten years of air quality management in South East Asia, especially in Thailand and The Philippines. The team should be highly qualified in judgement of cost-efficiency for alternative approaches to strengthening air quality management in the Thai/Philippine context. The team should also be able to prove good knowledge from development assistance in the field of air quality management, including reference projects.

At least one of the team members should be able to read and understand Swedish, see the List of Background documents, Annex B.

The evaluation will include a two-week mission to Bangkok and Manila. Sida will set up the initial itinerary for the mission, but room will be left for additional contacts deemed appropriate for the scope of the evaluation during the visit. One week should be allocated in advance for preparation and reading through the background documents. Yet another two weeks will be allowed for writing the report and receiving comments from major actors involved before finalising the draft.

The counterparts in the different projects should be contacted in advance by the evaluating team and asked if they would like to submit additional information or comments to the Terms of Reference for the evaluation. They will also be asked for comments to the Draft evaluation report.

Sida will be giving the final comments to the Draft report and acceptance of the final report.

The list of background documents is attached in Annex B to this document. Each project is also described in Annex A. Together this is intended to give a sufficient background for the evaluation team.

The evaluator should clearly describe the methodology used. Multiple lines of evidence and a combination of quantity and quality type of analysis shall be used. The interviews and observations shall follow a clear and well thought through methodology. Sida's archives and files are publicly available.

Interviews should also be made, with the Swedish counterparts throughout the projects, and a special attention should be given to the input from institutional partners like Swedish Environmental Protection Agency and the Municipality/Region of Gothenburg. When appropriate, interviews could be done via telephone or in a written form.

5 Reporting

A draft report shall be produced and presented to Sida not later than three weeks after concluding the mission to South East Asia. Another three weeks will be allowed for comments from Sida and interested parties. Hereafter the report should be finalised.

The evaluation report shall be comprehensive and written in English. For maximal use, technical background and other supporting facts should be put in annexes. Format and outline of the report shall follow the guidelines in *Sida Evaluation Report – a Standardised Format* (see Annex 1). The draft report and later on the final version, shall be submitted to Sida electronically and in 3 hardcopies (air-/surface mailed or delivered). The evaluation report must be presented in a way that enables publication without further editing. Subject to decision by Sida, the report will be published in the series *Sida Evaluations.*

The report shall follow the structure and emphasis put in these Terms of Reference. Conclusions and main findings shall be reported and validated. Description of the projects, corresponding to Annex A, should be put in Annex to the report, with complements and all amendments found appropriate by the evaluator. Interviews and other fact-finding results should also be put in annexes.

The evaluation assignment includes the completion of *Sida Evaluations Data Work Sheet* (Annex 2), including an *Evaluation Abstract* (final section, G) as defined and required by DAC. The completed Data Worksheet shall be submitted to Sida along with the final version of the report. Failing a completed Data Worksheet, the report cannot be processed.

Appendix 2
List of Persons Consulted or Interviewed by the Evaluators

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Appendix 3 Documentation and References

A number of background documents were provided by Sida in advance of our visit to Thailand. The folder included mostly correspondence and memos and few technical reports. The documents further included project descriptions, assessments and some results for each project found in the Sida archive files. BITS was the Swedish agency for Contract financed Technical Cooperation until July 1995. Since then the contract financed assistance is part of Sida.

THA 1:

1. Agreement between ONEB and SWEEP on a project providing SWEEP expertise to ONEB for assistance in a review of current air quality management in Bangkok including the needs for an improved air quality monitoring. Signed 30 September 1991. Note: Annex 1 ToR is missing. 5 pages.

2. Draft agreement ONEB/SWEEP 1991-01-23. Includes draft ToR and comments in Swedish. 21 pages.

3. Beslut nr 42-91 Thailand: Luftkvalitet i Bangkok. BITS 1991-01-23. 4 pages.

4. Report Air Quality Management in Bangkok – Project formulation Study+ Annexes, ToR and proposal. Bengt-Erik Olsson. 1990-12-16. 20 pages.

5. Fax från Lennart Danielsson/AIT *Brief review of a project proposal "Miljöprojekt Thailand" and of some Related Documents* som slutrapport från det uppdrag SWEEP har haft angående luftföroreningar i Bangkok, samt Några personliga kommentarer. 891117. 8 pages.

THA 2:

6. Agreement between DPC and SWEEP on a project that provides SWEEP expertise to DPC for assistance in the development of
   a) an Air Pollution Emission Inventory/Database, initially for the Bangkok Metropolitan Region and, subsequently
   b) a System for Forecasting Ambient Air Quality in the Bangkok Metropolitan Region. Signed 1 October 1992. 22 pages.

7. Fortsättning i Bangkok med nästa projektfas och workshop i December. Telefax från Indic, Björn Wahlström till BITS. 13 februari 1993. 2 pages.

8. Organisation charts MOSTE. 2 pages.

9. Deltagare i konferens och kurs i Schweiz för användare av Indic-systemet hos DPC i Bangkok. Brev från Indic till SWEEP 1992-09-07. 11 pages.

10. Letter from ONEB to BITS 20 February 1992. 4 pages.

11. Bangkok metropolis and its air pollution problems. Conference presentation by Mr Suphapodok. Jan 1992

12. Proposal to The World Bank for "Strengthening the ONEB". 10 pages.

13. Brief summary of the status of projects being supported by BITS. 23 Jan 1992. 5 pages.

14. Beslut nr 221-91/92 Thailand: Luftföroreningar i Bangkok, metodutveckling och systemuppbyggnad – fas 2. 1992-05-20. 6 pages.

15. Progress report on the current project air quality management in Bangkok metropolitan during 1992–1993 and proposed future projects. March 1993. 4 pages.

16. Final report November 1993. Air emission inventory and the development of a computer aided air quality management system for the BMR area, Thailand. 44 pages.

THA 3:

17. Agreement between DPC and PGGB on a project for The Configuration, Design and Specification of a Nationwide Automated On-line Ambient Air Quality Measurement Network for Thailand. Signed 1 June 1993. 20 pages.

18. Beslut nr 138-92/93 Thailand Luftföroreningar i Bangkok-design av rikstäckande mät- och kontrollsystem. 1993-06-01. 5 pages.

19. Framställan från PCD. Dokumentet är identiskt med 15. ovan, samt ett följebrev från ambassaden. 19930318. 6 pages.

20. Fax från Indic till BITS: Funderingar kring och behov av en projektdiskussion för Thailand. 1993-04-20. 2 pages.

21. Request for continuation of assistance in AQM from PCD. 13 October 1993. 8 pages.

22. Newspaper articles on air pollution in Bangkok Oct 1993, Jan 1994. 7 pages.

THA 4:

23. Agreement between PCD and PGGB on a project for an Intensive Training Course for the PCB staff on the Computerized Air Quality Management System for Thailand. Unsigned. Faxed copy November 1993. 18 pages.

24. Bekräftelsebrev från BITS. November 1993. 3 pages

25. (THA4?) Conference announcement and call for papers. The 2nd international conference on computerized Air Quality Management. Nov/Dec 1993. 4 pages.

26. Project Report Intensive Training Course for the PCB staff on computerized AQMS. 26 November 1993. 4 pages.

THA 5:

27. Agreement between PCD and PGGB on a project for the Enhancement of the Existing Swedish-Assisted Computerized Air Quality Management System for Bangkok Metropolitan Region. Signed March 1994. 90 pages.

28. Beslut nr 94-93/94 och bekräftelsebrev Thailand Luftvårdsövervakning i Bangkok i Fas 3. 1994-02-25. 10 pages.

29. Draft Interim Report No1. 15 May 1994. 5 pages.

30. Executive Summary Presentation of results from the Airviro Software. August 1994. 10 pages.

31. Draft Interim report No2. 7 september 1994. 10 pages.

32. Kort rapport från PCD projektet. Conexor Oktober 1994. 4 pages.

33. Interim report No3. Unsigned. 19 Febr 1995. 7 pages.

34. Formell begäran om förändringar i projektet vid tre olika tillfällen. Oktober 1994, maj 1995 och juni 1995. 9 pages.

35. Training/Study visit to Sweden. Invitation and Program. Feb/March 1995. 9 pages.

36. Lägesbeskrivning BITS/Sida projekt i Thailand. Lst Gbg o Bohuslän. 1995-10-04. Bifogad kopia av rapport saknas. 2 pages.

37. THA4/5 Enkät-projektuppföljning Länsstyrelsen i Göteborg och Bohus Län. Mars 1997. 4 pages.

38. THA4/5 Evaluation questionnaire. PCD. July 1997. 4 pages.

39. Thailand generellt. Avsnitt 8 Informationsförsörjning (på luftvårdsområdet) – mål principer, utformning. 16 pages.

THA 6:

40. Agreement between PCD and PGGB on a project for the Enhancement of the Air Quality Management Project to Four Regional Nodes in addition to the Continued Support for Cantral PCD and the Support to Establish an Air Quality Laboratory at the PCD. Signed 27 January 1997. 96 pages.

41. Beslut INEC/EKOSAM 1080/96 1996-12-30. 16 pages.

42. Tilläggsbeslut framtagande av informationsmaterial. INEC/EKOSAM 841/97 1997-11-03. 3 pages.

43. Information material on Thai-Swedish Co-operation AQM and information in Thailand. November 1997. 7 pages.

44. Interim report No1. 31 March 1999. 24 pages.

45. Final Report December 2000. 30 pages.

Thai visit Documentation

During the mission to Thailand, we collected the following additional documents:

1. Thailand, State of the Environment. The Decade of 1990s. Prepared by Pollution Control _ Department, Ministry of Natural Resources and Environment
2. Bangkok State of the Environment 2001. Prepared by BMA with support from UNEP.
3. Bangkok State of the Environment 2002. Prepared by BMA with support from UNEP.
4. Traffic crisis and Air Pollution in Bangkok – Boontherawara, Paisarnnutpong et al, TEI Environment Journal, Vol 2, no3, Jul-Sep 1994
5. Report by Connexor on Thai Swedish Co-operation project, Nov 1997 (BE2540)
6. Air Quality in Thailand at the crossroads – video produced by World Bank, 2002
7. PowerPoint presentation produced by MONRE for Study Visit to USEPA by Thai Delegation
8. PowerPoint presentation produced by PCD for Thai Environment Air Quality Monitor 2002
9. PCD Summary and results from of a public survey of Public Survey research project on Bangkok air quality perception
10. PCD Remit and Terms of Reference, 2002
11. PCD PowerPoint presentation on Thai/Swedish co-operation projects in Air Quality Management, June 2004
12. PCD/JICA final report and support documents, data from Joint Study on Acid Deposition Control Strategy in the Kingdom of Thailand, Feb 2003
13. Thailand Environment Monitor Air Quality 2002 – World Bank, June 2002 (pdf)
14. Annual and monthly data summaries from #13 (xls)

Websites consulted

www.worldbank.or.th/monitor

www.pcd.go.th/

www.aqnis.pcd.go.th/

www.conexor.se/

www.conexor.se/_private/thailand/thailand.htm

www.sida.se/Sida/jsp/Crosslink.jsp?d=376&a=8959

www.sida.se/Sida/jsp/polopoly.jsp?d=107

www.indic-airviro.smhi.se/

Technical Annex 1 PCD Responsibilities within MONRE, 2002

1) Current Pollution Control Department Responsibilities

PCD has the overall mission to regulate, supervise, direct, coordinate, monitor and evaluate with respect to rehabilitation, protection and conservation of environmental quality. Details are listed below:

1) Submit opinions for the formulation of national policy and plans for the promotion and conservation of environmental quality enhancement with respect to pollution control,

2) Make recommendations for establishment of environmental quality standards and emission/effluent standards,

3) Develop environmental quality management plans and measures to control, prevent, and mitigate environmental pollution,

4) Monitor environmental quality and prepare an annual report on the state of pollution,

5) Develop appropriate systems, methodologies and technologies for the application in the management of water quality, air quality and noise, hazardous substances and solid wastes,

6) Coordinate and implement measures to rehabilitate and remedy damages caused by pollution in the contaminated area and assess the environmental damages,

7) Provide assistance and advise on environmental management,

8) Cooperate with other countries and international organizations on environmental management,

9) Investigate public complaints on pollution,

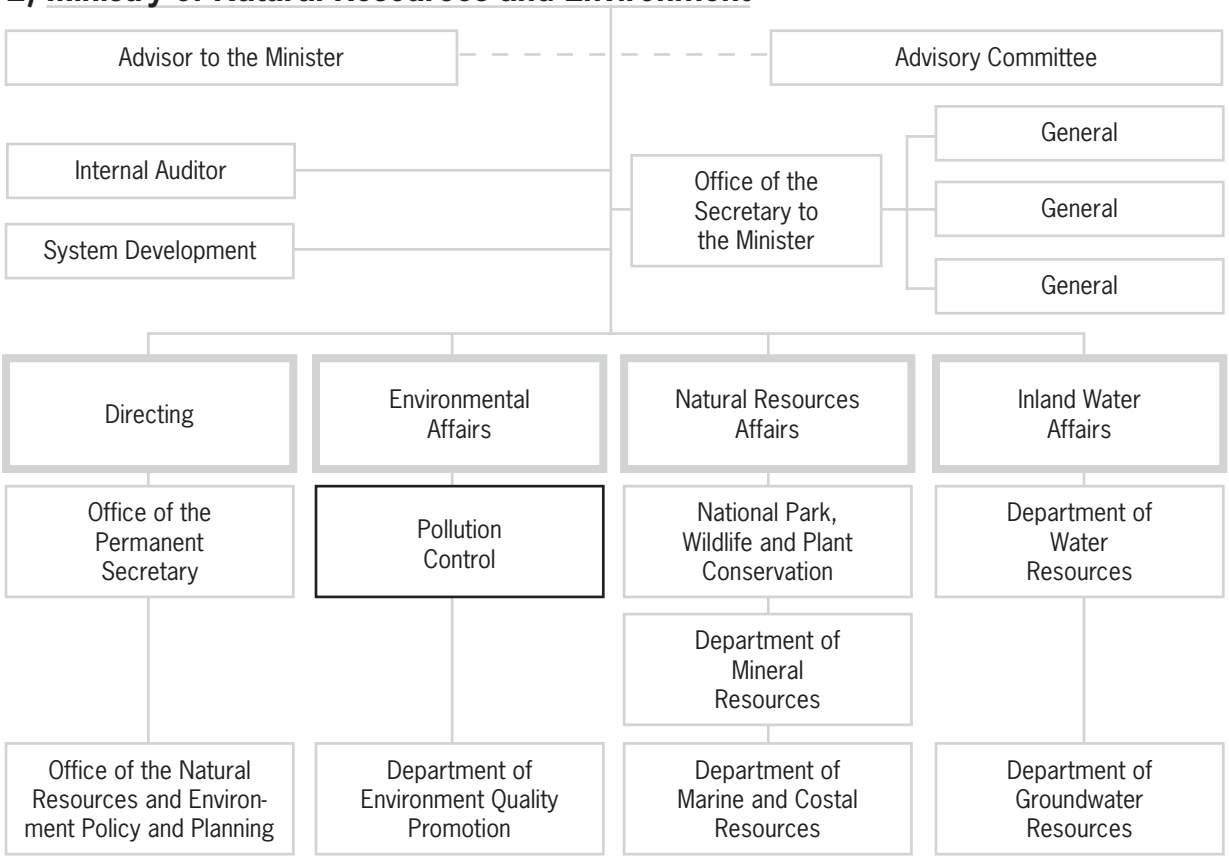
10) Perform other functions on pollution control as specified by the Enhancement and Conservation of National Environmental Quality Act B.E. 2535 (1992) and other related laws,

11) Perform other functions as required by law to be the authority and duty of the Pollution Control Department or as designated by the Ministry or the Cabinet

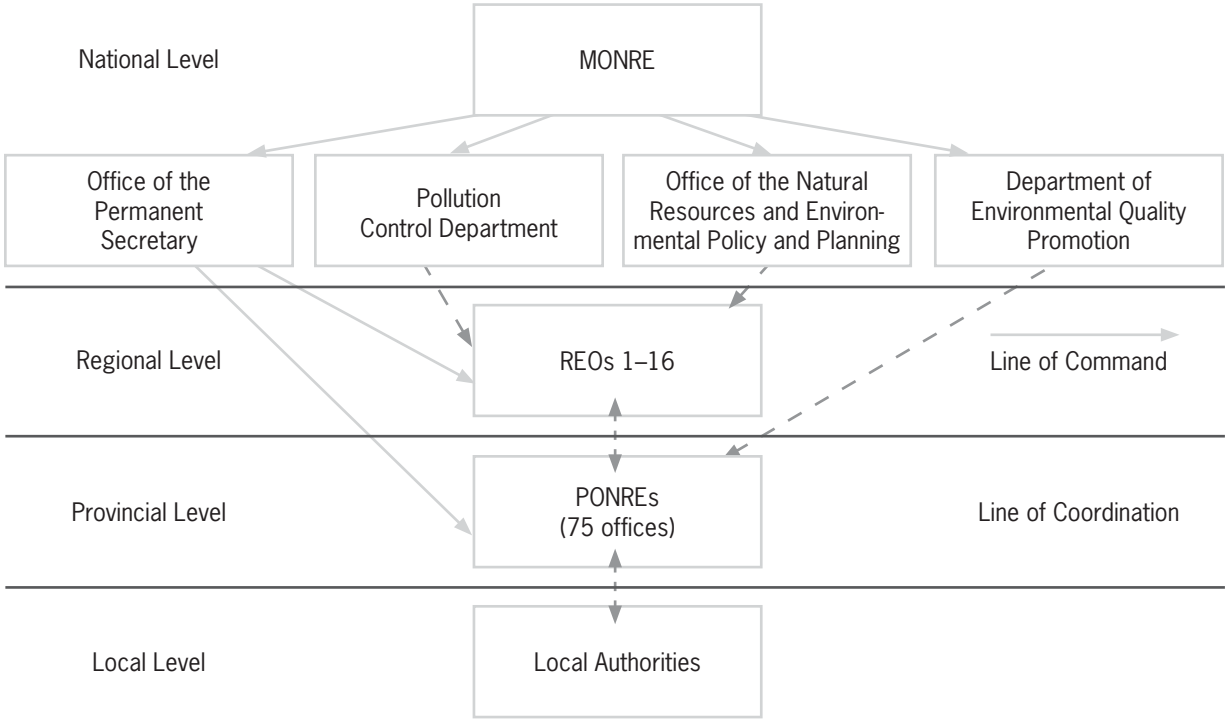
MONRE's overall structure and the position of PCD within it is summarised overleaf.

This is followed by a depiction of the relationship of MONRE to its regional and provincial offices.

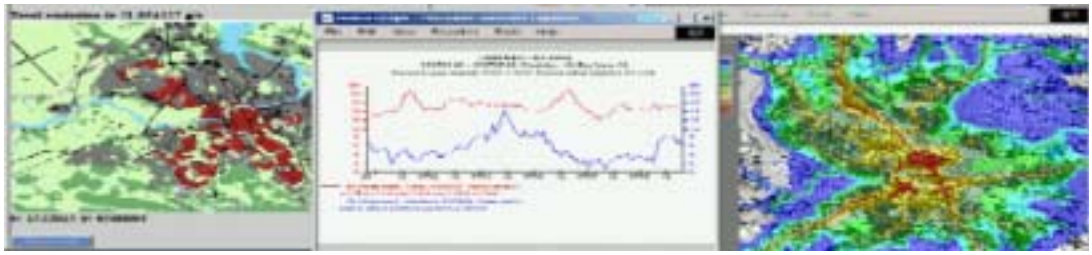
2) Ministry of Natural Resources and Environment



3) Decentralization of Environmental Management in Thailand



Technical Annex 2 An Outline Description of the Airviro System



Airviro is a system for analysis, planning and decision-taking in the management of air and water quality problems. The system is built around the following basic components:

- Databases for
  - Monitored data
  - Emissions to the air and water environment
- User interface modules for
  - Handling data collection
  - Analysis and presentation of time series data
  - Presentation/operation modules for the emission databases
  - Different dispersion models and a receptor model

Airviro is divided up into several different self-contained modules. An Airviro installation can consist of just one of these modules, although usually a combination of modules is chosen.

The software has been designed so that

- It can be fully operated using easy-to-use windows and menus
- Results are presented clearly and informatively, mostly on background maps

The latest version of Airviro, v3.0, is a completely Web-based environmental GIS tool. This makes it a distributed application suitable for regional or corporation use, as well as small standalone systems for inexperienced users.

There are more than 80 Indic-Airviro customers world-wide; authorities and industries, use the system to improve and structure their environment management work. Airviro sites range from regional internet systems with hundreds of users to intranet with just a few users.

The Airviro server runs on normal PCs using Linux as operating system. Its main functional modules are as follows:

Data Collection

Data are collected automatically from instruments measuring meteorology, air quality and other variables relevant to air pollution. Validation routines are applied and the operator is informed of any possible malfunction in the measurement systems.

Data Presentation

The Airviro Indico module provides tools for presentation and advanced analysis of time-series data. Selection criteria and mathematical transformations can be applied to data. Regression functions are also provided for model-building and testing of hypotheses.

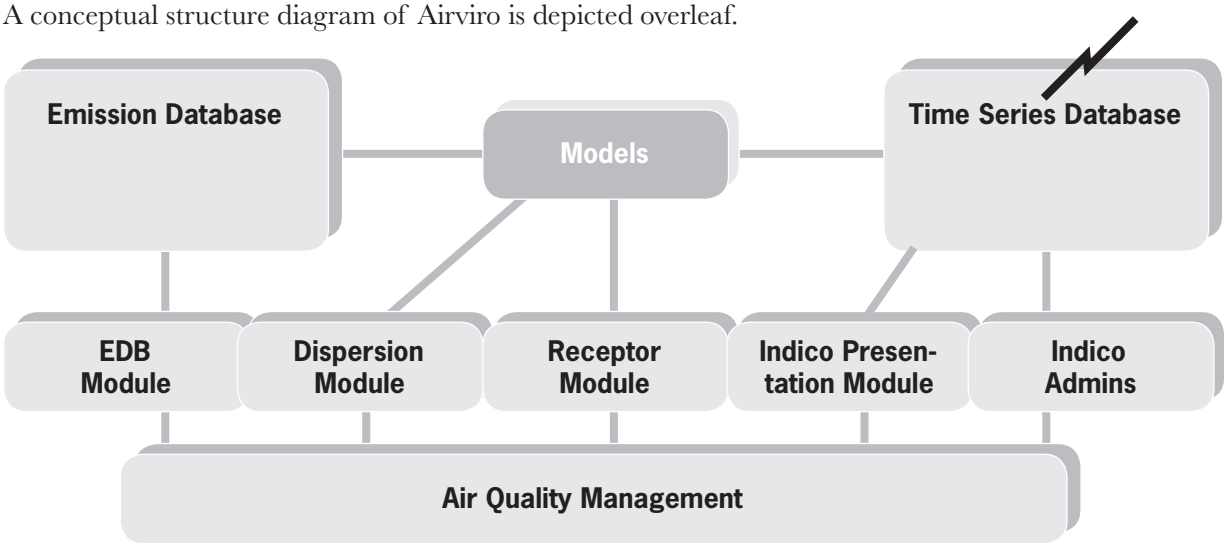
Dynamic Emission Database (EDB)

The dynamic emission database included in the system is designed to store static as well as dynamic emission characteristics for large numbers of pollution sources and types.

Dispersion Module

A number of dispersion models are available in the system, allowing the operator to investigate different scenarios in which processes such as deposition and accumulation of pollutants are taken into account. Results of different simulations can be stored for subsequent presentation and comparison.

A conceptual structure diagram of Airviro is depicted overleaf.



Outline of Typical Airviro System

Impacts, Outputs and Effects from Sida-funded Air Quality Management Projects in the Philippines

Jon Bower
Steinar Larssen

Department for Infrastructure and Economic Cooperation

Figure 1 – The scale of the problem: massive traffic congestion in the bus lanes of the EDSA Highway, Metro Manila

Executive Summary

Sweden has for many years supported a range of co-operative projects designed to support Air Quality Management (AQM) activities in Southeast Asia. Under the two-phase assistance programme to Philippines, undertaken from 1997 to 2002, Sida contractors and consultants provided 48 manmonths of effort and financial inputs of 7.08 million Swedish Kröner. This was matched by corresponding Philippine Government inputs of manpower from the main programme beneficiary – the Environmental Management Bureau of DENR, the Department of Environment and Natural Resources, Manila. The main objective of this large-scale co-operative programme was the development of a state-of-the-art air quality monitoring and management system in Metro Manila.

In this report, we provide an independent evaluation of the Swedish assistance programme. In particular, we focus on its appropriateness to local needs, value-for-money, cost-effectiveness and long-term sustainability. We also make a number of recommendations designed to provide a sound basis for future Sida assistance in Philippines. Our report is based primarily on findings and direct interviews with programme beneficiaries and stakeholders, undertaken during a one-week visit to Philippines in October 2004.

This report should be read in conjunction with an earlier report that evaluated the effectiveness of Sida support to the development of air quality management systems in Bangkok, Thailand (Bower and Sivertsen, June 2004).

Any programme of this scope, complexity and aspirations will inevitably have its successes and failures; this programme is no exception. Positive features of the Philippine programme include:

- A functional Airviro system has been established within DENR/EMB
- This could *potentially* be utilised for a range of key AQM functions in future
- Training has been provided on the use of this system
- Personnel are still able to operate parts of the system
- A partial emission database has been prepared, although data quality is uncertain

Unsuccessful aspects of the assistance include:

- Intended linkages with the parallel ADB project failed to materialise when this was delayed
- IT systems supplied under the assistance are complex, difficult to support, inflexible and presently out of date
- For a variety of reasons, no Airviro functionalities have been used by DENR/EMB thus far
- Overall cost-effectiveness and value-for-money of the assistance must therefore be regarded as poor
- Equipment provided will be difficult to adapt to EMB's future needs without continuing Swedish assistance
- Core technologies transferred to EMB may therefore not be fully sustainable in the long term
- Training focussed too much on Airviro use and did not adequately cover fundamental aspects of Air Quality Management
- The overall Air Quality Management capacity of EMB has not been enhanced through the assistance
- In consequence, the project has not had any overall impact on Manila's air quality, although there may now be greater awareness of AQM tools and issues within EMB

- EMB have not thus far 'bought in' to the Sida assistance or been able to provide the necessary long-term staff and management commitment to progress the work

We believe there are three core reasons for the lack of success of the project overall:

- Continuing capacity and organisational constraints within EMB
- The delay of monitoring data from the parallel ADB project
- A sub-optimal training component, influenced partly by the above factors

By comparison with the Thai/PCD assistance already evaluated, the corresponding Philippine project must be adjudged as substantially unsuccessful. In the view of these evaluators, this greater comparative success of the Thai effort was primarily due to:

- Strong, stable and consistent technical leadership, matched by sustained working-level commitment to the projects in Thailand
- After a difficult start, PCD 'bought in' to the assistance and were able to provide powerful matching *local* funding and resources to the work
- There was sufficient time and flexibility for the Thai authorities to develop their own approaches to AQM when Airviro's capabilities proved to be inappropriate or cost-ineffective.

If substantive additional assistance is going to be provided by Sida in the Philippines in future, we believe that a number of additional pre-conditions and safeguards must be introduced. These include:

- Learning lessons from previous Philippine assistance programmes, both involving Sida and other donors
- Adoption of a broader, inclusive approach which includes other centres of air quality expertise in addition to DENR/EMB
- An independent reality-check needs to be undertaken for any future projects, prior to initiation
- Substantially greater monitoring of performance and success, quantified through clear and unequivocal deliverables, is required throughout the course of any future projects;
- Benchmarking should be undertaken independently of DENR/EMB and the Swedish consultants, using a combination of independent international and local experts
- Project outputs, deliverables and training plans must be properly documented and adequately disseminated
- There should be considerably greater transparency and openness in how Swedish consultants and project participants are selected, with greater use of the competitive tendering process
- Projects should focus more on people, training and capacity building than on hardware.
- Focus on maximising management and working level buy-in; this is the only way to guarantee long-term sustainability.
- Focus on project tasks that are easy to verify, practicable and achievable.
- Greater use of smaller, incremental project tasks, implemented in stages
- Obtaining, as far as possible possible, assurances from beneficiaries that stable, consistent and adequate staff/resources will be committed throughout the course of projects

Subject to these necessary pre-conditions, our main recommendations are for a sequential 4-stage assistance programme, with progression through the individual phases contingent on the verified success of the preceding component:

Stage 1

- Generic background AQM training, using both Philippine and international experts.
- This to involve a range of organisations in Manila beyond DENR/EMB
- Immediate support, as required, to enable real-time data collection from Manila's ADB-funded automatic monitoring stations (via Airviro or alternate systems)
- Specific support to establishing necessary procedures (including software-based screening and manual review by data manager) for front-end review of measured data prior to public dissemination

Stage 2

- Multi-organisational feasibility study for a programme of public data presentation – via web and media – designed to raise societal awareness of air pollution in Manila
- Support and advice for the establishment of an Air Pollution Index (API) system to be used in reporting data to the public
- Assess scope for use of simpler data management and air monitoring techniques in Metro Manila
- Review of current air monitoring systems in Manila and definition of additional requirements

Stage 3

Depending on the outcomes of Stages 1 and 2, this phase might include

- Update of Airviro hardware and/or support/training for use of alternate, simpler IT systems
- Training and pilot studies, focussing on roadside environments, using passive sampler monitoring techniques
- Support in development of a database-driven public air quality website
- Training on development of abatement strategies and action plans

Stage 4

- Provision of equipment for establishment of automatic monitoring stations in near-road environments

There are a number of broader, generic lessons that can be learnt from the successes and failures achieved under the Sida assistance projects in Thailand and the Philippines. These are summarised in Section 6. In general, regional experience suggests that hardware-led assistance programmes tend to perform relatively poorly in developing the long-term AQM capacity of Asian megacities; more successful programmes tend to be characterised by their emphasis on staff training, capacity building and the use of appropriate, sustainable technologies for both monitoring and information management/analysis. Successful programmes also engage local personnel and institutions, leading to genuine co-operative effort to tackle air quality problems.

1. Programme Context

1.1 Introduction

Sweden has for many years supported a range of projects designed to combat the emerging air pollution problems in Southeast Asia. In particular, Thailand and Philippines have been the main recipients of bilateral aid support, focussing on serious air pollution caused by traffic, construction and industrial emissions in megacities such as Bangkok and Metro Manila.

Sida now wishes to evaluate two sets of projects directed at supporting the relevant authorities in these cities. These projects were targeted at improving their overall capacity for sustainable and effective air quality management.

An independent review of the success – or otherwise – of these projects is therefore sought by Sida. Its main objective is to learn from the activities performed and to inform the implementation by Sida of future projects designed to improve air quality in the region. Specifically, the evaluation will also contribute towards a decision on how to proceed with current proposals for three new projects in the area.

This report deals with the assistance provided to the Philippines Government from 1997 to 2002. An earlier companion report (Bower, Sivertsen – June 2004) has covered the corresponding work undertaken in Bangkok, Thailand.

In Section 1, we review the background to the study and main features of the overall Sida assistance programme in the Philippines. Our evaluation methodology is outlined in Section 2, following which we present our findings in detail in Section 3. Our main conclusions and recommendations are presented in Sections 4 and 5 respectively. Finally, some broader generic lessons drawn from the two assistance programmes are outlined in Section 6.

1.2 Background

1.2.1 Air Quality in Philippines

Air pollution poses a significant threat to human health, welfare and the environment throughout the world. The impacts have proved to be particularly severe in rapidly developing Asian megacities such as Metro Manila; in this city, increasing levels of environmental stress over the last decade have resulted from:

- High levels of urbanisation and population density
- Rapid social, economic, industrial and infrastructural development
- Massive increases in traffic density – the Asian Development Bank estimated that total vehicle numbers in Metro Manila increased from 800,000 in 1993 to 1,200,000 in 2000 and an estimated 1,400,000 today.
- Emissions from the ubiquitous 500,000 'jeepneys' – together with busses and other commercial vehicles, one of the most important pollution sources in the city

Poor air quality affects the health and welfare of a large proportion of the 20 million residents in Metro Manila and its surrounding areas. If not addressed, the detrimental impacts of air pollution on population health and welfare – and on the environment as a whole – threaten to significantly erode any future gains of economic and social development.

Recent reports from the World Bank variously indicate that:

- Eighty percent of the Metro Manila population live in areas where the national standard for air quality is exceeded
- Average TSP (total suspended particle) concentrations are frequently five times higher than the World Health Organization Air Quality Guidelines.
- Long-term measured lead levels also exceed both national and WHO Air Quality Criteria.
- Sulphur dioxide and total oxidants are also observed to exceed national standards, while nitrogen oxides, ozone, and carbon monoxide levels all remain within the standards. Ambient levels of lead have dropped significantly
- Health costs in 2001 of exposure to particulate matter PM10 in four urban centres – Metro Manila, Baguio City, Cebu City and Davao City – are estimated to be over US $ 430 million. This amount is equivalent to 0.6 percent of the country's national gross domestic product.
- Over 2,000 people die prematurely from the effect of air pollution in Metro Manila. This loss is valued at about US $ 140 million. Over 9,000 people suffer from chronic bronchitis, which is valued at about US $ 120 million. Nearly 51 million cases of respiratory symptom days in Metro Manila (averaging twice a year in Davao and Cebu, and five to six times in Metro Manila and Baguio), cost about US $ 170 million.
- According to the World Bank's 2000 Annual Review, the mortality rate in Manila is the third highest for a city in the east Asian region after Beijing and Jakarta.
- Air pollution also costs $1.5 billion every year in lost wages, medical treatment in the urban sprawl of Metro Manila, and the cities of Cebu, Davao and Baguio (P79.5 billion) — a figure equivalent to two percent of the country's annual gross domestic product (GDP).
- The main single pollutant contributing to the high mortality and morbidity rates is fine particulate matter emitted by diesel engines, emissions from factories and power plants and solid waste burning.

Figure 2 – Another view of the massive EDSA Highway in downtown Metro Manila; count the lanes…

Figure 3 – Jeepneys – picturesque but polluting

Air pollution in Metro Manila not only has immediate localised impacts on human health and social amenity, but also contributes to Asian transboundary problems (the 'Asian haze'), as well as global pollution. It poses severe economic implications due to increased mortality and illness, damage to ecosystems, property and infrastructure. Traffic congestion and the air pollution it produces not only makes Metro Manila an unpleasant environment for its citizens, it also discourages tourism, business and inward investment.

Awareness and concern about air pollution grew rapidly in the media, Government and general public in Philippines during the 1990s. DENR's Environmental Management Bureau also saw an increasing level of complaints about air pollution from the general public. This was been matched by increasing concern and political focus from the Philippine Congress. As recently as August 2004, there has been considerable media controversy relating to announcements by DENR concerning air quality in the capital.

In a situation of clearly deteriorating air quality throughout the 1990s, a comprehensive Air Quality Act was promulgated by the Philippine Government in 1999. Amongst its major policy provisions, it commits Government to:

- Formulate a holistic national program of air pollution management that shall be implemented by the government through proper delegation and effective coordination of functions and activities;
- Encourage cooperation and self-regulation among citizens and industries through the application of market-based instrument;
- Focus primarily on pollution prevention rather than on control and provide for a comprehensive management program for air pollution;
- Promote public information and education and to encourage the participation of an informed and active public in air quality planning and monitoring; and
- Formulate and enforce a system of accountability for short and long-term adverse environmental impact of a project, program or activity.

Following the enactment of this legislation, The Metro Manila Air Quality Improvement Sector Development Program (MMAQISDP) was formulated. This was a comprehensive government effort to support the implementation of the Philippine Clean Air Act of 1999 and to address urgent issues in air quality management.

The Program was financed by a combination of loan and grant assistance from the Asian Development Bank (ADB) and the Japan Bank of International Corporation (JBIC). Following significant delays in some elements of the programme and a resulting three-year extension, this work continues to date.

Against the background of the new legislation, the two-phases of the Sida AQM co-operation project commenced in 1997. This effort was initially designed to assist in the development of an effective Air Quality Management System (AQMS) within DENR/EMB, potentially acting as a precursor and pilot for further assistance in other parts of the Philippines. In the next section, we outline the major components and importance of such a system.

1.2.2 Air Quality Management Systems

An Air Quality Management System – whether in Manila or any other city – is fundamentally concerned with the achievement of societal, economic, awareness and regulatory objectives. In scope, it therefore needs to cover the entire process of assessing and tackling air quality problems, from quantification of poor air quality through to formulation and execution of an effective remediation strategy. Initial assessment of the problems is one of the main tasks of ambient monitoring; this includes the identification of significant sources of air pollution – such as traffic, industry, domestic, commercial or agricultural – together with 'hotspots' or areas of elevated pollutant concentrations.

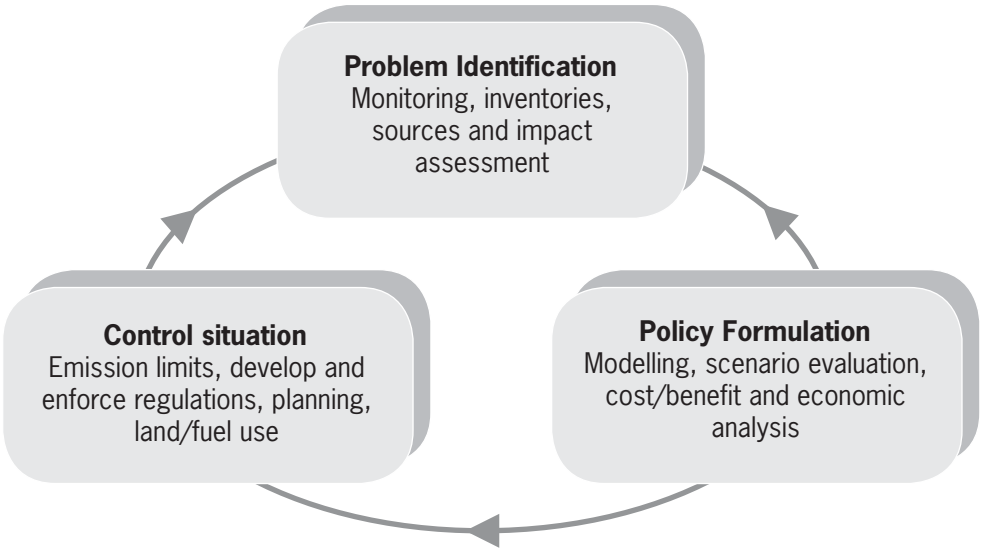


Figure 4 – The Air Quality Management process: a simple conceptual outline

Once priority targets are identified, an AQMS must facilitate the systematic evaluation of the options available for controlling emissions and improving air quality to an acceptable level – this process is often referred to as 'scenario evaluation'. This acceptable level is defined in terms of national or international air quality standards, usually designed to protect population health. Current Air Quality Standards in the Philippines are summarised in Technical Annexe 2.

Figure 4 above shows the main processes and tasks involved in air quality management, outlined in a simple, conceptual way. From the perspective of planners and regulators, effective air quality management offers decision support to enable least-cost compliance with current and emerging legislation. For the population at large, however, AQM serves to protect health, amenity and quality of life in a rapidly changing world.

The development of an effective Air Quality Management System (AQMS) within Metro Manila will ultimately require the following technical components:

- Reliable information on ambient air quality (a monitoring network)
- A complete and accurate emission inventory
- Adequate meteorological and topographic data
- An appropriate, validated dispersion modelling capability
- Effective means to disseminate data and information to public, policy, planning and other end-users
- The ability to quantify the costs of air pollution impacts on population health, ecosystems and the built environment, together with the costs of alternative remedial/control strategies
- Economic models developed for the local situation

The packaged Airviro System installed and developed under the present Swedish/Philippines co-operation programme was designed to provide the basic tools and functionalities needed to enable DENR/EMB to discharge its policy and regulatory Air Quality Management responsibilities in a responsible, effective and informed manner. An outline of the Airviro system in provided in Technical Annex 2.

1.3 Project History and Scale

Support was provided over an extended period from 1997 to 2002; the main mechanism was through contract financing by Sida of technical co-operation with responsible organisations in the Philippine Government.

Swedish assistance focussed on providing advice, training and consultancy, matched primarily to the functionalities and use of the turnkey Airviro AQMS. This assistance was matched by corresponding investment in manpower and expenditure from within DENR/EMB.

Later stages of the project were designed to work in conjunction with the proposed establishment of an ambient air quality monitoring network, funded by the Asian Development Bank (ADB) in Metro Manila.

However, as we shall see later in this report, delays in the ADB programme posed important knock-on implications for the Sida assistance. The two programmes were originally intended to be technically and operationally complementary, with the Airviro system tasked to acquire, database, analyse and disseminate data from the ADB network. In consequence, therefore, this potential synergy was lost.

The Sida projects involved the following Swedish consultants and local beneficiary/partner:

Organisation	Project Role
Environment Management Bureau (EMB) under Department of Environment and Natural Resources – DENR	Philippine partner and beneficiary
Swedish International Development Cooperation Agency (Sida)	Funding for Swedish technical consultancy and support
Connexor Sensus AB	Project Swedish partner, project management, general training
SMHI, Sweden	Supply, service and maintenance of Airviro AQM system software and hardware; meteorology, modelling and inventory development
Manrax AB	Support to Airviro system, IT training, monitoring network specification
Other Swedish consultants	As required – specialised training and institutional review/ analysis

The main project beneficiary was the Environmental Management Bureau (EMB), a line bureau of the Department of Environment and Natural Resources (DENR). This Bureau is primarily responsible for the implementation and enforcement of the Philippine Clean Air Act of 1999. Its key function is to develop comprehensive national program to achieve and maintain air quality that meets the National Ambient Air Quality Guidelines for Criteria Pollutants and their emission standards, while minimising possible resulting negative impacts on the country's economy.

The timing, rationale, manpower inputs and project costs (to Sida only) of the two projects undertaken are summarised overleaf.

The full programme of assistance necessitated total Swedish manpower inputs of 48 man months and total financial inputs of SEK 7.084 million. Correspondingly large inputs of time and investment were forthcoming from the Philippine partner; however, it has not proved possible to quantify this matching effort from DENR/EMB.

Project	Rationale	Manpower, Duration	Cost, SEK
PHI 1	Strengthen and modernise Air Quality Management functions through: • Assessment of current organisational/institutional situation • Evaluation of monitoring and communication equipment needs • Basic Airviro system installation and optimisation • Identify main polluters and commence inventory development • Basic scenario evaluation • AQM training • Day-to-day assistance • Information seminar	12 months 1997–1998	2092k
PHI 2	Build up modern AQM function within DENR/EMB through project activity areas: 1. Establishment of validated baseline ambient air quality levels 2. Produce inventory of point and traffic emissions 3. Training in use/support of turnkey Airviro AQM system 4. Establish comprehensive training platform 5. Supporting DENR in activities related to possible ADB loan-financed projects.	36 months, 1999–2002	4992k (4144k fees)

So, the cumulative scale of the two AQM projects evaluated here been large; it has also been ambitious in terms of its scope, complexity and overall aspirations. It is therefore important that its success, and the achievement of its overall objectives, is fairly and impartially established. This is the main task of our evaluation, and its findings are summarised in this report.

2. Evaluation Methodology

2.1 Scope of Evaluation

The scope of the current evaluation is clearly defined in its Terms of Reference:

- Evaluation of results, effects and impacts of two projects undertaken in the Philippines and aimed at establishing an effective Air Quality Management System in Metro Manila.
- Initial assessment of the relevance, feasibility and appropriateness of a new project proposal for continued technical support towards the establishment of a computerised air quality management system for the Metro Manila airshed.
- Forming an opinion on further activities that may now be needed, and how these should best be designed to meet local needs and conditions.

As requested, the full Terms of Reference for the evaluation are detailed in Appendix 1.

The evaluation team has also been asked to address the following key issues:

- What has been the impact of the projects?
- How did they relate to other activities in the field of air pollution control in the Philippines?
- What are the current ongoing activities, priorities and current plans for Air Quality Management?

The evaluation team recognises that its findings will be used for Sida's appraisal of current proposals for further support in the Philippines, and that they will be widely disseminated to project participants and stakeholders, as well as external organisations such as the Asian Development Bank.

2.2 General Approach

The evaluation team for the Philippine projects comprised two independent international consultants, both having extensive practical experience of air quality monitoring, assessment and management projects in the SE Asia Region and world-wide:

- Jon Bower, Chief Air Quality Consultant and Project Director – AEA Technology, UK
- Steinar Larssen, Research Director – NILU, Norway

Jon Bower was also involved in assessing the corresponding Sida assistance effort in Thailand.

Our overall assessment of the Philippine AQM projects was undertaken through:

1. A thorough review of the various background project papers, correspondence and reports provided in advance by Sida. It may be noted at the outset, however, that the initial literature review proved to be of fairly limited utility for the purposes of our evaluation. This issue is addressed in greater detail in the next section.
2. A one-week visit to Metro Manila undertaken from 4 to 8 October 2004. Its main purposes were to:
   a. Meet a comprehensive range of project participants, beneficiaries and data end-users, both within and external to DENR. In addition to a number of meetings with DENR/EMB, we also met personnel from:
      – Emission Technologies International

- Connexor
- The Asian Development Bank
- The Metro Manila Meteorological Observatory
- Klima Climate Change Centre
- Partnership for Clean Air

A full list of our contacts is provided in Appendix 2.

b. Discuss the AQM systems, tools and technologies introduced under the projects with working level as well as senior/management personnel
c. Obtain frank and open feedback from as wide a spectrum of project participants and stakeholders as possible
d. Obtain written documentation on the project and deliverables (not available to us in advance), together with background information on air quality and AQM in Philippines
e. Assess project technologies, hardware and software, focussing on Airviro and its various functionalities
f. Review as far as possible DENR's Air Quality Management systems in routine operation
g. Assess current priority AQM needs in Philippines, together with specific requirements of DENR/EMB
h. Evaluate potential synergies with future ADB assistance in the area.

The two Sida technical co-operation projects were closely integrated and inter-connected in terms of their overall rationale and global aspiration; this was to enhance DENR's overall AQM systems and capabilities in a way that was:

- Appropriate to local needs and conditions
- Cost-effective
- Sustainable in the long term

We have not focussed, therefore, on the detailed inputs, objectives and deliverables of the separate projects. Rather, we have sought in this evaluation to consider the effectiveness of the entire programme.

To this end, we formulated prior to our Manila visit a list of the primary questions and issues to be addressed within the evaluation. This approach followed the questionnaire used successfully in our previous Bangkok project evaluation. The main issues and questions to be addressed are summarised in Box 1.

This issue list was emailed to our main contacts in DENR, ADB, Connexor, the Manila Observatory and Swedish Embassy well in advance of the evaluator's visit. It formed the basis of many of our discussions and now provides the focal point for this project evaluation report.

Box 1. Main Issues and Questions addressed in Evaluation – I

- Do you think the overall Air Quality Management approach adopted during the projects was appropriate to the local situation?
- Similarly, were the information technologies and systems adopted (specifically Airviro) suitable for local circumstances and needs?
- In general, were the technologies and approaches to AQM cost-effective? Or do you think that simpler approaches might have been as effective?
- Was sufficient practical and theoretical training provided in the new approaches and technologies?
- Was sufficient training provided in basic AQM tools such as monitoring, emission inventories, models, scenario evaluation etc?
- Were local stakeholders and end-users consulted sufficiently before the various phases of assistance were provided?
- Do you feel you were adequately involved in setting the targets and objectives of the various project components?
- Phasing and rationale of the projects- do you feel that there was sufficient time given for assimilation of results of one project before proceeding to the next one?
- Was the overall AQM capability of your organisation enhanced through the assistance? What about other organisations?
- Institutional and demarcation issues- were all necessary local organisations involved in the work? Or should some other relevant organisations also have been included?
- Did any institutional or staffing issues in beneficiary organisations hinder the project as a whole?
- How would you rate the projects overall in terms of their usefulness and value for money?
- Was the scope of assistance appropriate or too ambitious? Similarly, was its geographical coverage appropriate?
- Did you get what you wanted out of the projects? If so, what was this? If not, what was missing?
- We are particularly keen to explore the long-term sustainability of the project. So, are the systems, technologies and approaches introduced still in use?
- Do you feel you have received sufficient support, follow-up and services from the Swedish consultants in the course of the projects?
- Do you feel you have received adequate support after project completion?
- Was the balance between local and Swedish inputs to the work correct?
- Do you feel that the assistance provided has enabled you to more effectively tackle air quality problems in the BMR?
- Has their been a positive or measurable impact on local air quality; if so, do you think that this has resulted from the project?
- If Sida or another similar organisation offered you assistance now, would you do anything different this time round?
- What are your current AQM priorities?
- In what areas would you most like to see future assistance from Sida?

2.3 Limitations of the Study

As noted previously, our initial literature review proved to be of limited utility. This was because the documentation provided proved to be substantially incomplete. We also observed this in relation to the earlier Sida Bangkok projects.

Some of the documentation was, however, subsequently supplied to us in the Philippines; this ameliorated the problem to some extent. Nevertheless, we find this situation surprising for a project of this scale, duration and expenditure level. Important correspondence related to project justifications, workplans and deliverables was, likewise, not initially available to us.

We therefore *recommend* that a more thorough level of project documentation, monitoring and reporting would be appropriate for future projects of this type.

Although we cannot say that we were able to meet *all* system end-users, stakeholders, managers and interested parties during our visit, we were able to form a clear perception of the overall project, its successes, failures and ultimate deliverables.

Note:
Some of the comments in this evaluation report are of a sensitive nature, or could be regarded as placing certain of the project participants in an unfavourable light. Comments of this nature are highlighted thus in the text.

The evaluators feel that frank statements of this kind are necessary and appropriate when discussing certain aspects of the Sida Philippines technical co-operation projects. In short, we would be remiss were we not to fully appraise both the positive and negative aspects of the projects.

Sida may, however, wish to consider carefully how widely these highlighted comments are disseminated.

Figure 5 – Atmospheric haze at dusk, Metro Manila

Figure 6 – Atmospheric haze, early morning, Metro Manila

3 Findings

In this section of the report, we summarise our assessment of the viability, cost-effectiveness, fitness-for-purpose and overall sustainability of the assistance provided by Sida to DENR from 1997 to 2002. As noted previously, our assessment is based on, and organised around, the list of questions and discussion issues that was pre-circulated to AQMS stakeholders and project participants.

For each question posed, we try where possible to provide a succinct summary answer. We also provide supplementary information and explanation, as necessary. Throughout, we have been careful to make a clear distinction between:

- Feedback and opinion of beneficiaries (DENR/EMB), Stakeholders and interested parties (such as ADB) and other interviewees
- Judgement and perception of the independent evaluators

Responses to these questions are provided in Sections 3.1 to 3.19. Summaries of our findings and a list of recommendations are provided in Sections 4 and 5.

3.1 Overall Air Quality Management Approach

Do you think the overall Air Quality Management approach adopted during the projects was appropriate to the local situation?

DENR/EMB – The AQM approach has been based exclusively around the packaged Airviro system. Although we need many of its functionalities and outputs to fulfil our roles in airshed management and implementing Clean Air legislation, many of its most important components are not utilised at this time, specifically:

– Monitoring data acquisition

– Analysis and reporting

– Modelling and forecasting

– Emissions inventory

– Scenario evaluation

– Airshed management support

Evaluators – Reliance on a single software-system approach to AQM is inflexible and can be particularly problematical when that system – for one reason or another – cannot be made fully operational or genuinely sustainable in the long term. Use of a broader and pragmatic selection of AQM tools, appropriate to the local situation, is always advisable.

We will return to further discuss these points, as well as reviewing why Airviro is not being used, throughout our assessment.

Feedback from other organisations: Manila Observatory, Asian Development Bank and Partnership for Clean Air

The people we met in these organisations were knowledgeable and helpful. It is clear to the evaluators that there are centres of AQM expertise in the Philippines, although these tend to be somewhat fragmented and – mostly – located in organisations outside DENR/EMB. These experts were also able to provide their perspective on the Sida assistance, its success and fitness for purpose, as well as clarifying the administrative and organisational environment in DENR/EMB. Other assistance projects, including the ADB project, have faced similar problems, so many of their comments are general.

There was strong consensus in the opinions expressed to us. We here summarise their main conclusions:

- The Sida project has not been successful. Moreover, the large-scale ADB assistance program, which it matches, has also encountered serious problems.
- The Sida projects have failed due to a combination of technical and organisational/ institutional reasons; however, the latter issues dominate.
- The training provided was not successful or appropriate, again partly due to organisational/institutional difficulties
- Staff have had difficulties with Airviro because of its UNIX platform and general complexity.
- There has been insufficient stability in personnel and management within DENR/EMB, combined with a lack of consistent leadership or direction.
- Due to its low status in Government, DENR has historically been under-manned and under-resourced; moreover, because of the poor salaries on offer, staff have not always been of the highest calibre. Personnel with marketable skills usually move to the better conditions and salaries prevailing in the private/commercial sector.
- Although there have been some improvements over recent years, DENR/EMB has insufficient experience or capability to successfully manage technology-led projects; hence many aspects of its emerging AQMS must be outsourced: for instance monitoring site procurement, operation and quality assurance.
- These procurement exercises have been severely affected by bureaucratic issues, general inefficiency, changes in policy direction (mandated by changes in Administration) and downright corruption.
- There is a long history of failure of grant-aid projects in Philippines which were high-technology or hardware-led. These did not always adequately consider local capacity and needs.
- This history has extended over several decades and covers assistance from Germany, Japan, World Bank and now ADB and Sida. All have left repeated generations of unsustainable and unused high technology air quality monitoring and management equipment. Although operable for a period, all eventually fell out of use because of lack of budget, spares and maintenance. In short, these efforts were not sustainable.
- The bureaucratic Government culture within Philippines Government, combined with its inability to retain technical and IT specialists, makes it difficult for technology-led projects of this nature to succeed.
- This situation is unlikely to change dramatically in the foreseeable future.
- There are serious doubts as to whether the current ADB-funded monitoring effort can be sustained after the current monitoring subcontract to ETI expires in 3–4 years, unless continued service/maintenance support can be provided. Historic precedents do not augur well.
- The Sida assistance – and the technologies provided – has many elements in common with previous bilateral and grant-aid programmes in the Philippines, which did not prove to be sustainable in the long-term
- Historically, one of the major problems in such programmes has been the difficulty in local beneficiaries 'buying into' the assistance to achieve a genuinely co-operative effort.
- Ensuring this 'buy in' is difficult; it may be precipitated by genuinely committed personnel in a position of power (evaluator comment – such as Dr Supat Wangwongwatan in PCD/Bangkok). However, this is made less likely in Philippines by the transitory nature of senior management/technical personnel in Philippine civil service, and by the widespread recourse to placement of political appointees in technical supervisory/management roles.

3.2 Suitability of IT Technologies

Were the IT technologies adopted suitable for local circumstances and conditions?

DENR/EMB – In practice, we have found the system to be complex and relatively inflexible. Despite training provided to a number of DENR/EMB staff, we cannot use all Airviro's functionalities or modify/customise it to meet our needs without external (Swedish) assistance. This is evidenced by our

current problems in acquiring data from the automatic monitoring sites. At present, we have had to bypass Airviro for this task because of what we believe to be compatibility issues with on-site loggers, and use an alternative system provided by the monitoring contractors.

We also believe the current version to be 'obsolete' because of its UNIX\basis. This also affects long-term sustainability and makes it difficult to use. It's very difficult for us to retain IT-oriented staff, so simplicity of in-house operation and support is essential. DENR may also need to adapt/develop system in future – it's impossible to see how this can be done without continuing external support.

But we would like to continue to work with the Airviro system, and would like to see the current version updated.

Evaluators – These comments mirror very closely those made to us by PCD in our corresponding Thailand assessment.

Some fundamental problems are clearly evidenced here. The overall IT systems approach provided under the assistance projects has been:

- Limited to one packaged system
- Complex
- Proprietary and therefore difficult to modify/optimise
- It has made DENR/EMB dependent on continued Swedish support, therefore compromising long-term sustainability
- For a number of reasons, Airviro has not been used and has therefore not been able to fully meet the operational objectives set under PHI 1 and 2.

In our earlier Thai evaluation, we observed that – over the nine years covered by individual projects THA1 to 6 – many Airviro functionalities had progressively been bypassed, duplicated or not fully used by PCD. DENR/EMB has had far less time to work with the Airviro system; in consequence, it has had less opportunity to find alternative solutions. Many of the basic AQM tasks for which Airviro was acquired cannot, therefore, be undertaken at present.

The consultants differ somewhat in their opinion on the overall long-term utility of packaged AQM solutions like Airviro. Larssen is of the opinion that these are necessary part of the toolkit for carrying out AQM functions in a megacity. He agrees that such systems are complex, and not easy to modify without external assistance. He also notes that more general AQM knowledge and expertise is needed for responsible organisations like EMB, so that they can utilise also other AQM tools for simpler AQM-related tasks.

By contrast, Bower opines that such systems often prove to be too complex and inflexible to deal with many of the problems in developing countries, particularly those that may have limited a priori experience of Air Quality Management. Real-world experience in the region suggests that simpler solutions are intrinsically more sustainable, and he cites the successful Thai/PCD approach as a model in this regard. He also notes that, world-wide, packaged AQM solutions of this nature are not widely utilised in developing or developed countries. In fact, their use tends to be concentrated in Scandinavia. He notes, also, that many UK local authorities that initially used Airviro found it too complex, inflexible and expensive, and therefore discarded it.

Although state-of-the-art in the early 1990's, the Airviro version used in the Philippines now appears out of date, mainly due to its UNIX platform; however, later Airviro versions provide new capabilities and web-based functionalities – this continuous evolution is expected for any product of this nature and, indeed, is essential in order to stay abreast of current developments Updating the EMB's system to newer versions is not technically problematic in itself. However, the need for continued external assistance for such updates – although required for *any* AQM tools – affects overall sustainability. Updating AQM tools, including Airviro, cannot alone help EMB to respond to changing technical needs and policy imperatives over time.

The current core issue – that Airviro cannot presently acquire real-time data from the automatic monitoring network – should, however, be technically very straightforward to resolve. Airviro can readily be interfaced with the widely-used data loggers deployed on-site. We are surprised that this has not been done already. This would immediately make monitoring data available to DENR/EMB, facilitate its further public dissemination and precipitate wider use of Airviro.

We therefore *recommend* that this issue should be resolved as soon as possible. In an attempt to precipitate action and resolve the obvious frictions and lack of communication between the various network contractors and EMB, we have therefore issued an open letter to the stakeholders and organisations we met; this suggests a fairly obvious and easily implemented approach to tackling this issue. See Appendix 4 for further details.

We discuss in Sections 4 and 5 more long-term ways forward on the IT front.

3.3 Cost-effectiveness of the approach and technologies

Were the technologies and approaches to AQM cost-effective? Or do you think that simpler approaches might have been as effective?

DENR/EMB – We have limited experience of other generic approaches to AQM. However, given our resource constraints and our difficulties in retaining technical/IT personnel (discussed further in 3.8), we are certainly interested in the possibility of performing some AQM functions using simpler data management and monitoring systems.

We are also interested in making greater use in future of simple monitoring technologies such as passive samplers. We were introduced to these (for NO2 and SO2) under a JICA assistance program, now ended.

Manila Observatory

We are also interested in the idea of using simple air monitoring and management systems in Metro Manila and throughout the Philippines.

Evaluators – Airviro has not proved thus far to be at all cost-effective; as noted previously, most of its capabilities are not yet being used. This is a for a variety of technical and organisational reasons:

- Sub-optimal training
- Lack of monitoring data
- Capacity and organisational constraints within EMB

It is the opinion of one of the evaluators (Bower) that DENR/EMB could actually operate successfully in the long-term with much cheaper and open-ended technologies. For example, real-time data acquisition from on-site data loggers to a PC in DENR/EMB would be relatively straightforward to implement. Larssen is of the opinion that such simpler systems can certainly assist EMB with some of its AQM tasks, but would not be sufficient in the long term.

Not in dispute, however, is the need for a short-term fix. DENR/EMB advised us that they would certainly be able to make greater use of Airviro should the necessary interface issues be resolved, enabling in to collect data from the monitoring network. As commented above, this is an obvious priority action with high reward/effort ratio and should therefore be expedited as soon as possible.

The evaluators differ somewhat on our perception of the best way forward. Larssen is in favour of continued support and use of Airviro, including its upgrading to newer versions. Airviro should, however, be only one of the tools that EMB should use for AQM work, in addition to other simpler approaches. Systems like Airviro are data-intensive, but are effective for doing cost-effectiveness analysis of abatement scenarios that are not easily undertaken with simpler systems. Integrated systems platforms like Airviro, although complex, may well be a suitable solution in an environment like in EMB, which is without personnel with high AQM expertise. AQM platforms like Airviro offer advantages because they are general platforms enabling non-experts to handle different AQM tasks in one place.

Bower favours a somewhat different long-term approach: diversification and simplification through increased emphasis on the use of non-proprietary and open-ended IT systems; this is the approach used with conspicuous success by PCD in Thailand. He also notes that authorities should undertake simple AQM tasks first before moving to more complex activities; with suitable experience, even these activities can then be carried out with robust methodologies which are used world-wide.

Actually, this divergence of opinion comes down in the end to one of emphasis, but we feel it should be noted here, nevertheless.

We also note and support DENR/EMB positive response to our question regarding the potential utility of simple, cost-effective monitoring technologies. These could:

- Usefully supplement existing automatic measurements
- Enhance cost-effectiveness
- Maximise sustainability of effort in the long-term
- Be particularly appropriate for future use for area screening, network design and model validation in areas outside Metro Manila
- Provide valuable data on roadside levels of NO2, SO2 and BTX (Benzene, Toluene and Xylene)

However, we would emphasise that the effective use of automatic monitoring network funded by ADB, and of the Airviro system, must also be assured. Simple systems cannot replace these, but could certainly complement them.

3.4 Adequacy of Training

Was sufficient practical and theoretical training provided in new approaches and technologies?

Was sufficient training provided in basic AQM tools such as monitoring, emission inventories, models and scenario evaluation?

DENR/EMB – The practical and theoretical training provided was devoted wholly to operation of the Airviro system. We would have liked first to have received training to improve our fundamental understanding of air pollution issues and air quality management. Such training would still be extremely valuable.

The training was highly compartmentalised. Separate small groups were trained on different functionalities, and not sufficiently brought together for broader appreciation and review/discussion sessions.

Evaluators – It may be noted that the opinions expressed to us by DENR/EMB are identical to those we received from PCD in Thailand. Training was poorly expedited in both these projects.

We strongly concur with the perception of both DENR and PCD that the balance of training provided here was too centred on Airviro and how to use it. We believe this to have been inadvisable and inappropriate. It seems self-evident to us that a basic appreciation of Air Quality problems and AQM tools is essential for the successful operation of any Air Quality Management System. Such generic training

must come first, therefore, followed by more system-oriented training covering the use of a specific commercial AQM product. This approach has not been adopted here, however.

In fairness, we would note here the comments from Connexor that characterised the training method thus: "Airviro was used as a training platform. The Airviro modules and functions were put in a general AQM context and, in that context, the personnel were trained in the operation of the system". Still, it appears to the evaluators this is not how the training was perceived by EMB personnel.

Our second main criticism concerns the compartmentalisation of the training. Air Quality Management is intrinsically a multi-disciplinary and inter-connected activity (see Figure 7 overleaf). As such, collective training – giving personnel a basic appreciation of the role, needs and problems in other task areas – is essential. In this context, however, the Connexor consultant points out that the lack of availability and stability of personnel made any form of integrated training difficult within EMB. Attempts to assemble a structured AQM group with clearly defined leadership and responsibilities also proved unsuccessful.

We recognise that the lack of stability of the staff being trained, together with the organisational problems within the EMB, seriously compromised the success of the overall training efforts.

We would also comment here that we were initially unable to secure copies of any training systems or manuals used by Connexor or other Swedish Consultants – either in Philippines or earlier in Thailand. This clearly unsatisfactory situation is matched by a corresponding lack of adequate documentation covering overall project performance, benchmarking or outputs. We will have more to say on project monitoring – and the need for this to be *independent* – later in our recommendations.

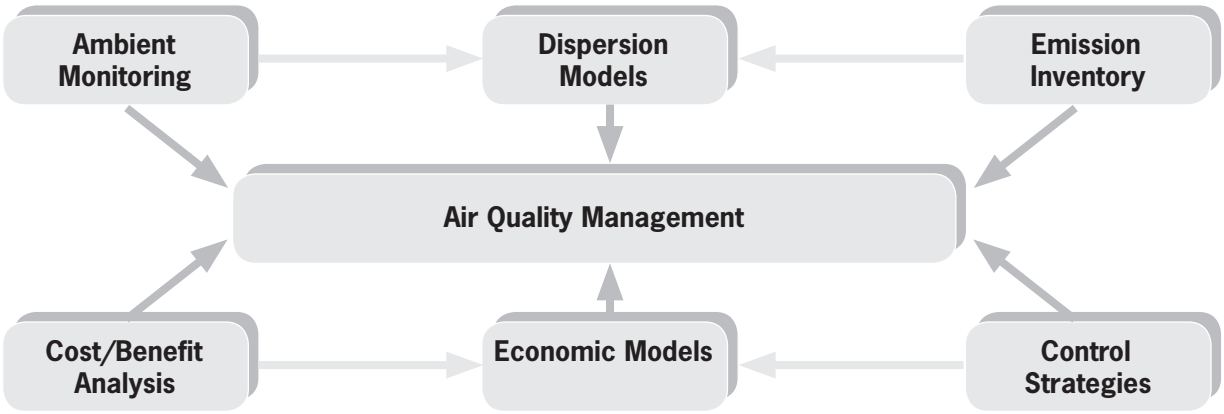


Figure 7 – AQM is a multi-disciplinary and integrated exercise: it therefore demands 'joined-up' thinking and training

3.5 Consultation with End-users

Were local stakeholders and end-users consulted sufficiently before the various phases of assistance were provided?

Do you feel you were adequately involved in setting the targets and objectives of the various project components?

DENR/EMB – We have no problems in this regard.

Evaluators – This is clearly not a core issue in these projects.

3.6 Phasing and Rationale of Projects

Do you feel there was sufficient time for assimilation of results of one project before proceeding to the next one?
DENR/EMB Yes, we were fully involved in all aspects of the project developments, as well as in its

evolution from one phase to the next. We also participated actively in the selection of monitoring and IT systems. We do not think the pace was 'pushed' in any way.

However, we think that delays to the ADB-funded monitoring programme, which were outside our control, have seriously affected the success of the Sida assistance. The two programs were supposed to be technically and operationally linked. However, Sida work ended before the nine existing automatic monitoring stations in Metro Manila became operational from Oct 2003 to April 2004; this substantial programme slippage made it impossible to test Airviro data acquisition functionalities on real inputs. Because the two programmes became out of phase, all potential complementarity/synergy was therefore lost.

ADB (Regarding the Automatic Monitoring network)

ADB confirmed that there were several reasons for the substantive delays in establishing the monitoring network:

1) Equipment and service procurement issues – both of a procedural nature and due to general bureaucratic inefficiencies within Government.
2) Two changes of administration- different governments had different priorities. One (Estrada) did not view the Environment as having any importance.
3) The tender had to be completely reviewed and re-evaluated each time the Government changed
4) The original winner of equipment supply tender withdrew because the continuing delays had seriously compromised their perception of its ultimate financial viability
5) The last remaining bidder was 50% more expensive and, as a result, the entire exercise went substantially over-budget
6) Corruption

Evaluators The monitoring stations appear well designed and built, for long-term sustainability in the demanding Manila climate. Bower believes, however, they may be somewhat over-engineered and – in consequence – over-priced. He also believes there may have been some over-specification in the ToR, with a suite of meteorological measurements undertaken at each site that would be more appropriate to a fully-blown micrometeorological research facility.

However, both evaluators have the opinion that, given adequate long-term support and maintenance, these monitoring stations will be capable of extended long-term operation over many years.

It has become clear to us that the supply/operation contractor (ETI) and QA/QC contractor (Maunsells) do not co-operate well or work effectively together. Moreover, there appear to be unresolved communication and demarcation issues between both contractors and DENR/EMB.

To compound these relational problem, it appears that DENR/EMB is sometimes insufficiently forceful in making quite legitimate requests to its contractors. Two specific examples of this: 1) in securing even such simple courtesies as site access 2) in requiring – correctly – that some stations be established in representative near-road locations). This may simply be due to lack of confidence but, in the future, DENR/EMB must realise that reasonable requests by the *customer* should always be met by *contractors*. At present, the balance of power appears to lie with the contractors, rather than the ultimate end-user of the network and its data.

Although not central to our evaluation, we would comment that the whole network service outsourcing situation has not been well handled by the customers, beneficiaries or contractors.

Evaluators – DENR/EMB feels it was fully and adequately involved in setting the pace for project timing and inception.

We agree that delays in the ADB monitoring system procurement will inevitably have had knock-on implications for the matching Sida work. The Airviro system was installed and completed under the Sida assistance programme 18 months before the first network stations were commissioned; only now has interfacing and testing of the data communications functions become possible.

With the benefit of hindsight, it would have been sensible for the latter, practical stages of to have been delayed until the ADB network had been completed and real-world measurement data from it become available.

Figure 8 – ADB-funded monitoring station at Namria

Figure 9 – Airviro installation at EMB headquarters

3.7 Building Air Quality Management Capacity

Was the overall AQM capability of your organisation enhanced through the assistance? What about other organisations?

DENR/EMB – No. But we can move forward when we can actually collect data from the monitoring network.

Manila Observatory

The overall AQM capability of DENR/EMB now is very much as in 1997- there is no perceptible improvement, maybe things have even got worse.

ADB DENR/EMBs overall capacity remains severely constrained by institutional, resource and management issues:

- Its low status within Government, leading in turn to chronic under-resourcing and under-manning
- Inability to retain high quality staff
- Lack of senior management commitment and 'buy-in' to either the ADB or Sida grant-aid projects (and to previous assistance of this nature)

Evaluators

We concur with the conclusion- also expressed to us by Connexor- that DENR/EMB presently lacks the commitment, as well as the technical and management capacity, to fully perform the AQM responsibilities assigned to it. Even with the projected recruitment of four additional staff, we cannot see this situation changing in the foreseeable future; to do this would need a wholesale change in its bureaucratic culture.

We will highlight some implications of this in the next section.

3.8 Institutional and Demarcation Aspects

Were the right beneficiaries involved? Do you feel that all relevant local organisations were sufficiently included in the process?

Did any institutional or staffing issues in beneficiary organisations hinder the project as a whole?

DENR/EMB – Since we are directly tasked with responsibility for implementing the 1999 Clean Air Act and its requirements, we remain the appropriate beneficiary for previous – and future – Sida assistance.

A number of institutional and organisational issues within DENR/EMB have affected project delivery and are expected to continue as constraints to future progress:

- Inadequate staff numbers:
  - 14 for AQ in EMB, with four more being assigned
  - 15 for the parallel ADB project and
  - 3 in each of the 3 Metro Manila Regional Offices.
- Retaining staff, especially those with specific technical or IT competencies; these tend to be lost to the private sector, where pay and conditions are superior
- Changing Governments and priorities

Evaluators – DENR/EMB is the recognised and authoritative government body for national environmental management and regulation in Thailand. It therefore remains an appropriate primary beneficiary for assistance. The staffing and institutional problems and constraints identified by DENR are, of course, common throughout the Region. Some countries have, however, been more successful in addressing them or finding 'workaround' solutions.

On the face of it, the staff numbers within DENR/EMB assigned to general AQM and the ADB project office functions would appear to be broadly sufficient if 1) the monitoring and data management technologies were mature, appropriate and fully functional and 2) all staff had the necessary experience and training. However, neither of these pre-conditions are applicable in the Philippines at the present time.

We highlighted in the previous section our assessment that DENR/EMB presently lacks the necessary technical, management and institutional capacity to develop and implement a modern and successful Air Quality Management System. Nor can one be imposed through the supply of necessary equipment and training. Institutional buy-in is a pre-requisite for a sustainable effort.

In subsequent sections, we highlight some possible ways forward. Most of these would depend on any future assistance from Sida including other organisations in the Philippines- such as the Manila Observatory- with necessary competencies in different AQM tools and technologies. Including these organisations brings a number of potential benefits:

- It makes the fullest use of the fragmented – but substantive- Air Quality expertise available within the country
- Provides a genuinely independent perspective of the work undertaken
- Maximises dissemination and use of projects outputs and data
- Involves organisations with valuable expertise in such areas as:
  - Public awareness (PCA)
  - Atmospheric science, meteorology and modelling (MO)
  - Particle measurement, analysis, speciation and receptor modelling (Philippine Nuclear Research Program)
- Fosters the productive exchange of experience and expertise
- Increases capacity of DENR/EMB in the long run

3.9 Value for Money

How would you rate the projects overall in terms of their usefulness and value-for-money?

DENR/EMB and others felt they could not easily comment on this question.

Evaluators – It is our role here to comment specifically on the value for money offered *by the Swedish technical co-operation inputs.* Primarily on the basis of previous comments relating to overall cost-effectiveness (Section 3.3), we would comment that these projects have *not* offered Sida or DENR/EMB good value for money.

As noted previously, none of the primary functionalities of the core Airviro system are used at this time. Moreover, some authorities consulted felt that there was an important role for alternative, simpler monitoring and information systems that were easy to use for some AQM tasks and sufficiently flexible to adapt to their changing needs in future.

In Section 3.4, we noted concern that the training was too focussed on Airviro and therefore neglected basic Air Quality Management issues and tools. Since training and capacity building has been an important aspiration of the co-operation programme, this perception must also negatively affect our assessment of its overall value for money.

Lastly, the limited long-term sustainability of the assistance provided (discussed more fully in section 3.12) must also be reflected in our poor overall assessment of its VFM.

However, we would note that some of the key factors responsible for the limited success of the work- including the internal problems within EMB and delays in initiating the parallel ADB project – were outside the control of Sida or its contractors.

3.10 Scope of Assistance

Was the scope of assistance and project geographical coverage appropriate or too ambitious?

DENR/EMB – Our most serious air quality problems are apparent in the Metro Manila area. However, we must implement the Clean Air Act and undertake airshed management throughout the rest of the country in due course.

Evaluators – It is clear that initial focus in the Sida assistance was correctly placed on Manila. If a successful AQMS cannot be established here, it will certainly not be possible elsewhere. The metropolis may therefore be regarded as a pilot for successful air quality management in future in other parts of the country.

However the experience of Thailand – which has a partially successful Airviro-based AQMS in Bangkok, but has not thus far been able to successfully disseminate this to other parts of the country – should be noted here. Even success over a large capital city cannot always be guaranteed to lead on to successful programmes in regional areas which may have even more severely limited AQM experience and constrained resources.

Transfer of the assistance to regions outside MM was not, however, part of the TOR for this work. Such transfer could be based upon various knowledge-transfer models, but these lie beyond the scope of this current evaluation.

3.11 Beneficiary Satisfaction

Did you get what you wanted out of the projects? If so, what was this? If not, what was missing?

DENR/EMB – Yes, we have a working Airviro system, but there are some problems and we cannot yet effectively use it.

Evaluators – We agree. Acquiring data in real-time from monitoring stations is a key first step. This should be possible with the co-operation of EMB's contractors under the ADB monitoring network.

3.12 Long-term Sustainability

Are the systems and technologies provided under these projects still in use?

DENR/EMB – No, but we would like to use Airviro in future, provided it can be modernised and updated to a PC-based version and the system integration issues with monitoring stations can be rectified.

Evaluators – general comments on sustainability

DENR/EMB have expressed to us the opinion that, to achieve long-term operation and the continued effectiveness of Airviro, EMB would depend on additional system support and upgrading from Swedish consultants. They are not able to customise and update it themselves because of its complexity, proprietary nature and (presently) UNIX platform.

We agree with these opinions. It is clear that the Swedish support has NOT thus far provided a sustainable AQM capability. In fact, this is probably one of the weakest features of the entire programme. It appears that the use of proprietary 'closed' IT systems and especially the UNIX platform has made EMB dependent on Swedish experts for updates and further assistance.

This was recognised by PCD Thailand; as a result they proceeded – with considerable success – to circumvent, bypass or 'build around' Airviro in a number of areas.

There are, unfortunately, many precedents of equipment-led AQM aid projects failing in the Philippines; these stretch back over several decades, in fact. How can we avoid the Sida assistance failing in the same way? Of the two evaluators, Bower believes proprietary, complex turnkey technologies intrinsically lack long-term sustainability, and that the Thai approach based on:

1. The use of simpler, cost-effective technologies and
2. The diversification of AQM tools

is therefore both sensible and appropriate in the Philippines.

Larssen has a different emphasis, and believes that continued use should be made of Airviro in the Philippines in future, including upgrading, together with other, simpler approaches where appropriate. He has the opinion that AQM systems such as Airviro possess capabilities that other simpler systems lack, and that continued experience and training in an improved organisational environment at EMB, provided proper local buy-in into the project, will improve its overall sustainability. He notes, also, that EMB staff would like to continue using Airviro where possible.

We would emphasise here that the lack of sustainability in the Sida assistance provided thus far is not, of course, exclusively due to the nature of the IT hardware provided. As highlighted already, poor training and the lack of stable management, staff continuity and commitment in EMB have also been major contributing factors.

3.13 Overall Support and Follow-up

Do you feel you have received sufficient support, follow-up and services from the Swedish consultants in the course of the projects?

Do you feel you have received adequate support after project completion?

DENR/EMB – No support has been supplied since the projects ended.

Evaluators – It is clear that post-project support has not been sufficient to meet PCD needs; the present arrangement is not sustainable and needs to be reviewed and formalised. Nevertheless, we would note that post-project follow-up was not formally part of the assistance programme.

3.14 Balance of Project Inputs from Sweden and Philippines

Was the balance between Swedish and Philippine project inputs correct, or do you feel a different emphasis might have been appropriate?

DENR/EMB – No comment.

Evaluators – This is not a core issue for these projects. However, we believe the balance was about right for a project of this scale and complexity.

3.15 Tackling Air Quality Problems

Do you feel that the assistance provided has enabled you to more effectively tackle air quality problems in Metro Manila?

DENR/EMB – No, because we cannot as yet use Airviro for its intended purpose.

Evaluators – Although many factors have contributed to the lack of practical usage of Airviro, this conclusion is inescapable. In later sections, we recommend some priority immediate actions once communications between Airviro and the monitoring network can be established.

3.16 Impact on Local Air Qquality

Has there been a positive or measurable impact on local air quality? If so, do you think this has resulted from the project?

DENR/EMB – No

Evaluators – Agreed, for the various reasons discussed above. However, we feel that useful efforts in public awareness and information access could be readily expedited with minimum additional expenditure.

3.17 Some Lessons Learnt

If someone offered you similar assistance now, would you do anything differently second time round?

DENR/EMB – More basic fundamental training would be requested, as well as better co-operation and relationships with the main Sida contractor. The timing was wrong, also. More assistance should have been provided once the ADB-funded monitoring commenced.

Evaluators – We note a strong opinion from within DENR/EMB and all stakeholders we consulted in favour of fundamental AQM training rather than system/hardware-oriented training. The same opinions were expressed to us in Thailand.

This is paralleled by a high level of interest from all parties in the use of simple monitoring methods, an area not included in the project ToR and therefore not addressed throughout the assistance.

We would also be remiss here were we not to note the problematical working relations between Connexor and DENR/EMB. There are many reasons for this, and it is difficult for us to make an impartial assessment of where the fundamental problems really lie.

However, we strongly *recommend* that future assistance from Sida – if any – would best be directed towards a wider community of organisations beyond DENR/EMB.

3.18 Air Quality Priorities

What are your current Air Quality priorities?

DENR/EMB – Our current priorities include:

- Enforcement
- Particles
- Ozone and other photochemical pollutants. There is frequently a brown smog in Manila, but we don't yet know what causes it.

Manila Observatory Our perceived priorities at this time are:

- Jeepneys, busses, trikes and general traffic emissions
- Near-source and hot-spot levels, as opposed to general background ambient concentrations
- Suspended Particulate Matter (SPM) and its health impacts.
- Photochemical smogs.
- Long-range transport (Asian Haze)
- Raising public awareness

PCA and Air Quality Forum

- High priority should be placed on public information and real-time dissemination of monitoring data to the public…
- In an easily understandable form meeting their needs

- The development and promulgation of an API (Air Pollution Index) for this purpose

Evaluators – These priorities seem sensible, given current regulatory drivers and our emerging understanding of Metro Manila's air pollution climate. We note and support the emphasis placed on public information services by all the organisations we consulted in Manila.

We believe and *recommend* that a public information reporting system could be reasonably easily and rapidly implemented, given that the hourly and daily outputs form the current 9-site ADB-funded automatic air monitoring network are already in a suitable form for PC-based data acquisition and dissemination.

Such a system could catalyse increased public and government concern about air quality. Moreover, it would empower Metro Manila's citizens through access to reliable information on the quality of the air they breathe.

There are, however, a number of pre-requisites for such a system:

1) Data communications to sites should be established, either using Airviro (as originally intended) or the alternate PC-based system provided by ETI;
2) Raw data need to be flagged and suspect data removed from the reporting datastream before its broader dissemination. It may be noted that Airviro has such screening functionalities built-in.
3) We would also strongly recommend the assignment of a data manager (who need not necessarily reside within EMB) to undertake regular reality-checks of output data.

One surprising aspect of this network, however, may be noted here. All the stations are situated in urban background locations, consistent with USEPA Criteria 58. Although data from such locations are appropriate and necessary for the single purpose of overall airshed management, they do not adequately represent the near-road exposure of a large proportion of Metro Manila's population.

We were advised that both DENR/EMB and Connexor had originally- and sensibly- suggested that stations should be sited in a broad mix of representative location types including airshed (background urban), near-road and industrial. This would be accepted- indeed mandated- monitoring practice in much of the world. However, the monitoring subcontractor (ETI) had apparently determined that all stations should be compliant with strict USEPA criteria for background ambient (airshed) stations. This seems to the evaluators a triumph of dogma over both common sense and the customer's genuine requirement.

3.19 Future Needs

In what areas would you most like to see future assistance from Sida?

DENR/EMB

- Fundamental AQM training
- Further advice and assistance on passive samplers and simple monitoring technologies; these to be used for –
  - More roadside monitoring
  - Co-location with automatic stations
- Upgrade Airviro so that it does what we want:
  - Acquire monitoring data
  - Analyse/assess the data
  - Disseminate and report it

  - Progress inventory compilation and
  - Use models for scenario evaluation and airshed evaluation
- Extend monitoring capability to other parts of the country, a process already initiated with Philippine funding and resources

Manila Observatory

- General training on AQM, involving a wide community of policy, planning, NGO and other air quality Stakeholders and end-users.
- Greater use of simple technologies
- Awareness-raising and public information systems

Evaluators

These priorities appear broadly sensible. However, there are many activities proposed here, and clearly some prioritisation of effort and commitment will be necessary. Focus should be placed on measures which:

- Are practical and realisable, given current conditions and institutional capabilities within Philippines
- Offer maximum cost-effectiveness ('bang per buck')
- Offer short-term, substantive and readily verifiable results in the context of the Philippine Clean Air Act
- Adopt a realistic step-wise approach, recognising that over-ambitious one-stop efforts are unlikely to prove successful
- Maximise inclusiveness and participation of the various Air Quality stakeholders in Manila

We now proceed to summarise and draw together our main findings, prior to presenting our key recommendations to Sida.

4 Conclusions

In this section, we summarise the evaluator's main conclusions. Our emphasis is on conciseness. We base these conclusions primarily on our on-the-spot assessment undertaken in Metro Manila from 4 to 8 October 2004. Its main findings have been presented in full in Section 3.

The full programme of Sida assistance has involved total Swedish manpower inputs of 48 man months and total financial inputs of SEK 7.084 million. Correspondingly large inputs of time and investment were forthcoming from the Philippine partners, although it has not proved possible to quantify these. Our remit here, however, is to examine as far as possible the overall effectiveness, value for money, long-term sustainability and outcomes from the *Swedish assistance.*

Any programme of this ambitious scope, complexity and wide-ranging aspirations will inevitably have its successes and failures. We will now broadly summarise these.

Box 2. Main *successful* features of the Swedish Assistance

- Functional Airviro system established within DENR/EMB
- This could *potentially* be utilised for a range of key AQM functions in future
- Training has been provided on the use of this system
- Personnel can still operate parts of the system
- A partial emission database has been prepared, although data quality is uncertain

Box 3. Main *unsuccessful* features of the Assistance

- Intended linkages with ADB project did not materialise when this was delayed
- IT systems supplied are now out of date
- For a variety of reasons, no Airviro functionalities have been used by EMB thus far
- Overall cost-effectiveness and value-for-money of the assistance must therefore be regarded as poor
- IT systems are relatively complex and inflexible
- These will be difficult to adapt to EMB's future needs without continuing Swedish assistance
- Core technologies transferred to EMB may therefore not be fully sustainable in the long term
- Training focussed too much on Airviro use and did not adequately cover fundamental aspects of Air Quality Management
- Overall AQM capacity of EMB has not been enhanced
- EMB have not thus far 'bought in' to the assistance or been able to provide the necessary long-term staff and management commitment to progress the work

The evaluators have worked on a wide range of bilateral and grant-aid assistance projects, both in Asia and world-wide. We would comment here that this balance of positive and negative features is fairly typical for work of this nature! However, by comparison with the Thai/PCD assistance already evaluated, the corresponding Philippine project must be adjudged as substantially unsuccessful.

We conclude this section by trying to assess the overall effectiveness of the assistance, having regard to both the successes and failures listed in Boxes 2 and 3. In our introduction, we noted that our primary intention has been to assess the Sida assistance in terms of its:

- Appropriateness to local needs and conditions
- Cost-effectiveness and value for money
- Sustainability in the long term
- Impacts, benefits and outcomes

We have also been asked to comment on:

- Sida's judgement on the transition phase between PHI 1 and 2
- Implications of changes during PHI 2 upon its implementation
- Balance between equipment and capacity building needs
- PHI 2 as example of export of Swedish expertise
- Interface with other AQM activities in the Philippines
- The role of a private consultant instead of an institutional partner
- Involvement of local institutions and stakeholders
- What are the current ongoing activities, priorities and current plans for Air Quality Management?

We now address these issues point-by point

Appropriateness

EMB have commented that Airviro is complex and inflexible; for this and other reasons – most notably because of fundamental institutional/organisational problems within EMB – the technology has not been seriously utilised thus far. Experience in many parts of the world shows that reliance on complex, high-technology Air Quality Management Systems such as Airviro may not necessarily represent the most appropriate approach for rapidly developing countries; the use of simpler AQM tools and technologies, at least initially, is one we would recommend in most circumstances. Once these have been mastered, more complex approaches and technologies can be adopted.

The mix and time-sequencing of introducing various AQM tools depends crucially on the institutional capacity and commitment of the recipient. In the case of this assistance program to the Philippines, with the noted lack of institutional 'buy-in' and commitment, it is an open question whether the use of any AQM tools would have proved successful.

Cost-effectiveness and Value for Money

The assistance has not proved to be cost-effective. As noted previously, most of Airviro's capabilities are not yet being used. This is due to both technical problems and organisational/institutional issues within EMB.

Without these external problems, and with a more efficient training component requiring reduced person-month inputs from Swedish experts, the costs would have been lower and the outputs much improved.

It is the opinion of one of the evaluators (Bower) that DENR/EMB could actually operate successfully in the long-term with much cheaper and open-ended technologies for many AQM tasks. Both EMB and the Manila Observatory welcome the use of such technologies. However, both evaluators would both stress that some AQM functions – such as developing abatement strategies and action plans under the new Clean Air Act – depend on high technology IT or measurement technologies.

There is a further rationale for the use of simpler technologies and approaches. The bureaucratic Government culture within Philippines Government, combined with its inability to retain technical and IT specialists, makes it difficult for technology-intensive projects to succeed without substantial outsourcing. Outsourcing, however, is not a panacea and comes with its own set of serious problems in the Philippines.

Much of the training effort in the Sida projects was directed towards day-to-day system operation, to the detriment of more fundamental capability development in air quality management tools and principles. This important aspect of the assistance cannot therefore be adjudged cost-effective.

Technology provision and training formed the two major functional components of the assistance: neither of these components have offered the end-users or donors value-for-money.

Long-term Sustainability

The assistance has not thus far proved sustainable. The core technologies provided and approaches adopted remain dependent on continued Swedish support. Without this, further effort appears to have ceased. In particular, the proprietary nature of the IT hardware architecture and software means that it cannot readily be adapted or upgraded without continuing support in future. However, the need for such support would diminish if and when the end-user acquires sufficient experience. This might take some time in the case of EMB. Upgrading costs and efforts are not necessarily large.

The lack of long-term sustainability has not just been due to technological problems, of course. There are also serious institutional issues, outside the control of Sida or the consultants, which have influenced the overall long-term sustainability of the assistance. DENR/EMB presently lacks the necessary technical, management and institutional capacity to develop or implement a modern and successful Air Quality Management System. Nor can one be imposed through the supply of necessary equipment and training. Institutional buy-in is a pre-requisite for a sustainable effort. It is difficult to see this being forthcoming without substantial cultural and organisational change within the Bureau.

Sustainability would have been enhanced through the provision of more generic training on AQM tools and techniques. This is a priority recommendation in Section 5, therefore.

Sida's Judgement on the Transition Phase between PHI 1 and 2

We have noted above that the most important experience gained under PHI was that there was a lack of capacity and funding within EMB for its own AQM work, or for properly absorbing the services and training provided under this project. This was duly reported to Sida. It seems to the evaluators, however, that this key lesson was not sufficiently taken into account in the planning of PHI 2, which offered basically 'more of the same. Crucially, no necessary pre-conditions for improving capacity and funding in EMB were placed prior to the initiation of PHI 2.

A further significant development in the phases between the two TAs was the provision of an ADB loan and subsequent initiation of the ADB project. This incorporated an important AQM component that related directly to a continuing Sida TA – the establishment of a new automatic monitoring network in MM.

We have noted the following key steps in the transition phase:

1. The various documents show that the ADB considered the continuation of the Sida TA as important, since it was to provide the necessary AQM-related expertise and training within EMB to handle the data from the monitoring, as well as to enhance the overall ability of EMB to handle its AQM responsibilities. Moreover, the ADB project also included the development of an Air Pollution Action Plan, the implementation of which would place significant new responsibilities on EMB.
2. The ADB also considered it important that a Sida Concessionary Credit (CC) provide additional monitoring stations, as well as an Internet-based Information System for data dissemination.
3. We understand that, even before Sida had actually decided on the CC, ADB considered that it had been agreed. We can see that might have put Sida in a difficult position and may possibly have influenced its decision to proceed.
4. We note also the involvement of the Swedish Embassy in Manila in this exchange.
5. The evaluations carried out by IVL and SMHI regarding the continuation of the Sida involvement in Manila after PHI 1, gave disagreeing advice: SMHI for, and IVL against. However, they both indicated that the lack of background documents made the evaluation difficult.
6. The CC was originally coupled to providing a certain type of monitoring equipment ('open path') that was considered to be Swedish 'high technology' worthy of export. This coupling to open-path monitors is not consistently referred to in later reports, such as in the Final TA2 Report (section 4.9.1), although it appears again in the request to Sida for a TA3 (Ref.: INEC-1996-0979/PHL 0571). Our opinion is that the TOR of a CC should not initially limit the selection of technology to a certain type. We also note that this technology was not appropriate to the needs of EMB.

As evaluators, we don't feel we have sufficient information to properly evaluate Sida's judgement and decision to proceed with a second TA as well as a CC. We would, however, state the following:

- There should have been a better assessment of EMB's organisational problems, and whether it was able to absorb the services provided by PHI 2, before this second phase was initiated. The lessons from PHI 1 should also have been strongly influenced the project plan. If necessary, a two-phase

approach could have been adopted: first ascertain the capacity and EMB budget issues, then proceed with a continuation if the results of a first phase was considered acceptable. This type of project phasing is recommended by the evaluators in the next Section.

- As regards the CC, this should also have been made dependent upon a first successful phase of work and its verified results. Its ToR should not have proscribed a certain type of monitors.

Implications of the Changes During PHI 2 upon its Implementation

PHI 2 when started, was based on a fairly ill-defined project plan which was – to a large degree – dependent upon the timely implementation of the ADB project. This linkage broke down and, in the end, the delay in monitoring equipment procurement extended beyond the PHI 2 time frame of 36 months. This appears to have created a vacuum in the training and implementation activities under the project. Problems were further exacerbated because the intrinsic capacity shortfall within EMB – noted in PHI 1 – had not been seriously addressed.

We don't see that any corrective or adaptive action was taken. Although the situation was regularly reported in the quarterly reports, it was merely noted that "No significant changes to the plans can be reported".

Although the situation 'on the ground' may well have looked different to the consultant at the time, it appears to the evaluators that major task re-scheduling should have been initiated; remaining tasks should have been deferred until the ADB systems were in place/operational and necessary capacity issues within EMB had been adequately tackled.

Balance between Equipment and Capacity Building Needs

These assistance projects centred on the provision of both equipment and training-oriented capacity building. There appears to have been an appropriate balance between the two task areas in PHI 1. It is clear, however, that by the end of the two projects, the equipment and hardware had been provided according to plan but the capacity-building component had substantially failed.

TA2 as Example of Export of Swedish Expertise

The recipients at EMB expressed the wish that the training be carried out by experts more directly related to the topics at hand. In this respect, a project involving greater involvement of expert institution partners in Sweden might have offered better transfer of expertise.

Regarding the equipment transfer, the AirViro system represented the state-of-the-art of such packaged systems at the start of TA1. However, it no longer does so. Upgrading to newer versions (e.g. for PC platforms) remains an issue.

Interface with other AQM Activities in the Philippines

The Sida assistance programme and parallel ADB-funded air monitoring networks were designed to be both technically and organisationally linked. The Sida-funded Airviro was – in fact – intended to acquire, manage and disseminate data from the network. This linkage failed as a result of major delays to the ADB programme. Despite assertions made originally by Connexor during the project planning/funding phases that the two projects were independent, the resulting loss of synergy had major operational and technical consequences for the Sida programme.

More generally, it appears to the evaluators – and this was also inferred by ADB – that the interface between the Sida assistance and other grant-aid organisations working in-country was not well managed throughout.

The Role of a Private Consultant instead of an Institutional Partner

In PHI 1, it may be seen as an appropriate starting point to have a locally based (private) consultant as Project Manager; the appointee was already in-country, had considerable local experience and would

be well-placed to provide continued follow-up services. However, the pre-requisite for this being a successful solution would be that he would also be able to actively network with local stakeholders, institutions and expertise; this would enhance sustainability of effort and ensure that the TA incorporated necessary participants for the training and capacity building components.

Involvement of Local Institutions and Stakeholders

However, after our meetings with local stakeholders and institutions, it is not apparent to the evaluators that sufficient networking took place. As a result, the Sida assistance provided under both projects was not well integrated with local institutions (other than EMB) or other centres of expertise.

Impacts of the Projects

These have – thus far – been minimal. DENR/EMBs overall capacity for Air Quality Management, and its ability to discharge its mandated commitments under the Clean Air Act, have not been enhanced through the assistance. However, there is probably greater awareness of some of the core tasks and tools required for AQM. Nevertheless, there has been no impact on Manila's burgeoning air quality problems.

The evaluators believe that a substantial impact on public awareness could, however, be achieved through the provision of near real-time data on local air pollution levels. Some of our key recommendations (Section 5) therefore focus on the need to develop this capability.

Current Activities

DENR/EMBs primary rationale and remit is to implement the Clean Air Act. It presently lacks the technical and institutional tools necessary to do this. This is not a unique situation in the Region. Many countries have adequate legislatory structures but are unable to adequately monitor compliance or enforce regulations.

The ADB-funded monitoring network, together with the data management, modelling, emission inventory and scenario evaluation tools provided within Airviro, were designed to provide EMB with the basic capability to discharge its statutory commitments. However, for a variety of reasons discussed in this report, this basic capacity enhancement has not yet succeeded.

In the next Section, the evaluators offer some possible ways forward. In Section 6, we attempt to distil our findings from both the Philippines and Thailand and draw some generic lessons from the Sida assistance to these countries.

5. Recommendations

5.1 Introduction

As we have seen in the preceding sections, the Sida assistance provided to DENR/EMB from 1999 to 2002 cannot be adjudged successful. A mix of failings in organisational, training and institutional implementation – combined also with some technical problems – have resulted in:

- Little or no real improvement thus far in the overall AQM capacity of the main targeted beneficiary – DENR/EMB
- No consequent improvement in Manila's severe air quality problems
- A centrepiece Airviro Air Quality Management System which is not utilised at present, but which could be exploited more in future

- Limited long-term sustainability of the assistance provided this far
- Poor Value for Money to Sida and Swedish taxpayers

In most regards, the corresponding assistance provided to PCD, Thailand must be regarded as a more successful example of this kind of bilateral technical co-operation programme. In the view of these evaluators, this greater comparative success was primarily due to:

- Strong, stable and consistent technical leadership and commitment to the projects in Thailand
- After a difficult start, PCD 'bought in' to the assistance and were able to provide powerful matching local funding and resources to the work
- There was sufficient time and flexibility for the Thais to develop their own approaches to AQM when Airviro's capabilities proved to be inappropriate or cost-ineffective.

There is an extended history of unsuccessful technology-led Air Quality Monitoring and Management projects in Philippines, covering several decades. These include grant-aid and bilateral programmes from – variously – Japan, Germany, the USA, World Bank and now both Sida and ADB. These have all substantially failed in the long-term because the technologies provided were ultimately proved inappropriate to local needs, capabilities or conditions.

ADB advised us that, when assessing the overall AQM capacity of cities and countries in Asia, the lowest assessments were associated with situations where bilateral and equipment-led assistance had been provided. Successful AQM capabilities, by contrast, were usually developed in countries where local 'buy-in' and matching funding could be secured over time. In fact, 'buy-in' appears to be a pre-requisite for the success of any assistance programme.

It appears that Sida is now faced with two generic choices on how best to now proceed:

1) Having regard to the extended history of Air Quality assistance in the Philippines, as well as the performance of the latest ADB and Sida efforts, *discontinue its in-country assistance in Philippines*

2) Learn from the previous collective mistakes of the grant-aid community and *proceed with a more carefully crafted and targeted aid programme.*

Making this choice lies substantially in the political domain – and therefore well outside the remit of these evaluators. We would comment, however, that choosing Option 1 guarantees automatically that all the effort and resources committed thus far by Sida and DENR/EMB will have been wasted. Our limited technical recommendation therefore, is for option 2), with strong qualifications as follows (Box 4):

Box 4. Necessary pre-conditions for further Sida Assistance in Philippines

- Careful examination of the lessons and findings of this report, in order to avoid repeating or compounding past failures.
- Adoption of a broader, inclusive approach; this would recognise that DENR/EMB – as implementing authority for the Clean Air Act – must be involved, but would also seek to draw together and utilise relevant competencies of other local organisations such as Manila Observatory and the Partnership for Clean Air.
- As part of this movement to greater inclusiveness, there should be better ongoing co-ordination and liaison with other grant aid bodies – and particularly ADB – that are presently active in-country
- Built-in safeguards, including an independent reality-check of any project to be undertaken prior to initiation
- Substantially greater monitoring of performance and success, quantified through clear and unequivocal deliverables, throughout the course of projects; this benchmarking should be undertaken independently of DENR and the Swedish consultants. A combination of independent international and local experts could be utilised for this purpose
- Only evaluating projects after they are completed is not adequate – failing projects need to be identified much more rapidly
- Ensure project outputs, deliverables and training plans are properly documented – this has clearly not been done in either the Thai and Philippine projects
- There should be considerably greater transparency and openness in how Swedish consultants and project participants are selected, with greater use of the competitive tendering process
- Projects should focus more on people, training and capacity building than on hardware. In general, the history of hardware-led grant aid AQ programmes throughout Asia is one of consistent and repeated failure.
- Focus on maximising management and working level buy-in; this is the only way to guarantee long-term sustainability. Only successful AQM systems with substantial local involvement, stockholding and funding will actually improve the AQM capacity of beneficiaries in the long-term.
- Focus on project tasks that are easy to verify, practicable, achievable and maximise cost-effectiveness
- Focus on smaller, incremental projects. Step-wise implementation, means that work only progresses to subsequent stages once verifiable success has been achieved in earlier components. Do not compound, hide or bypass failure
- Ensure, if possible, verification from the beneficiary that stable, consistent and adequate staff/resources will be committed throughout the course of projects

5.2 Our Recommendations

Subject and further to our above guidelines, our main technical recommendations are for a sequential 4-stage assistance programme, with progression through the phases contingent on the verified success of the preceding component:

Stage 1

1) Generic background AQM training, using both Philippine and international experts. This should focus, *inter alia* on:
   - Air Pollutants, their sources, phenomenology and health/ economic impacts
   - Fundamentals of Air Quality Management
   - Basic air monitoring technologies – including simple approaches such as passive samplers
   - Principles of network design
   - Quality assurance and control for air monitoring
   - Analysis and use of air quality data
   - Different approaches to air pollution modelling
   - Emission inventories and GIS fundamentals
   - Abatement scenario analysis
   - Economic and cost-benefit analysis

- This training to involve a range of organisations in Manila beyond DENR/EMB, including the Manila Observatory and Partnership for Clean Air
- Immediate support, as required, to enable real-time data collection from automatic monitoring stations (via Airviro or alternate systems)
- Specific support to establishing a data manager position in EMB to lead the data acquisition and processing activities, including the important front-end review of data prior to public dissemination; experts in MO could also be used as independent evaluators.
- Matching support to ensure necessary automatic data review procedures are applied to output data from the ADB-funded network

Stage 2

- Multi-organisational feasibility study for the development of a programme of public data presentation – via web and media – designed to raise societal awareness of air pollution in Metro Manila
- Support and advice for the establishment of an Air Pollution Index (API) system to be used in reporting data to the public in a simple, clear and understandable form meeting their needs
- Assess the scope for use of simpler data management and air monitoring techniques in Metro Manila
- Review of current monitoring systems – both automatic and sampler based – in Metro Manila and identification/gap-analysis of future additional requirements for effective:
  - Health impact assessment
  - Comparison with national standards under the Clean Air Act
  - Airshed management
  - Model validation
  - Public information provision

Stage 3

Depending on the outcomes of Stages 1 and 2, this phase might include:

- Updating Airviro hardware to current PC and web-enabled version *and/or* provide support/training for use of simpler open-ended IT systems
- Training and pilot studies, focussing on roadside environments, using passive sampler monitoring techniques for pollutants such as NO2, SO2, O3 and BTX (Benzene, Xylene, Toluene)
- Training and activities related to development of abatement strategies: continued work on emission inventories, modelling, analysis of effect of control measures/scenarios.
- Support in development of a database-driven public air quality website

Stage 4

- Provision of equipment for establishment of automatic monitoring stations in near-road environments

6. Lessons from the Thai and Philippine Technical Co-operation Projects

We would like to keep these short and to the point (Box 6). For the most part, they essentially mirror the lessons highlighted following the consultant's earlier evaluation of Sida-supported AQM projects in Bangkok, Thailand. We would also refer readers to the generic recommendations made in Section 5.1 in relation to further possible Sida support in-country.

Box 6. Major lessons from the Thai and Philippine AQM Assistance Programmes

- All multidisciplinary environmental assistance programmes end up being partly successful, at best. The most successful programmes tend to be those with a tight focus, clear objectives and based on a realistic assessment of what is practical and possible in the beneficiary country.
- A prerequisite for successful programmes is the management and working-level commitment of personnel in the beneficiary organisation(s). Without this project 'buy-in' and matching local resource commitment, any collaborative effort will fail.
- Keep technologies and approaches as simple as possible, consistent with local needs and capabilities. Simple approaches:
- Are often the most appropriate to local requirements, resource constraints and skill-base
- Maximise user uptake
- Are easier to maintain, support and adapt over time.
- Enhance cost-effectiveness and value-for-money
- Will prove most sustainable in the long-term
- It is best for projects to start simple, and then proceed to develop more complex approaches and use more advanced technologies in a phased manner, when appropriate and when local capabilities permit.
- High technologies are not always the solution to Air Quality Management. Sometimes they become the problem!
- An inflexible 'one-size-fits-all' approach to Air Quality Management is not usually recommendable. Techniques and technologies that work in developed countries such as Sweden, USA and UK may not always be fully appropriate or readily transferable to rapidly developing countries in Asia. At all stages of an assistance programme, AQM approaches and tools therefore need to be carefully targeted and optimised to meet specific local needs, capabilities and resources.
- In general, we would not recommend exclusively technology or equipment-led air programmes. The emphasis in assistance programmes needs to be on people rather than technologies. Tools, although necessary, are the means to an end; the people using those tools are the key beneficiaries. Training and capability development are therefore core components of any successful assistance programme.
- Training should not focus exclusively on the use of proprietary technologies or systems; rather, it should first seek to raise awareness of general principles and fundamental issues before dealing with such tool-oriented matters. Such training needs to be as broad-ranging and inclusive of other stakeholder organisations as possible.
- Sida should require, monitor and demand an adequate level of project documentation and reporting from its contractors
- Projects should be independently reality-checked and evaluated before inception and throughout their implementation. Evaluation only after completion is not sufficient; evaluation should be undertaken both by international and – wherever possible – local experts.

Appendix 1 Terms of Reference

For the Evaluation of Results (impact, outputs and effects) from the Air Quality Management projects in Thailand and the Philippines supported by BITS and Sida.

1 Background

Sweden has supported the work to combat air pollution problems in Southeast Asia during the last decade. Thailand and The Philippines have been the main counterpart countries, especially focussing on the deteriorating air quality in mega-cities like Bangkok and Metro Manila. The support has been given through contract financing of technical co-operation, a financial instrument open to middle-income countries. This type of support is based on the assumption that the country has a responsible organisation, officially designated to handle the question at issue, and that the organisation can specify their needs and priorities sufficiently for forming the basis of a contract between them and the consultant. Sida then finances the technical assistance part of the contract, while the local part should finance the local costs. Sida can take a more hands-off role in these projects, as long as they are projects based on principles like "demand-driven", "cost-sharing", "competent partners" and "limited assistance with a clear exit".

Two sets of projects, both directed at support to environmental authorities for improving the air quality, should be evaluated. Both sets of projects involve the same main Swedish partner, and share more or less the same project objective: to establish a modern Air Quality Management (AQM) system. The first set of projects (six) was directed to support the authorities in Thailand (Bangkok), the second project (two phases) to support similar efforts in Metro Manila.

An overview of the projects to be evaluated, covering project objectives, duration, main activities and results, project owners and other important stakeholders, implementing organisations and project costs is provided as Annex A to this document. Please note the preliminary comments to be considered by the evaluator for each project. All the projects have now been finalised and final reports have been provided to Sida. New proposals have been submitted during the project periods, and three are still pending awaiting a decision on how to continue the Swedish support through contract financing of technical co-operation in the field of air pollution in South East Asia (see Annex C). The timing of the evaluation is chosen to be either the start of a new phase of support, or resuming that the support requested or needed does not fit with Sida´s current possibilities. Thai projects were assessed by an independent consultant in conjunction with an evaluation of all support to environmental activities in Thailand in 1995[1]. Besides this no evaluation has been undertaken until now.

2 The Purpose and Scope of the Evaluation

The main purpose of the evaluation is to learn from the activities performed, and to achieve informed advice on efficient ways for Sida to support the improvement of air quality in South East Asia Mega cities, especially in Thailand and the Philippines. Both local and regional air pollution problems should be addressed.

Key issues are:

1. What has been the impact of the Sida (BITS) financed projects and what was their relation to other changes in the field of air pollution control in respectively Bangkok (Thailand) and Metro Manila (The Philippines)?

[1] The report has not been found in Sida's archive.

2. How is the present situation regarding air pollution control and management in respectively Bangkok (Thailand) and Metro Manila (The Philippines)? Describe ongoing activities, existing priorities and current plans.

The evaluation should put the projects financed by Sweden in the context of the, respectively, Thai and Philippine work to combat air pollution.

The scope of the evaluation is:

1. Five consequential projects in Thailand, aimed at establishing and supporting the development of an air quality management system in Bangkok. Evaluation of results effects and impact.
2. One project in The Philippines, divided into two phases, aimed at establishing an air quality management system in Metro Manila. Evaluation of results effects, and impact.
3. Initial assessment of the relevance, feasibility and appropriateness of three new project proposals/ideas:
   a. Thailand. Development of laboratory competence for air quality sampling and analysis. Counterpart: PCD (Pollution Control Department) in Bangkok[2]
   b. Thailand. Developing a strategy for handling air pollution problems caused by VOC, NOx and PAH in the Bangkok Metropolitan region. Counterpart: ERTC (Environmental Training and Research Centre) at DEQP (Department of Environmental Quality Promotion)[3]
   c. The Philippines. Initial request for continued Technical assistance, (TA3) support in developing an Air quality Management system for Metro Manila.Counterpart: EMB (Environmental Management Bureau) at DENR (Department of Environment and Natural Resources)
4. The own view[4] of the evaluation team on activities immediately needed and how they best should be designed to be best suited to combat air pollution in Bangkok (Thailand) and Metro Manila (The Philippines). This point is independent from earlier activities and existing proposals, and should reflect the view of an independent and highly competent consultant in the field of AQM.

The finding and recommendations will be used for Sida´s appraisal of further support. They will also be provided to all actors involved in the projects as guidance for future action to be taken. The evaluation report will be publicly available through the archive of Sida Evaluations. Amongst the interested parties, the environmental authorities at local, regional and national level in Thailand and The Philippines are to be found, as well as The Asian Development Bank.

3 The Assignment (issues to be covered in the evaluation)

Relevance of the projects performed is the main issue. It should be noted that the overall objective for the projects to be evaluated has been an improved air quality. The evaluation should discuss the appropriateness of the methods chosen to reach this objective, their timing, balance between providing equipment and technical assistance, ownership issues and division of roles and responsibilities between consultants and counterparts, in theory as well as in practice.

Achievement of project objectives should be assessed with an emphasis on effects and impact.
The immediate results have been reported (see List of Background documents, Annex B) as part of each project. This results should be validated when possible and within the scope of the key questions for the evaluation.

[2] Possibly there is a change regarding the coming duties of the PCD laboratory. This may make this project less relevant or require changes in the project design.
[3] It is uncertain if there is still an interest in Thailand to involve a Swedish consultant in the project.
[4] After consultation with relevant professionals

Effects on target groups shall be assessed and validated when possible. A major obstacle will be the changes in staff at the organisations involved in the project and subject to training as part of the projects. The evaluating team should focus on effects and impact, in this case if persons trained can be found in other capacities where their improved skills have been of use for the purpose of the projects. See further the project descriptions in Annex A for definition of target groups. Gender aspects should be considered when relevant and interesting.

Focus is mainly on the sustainability of the interventions. The report should include a cause and effect analysis, and discussion of deviations from what was anticipated, or initially overlooked, in the project design. The long-term impact of the projects should be described as well as what led up to them. A general assessment of the cost-effectiveness of the different projects/main activities in the projects shall be made and presented, followed by an analysis of major causes. A brief assessment of the legitimacy and capacity of the major institutions involved.

The report shall include any relevant links to enhancing sustainable development and improvement of living conditions for the poor. Of special interest is the validation of such effects from the project interventions and from the development of the AQM in general.

4 The Methodology, Evaluation Team and Time Schedule

The scope of the evaluation should be held within 40 days of work. The evaluation team should consist of two persons, of which at least one should have a specific and broad technical competence in the field of air quality monitoring. At least one should have a genuine knowledge and experience from the existing situation and the development during the last ten years of air quality management in South East Asia, especially in Thailand and The Philippines. The team should be highly qualified in judgement of cost-efficiency for alternative approaches to strengthening air quality management in the Thai/Philippine context. The team should also be able to prove good knowledge from development assistance in the field of air quality management, including reference projects.

At least one of the team members should be able to read and understand Swedish, see the List of Background documents, Annex B.

The evaluation will include a two-week mission to Bangkok and Manila. Sida will set up the initial itinerary for the mission, but room will be left for additional contacts deemed appropriate for the scope of the evaluation during the visit. One week should be allocated in advance for preparation and reading through the background documents. Yet another two weeks will be allowed for writing the report and receiving comments from major actors involved before finalising the draft.

The counterparts in the different projects should be contacted in advance by the evaluating team and asked if they would like to submit additional information or comments to the Terms of Reference for the evaluation. They will also be asked for comments to the Draft evaluation report.

Sida will be giving the final comments to the Draft report and acceptance of the final report.

The list of background documents is attached in Annex B to this document. Each project is also described in Annex A. Together this is intended to give a sufficient background for the evaluation team. The evaluator should clearly describe the methodology used. Multiple lines of evidence and a combination of quantity and quality type of analysis shall be used. The interviews and observations shall follow a clear and well thought through methodology. Sida's archives and files are publicly available.

Interviews should also be made, with the Swedish counterparts throughout the projects, and a special attention should be given to the input from institutional partners like Swedish Environmental Protection Agency and the Municipality/Region of Gothenburg. When appropriate, interviews could be done via telephone or in a written form.

5 Reporting

A draft report shall be produced and presented to Sida not later than three weeks after concluding the mission to South East Asia. Another three weeks will be allowed for comments from Sida and interested parties. Hereafter the report should be finalised.

The evaluation report shall be comprehensive and written in English. For maximal use, technical background and other supporting facts should be put in annexes. Format and outline of the report shall follow the guidelines in *Sida Evaluation Report – a Standardised Format* (see Annex 1). The draft report and later on the final version, shall be submitted to Sida electronically and in 3 hardcopies (air-/surface mailed or delivered). The evaluation report must be presented in a way that enables publication without further editing. Subject to decision by Sida, the report will be published in the series *Sida Evaluations.*

The report shall follow the structure and emphasis put in these Terms of Reference. Conclusions and main findings shall be reported and validated. Description of the projects, corresponding to Annex A, should be put in Annex to the report, with complements and all amendments found appropriate by the evaluator. Interviews and other fact-finding results should also be put in annexes.

The evaluation assignment includes the completion of *Sida Evaluations Data Work Sheet* (Annex 2), including an *Evaluation Abstract* (final section, G) as defined and required by DAC. The completed Data Worksheet shall be submitted to Sida along with the final version of the report. Failing a completed Data Worksheet, the report cannot be processed.

Appendix 2
List of Persons Consulted or Interviewed by the Evaluators

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Appendix 3 Documentation and References

Background Documents Supplied by Sida

A number of background documents were provided by Sida in advance of our visit to the Philippines. The folder included mostly correspondence and memos and few technical reports. The documents further included project descriptions, assessments and some results for each project found in the Sida archive files.

PHI 1:

1. Beslut INEC/EKOSAM 602/97 1997-08-18
2. Letters of conformation. July/August 1997
3. Agreement between DENR, Department of Natural resources, Manila, Philippines and Connexor Sensus AB on a project for the first steps of an Air Quality management Project to strengthen and modernise the AQM functions at the Environmental Management Bureau in Metro Manila.
4. Background report Dec 1996
5. Project Organisation scheme
6. Project changes and comments. Connexor 1997-06-09
7. Request for soft loan to the AQM project with the EMB (undated document, later referred to as per 1996-11-21)
8. Modified portions of the proposed project on AQM. 1997-05-19
9. Fax from ADB re: Proposed Metro manila Air Quality improvement Project. 1997-06-20
10. Final report Phase 1 September 1997–April 1999. 1999-04-15. Annex 1 from SMHI is missing.
11. Request for financial support for the continuation of the AQM project with the EMB in the Philippines

PHI 2:

12. Beslut INEC-IKTS 571/99. 1999-06-22
13. Letter of confirmation 1999-06-24
14. Undertaking by Sida to pay for consultancy services. 1999-06-24
15. Agreement between DENR/EMB and Connexor Sensus AB on a project for the second steps of an AQM project to strengthen and modernise the AQM functions at the Environmental Management Bureau in Metro Manila TA2. December 1999.
16. Interim Report 1998-06-22
17. Beslut om insatsstöd: Biståndskredit till mäturtrustning för luftvård i Manila.
18. Email from ADB Metro Manila Air Quality Improvement Program 1998-01-06
19. Underlag för beredning av TA2. Connexor 1999-04-09
20. Underlag för TA2 budgetspecifikstion. Conenxor
21. Review of a concessionary credit proposal for air quality monitoring in Metro Manila. IVL 1999-03-25
22. Evaluation of the ADB project Metro Manila Air Quality Improvement Sector Development Program. SMHI 1999-05-31
23. Preliminary proposal for an air quality monitoring program in Metro Manila. IVL 1999-06-24
24. Mail correspondence between IVL and Connexor re evaluation. May 1999.

25. Synpunkter internt Sida. Mätning av luftkvalitat Manila. 1999-06-11
26. Kommentarer till IVL:s rapport om luftvårdsprojekteet. Sv ambassad Manila (ej signarat) 1999-03-20
27. Ten status reports June1999–Feb 2002
28. Draft mission review report ASDB Nov 2001
29. BTOR of a loan review mission inter-office memorandum ASDB 200-05025
30. Fax correspondence Sida-AsDB between spring 1999, 2000 and 2001
31. Action priorities for AQM. Connexor 2001-08-24
32. Additional follow-up of progress in the Sida TA2. Connexor 2001-10-18
33. *(withdrawn)*
34. Project overview DENR/Conexor 2002-06-04
35. Final Report TA2 June 1999–August 2002 (not signed). 2002-08-14

Other Documentation Reviewed as Part of the Evaluation

1. Air Quality Management Programs: the case of Manila. Presentation by Charles Melhuish of ADB to Clean Air Initiative for Asia Meeting, Bangkok 2001
2. Republic of the Philippines Act No 8749 – 'An Act providing for a comprehensive air pollution control policy and for other purposes' (the Clean Air Act).
3. Air Pollution Control Policy Options for Metr0 Manila. Alan Krupnick, Richard Morgenstern, Carolyn Fischer, Kevin Rolfe, Jose Logarta, and Bing Rufo. December 2003. Resources for the Future Discussion Paper 03–30
4. A strategic framework for Air Quality Management in the Asian Region. Clean Air Initiative for Asia – consultation paper, October 2003
5. Metro Manila Air Quality Program – presentation by Luis Manuel Virtucio of Department of Transport and Communications to Workshop on Air Pollution in the Megacities of Asia. Seoul, Korea – September 2001
6. Urban air quality management strategy in Asia: Metro Manila report. Edited by Jitendra Shah and Tanvi Nagpal. World Bank Technical Paper no 380, 1997
7. 2002 National Air Quality Status Report – produced by Environmental Management Bureau of Department of Environment and Natural Resources
8. Special report on outdoor pollution in Developing Countries of Asia: a literature review. Health Effects Institute, April 2004
9. A Strategic Framework for Air Quality Management in Asia – Stockholm institute, CAI – Asia, UNEP, WHO, Korea Environment Institute. ISBN 89-8464-095-6, 2004.

Documentation from Clearing the Air: A Forum on Monitoring and Reporting Air Quality in Metro Manila, 5 October 2004 at Asian Development Bank

An ADB-funded fully-automated Metro Manila air quality monitoring network has been in operation for almost a year now. Prior to this network system, the Environmental Management Bureau – Department of Environment and Natural Resources (EMB-DENR), as well as the Manila Observatory and the Philippine Nuclear Research Institute (PNRI) have been separately conducting various monitoring activities in Metro Manila. To fully maximize the benefits from these different monitoring initiatives, an open discussion was held on how these different approaches could be used towards effective air quality monitoring and reporting in Metro Manila.

The forum was organised by Manila Observatory, the Partnership for Clean Air (PCA) and the Clean Air Initiative for Asian Cities (CAI-Asia).

This event was conducted through the assistance of the Public Awareness Component of the ADB Metro Air (formerly MMAQISDP) program. This occasion provided a venue for an exchange of ideas on the current status of air quality (AQ) monitoring and the development of reporting guidelines for AQ monitoring data generated by the various AQ stations in Metro Manila. The forum further aimed to establish an information dissemination protocol for AQ monitoring in line with the Air Quality Monitoring and Information Network set up under the Clean Air Act.

1. Methodology and results of the new ambient air quality monitoring system – Brian Lee, ETI International
2. Monitoring of PM 2.5 and PM10 in Metro Manila – Flora Santos, Philippine Nuclear Research Program
3. Air Quality Monitoring undertaken by Manila Observatory – Jett Villarin, Manila Observatory
4. The continued need for roadside monitoring – Cesar Siador Jr., DENR
5. Communicating the results of Air Quality Monitoring in Metro Manila – Elena Basug, EMB-EEID and Marissa Cruz, DENR-PAO

Websites consulted

www.sida.se/Sida/jsp/Crosslink.jsp?d=376&a=8959

www.sida.se/Sida/jsp/polopoly.jsp?d=107

www.indic-airviro.smhi.se/

www.emb@denr.gov.ph/

http://www.emb.gov.ph/eeid/airpol.htm

www.cleanairnet.org/caiasia/1412/article-58416.html

http://www.adb.org/Documents/Profiles/LOAN/30480023.ASP

http://www.adb.org/Documents/Profiles/LOAN/30480013.ASP

http://www.adb.org/Documents/Profiles/LOAN/30480033.ASP

www.tda.gov

http://wwwwds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000009265_3980313101901

http://www.cleanairnet.org/caiasia

www.up.edu.ph

http://www.usaid.gov/locations/asia_near_east/countries/philippines/philippines.html

http://www.geocities.com/benign0/300_Makati/pollution.html

http://www.philsol.nl/news/03/CleanAir01–jan03.htm

http://www.doh.gov.ph/ra7885.htm

www.rff.org

http://www.conexor.com

http://www.cleanairnet.org/caiasia/

http://www.cleanairnet.org/caiasia/1412/article-59026.html (Clean Air Forum, 5/10/04)

http://www.conexor.se/philippines/denr/denr.htm

http://www.admu.edu.ph/office.php?office_id=50

Appendix 4 Regarding Air Data Acquisition from the Metro Manila Automatic Monitoring Network

An email sent to Air Quality Stakeholders following the consultant's evaluation.

Memorandum

Collecting real-time data from Manila's Air Quality Monitoring Network

To: Cesar Siador, Teresita Peralta (DENR/EMB)
Brian Lee (ETI),
Charles Melhuish, Cornie Huizenga (ADB)
Copy: Björn Wahlstedt (Connexor),
Jojie Manalaysay (PCA),
Daniel McNamara (MO)
Date: Saturday 9 October

Dear Friends

First of all, let me thank you all for your hospitality this week, together with all the comprehensive advice and information you have provided us; this has all helped make our evaluation of the Sida/EMB co-operative projects very much easier!

One of the things that we have seen and been told about repeatedly this week, is the strange situation that the Airviro system supplied by Connexor/Sida cannot at present communicate and collect real-time data from the ADB-funded automatic air quality monitoring stations. After all, this is one of its main intended functions; it would clearly be to everyone's benefit, therefore, that the appropriate interfacing is arranged as soon as possible. This would then make it possible to report air quality data rapidly to the public. This is something that all parties agree would do much to raise public awareness, as well as empowering citizens through access to information on the quality of the air in Metro Manila.

We have spoken to Björn Walstedt of Connexor about this situation, and he has kindly agreed to use his good offices to assist in resolving this situation. As a first step, all he would need is the diallup phone numbers of all the monitoring stations, together with details of any passwords in place. He will then pass these to Airviro in Sweden, who should be able to remotely diagnose and evaluate the problem. At least they will do their best to try!

Brian, could we collectively ask you to supply these details to EMB and/or directly to Björn, please?

This really shouldn't be a substantive technical issue – Airviro is clearly functional, and similar installations of this system in many other parts of the world communicate successfully every day with the industry-standard loggers installed on site. So, I am sure this is something that – working together – we should be able to fix very easily. And, when we do, this will do much to 'kick start' further air quality interest and initiatives in the city.

Please keep us informed of progress, and I am sure Sida will be in touch when our report has been finalised and assessed. And, lastly, let me wish you all the best of luck!

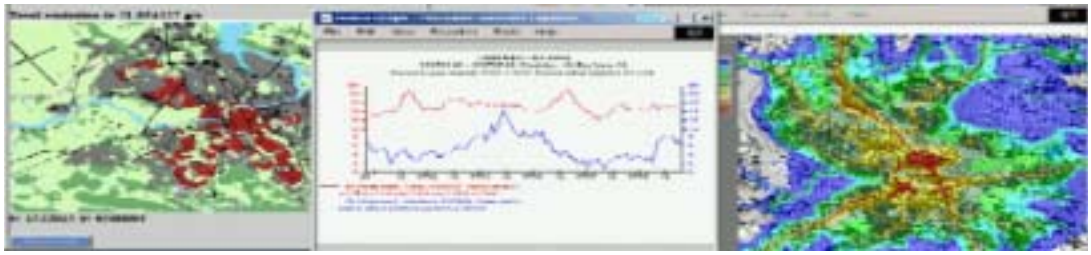
I hope we have an opportunity to work together again in the future.

With very best wishes

Jon Bower *Steinar Larssen*

PS Tess – we will also try to locate for you some information on data quality assurance/control and analysis on our return

Technical Annex 1
An Outline Description of the Airviro System



Airviro is a system for analysis, planning and decision-taking in the management of air and water quality problems. The system is built around the following basic components:

- Databases for
  - Monitored data
  - Emissions to the air and water environment
- User interface modules for
  - Handling data collection
  - Analysis and presentation of time series data
  - Presentation/operation modules for the emission databases
  - Different dispersion models and a receptor model

Airviro is divided up into several different self-contained modules. An Airviro installation can consist of just one of these modules, although usually a combination of modules is chosen.

The software has been designed so that

- It can be fully operated using easy-to-use windows and menus
- Results are presented clearly and informatively, mostly on background maps

The latest version of Airviro, v3.0, is a completely Web-based environmental GIS tool. This makes it a distributed application suitable for regional or corporation use, as well as small standalone systems for inexperienced users.

There are more than 80 Indic-Airviro customers world-wide; authorities and industries, use the system to improve and structure their environment management work. Airviro sites range from regional internet systems with hundreds of users to intranet with just a few users.

The Airviro server runs on normal PCs using Linux as operating system. Its main functional modules are as follows:

Data Collection

Data are collected automatically from instruments measuring meteorology, air quality and other variables relevant to air pollution. Validation routines are applied and the operator is informed of any possible malfunction in the measurement systems.

Data Presentation

The Airviro Indico module provides tools for presentation and advanced analysis of time-series data. Selection criteria and mathematical transformations can be applied to data. Regression functions are also provided for model-building and testing of hypotheses.

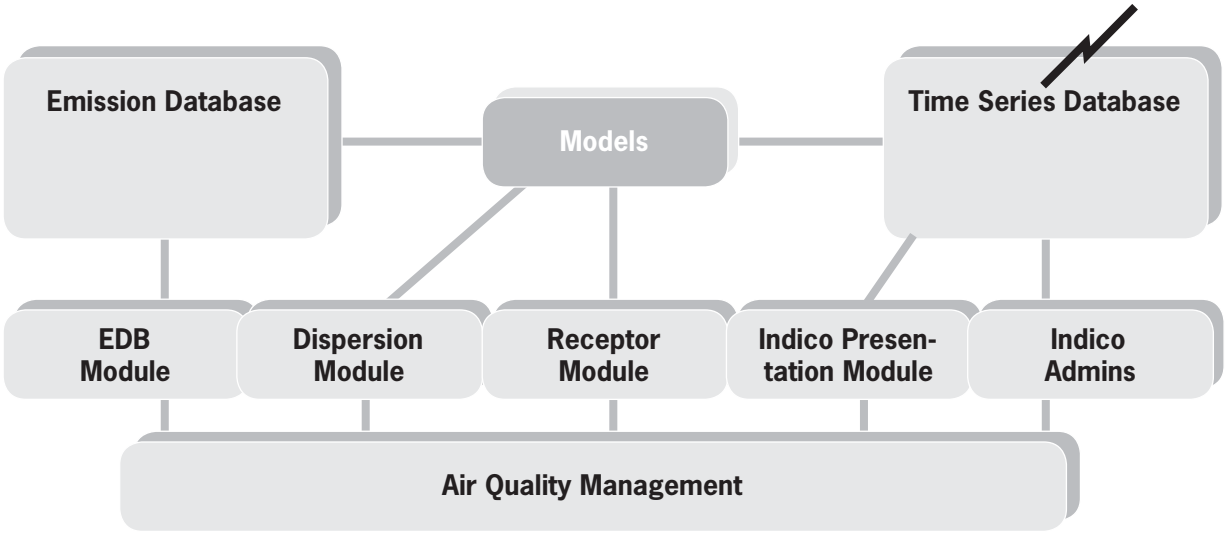
Dynamic Emission Database (EDB)

The dynamic emission database included in the system is designed to store static as well as dynamic emission characteristics for large numbers of pollution sources and types.

Dispersion Module

A number of dispersion models are available in the system, allowing the operator to investigate different scenarios in which processes such as deposition and accumulation of pollutants are taken into account. Results of different simulations can be stored for subsequent presentation and comparison.

A conceptual structure diagram of Airviro is depicted overleaf.



Outline of a typical Airviro System

Technical Annex 2
Philippine National Ambient Air Quality Guideline for Criteria Pollutants – from the Clean Air Act of 1999 (Republic Act No. 8749)

Short Term[a]				Long Term[b]		
Pollutants	**µg/m³**	**ppm**	**Averaging Time**	**µg/m³**	**ppm**	**Averaging Time**
Suspended Particulate						
Matter[a] – TSP	230[d]		24 hours	90	--	1 year[c]
PM-10	150[f]		24 hours	60	--	1 year[c]
Sulfure Dioxide[c]	180	0.07	24 hours	80	0.03	1 year
Nitrogen Dioxide	150	0.08	24 hours	--	--	--
Photchemical						
Oxidants	140	0.07	1 hour	--	--	--
As Ozone	60	0.03	8 hours	--	--	--
Carbon Monoxide	35 mg/Ncm	30	1 hour	--	--	--
	10 mg/Ncm	9	8 hours	--	--	--
Lead[g]	1.5	--	3 months[g]	1.0	--	1 year

[a] Maximum limits represented by ninety-eight percentile (98%) values not to exceed more than once a year.
[b] Arithmetic mean
[c] SO2 and Suspended Particulate matter are sampled once every six days when using the manual methods. A minimum of twelve sampling days per quarter or forty-eight sampling days each year is required for these methods. Daily sampling may be done in the future once continuous analyzers are procured and become available.
[d] Limits for Total Suspended Particulate Matter with mass median diameter less than 25–50 nm.
[e] Annual Geometric Mean
[f] Provisional limits for Suspended Particulate Matter with mass median diameter less than 10 microns and below until sufficient monitoring data are gathered to base a proper guideline.
[g] Evaluation of this guideline is carried out for 24-hour averaging time and averaged over three moving calendar months. The monitored average value for any three months shall not exceed the guideline value.

Recent Sida Evaluations

06/03 Sida Support to the Afrobarometer Network
Raymond Gervais, Camille Tremblay, Anthony Kwaku Batse, Tabitha Mulyampiti, Franck Yelles
Department for Democracy and Social Development

06/04 Partnership Evaluation of PMU-Interlife
Anders Ingelstam, Håkan Jarskog, Cecilia Karlstedt, Lennart Peck
Department for Cooperation with Non-Governmental Organisations, Humanitarian Assistance and Conflict Management

06/05 Sida Support to Health Economics Capacity in Sub-Saharan Africa through the Health Economics Unit, University of Cape Town
Bo Erlandsson, Veronica Gunnarsson
Department for Democracy and Social Development

06/06 Institutional Capacity Building of Health Economics in Zambia
The Purchaser-Provider Model and Institutional Collaboration in Zambia
Bo Erlandsson, Veronica Gunnarsson
Department for Democracy and Social Development

06/07 Èvaluation du Partenariat PMU-Interlife
Anders Ingelstam, Håkan Jarskog, Cecilia Karlstedt, Lennart Peck
Department for Cooperation with Non-Governmental Organisations, Humanitarian Assistance and Conflict Management

06/08 Evaluación del proyecto vivienda para familias afectadas por los terremotos en El Salvador
Eberto de León, Julio Urias, Carlos Rodriguez, Ernesto Barraza
Department for Latin America

06/09 Pangani Falls Re-development Project in Tanzania
Roger Andersson, Fritz Wänseth, Melinda Cuellar, Ulrike von Mitzlaff
Department for Infrastructure and Economic Cooperation

06/10 African Books Collective Mid-Term Review 2006
Nigel Billany, Jane Katjavivi, Ruth Makotsi
Department for Democracy and Social Development

06/11 Apoyo Sueco a los Esfuerzos Guatemaltecos de Establecer un Sistema Nacional Catastral, 1997–2005
Thomas Alveteg, Benito Morales
Department for Latin America

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Department for Research Cooperation

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